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# Early Direct Costs of Diagnostic and Therapeutic Services for Patients with Cancer: A Descriptive Study in Semnan, Iran, 2011 - 2014

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## Abstract

**Objectives:** Knowledge about the pattern and direct costs of medical services allocated to a given disease in a particular community can help to realize its economic burden in that community better regarding its socioeconomic features. A significant part of medical diagnostics and therapeutics for patients with cancer is made within three to six months after its detection, and their related costs are named as early direct costs. The current study aimed at evaluating the early direct costs of the incidence of cancer in a sample of Iranian patients.

**Methods:** The current descriptive study was conducted on some patients with cancer referred to the only oncology clinic in Semnan city, Iran, from 2011 to 2014 for chemotherapy. Some primary information about the type of services received and their direct costs, and also some demographics and social characteristics were gathered from patients' medical records. Costs were converted to US dollars and their means ± standard deviation (SD) were reported.

**Results:** Fifty patients participated in the study. The most common types of cancer were breast cancer (n = 18, 36%), followed by colorectal cancer (n = 13, 26%). Other types included the esophagus, gastric, pancreas, lymphoma, ovarian, leukemia, and nasopharyngeal carcinomas. The mean ± SD of cost for doctor visits was US$1666.58 ± 41.64, US$221.97 ± 149.72, for imaging, US$200.55 ± 86.62 for lab tests, US$693.70 ± 530.90 for drugs, US$375.18 ± 156.89 for chemotherapy, US$492.03 ± 774.87 for surgical hospitalization, and US$75.86 ± 40.26 for non-surgical services, with the total average cost of US$2164.52 ± 1156.56. The total calculated early direct costs to manage colorectal cancer were estimated US$3017.26, and for breast cancer US$1923.23. No difference was observed in the costs of services including doctor's visits, imaging, laboratory tests, medications, or non-surgical services among the different subtypes of cancers; however, higher costs for chemotherapy and surgical services were specified to colorectal cancer.

**Conclusions:** The study findings suggested that the economic burden of colorectal cancer in Iran was larger than the other types of cancer regarding its early direct costs.

*Keywords:* Cancers, Cost of Illness, Economics

## 1. Background

Cancer is one of three main causes of death worldwide with a multi-factorial genetic and environmental etiology leading to high rates of mortality and disability. In fact, cancer is increasingly one of the most prevalent diseases in the world in the coming decades with an expected prevalence of 51 million by 2020 (1, 2). Cancer can affect the individual and society in various aspects such as financial concerns. Diagnosis and treatment of cancer are often complex, time consuming, and expensive; therefore, advances in its diagnosis and treatment leads to an inevitable increase in the related costs (3-5). Many patients should pass costly diagnostic and therapeutic courses including biopsy, imaging, surgery, chemotherapy, radiotherapy, and taking certain drugs. Many people may not have direct access to such measures and thus additional fees are compelled to achieve such essential services (6, 7). It is a fact that the costs imposed on patients in each disease undeniably depend on the continued treatment and expected success. Financial pressures are certainly affecting the treatment management of patients (8). In many cases, the patient is forced to bear the heavy and huge payments for treatment. It is also possible to ignore therapeutic proce-

dures due to financial debility (9, 10).

Knowledge of the patterns of medical diagnostic services and costs related to a specific disease at any time and in every region, as an inevitable necessity, can help to estimate the burden and cost of a particular disease in the community. In fact, the aim of the studies examining the costs of diseases is to identify and estimate the amount and pattern of expenditures imposed on patients and society at various stages of diagnosis and treatment to finally anticipate the necessary and sufficient resources for the costs (11). These costs can be categorized into three direct, indirect, and intangible groups. Direct costs of diagnosis and treatment are a part of the financial resources that should be paid to the service provider including physician office visits, tests, expensive drugs, chemotherapy, surgery and biopsy, imaging, and home nursery costs (12). Indirect costs include costs caused by the lack of manpower or shortage of productive forces due to death and disability. Some costs imposed by illness may be completely intangible such as the inability caused by the disease, loss of job, or poverty (12).

## 2. Objectives

According to the importance of this subject and considering that a few number of the studies evaluating the costs of treatment for patients with cancer in the country, the current prospective study aimed at evaluating the direct costs of cancer at early stages of diagnosis (three to six months after diagnosis) in a sample of Iranian patients.

## 3. Methods

The current cross sectional study was conducted on 50 patients with cancer at the beginning of the diagnosis, referred to oncology clinics in Semnan city, Iran from 2012 to 2014 to undergo chemotherapy. The samples were selected through census method and convenient sampling approach. Initially, patients were interviewed by the authors. The study objectives were explained to the patients, and the interested candidates signed informed consent form and were interviewed to participate in the study. Each patient was given an identification code to follow. Then, the personal and demographic information, as well as the details of provided services were asked and recorded on the coding form. To collect information about the services and costs, a specific questionnaire was used. The patients were asked about the type of service, diagnosis, and treatment costs during the initial phase of diagnosis (three to six months after diagnosis). To complete the information, all patients were asked to provide documents or bills related to the type and cost of services. In general, each patient had at least three appointments and interviews. With this approach, data were collected on the type and cost of services. If the patient was not informed about the cost of services or if he could not provide documents/bills of costs, the costs were estimated and recorded according to the patients' statements or based on tariffs. Results were presented as mean $\pm$ standard deviation (SD) for quantitative variables, and were summarized by absolute frequencies and percentages for categorical variables. Categorical variables were compared using chi-square or Fisher exact test. Quantitative variables were also compared with the Mann-Whitney U test. $P \leq 0.05$ was considered as the level of significance. All statistical analyses were performed with SPSS version 19.0 (SPSS Inc., Chicago, Illinois).

## 4. Results

Totally, 50 patients with different types of cancers were assessed (some demographic characteristics of the studied patients are presented in Table 1). The most common types of cancers included breast cancer (36%), followed by colorectal cancer (26%), and other types were the esophagus, gastric, pancreas, lymphoma, ovarian, leukemia, and nasopharyngeal carcinomas. The mean age of the patients was 49.86 $\pm$ 12.37 years ranging from 29 to 77 years and 64% were female. With regard to residency, 92% resided in urban areas and the others in rural areas. Regarding occupational status, 56% were housewives, 16% retired, 14% self-employed, and 14% were employed. Regarding the educational level, 10% were illiterate, 24% had primary education, 16% had secondary education, 28% had a high school diploma, and others had a college degree. Economically, and considering the actual US dollar exchange rate as 36,500 Rials, 16% had a monthly income less than US$137, 58% from US$138 to US$274, 18% from US$275 to US$411, 6% from US$412 to US$548, and only 2% had an income higher than US$548 (see the self-reported incomes in Rials in Table 1). Regarding insurance status, 56% were covered by social security, 8% by charity committee, and 72% had complementary health insurance. The mean length of hospital stay for surgical services was 4.83 $\pm$ 3.83 days, ranging from 1 to 16, and for non-surgical cares was 6.31 $\pm$ 5.35 days, ranging from 2 to 20.

The details of the early direct costs are summarized in Table 2. According to these data, the average cost of doctor visits was US$1666.58 $\pm$ 41.64, imaging US$221.97 $\pm$ 149.72 , lab tests US$200.55 $\pm$ 86.62 , medicine US$693.70 $\pm$ 530.90 , chemotherapy US$375.18 $\pm$ 156.89 , surgical hospitalization US$492.03 $\pm$ 774.87 , and non-surgical services US$75.86 $\pm$ 40.26 , with the total cost of US$2164.52 $\pm$ 1156.56. The

**Table 1.** Characteristics of the Studied Patients

| Characteristic | No. (%) |
|---|---|
| **Gender** | |
| Male | 18 (36) |
| Female | 32 (64) |
| **Type of cancer** | |
| Breast | 18 (36) |
| Colon | 13 (26) |
| Lymphoma | 6 (12) |
| Gastric | 5 (10) |
| Pancreas | 4 (8) |
| Ovary | 1 (2) |
| Esophagus | 1 (2) |
| Nasopharynx | 1 (2) |
| Leukemia | 1 (2) |
| **Job** | |
| Housewife | 28 (56) |
| Retired | 8 (16) |
| Government employee | 7 (14) |
| Not-government employee | 7 (14) |
| **Education** | |
| Illiterate | 5 (10) |
| Elementary | 12 (24) |
| Lower than diploma | 8 (16) |
| Diploma | 14 (28) |
| Associated degree | 4 (8) |
| Bachelor's degree | 6 (12) |
| Master's degree and higher | 10 (20) |
| **Income, IR Rials** | |
| < 5 million | 8 (16) |
| 5 - 10 million | 29 (58) |
| 10 - 15 million | 9 (18) |
| 15 - 20 million | 3 (6) |
| 20 million and above | 1 (2) |
| **Type of insurance** | |
| Rural health insurance | 2 (4) |
| Government employee health insurance | 7 (14) |
| Health insurance for other social strata | 7 (14) |
| Iranians health insurance | 1 (2) |
| Social security insurance | 28 (56) |
| Self-ordered health insurance | 1 (2) |
| Health insurance for armed forces employee | 3 (6) |
| **Year of diagnosis** | |
| 2011 | 1 (2) |
| 2012 | 2 (4) |
| 2013 | 35 (70) |
| 2014 | 12 (24) |
| **Total** | 50 (100) |

cost of different services was independent of baseline characteristics including gender, residency, coverage by charity committee, or complementary health insurance. As shown in Table 3, no difference was observed in the costs of some services including doctor's visits, imaging, laboratory tests, medications, or non-surgical services between the different subtypes of cancers; however, higher costs for both chemotherapy and surgical services were specific to colorectal cancer. In this regard, the total cost to manage colorectal cancer was estimated US$3017.26, and for breast cancer US$1923.23.

**Table 2.** The Mean Total Costs for any Services Regardless of the Type of Cancer (in US Dollars)

| Service | Mean ± SD | Minimum | Maximum |
|---|---|---|---|
| **Doctor visits** | 166.65± 41.64 | 82.19 | 260.27 |
| **Imaging** | 221.97 ± 149.72 | 6.84 | 808.21 |
| **Lab tests** | 200.55 ± 86.62 | 57.53 | 630.13 |
| **Drugs** | 693.70 ± 530.90 | 16.43 | 2739.72 |
| **Chemotherapy** | 375.18 ± 156.89 | 35.61 | 821.91 |
| **Surgery services** | 492.03 ± 774.87 | 54.79 | 5205.47 |
| **Non-surgical services** | 75.86 ± 40.26 | 2.73 | 164.38 |
| **Total** | 2164.52 ± 1156.56 | 1101.36 | 8136.98 |

## 5. Discussion

According to recent international reports, the highest direct costs related to managing cancer are in the initial year of diagnosis followed by in the last year of life. In this regard, the highest costs for cancer care are specified to lung and colorectal cancers and the lowest to breast and prostate cancers (13, 14). According to the current study findings and similar to previous reports, those patients with colorectal cancer have the highest cancer caring financial burden. In this regard, the highest and lowest expenditures were attributed to surgical interventions and providing drugs. Different reports on the prevalence of colorectal cancer in Iran show an increasing trend within recent years (15-19).

In addition to the late diagnosis of the disease as the main reason for this upward trend, high expenditures of colorectal cancer caring, and financial debility of the affected people are other causes of increasing trend of this type of cancer. Furthermore, low rate of coverage by health insurance in most of the patients is a major cause for the unwillingness of patients to follow-up warning signs leading to late diagnosis and obtaining poor outcomes. The current study results showed that 28.8% of total expenditures for caring colorectal cancer are specified to providing drugs, and 30.3% to surgical interventions. Also, regarding the expenditures for caring breast cancer, 37.7% of expenditures are specified to providing drugs and 14.3%

**Table 3.** The Costs for any Services With Regard to the Type of Cancer (in US Dollars)

| Service | Breast | Colorectal | Other | P Value |
|---|---|---|---|---|
| **Doctor visits** | 163.56 ± 36.72 | 180.17 ± 42.42 | 160.35 ± 45.42 | 0.39 |
| **Imaging** | 217.81 ± 118.71 | 241.83 ± 194.08 | 212.33 ± 148.99 | 0.85 |
| **Lab tests** | 192.39 ± 65.83 | 220.78 ± 123.27 | 189.62 ± 73.98 | 0.42 |
| **Drugs** | 747.64 ± 37.51 | 902.22 ± 80.14 | 499.92 ± 36.37 | 0.09 |
| **Chemotherapy** | 300.47 ± 107.53 | 505.37 ± 143.18 | 356.88 ± 155.69 | 0.01 |
| **Surgery services** | 283.86 ± 123.40 | 949.42 ± 139.65 | 369.86 ± 28.59 | 0.04 |
| **Non-surgical services** | 78.77 ± 23.39 | 136.98 ± 27.40 | 75.85 ± 42.92 | 0.28 |

to surgeries. Along with the high expenditures of caring and diagnosing cancers, more than two-thirds of the affected patients had monthly income less than $270 and only half of the patients were covered by the social security. On the other hand, financial debility and low rate of insurance coverage are the two major causes of imbalance between cancer incidence and the related cancer caring. Fortunately, the current government took steps toward public health insurance; leading to high insurance coverage nationwide, and appropriate control over the direct costs of cancer caring. These efforts can be very valuable for financially aiding the affected patients with colorectal cancers due to its considerably high caring expenditures.

One of the main important points in the current study was the low mean age of the patients with different types of cancers in the population under study that was much lower than that of the Western countries (20-23). According to the reports by Davari et al. (24), 33% of the patients with colorectal cancers were under 50 years old; the statistics given in the second international digestive cancer congress stated that 45% - 47% of the patients with colorectal cancers in Iran were under 50 years old (25). This is while this ratio in European countries was below 20% in 2004 (25). Also, regarding the prevalent age group of patients with breast cancer in Iran, the mean age of patients with this cancer is reported < 55 years with an increased annual incidence rate of 6.2% in the age group of 40 - 44 years, and 5.3% in the age group of 45 to 59 years (26, 27). The prevalence of breast cancer in Western Europe and Northern America is 8% to 10% and in Asian countries is approximately 1% (28). In Iran, 6.7 females per 1,000 are diagnosed with this disease (29). Breast cancer also constitutes 21.4% of all cancers among Iranian females (30). These findings suggest that the burden of colorectal and breast cancers in Iran is larger than that of the Western countries; suggesting this fact that patients face higher direct costs of caring for such cancers in Iran. Due to the relatively short duration of follow-up, as well as the small number of patients, the study could only compare the main types of cancers in terms of cost, which was the most important limitation of the current study.

In conclusion, colon and breast cancers were the most expensive cancers in the studied population. Therefore, it is better to plan preventive and screening programs to prevent imposing enormous costs on patients and their families. In this regard, policymakers should consider additional insurance protection policies to minimize this financial burden.

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## Footnotes

**Conflict of Interests:** Authors declared no conflict of interest.

**Ethical Considerations:** The study protocol was approved by the Ethics Committee of Semnan University of Medical Sciences and all the procedures were in accordance with the ethical principles and standards for medical research in Iran (ethical code: IR.SEMUMS.REC.1397.261).

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