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## ONCOLOGY | REVIEW ARTICLE

# Cancer prevalence, incidence and mortality rates in Pakistan in 2012

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**Abstract:** According to estimates from the International Agency for Research on Cancer (IARC), there were 14.1 million new cancer cases and 8.2 million cancer deaths in 2012 worldwide. In this article, we provide an overview of the cancer burden in Pakistan, including the 1, 3, 5-years prevalence, estimated number of new cancer cases and deaths in 2012 by age. Data from GLOBOCAN 2012, produced by the IARC, were used. GLOBOCAN provides estimates of cancer prevalence, incidence and mortality worldwide, and for countries and regions. This article concluded that the most prevalent cancers in Pakistan include breast, lip and oral cavity, cervix uteri, colorectum and bladder, respectively. The cancers responsible for the highest incidence in both the genders (total = 148,041) in Pakistani population includes breast ( $n = 34038$ , 23%), lip and oral cavity ( $n = 12761$ , 8.6%), lung ( $n = 6800$ , 4.6%), non-hodgkin lymphoma ( $n = 5964$ , 4%) and colorectum ( $n = 5335$ , 3.6%), respectively. Whereas, the cancers responsible for the highest deaths (total = 101,113) in Pakistani population includes breast ( $n = 16232$ , 16.1%), lip and oral cavity ( $n = 7266$ , 7.2%), lung ( $n = 6013$ , 5.9%), oesophagus ( $n = 4748$ , 4.7%) and non-hodgkin lymphoma ( $n = 4374$ , 4.3%), respectively.

**Subjects:** Medicine, Dentistry, Nursing & Allied Health; Medicine; Oncology

**Keywords:** cancer; statistics; epidemiology; prevalence; incidence; mortality; Pakistan

### 1. Introduction

IARC estimates that globally 14.1 million cases of cancers have emerged in 2012, in which the majority of cases i.e. almost 8 million have been reported from economically developing countries; encompassing 82% population of the world (Torre et al., 2015). Since non-melanoma skin cancers cannot be tracked in cancer registries, so this estimation does not include them. In 2012, the total



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### PUBLIC INTEREST STATEMENT

Cancer is the leading cause of death worldwide. About 14.1 million cases of cancers have emerged in 2012, in which the majority of cases i.e. almost 8 million have been reported from economically developing countries; encompassing 82% population of the world. Similarly, cancer poses an emerging and potentially significant health burden in Pakistan. This review revealed that in 2012, an increased frequency of cancers of breast, lip and oral cavity, lung, non-hodgkin lymphoma, colorectum, cervix uteri, esophagus and bladder are experienced in Pakistan.

number of deaths due to cancer were 8.2 million (approximately 22,000 cancer deaths per day), including 2.9 million cases from economically developed countries; whereas, the rest of them from the economically developing countries (American Cancer Society, 2015).

It is predicted that by 2030, the number of new cancer cases will mount to 21.7 million and 13 million sufferers of cancer will die owing to the growth and aging of the population (Bray, Jemal, Grey, Ferlay, & Forman, 2012). It is estimated that in future the burden of cancer will markedly rise due to the lifestyle adoption which are linked with increased risk of cancer i.e. smoking, physical inactivity, improper diet and a decreased number of pregnancies in economically developing countries (Bray & Møller, 2006). The cancers which are influenced by these factors include lung, breast, and colorectal cancers, and these are already abundant in economically transitioning countries. In case the preventive measures are not taken than the cancers which are widely present in Western countries will keep on rising in developing countries.

As far as the non-communicable diseases are concerned in Pakistan, cancer is the leading cause of death. To-date, no study from Pakistan has reported age-standardized and cancer-specific incidence and mortality rates among men and women. Therefore, in this article, we provide an overview of the cancer burden in Pakistan, including the estimated number of new cancer cases and deaths in 2012 by age. We have commented on the scale and profiles of cancer, risk factors for a number of common cancers, as well as the preventive measures that have the potential to reduce the future cancer burden. Furthermore, we also present the 1, 3 and 5-year prevalence of cancers in Pakistan.

## 2. Data sources and methods

The data was obtained from GLOBOCAN 2012, which was produced by the IARC (Ferlay et al., 2015). Data about the global, country and region based incidence, mortality and prevalence of cancer can be obtained from GLOBOCAN. Data concerning the incidence of cancer are obtained through population-based cancer registries (PBCR) that may include the population of the whole country but it usually covers smaller, sub national areas including urban environments such as major cities. Nevertheless, quality of information retrieved from less developed countries is inadequate as compared to that obtained from more developed countries, PBCR serves as the leading source of information on the local scale and are eminent in developing and evaluating cancer control programs. World Health Organization (WHO) gathers and provides information on the total number of deaths in a country due to cancer annually (World Health Organization, xxxx). The national coverage and long-term availability are the two major merits associated with this data source; however, all data sets do not possess same quality or completeness.

The country wise incidence and mortality rates were estimated through GLOBOCAN (Ferlay et al., 2015), by using most up to date data gathered by the IARC or which was available in the routine reports of registries. The website of GLOBOCAN provides incidence and mortality rates of 27 types of cancer in various countries, and except for non-melanoma skin cancer provide data combined by sex and for 10 age groups (birth-14, 15-39, 40-44, 45-49, ... 70-74, and 75 years and older). The entire database of GLOBOCAN 2012 along with the complete descriptions of sources and methods used for individual countries are available online ([globocan.iarc.fr](http://globocan.iarc.fr)) (Ferlay et al., 2015).

The rates mentioned are age-standardized i.e. per 100,000 person-years, according to the World Standard Population as proposed by Segi and tailored by Doll and Cook (1967) and Daigaku & Kyōshitsu (1960). The cumulative risk linked with developing or dying due to cancer before the age of 75 years (in the absence of competing causes of death) is calculated as well and is expressed as a percentage.

To identify studies for comparison purpose, we explored sources likely to contain studies of interest, including PubMed and Google Scholar. The terms “Cancer”, “Cancer Statistics” “Epidemiology”, “Incidence”, “Mortality” and “Prevalence” were used in diverse combinations with BOOLEAN and MeSH search.

### 3. Results

#### 3.1. Prevalence

Table 1 presents the estimated numbers of 1, 3 and 5-year prevalent cancer cases in Pakistani adult population in 2012. Data reveals that lip and oral cavity, larynx, bladder, prostate and colorectum cancers are the most prevalent cancers among adult males; whereas, breast, cervix uteri, lip and oral cavity, ovary and corpus uteri are the most prevalent cancers among adult females in 2012.

#### 3.2. Incidence

An estimated 63,451 new cancer cases (approximately 174 new cancer cases diagnoses per day) appeared in 2012 in the Pakistani male population. Lip and oral cavity ( $n = 7068$ , 11.1%, crude = 7.7, ASR = 10.5, CR = 1.2), lung ( $n = 5772$ , 9.1%, crude = 6.3, ASR = 9.7, CR = 1.2), non-hodgkin lymphoma ( $n = 3721$ , 5.9%, crude = 4.1, ASR = 5.3, CR = 0.6), colorectum ( $n = 3138$ , 4.9%, crude = 3.4, ASR = 4.7, CR = 0.5) and prostate ( $n = 3041$ , 4.8%, crude = 3.3, ASR = 5.3, CR = 0.7) cancers comprise the top five most newly diagnosed cancers in male (Table 2). Among all newly diagnosed cancer cases in male; 4.6% ( $n = 2,926$ ) diagnosed in children aged 0–14 years, 64.3% ( $n = 40,760$ ) diagnosed in adults aged 15–64 years and 31.2% ( $n = 19,765$ ) diagnosed in elderly population aged  $\geq 65$  years.

Table 3 shows the estimated new cancer cases in 2012 in the Pakistani female population. The overall estimates were 84,590 cases (approximately 232 new cancer cases diagnoses per day). Breast ( $n = 34038$ , 40.2%, crude = 38.4, ASR = 50.3, CR = 5.2), lip and oral cavity ( $n = 5693$ , 6.7%, crude = 6.4, ASR = 9.1, CR = 1.1), cervix uteri ( $n = 5233$ , 6.2% crude = 5.9, ASR = 7.9, CR = 0.8), ovary ( $n = 3703$ , 4.4%, crude = 4.2, ASR = 5.6, CR = 0.6) and oesophagus ( $n = 2718$ , 3.2%, crude = 3.1, ASR = 4.4, CR = 0.5) cancers comprise the top five most newly diagnosed cancers in female. Among all newly diagnosed cancer cases in female; 2.0% ( $n = 1,659$ ) diagnosed in children aged 0–14 years, 81.5% ( $n = 68,893$ ) diagnosed in adults aged 15–64 years and 16.6% ( $n = 14,040$ ) diagnosed in elderly population aged  $\geq 65$  years.

#### 3.3. Mortality

An estimated 48,449 cancer deaths (approximately 133 cancer deaths per day) appeared in 2012 in the Pakistani male population. Lung ( $n = 5097$ , 10.5%, crude = 5.6, ASR = 8.7, CR = 1.1), Lip and oral cavity ( $n = 4046$ , 8.4%, crude = 4.4, ASR = 6.3, CR = 0.7), non-hodgkin lymphoma ( $n = 2719$ , 5.6%, crude = 3, ASR = 4.2, CR = 0.5), liver ( $n = 2682$ , 5.5%, crude = 2.9, ASR = 4.5, CR = 0.6), leukemia ( $n = 2598$ , 5.4%, crude = 2.8, ASR = 3.1, CR = 0.3) cancers comprise the top five most cancers responsible for death in male (Table 4). Among all cancer deaths in male; 4.9% ( $n = 2,390$ ) deaths in children aged 0–14 years, 54.2% ( $n = 26,298$ ) deaths in adults aged 15–64 years and 40.8% ( $n = 19,761$ ) deaths in elderly population aged  $\geq 65$  years.

Table 5 shows the estimated cancer deaths in 2012 in the Pakistani female population. The overall estimates were 52664 deaths (approximately 144 cancer deaths per day). Breast ( $n = 16,232$ , 30.8%, crude = 18.3, ASR = 25.2, CR = 2.8), lip and oral cavity ( $n = 3220$ , 6.1%, crude = 3.6, ASR = 5.4, CR = 0.7), cervix uteri ( $n = 2876$ , 5.5% crude = 3.2, ASR = 4.7, CR = 0.5), ovary ( $n = 2726$ , 5.2%, crude = 3.1, ASR = 4.5, CR = 0.6) and oesophagus ( $n = 2507$ , 4.8%, crude = 2.8, ASR = 4.0, CR = 0.5) cancers comprise the top five most cancers causing death in female. Among all cancer deaths in female; 2.7% ( $n = 1,416$ ) deaths in children aged 0–14 years, 71.2% ( $n = 37,439$ ) deaths in adults aged 15–64 years and 26.2% ( $n = 13,809$ ) deaths in elderly population aged  $\geq 65$  years.

Cancers those are most prevalent and responsible for the highest incidence and mortality in Pakistani population shown in Table 6.

**Table 1. Estimated 1, 3 and 5-year prevalent cancer cases in Pakistani adult population, 2012**

| Cancer                                     | ICD-10        | Male      |                |                |                 | Female    |                |                 |                 |
|--|---------------|-----------|----------------|----------------|-----------------|-----------|----------------|-----------------|-----------------|
|  |               | Incidence | 1-year (prop.) | 3-year (prop.) | 5-year (prop.)  | Incidence | 1-year (prop.) | 3-year (prop.)  | 5-year (prop.)  |
| Bladder                                    | C67           | 3,020     | 2,056 (3.4)    | 5,247 (8.8)    | 7,830 (13.1)    | 942       | 651 (1.1)      | 1,674 (2.9)     | 2,508 (4.3)     |
| Brain, nervous system                      | C70-72        | 2,382     | 1,179 (2.0)    | 2,747 (4.6)    | 3,863 (6.5)     | 1,351     | 693 (1.2)      | 1,617 (2.8)     | 2,274 (3.9)     |
| Breast                                     | C50           | -         | -              | -              | -               | 34,033    | 29,349 (50.4)  | 78,508 (134.9)  | 119,710 (205.8) |
| Cervix uteri                               | C53           | -         | -              | -              | -               | 5,233     | 3,940 (6.8)    | 10,201 (17.5)   | 15,323 (26.3)   |
| Colorectum                                 | C18-21        | 3,133     | 1,982 (3.3)    | 4,819 (8.1)    | 6,976 (11.7)    | 2,179     | 1,412 (2.4)    | 3,425 (5.9)     | 4,941 (8.5)     |
| Corpus uteri                               | C54           | -         | -              | -              | -               | 2,171     | 1,896 (3.3)    | 5,242 (9.0)     | 8,190 (14.1)    |
| Gallbladder                                | C23-24        | 543       | 196 (0.3)      | 457 (0.8)      | 655 (1.1)       | 1,296     | 493 (0.8)      | 1,141 (2.0)     | 1,616 (2.8)     |
| Hodgkin lymphoma                           | C81           | 1,096     | 758 (1.3)      | 2,069 (3.5)    | 3,230 (5.4)     | 559       | 407 (0.7)      | 1,123 (1.9)     | 1,773 (3.0)     |
| Kaposi sarcoma                             | C46           | 4         | 3 (0.0)        | 6 (0.0)        | 9 (0.0)         | 4         | 3 (0.0)        | 6 (0.0)         | 9 (0.0)         |
| Kidney                                     | C64-66        | 967       | 495 (0.8)      | 1,352 (2.3)    | 2,112 (3.5)     | 510       | 257 (0.4)      | 727 (1.2)       | 1,162 (2.0)     |
| Larynx                                     | C32           | 3,003     | 2,054 (3.4)    | 5,252 (8.8)    | 7,882 (13.2)    | 409       | 283 (0.5)      | 723 (1.2)       | 1,088 (1.9)     |
| Leukaemia                                  | C91-95        | 1,852     | 785 (1.3)      | 1,765 (3.0)    | 2,450 (4.1)     | 1,293     | 561 (1.0)      | 1,254 (2.2)     | 1,728 (3.0)     |
| Lip, oral cavity                           | C00-08        | 7,041     | 4,520 (7.6)    | 11,360 (19.0)  | 16,781 (28.1)   | 5,675     | 3,759 (6.5)    | 9,419 (16.2)    | 13,866 (23.8)   |
| Liver                                      | C22           | 2,813     | 601 (1.0)      | 1,238 (2.1)    | 1,653 (2.8)     | 1,495     | 331 (0.6)      | 684 (1.2)       | 910 (1.6)       |
| Lung                                       | C33-34        | 5,767     | 1,794 (3.0)    | 3,694 (6.2)    | 4,876 (8.2)     | 1,023     | 325 (0.6)      | 670 (1.2)       | 885 (1.5)       |
| Melanoma of skin                           | C43           | 190       | 113 (0.2)      | 309 (0.5)      | 479 (0.8)       | 129       | 87 (0.1)       | 233 (0.4)       | 355 (0.6)       |
| Multiple myeloma                           | C88+C90       | 419       | 212 (0.4)      | 470 (0.8)      | 636 (1.1)       | 320       | 171 (0.3)      | 384 (0.7)       | 526 (0.9)       |
| Nasopharynx                                | C11           | 559       | 410 (0.7)      | 1,031 (1.7)    | 1,514 (2.5)     | 228       | 152 (0.3)      | 390 (0.7)       | 577 (1.0)       |
| Non-Hodgkin lymphoma                       | C82-85,C96    | 3,439     | 1,686 (2.8)    | 4,090 (6.8)    | 5,970 (10.0)    | 2,130     | 1,069 (1.8)    | 2,580 (4.4)     | 3,744 (6.4)     |
| Oesophagus                                 | C15           | 2,450     | 838 (1.4)      | 1,756 (2.9)    | 2,334 (3.9)     | 2,718     | 968 (1.7)      | 2,044 (3.5)     | 2,732 (4.7)     |
| Other pharynx                              | C09-10,C12-14 | 1,819     | 1,133 (1.9)    | 2,828 (4.7)    | 4,197 (7.0)     | 879       | 570 (1.0)      | 1,415 (2.4)     | 2,087 (3.6)     |
| Ovary                                      | C56           | -         | -              | -              | -               | 3,633     | 2,558 (4.4)    | 6,344 (10.9)    | 9,268 (15.9)    |
| Pancreas                                   | C25           | 320       | 76 (0.1)       | 167 (0.3)      | 231 (0.4)       | 255       | 60 (0.1)       | 132 (0.2)       | 183 (0.3)       |
| Prostate                                   | C61           | 3,041     | 2,207 (3.7)    | 5,343 (8.9)    | 7,632 (12.8)    | -         | -              | -               | -               |
| Stomach                                    | C16           | 2,401     | 969 (1.6)      | 2,213 (3.7)    | 3,118 (5.2)     | 1,432     | 594 (1.0)      | 1,363 (2.3)     | 1,926 (3.3)     |
| Testis                                     | C62           | 807       | 546 (0.9)      | 1,588 (2.7)    | 2,610 (4.4)     | -         | -              | -               | -               |
| Thyroid                                    | C73           | 482       | 386 (0.6)      | 1,101 (1.8)    | 1,775 (3.0)     | 1,582     | 1,246 (2.1)    | 3,597 (6.2)     | 5,859 (10.1)    |
| All cancers excl. non-melanoma skin cancer | C00-97/C44    | 60,525    | 32,468 (54.3)  | 79,473 (132.9) | 116,217 (194.3) | 82,931    | 58,577 (100.7) | 151,700 (260.7) | 22,8026 (391.9) |

**Table 2. Estimated number of new cancer cases by age in Pakistani male population, 2012**

| Cancer                                     | Total               | 0-14        | 15-39         | 40-44       | 45-49       | 50-54       | 55-59        | 60-64        | 65-69        | 70-74       | 75+         | Crude | ASR  | CR [0-74] |
|--|---------------------|-------------|---------------|-------------|-------------|-------------|--------------|--------------|--------------|-------------|-------------|-------|------|-----------|
| Bladder                                    | 3,020 (4.8)         | -           | 119           | 107         | 191         | 313         | 386          | 495          | 502          | 418         | 489         | 3.3   | 5.1  | 0.6       |
| Brain, nervous system                      | 2,683 (4.2)         | 301         | 1,044         | 236         | 242         | 248         | 219          | 165          | 119          | 67          | 42          | 2.9   | 3.4  | 0.3       |
| Colorectum                                 | <b>3,138 (4.9)</b>  | 5           | 729           | 233         | 275         | 313         | 345          | 358          | 330          | 259         | 291         | 3.4   | 4.7  | 0.5       |
| Gallbladder                                | 543 (0.9)           | -           | 52            | 27          | 32          | 45          | 71           | 104          | 98           | 64          | 50          | 0.6   | 0.9  | 0.1       |
| Hodgkin lymphoma                           | 1,333 (2.1)         | 237         | 495           | 116         | 117         | 105         | 85           | 64           | 49           | 33          | 32          | 1.5   | 1.7  | 0.1       |
| Kaposi sarcoma                             | 4 (0.0)             | -           | 4             | -           | -           | -           | -            | -            | -            | -           | -           | 0.0   | 0.0  | 0.0       |
| Kidney                                     | 1,071 (1.7)         | 104         | 93            | 66          | 88          | 105         | 126          | 135          | 133          | 105         | 116         | 1.2   | 1.7  | 0.2       |
| Larynx                                     | 3,009 (4.7)         | 6           | 156           | 177         | 285         | 366         | 469          | 508          | 476          | 321         | 245         | 3.3   | 5.0  | 0.6       |
| Leukaemia                                  | 2,872 (4.5)         | 1,020       | 1,003         | 127         | 124         | 133         | 126          | 105          | 90           | 68          | 76          | 3.1   | 3.3  | 0.3       |
| Lip, oral cavity                           | <b>7,068 (11.1)</b> | 27          | 1,501         | 733         | 803         | 810         | 801          | 789          | 675          | 477         | 452         | 7.7   | 10.5 | 1.2       |
| Liver                                      | 2,824 (4.5)         | 11          | 132           | 130         | 254         | 377         | 451          | 449          | 449          | 314         | 257         | 3.1   | 4.7  | 0.6       |
| Lung                                       | <b>5,772 (9.1)</b>  | 5           | 216           | 216         | 359         | 550         | 838          | 1,047        | 1,011        | 767         | 763         | 6.3   | 9.7  | 1.2       |
| Melanoma of skin                           | 196 (0.3)           | 6           | 77            | 25          | 23          | 20          | 16           | 12           | 8            | 5           | 4           | 0.2   | 0.3  | 0.0       |
| Multiple myeloma                           | 423 (0.7)           | 4           | 19            | 14          | 34          | 67          | 79           | 52           | 71           | 45          | 38          | 0.5   | 0.7  | 0.1       |
| Nasopharynx                                | 567 (0.9)           | 8           | 184           | 55          | 65          | 71          | 74           | 41           | 11           | 13          | 45          | 0.6   | 0.8  | 0.1       |
| Non-Hodgkin lymphoma                       | <b>3,721 (5.9)</b>  | 282         | 896           | 258         | 316         | 366         | 388          | 362          | 320          | 249         | 284         | 4.1   | 5.3  | 0.6       |
| Oesophagus                                 | 2,450 (3.9)         | -           | 323           | 152         | 199         | 257         | 323          | 368          | 336          | 248         | 244         | 2.7   | 3.9  | 0.5       |
| Other pharynx                              | 1,819 (2.9)         | -           | 142           | 82          | 117         | 200         | 206          | 259          | 294          | 245         | 274         | 2.0   | 3.0  | 0.4       |
| Pancreas                                   | 320 (0.5)           | -           | 43            | 10          | 47          | 58          | 44           | 37           | 42           | 28          | 11          | 0.4   | 0.5  | 0.1       |
| Prostate                                   | <b>3,041 (4.8)</b>  | -           | 13            | 19          | 31          | 120         | 197          | 459          | 678          | 663         | 861         | 3.3   | 5.3  | 0.7       |
| Stomach                                    | 2,408 (3.8)         | 7           | 300           | 183         | 267         | 286         | 300          | 329          | 294          | 219         | 223         | 2.6   | 3.8  | 0.4       |
| Testis                                     | 870 (1.4)           | 63          | 610           | 69          | 46          | 22          | 14           | 16           | 13           | 9           | 8           | 1.0   | 0.9  | 0.1       |
| Thyroid                                    | 488 (0.8)           | 6           | 184           | 45          | 47          | 52          | 41           | 33           | 38           | 28          | 14          | 0.5   | 0.7  | 0.1       |
| All cancers excl. non-melanoma skin cancer | 63,451 (100)        | 2,926 (4.6) | 11,386 (17.9) | 4,030 (6.4) | 5,051 (8.0) | 6,014 (9.5) | 6,814 (10.7) | 7,465 (11.8) | 7,816 (12.3) | 5,880 (9.3) | 6,069 (9.6) | 69.4  | 96.0 | 10.5      |

Notes: Crude and age-standardized rates (ASR) per 100,000. Cumulative risk (CR) [0-74], percent. bold values indicate cancer types have the highest incidence and mortality.

**Table 3. Estimated number of new cancer cases by age in Pakistani female population, 2012**

| Cancer                                     | Total                | 0-14        | 15-39         | 40-44        | 45-49         | 50-54         | 55-59         | 60-64        | 65-69       | 70-74       | 75+         | Crude | ASR   | CR [0-74] |
|--|----------------------|-------------|---------------|--------------|---------------|---------------|---------------|--------------|-------------|-------------|-------------|-------|-------|-----------|
| Bladder                                    | 947 (1.1)            | 5           | 68            | 35           | 55            | 96            | 115           | 134          | 160         | 134         | 145         | 1.1   | 1.6   | 0.2       |
| Brain, nervous system                      | 1,570 (1.9)          | 219         | 484           | 128          | 171           | 176           | 149           | 111          | 75          | 39          | 18          | 1.8   | 2.1   | 0.2       |
| Breast                                     | <b>34,038 (40.2)</b> | 5           | 8,033         | 4,727        | 5,294         | 4,909         | 4,000         | 2,944        | 2,059       | 1,199       | 868         | 38.4  | 50.3  | 5.2       |
| Cervix uteri                               | <b>5,233 (6.2)</b>   | -           | 971           | 669          | 899           | 978           | 768           | 459          | 278         | 136         | 75          | 5.9   | 7.9   | 0.8       |
| Colorectum                                 | 2,197 (2.6)          | 18          | 559           | 195          | 237           | 254           | 266           | 253          | 199         | 125         | 91          | 2.5   | 3.3   | 0.4       |
| Corpus uteri                               | 2,171 (2.6)          | -           | 198           | 165          | 255           | 340           | 375           | 338          | 246         | 148         | 106         | 2.5   | 3.6   | 0.4       |
| Gallbladder                                | 1,296 (1.5)          | -           | 78            | 88           | 145           | 205           | 237           | 197          | 146         | 99          | 101         | 1.5   | 2.2   | 0.3       |
| Hodgkin lymphoma                           | 667 (0.8)            | 108         | 353           | 46           | 42            | 34            | 25            | 20           | 16          | 11          | 12          | 0.8   | 0.8   | 0.1       |
| Kaposi sarcoma                             | 4 (0.0)              | -           | 4             | -            | -             | -             | -             | -            | -           | -           | -           | 0.0   | 0.0   | 0.0       |
| Kidney                                     | 575 (0.7)            | 65          | 87            | 37           | 59            | 78            | 91            | 79           | 41          | 20          | 18          | 0.6   | 0.9   | 0.1       |
| Larynx                                     | 409 (0.5)            | -           | 43            | 24           | 45            | 56            | 71            | 49           | 26          | 30          | 65          | 0.5   | 0.7   | 0.1       |
| Leukaemia                                  | 1,737 (2.1)          | 444         | 592           | 125          | 134           | 132           | 113           | 83           | 58          | 33          | 23          | 2.0   | 2.2   | 0.2       |
| Lip, oral cavity                           | <b>5,693 (6.7)</b>   | 18          | 940           | 462          | 576           | 736           | 881           | 812          | 631         | 382         | 255         | 6.4   | 9.1   | 1.1       |
| Liver                                      | 1,500 (1.8)          | 5           | 78            | 88           | 165           | 253           | 264           | 245          | 196         | 122         | 84          | 1.7   | 2.5   | 0.3       |
| Lung                                       | 1,028 (1.2)          | 5           | 81            | 38           | 114           | 155           | 150           | 130          | 152         | 114         | 89          | 1.2   | 1.7   | 0.2       |
| Melanoma of skin                           | 129 (0.2)            | -           | 14            | -            | 16            | 28            | 40            | -            | 16          | -           | 15          | 0.1   | 0.2   | 0.0       |
| Multiple myeloma                           | 320 (0.4)            | -           | 17            | 22           | 23            | 29            | 59            | 76           | 63          | 30          | 1           | 0.4   | 0.6   | 0.1       |
| Nasopharynx                                | 228 (0.3)            | -           | 66            | 43           | 25            | -             | 28            | -            | 30          | 8           | 28          | 0.3   | 0.3   | 0.0       |
| Non-Hodgkin lymphoma                       | 2,243 (2.7)          | 113         | 458           | 179          | 228           | 264           | 275           | 232          | 193         | 143         | 158         | 2.5   | 3.4   | 0.4       |
| Oesophagus                                 | <b>2,718 (3.2)</b>   | -           | 433           | 235          | 311           | 307           | 373           | 391          | 314         | 202         | 152         | 3.1   | 4.4   | 0.5       |
| Other pharynx                              | 879 (1.0)            | -           | 153           | 35           | 52            | 117           | 165           | 145          | 101         | 61          | 50          | 1.0   | 1.4   | 0.2       |
| Ovary                                      | <b>3,703 (4.4)</b>   | 70          | 826           | 397          | 503           | 539           | 491           | 393          | 275         | 145         | 64          | 4.2   | 5.6   | 0.6       |
| Pancreas                                   | 255 (0.3)            | -           | 36            | 12           | 6             | 32            | 42            | 48           | 45          | 20          | 14          | 0.3   | 0.4   | 0.1       |
| Stomach                                    | 1,432 (1.7)          | -           | 285           | 162          | 183           | 183           | 179           | 160          | 126         | 83          | 71          | 1.6   | 2.2   | 0.2       |
| Thyroid                                    | 1,587 (1.9)          | 5           | 623           | 189          | 190           | 163           | 136           | 110          | 81          | 50          | 40          | 1.8   | 2.2   | 0.2       |
| All cancers excl. non-melanoma skin cancer | 84,590 (100)         | 1,659 (2.0) | 18,168 (21.5) | 89,08 (10.5) | 11,056 (13.1) | 11,441 (13.5) | 10,734 (12.7) | 8,586 (10.2) | 6,776 (8.0) | 3,980 (4.7) | 3,282 (3.9) | 95.5  | 127.7 | 13.1      |

Notes: Crude and age-standardized rates (ASR) per 100,000. Cumulative risk (CR) [0-74], percent. bold values indicate cancer types have the highest incidence and mortality.

**Table 4. Estimated number of cancer deaths by age in Pakistani male population, 2012**

| Cancer                                     | Total        | 0-14        | 15-39        | 40-44       | 45-49       | 50-54       | 55-59        | 60-64        | 65-69        | 70-74        | 75+          | Crude | ASR  | CR [0-74] |
|--|--------------|-------------|--------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|-------|------|-----------|
| Bladder                                    | 1,825 (3.8)  | -           | 25           | 33          | 58          | 113         | 178          | 253          | 326          | 338          | 501          | 2.0   | 3.1  | 0.4       |
| Brain, nervous system                      | 2,081 (4.3)  | 233         | 554          | 187         | 226         | 241         | 214          | 169          | 125          | 76           | 56           | 2.3   | 2.8  | 0.3       |
| Colorectum                                 | 2,288 (4.7)  | 12          | 384          | 139         | 167         | 207         | 243          | 264          | 275          | 252          | 345          | 2.5   | 3.5  | 0.4       |
| Gallbladder                                | 506 (1.0)    | -           | 37           | 20          | 25          | 36          | 63           | 98           | 99           | 70           | 58           | 0.6   | 0.9  | 0.1       |
| Hodgkin lymphoma                           | 934 (1.9)    | 114         | 168          | 67          | 79          | 87          | 88           | 86           | 84           | 71           | 90           | 1.0   | 1.3  | 0.1       |
| Kaposi sarcoma                             | 3 (0.0)      | -           | 3            | -           | -           | -           | -            | -            | -            | -            | -            | 0.0   | 0.0  | 0.0       |
| Kidney                                     | 891 (1.8)    | 110         | 36           | 27          | 40          | 63          | 88           | 112          | 130          | 122          | 163          | 1.0   | 1.4  | 0.2       |
| Larynx                                     | 1,756 (3.6)  | 4           | 44           | 69          | 127         | 188         | 253          | 303          | 315          | 236          | 217          | 1.9   | 3.0  | 0.4       |
| Leukaemia                                  | 2,598 (5.4)  | 824         | 890          | 106         | 107         | 114         | 113          | 108          | 107          | 97           | 132          | 2.8   | 3.1  | 0.3       |
| Lip, oral cavity                           | 4,046 (8.4)  | 8           | 541          | 351         | 425         | 484         | 513          | 506          | 463          | 359          | 396          | 4.4   | 6.3  | 0.7       |
| Liver                                      | 2,682 (5.5)  | 10          | 100          | 101         | 201         | 313         | 386          | 435          | 455          | 348          | 333          | 2.9   | 4.5  | 0.6       |
| Lung                                       | 5,097 (10.5) | 6           | 108          | 141         | 283         | 473         | 734          | 905          | 917          | 732          | 798          | 5.6   | 8.7  | 1.1       |
| Melanoma of skin                           | 124 (0.3)    | 4           | 32           | 14          | 15          | 15          | 13           | 11           | 8            | 6            | 6            | 0.1   | 0.2  | 0.0       |
| Multiple myeloma                           | 377 (0.8)    | 2           | 6            | 7           | 20          | 50          | 61           | 47           | 74           | 57           | 53           | 0.4   | 0.6  | 0.1       |
| Nasopharynx                                | 382 (0.8)    | 3           | 63           | 27          | 38          | 55          | 60           | 39           | 12           | 18           | 67           | 0.4   | 0.6  | 0.1       |
| Non-Hodgkin lymphoma                       | 2,719 (5.6)  | 195         | 363          | 124         | 166         | 223         | 271          | 301          | 325          | 310          | 441          | 3.0   | 4.2  | 0.5       |
| Oesophagus                                 | 2,241 (4.6)  | -           | 256          | 129         | 172         | 237         | 297          | 321          | 307          | 245          | 277          | 2.5   | 3.6  | 0.4       |
| Other pharynx                              | 1,542 (3.2)  | -           | 79           | 45          | 70          | 112         | 151          | 207          | 267          | 259          | 352          | 1.7   | 2.6  | 0.3       |
| Pancreas                                   | 305 (0.6)    | -           | 29           | 9           | 42          | 53          | 45           | 42           | 43           | 28           | 14           | 0.3   | 0.5  | 0.1       |
| Prostate                                   | 2,356 (4.9)  | -           | 13           | 5           | 4           | 7           | 16           | 110          | 348          | 608          | 1,245        | 2.6   | 3.9  | 0.4       |
| Stomach                                    | 2,249 (4.6)  | 13          | 248          | 155         | 196         | 238         | 272          | 290          | 288          | 245          | 304          | 2.5   | 3.6  | 0.4       |
| Testis                                     | 551 (1.1)    | 77          | 256          | 33          | 29          | 17          | 15           | 27           | 31           | 30           | 36           | 0.6   | 0.7  | 0.1       |
| Thyroid                                    | 260 (0.5)    | -           | 5            | 3           | 6           | 9           | 16           | 30           | 62           | 74           | 55           | 0.3   | 0.4  | 0.1       |
| All cancers excl. non-melanoma skin cancer | 48,449 (100) | 2,390 (4.9) | 6,062 (12.5) | 2,335 (4.8) | 3,163 (6.5) | 4,082 (8.4) | 4,972 (10.3) | 5,684 (11.7) | 6,637 (13.7) | 5,802 (12.0) | 7,322 (15.1) | 53.0  | 75.4 | 8.5       |

Notes: Crude and age-standardized rates (ASR) per 100,000.

Cumulative risk (CR) [0-74], percent.

bold values indicate cancer types have the highest incidence and mortality.

**Table 5. Estimated number of cancer deaths by age in Pakistani female population, 2012**

| Cancer                                     | Total                | 0-14        | 15-39        | 40-44       | 45-49        | 50-54        | 55-59        | 60-64        | 65-69        | 70-74       | 75+         | Crude | ASR  | CR [0-74] |
|--|----------------------|-------------|--------------|-------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------|------|-----------|
| Bladder                                    | 571 (1.1)            | 3           | 16           | 11          | 20           | 35           | 50           | 71           | 105          | 110         | 150         | 0.6   | 1.0  | 0.1       |
| Brain, nervous system                      | 1,259 (2.4)          | 183         | 255          | 105         | 142          | 163          | 148          | 116          | 82           | 44          | 21          | 1.4   | 1.8  | 0.2       |
| Breast                                     | <b>16,232 (30.8)</b> | -           | 2,824        | 1,827       | 2,164        | 2,240        | 2,053        | 1,745        | 1,409        | 986         | 984         | 18.3  | 25.2 | 2.8       |
| Cervix uteri                               | <b>2,876 (5.5)</b>   | -           | 223          | 263         | 421          | 545          | 508          | 382          | 272          | 157         | 105         | 3.2   | 4.7  | 0.5       |
| Colorectum                                 | 1,615 (3.1)          | 45          | 319          | 125         | 149          | 177          | 197          | 195          | 171          | 121         | 116         | 1.8   | 2.5  | 0.3       |
| Corpus uteri                               | 797 (1.5)            | -           | 22           | 22          | 38           | 71           | 112          | 140          | 152          | 119         | 121         | 0.9   | 1.4  | 0.2       |
| Gallbladder                                | 1,215 (2.3)          | -           | 58           | 65          | 120          | 184          | 213          | 190          | 153          | 111         | 121         | 1.4   | 2.1  | 0.2       |
| Hodgkin lymphoma                           | 469 (0.9)            | 67          | 137          | 32          | 35           | 33           | 31           | 32           | 33           | 29          | 40          | 0.5   | 0.7  | 0.1       |
| Kaposi sarcoma                             | 3 (0.0)              | -           | 3            | -           | -            | -            | -            | -            | -            | -           | -           | 0.0   | 0.0  | 0.0       |
| Kidney                                     | 483 (0.9)            | 78          | 40           | 17          | 35           | 57           | 74           | 77           | 47           | 28          | 30          | 0.5   | 0.8  | 0.1       |
| Larynx                                     | 240 (0.5)            | -           | 11           | 10          | 22           | 29           | 39           | 30           | 18           | 23          | 58          | 0.3   | 0.4  | 0.0       |
| Leukaemia                                  | 1,582 (3.0)          | 364         | 540          | 107         | 113          | 115          | 104          | 83           | 65           | 45          | 46          | 1.8   | 2.0  | 0.2       |
| Lip, oral cavity                           | <b>3,220 (6.1)</b>   | 6           | 279          | 215         | 317          | 444          | 524          | 511          | 423          | 277         | 224         | 3.6   | 5.4  | 0.7       |
| Liver                                      | 1,433 (2.7)          | 4           | 61           | 74          | 142          | 209          | 243          | 236          | 210          | 141         | 113         | 1.6   | 2.5  | 0.3       |
| Lung                                       | 916 (1.7)            | 6           | 50           | 30          | 97           | 131          | 127          | 129          | 140          | 107         | 99          | 1.0   | 1.6  | 0.2       |
| Melanoma of skin                           | 81 (0.2)             | -           | 4            | -           | 8            | 15           | 25           | -            | 13           | -           | 16          | 0.1   | 0.1  | 0.0       |
| Multiple myeloma                           | 279 (0.5)            | -           | 6            | 11          | 14           | 20           | 48           | 72           | 69           | 38          | 1           | 0.3   | 0.5  | 0.1       |
| Nasopharynx                                | 150 (0.3)            | -           | 20           | 19          | 13           | -            | 21           | -            | 30           | 9           | 38          | 0.2   | 0.2  | 0.0       |
| Non-Hodgkin lymphoma                       | 1,655 (3.1)          | 79          | 199          | 85          | 120          | 161          | 190          | 197          | 199          | 180         | 245         | 1.9   | 2.7  | 0.3       |
| Oesophagus                                 | <b>2,507 (4.8)</b>   | -           | 381          | 206         | 251          | 307          | 347          | 343          | 293          | 201         | 178         | 2.8   | 4.0  | 0.5       |
| Other pharynx                              | 755 (1.4)            | -           | 98           | 22          | 35           | 90           | 129          | 130          | 105          | 74          | 72          | 0.9   | 1.3  | 0.2       |
| Ovary                                      | <b>2,726 (5.2)</b>   | 24          | 237          | 205         | 315          | 415          | 457          | 423          | 340          | 199         | 111         | 3.1   | 4.5  | 0.6       |
| Pancreas                                   | 247 (0.5)            | -           | 23           | 10          | 5            | 31           | 42           | 50           | 48           | 22          | 16          | 0.3   | 0.4  | 0.1       |
| Stomach                                    | 1,334 (2.5)          | -           | 242          | 137         | 151          | 161          | 162          | 150          | 131          | 97          | 103         | 1.5   | 2.1  | 0.2       |
| Thyroid                                    | 759 (1.4)            | -           | 20           | 14          | 28           | 29           | 61           | 115          | 155          | 152         | 185         | 0.9   | 1.4  | 0.2       |
| All cancers excl. non-melanoma skin cancer | 52,664 (100)         | 1,416 (2.7) | 7,728 (14.7) | 4,094 (7.8) | 5,604 (10.6) | 6,615 (12.6) | 6,998 (13.3) | 6,400 (12.2) | 5,821 (11.0) | 3,939 (7.5) | 4,049 (7.7) | 59.5  | 83.6 | 9.2       |

Notes: Crude and age-standardized rates (ASR) per 100,000. Cumulative risk (CR) [0-74], percent. bold values indicate cancer types have the highest incidence and mortality.



**Table 6. Top 5 cancers in Pakistan**

| 5-year prevalence                     | Incidence                             | Mortality                             |
|---------------------------------------|---------------------------------------|---------------------------------------|
| Breast (n = 119710, 34.8%)            | Breast (n = 34038, 23%)               | Breast (n = 16232, 16.1%)             |
| Lip and oral cavity (n = 30647, 8.9%) | Lip and oral cavity (n = 12761, 8.6%) | Lip and oral cavity (n = 7266, 7.2%)  |
| Cervix uteri (n = 15232, 4.5%)        | Lung (n = 6800, 4.6%)                 | Lung (n = 6013, 5.9%)                 |
| Colorectum (n = 11917, 3.5%)          | Non-hodgkin lymphoma (n = 5964, 4%)   | Oesophagus (n = 4748, 4.7%)           |
| Bladder (n = 10338, 3.0%)             | Colorectum (n = 5335, 3.6%)           | Non-hodgkin lymphoma (n = 4374, 4.3%) |

#### 4. Discussion

The most prevalent, frequently diagnosed and top most cause of cancer death in female population of Pakistan is breast cancer, having an estimated 5-year prevalence of 119,710 cases, 34,038 newly diagnosed cases and 16,232 deaths in 2012 (Table 6). Breast cancer encompasses almost 23% (25.1% worldwide) of all newly diagnosed cases of cancer and 16.1% (15% worldwide) of all deaths due to cancer among female population. Almost one-half of all breast cancer cases and 38% of deaths due to breast cancer occur in the more developed countries (International Agency for Research on Cancer, 2012a). The global variation in the incidence and prevalence rates of breast cancer is due to the differences in risk factors and availability of early detection. Risk factors associated with breast cancer are based on reproductive as well as hormonal factors such as a long menstrual history, never having children and recent use of oral contraceptives (Schottenfeld, 2006). The risk of breast cancer is decreased in lactating women and those giving birth to children (Schottenfeld, 2006). The risk factors which can be potentially modified comprise weight gain after age 18 years, physical inactivity, being overweight or obese (for postmenopausal breast cancer), alcohol consumption, using menopausal hormone therapy (combined estrogen and progestin) (Chlebowski et al., 2013). It was seen that the incidence rates of breast cancer peaked to almost 30% in Western countries, most probably due to alteration in reproductive factors, use of menopausal hormone therapy and due to increased screening (Althuis, Dozier, Anderson, Devesa, & Brinton, 2005). The decrease in the incidence rates observed in the early 2000s is due to the decrease in the use of menopausal hormone therapy in countries where it was initially common, such as the United States (US), Australia, the United Kingdom (UK) and France (Canfell, Banks, Moe, & Beral, 2008; Cronin, Ravdin, & Edwards, 2009; DeSantis, Siegel, Bandi, & Jemal, 2011; Parkin, 2009; Ravdin et al., 2007; Seradour, Allemand, Weill, & Ricordeau, 2009). Apart from the changes in use of menopausal hormone therapy, decreased or stable incidence rates in Western countries might be attributed to the participation in mammographic screening (Youlten et al., 2012). However, the death rates due to breast cancer are either stable or there is a decrement since around 1990 in Northern America and in the European countries with a higher-resource. This decrease can be attributed both to the early detection through mammography and improved treatment, even though the individual contributions of these factors is still not clear. The incidence rates of breast cancer have been rising in various countries of South America, Africa, and Asia (i.e. Pakistan) (Parkin, Whelan, Ferlay, & Storm, 2005). The exact reasons are yet unknown; however, changing reproductive patterns, breast cancer screening activity, increasing obesity and decreasing physical activity might be some of the reasons (Colditz, Sellers, & Trapido, 2006). These countries are also associated with an increased mortality rates, most probably due to lifestyle changes linked with westernization along with the delayed introduction of effective breast cancer screening programs and limited accessibility to treatment in some cases (Jemal, Center, DeSantis, & Ward, 2010). The risk of developing breast cancer can be alleviated to a larger extent by maintaining a healthy body weight, increasing physical activity, and decreasing the intake of alcohol. The early stage of breast cancer can often be detected through mammography, where it can be cured and treated more effectively. On the other hand, mammography screening cannot be termed as an effective method. All breast cancers cannot be detected by a mammogram, and certain breast cancers which are screen-detected might have a poor prognosis. It might be possible that mammography may lead to false-positive results, over-diagnosis and

over-treatment of some breast cancers. Despite these shortcomings, early detection via mammography may save lives and increases treatment options. Implementing population based, organized mammography screening programs is quite costly, especially for the less developed countries like Pakistan, hence it is a suggested method for those countries which are financially stable, possessing a good health infrastructure that can afford the expenses of long-term screening programs. Apart from this, the recommended strategies for early detection include responsiveness to early signs and symptoms, and screening via clinical breast examination.

Lip and oral cavity cancer is the second most prevalent, frequently diagnosed and leading cause of cancer death in Pakistan, with an estimated 5-year prevalence of 30,647 cases, 12,761 newly diagnosed cases and 7,266 deaths in 2012 (Table 6). Lip and oral cavity cancer accounts for 8.6% (2.1% worldwide) of all new cancer cases and 7.2% (1.8% worldwide) of all cancer deaths in Pakistan. Almost 66.4% of all lip and oral cavity cancer cases and 77.2% of deaths due to this cancer is in the less developed countries (International Agency for Research on Cancer, 2012a). Main risk factors associated with the cancer of lip and oral cavity include tobacco smoke from cigarettes, cigars, or pipes; poor nutrition, drinking alcohol, betel quid and gutka; ultraviolet light, and HPV infection (American Cancer Society, 2016). The areas of the lips that come in contact with the pipe stem are prone to the risk of lip and oral cavity cancer. One point must be kept in mind that the smokers who have received the treatment for oral cavity or oropharyngeal cancer must refrain from smoking, even in case their cancer appears to be cured. If such a person continues to smoke then the risk of acquiring cancer of mouth, larynx, throat or lung increases many folds. The oral tobacco products such as snuff or chewing tobacco are associated with the cancers of cheek, gums, and inner surface of the lips. Long term usage of oral tobacco products poses a high level of risk. Such products leads to diseases of gums, damage to the bone sockets around teeth, and tooth loss. Similarly, it is quite vital that the people treated for oral cavity or oropharyngeal cancer need to stop using any tobacco containing product (Torre et al., 2015). Many people in Southeast Asia, South Asia (i.e. Pakistan), and certain other parts of the world chew betel quid, comprising of areca nut and lime wrapped in a betel leaf. Inhabitants of these areas also chew gutka which is made up of betel quid and tobacco. People consuming betel quid or gutka are more prone to the cancer of the oral cavity (American Cancer Society, 2016).

Lung cancer is the third most commonly diagnosed and leading cause of cancer death in Pakistan, with an estimated 6,800 (4.6%) new cases and 6,013 (5.9%) deaths occurring in 2012 (Table 6). According to an estimate in 2012, almost 1.8 million new lung cancer cases and 1.6 million cancer deaths occurred worldwide in 2012, accounting for about 13% of total cancer diagnoses and 19.4% of total cancer deaths (International Agency for Research on Cancer, 2012a). More than 50% of deaths due to lung cancer were reported from China and other East Asian countries (Straif, Cohen, & Samet, 2013). The difference in the rates and trends of lung cancer internationally might be due to the diversity of the stage and degree of the tobacco epidemic (Bray & Weiderpass, 2010; Thun, Peto, Boreham, & Lopez, 2012). Multiple Western countries including Denmark, US and UK, which are linked with the tobacco epidemic from earliest time and reaching its maximum in the middle of the last century; have decreased mortality rates of lung cancer in men and increased in women (Torre, Siegel, Ward, & Jemal, 2014). The similar trend can be seen in countries like Spain and Hungary, in which the epidemic of tobacco rose later (Torre et al., 2014). However, in regions like Pakistan, Indonesia, China and some countries of Africa, where the epidemic has recently established and smoking has either increased or is continuously increasing, the rates of lung cancer are probably like to keep on increasing at least for the coming few decades, excluding interventions for smoking cessation and avoid initiation (Jha, 2009). Indoor air pollution resulting from unventilated coal-fueled stoves and cooking fumes (International Agency for Research on Cancer, 2012b), contact with certain occupational and environmental cancer causing agents like asbestos, radon, polycyclic aromatic hydrocarbons and arsenic also serve as risk factors for lung cancer (Fraumeni & Schottenfeld, 2006). Moreover, outdoor pollution is now also linked with lung cancer (Hamra et al., 2014). Lung cancer is among those cancers which could be prevented. Majority of the lung cancers can be evaded through eliminating smoke initiation and promoting smoking cessation among the current smokers.

For this purpose an extensive tobacco control program is required which demands increasing the price of tobacco products through excise taxes, prohibiting smoking in public places and supply of tobacco to minors, banning the advertisement and promotion of tobacco, counter advertising and provision of treatment and counseling to the tobacco dependent people. Adequate tobacco control program in various states of the US such as California and New York have resulted in remarkable decrement in smoking rates, ultimately resulting in decreased occurrence of lung cancer (Centers for Disease Control and Prevention, 2011). Many populous countries of the developing world such as China, Pakistan and India are just in the initial stages of tobacco epidemic. If more adequate measures are taken by these and other developed countries to encourage the cessation of smoking and to preclude its initiation, then it may not only remarkably decrease the rates of lung cancer but may also circumvent the burden of diseases related to smoking seen in developed countries.

Colorectum cancer is the fourth most prevalent and fifth most commonly diagnosed cancer in Pakistan, with an estimated 5-year prevalence of 11,917 (3.5%) cases, 5,335 (3.6%) newly diagnosed cases and 3,903 (3.9%) deaths occurring in 2012. According to some other studies, Australia/New Zealand, Northern America and Europe have the maximum incidence rates of colorectal cancer; whereas, Africa and South-Central Asia have a low incidence rate. Globally the rates of colorectal cancer are higher in male population as compared to female population (Torre et al., 2015). Smoking, unhealthy diet and obesity are some of the risk factors of this cancer (Center, Jemal, Smith, & Ward, 2009). By maintaining a healthy body weight, staying physically active, avoiding smoking and reducing the utilization of alcohol and red and processed meat may help to prevent this cancer to a larger extent (Botteri et al., 2008; Ferrari et al., 2007). Screening may lead to the detection of colorectal polyps which can be removed before they turn in to a lethal cancerous form; moreover, cancer which is in early stage can also be detected through screening which can be treated in a more successful way. It is generally not recommended to carry out population-based colorectal screening programs in the countries which are less developed and do not have a sufficient high incidence of disease to merit screening programs (Lambert, Sauvaget, & Sankaranarayanan, 2009). It is need of the time that in future special focus must be laid upon certain areas of developing world which have a western lifestyle with an increasing and aging population.

Non-hodgkin lymphoma is the fourth most frequently diagnosed and fifth leading cause of cancer death in Pakistan. An estimated 5,964 new cases of non-hodgkin lymphoma and 4,374 deaths occurred in Pakistan in 2012. Non-hodgkin lymphoma has various subtypes, each with a different incidence patterns. It is commonly found in developed areas like Australia, Northern America and Western and Northern Europe, which have highest incidence rates. In contrast to these countries, Asia and Eastern Europe have the lowest incidence rates (Torre et al., 2015). The risk factors for lymphoma are not clearly recognized; however, most of them are linked with an altered immune function. The risk of non-hodgkin lymphoma rises many folds in individuals who use immune suppressive agents for preventing organ transplant rejection, the people who are sufferers of severe autoimmune conditions, and in the individuals who are infected with human immunodeficiency virus, hepatitis C virus and human T-cell leukemia virus type I. Non-hodgkin lymphoma can be termed as an acquired immune deficiency syndrome (AIDS)- defining illness, whose risk is 60 times more in the sufferers of AIDS as compared to the general healthy population (Beral, Peterman, Berkelman, & Jaffe, 1991).

## 5. Limitations

The facts and figures presented by GLOBOCAN are collected through various methods depending upon the availability of data at country level related to the prevalence, incidence and mortality of cancer. Consequently, it must be kept in mind that the estimates provided by the GLOBOCAN 2012 may vary in accuracy, according to the validity and extent of data available, varying from the factual and valid counts of cases and deaths to approximation relying on samples or neighboring rates. PBCR covered almost 21% of the world's population in 2005 (Parkin, 2006); whereas, one-third of it was covered by means of mortality schemes based on medically certified deaths (Mathers, Ma Fat, Inoue, Rao, & Lopez, 2005). A scoring system has been made for indicating both the quality and

accuracy of estimate, which can assist the users to evaluate the data pertaining to each country in GLOBOCAN (these scores are accessible online at [globocan.iarc.fr](http://globocan.iarc.fr)). It is noteworthy that the quality as well as the availability of data are upgrading over time, which in turn is driven in most of the cases by the initiative for developing incidence of cancer and registration of mortalities. Regardless of these shortcomings, the estimates from GLOBOCAN 2012 are the most reliable statistics related to cancer and serve as genuine base to establish priority to control cancer in different parts of the world.

## 6. Conclusions

Cancer poses an emerging and potentially significant health burden in Pakistan and it is expected that this burden will increase in the times to come due to growth and aging of the population, and because of adopting such behaviors and lifestyle factors which leads to cancer. An increased frequency of cancers of breast, lip and oral cavity, lung, non-hodgkin lymphoma, colorectum, cervix uteri, esophagus and bladder are experienced in Pakistan. The burden of cancers can be prevented in Pakistan to a larger extent by promoting knowledge related to cancer control, comprising of tobacco control, timely detection, vaccination (for liver and cervical cancers), and encouraging physical activity and healthy dietary patterns. Appropriate therapy and palliative care may preclude additional suffering and premature death due to cancer. In order to eradicate the evil burden of cancer, a harmonized and intensified response is required from every segment of society, including contribution from governments, private sector, civil society and the individuals as well.

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