



The Economic Burden of Cancer in Iran during 1995-2019: A Systematic Review

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Abstract

Background: Cancer is the third cause of death following cardiovascular disease and accidents, in Iran. The purpose of this study was to systematically review the economic burden of cancer studies in Iran.

Methods: This systematic review examined the types of direct medical and non-medical costs and indirect costs in cancer patients and includes studies in English and Persian that were reviewed in Scopus, Web of science, SID, Iranmedex, Magiran and databases of Medline, etc., from 1995-2019.

Results: Twenty-one articles were included. Most studies have examined the direct costs of all types of cancers. The articles reviewed different types of cancer, such as prostate cancer (n=2), colorectal cancer (n=2), breast cancer (n=4), gastric cancer (n=2), oral and pharyngeal cancer (n=1), lung cancer (n=3), and blood cancer (n=4). The great number of studies were related to the gastrointestinal, breast and blood cancers. The gastrointestinal (gastric and colorectal) and breast cancer had the major economic burden than others.

Conclusion: It is necessary that special attention to patients, supportive measures to reduce the share of costs, and more budget allocation for prevention, screening and early detection being at priorities in the health system planning.

Keywords: Cancer; Economic burden; Iran; Direct medical costs; Indirect costs; Systematic review

Introduction

Cancer is a lethal disorder caused by destructive effect of heredity and environmental factors on human genes (1). According to the worldwide reports of International Agency for Research on Cancer (IARC), 18,000,000 new cases suffered from cancer and 9,500,000 of patients died (2). Moreover, it is predicted that the new diagnosed

cancer patients increased to 27,500,000 and 16,300,000 of patients died till 2040 (3).

Based on the GLOBALCAN project data, there were 110,115 newly diagnosed cancer in Iran in 2018. Furthermore, 55,785 cases of deaths due to cancer were reported in Iran in 2018 (4). The highest cause of mortality in this population was due to stomach, breast, prostate, lung and colorectal



cancers (5). In fact, cancer is ranked as the second main reason of health problems and the third source of died following cardiovascular disease and accidents in Iran (6).

According to the published reports, ten most common cancers are skin, stomach, breast, colorectal, bladder, esophagus, hematopoietic glands, prostate, lymph nodes, and lung cancers. As for the sex distribution of cancer, stomach and bladder cancers are more common in males and breast and colorectal cancer in females (5); therefore, it is important to estimate and calculate the cost and economic burden of cancer not only for patients and their families but also for the healthcare system and society.

Recent studies in European (EU) countries estimated €55,3 billion (approximately 44% of total costs) for the economic burden of lung, breast, colorectal and prostate cancers (7). In addition, €9,016 million was calculated for total economic burden of cancer in Spain (8). These costs are likely to increase, as more people require treatments, which become more expensive.

Today, studies on the economic burden of diseases are valuable because of the rising costs of cancer diagnosis and treatment. The studies mainly identify costs associated with healthcare utilization, such as prevention, diagnosis, treatment, rehabilitation, and palliative care and costs related to patient's loss of productivity. On the other hand, the direct costs consist of direct medical costs and direct nonmedical costs.

Direct medical costs are economic burdens provided by health institutions (medical visits, laboratory tests, diagnostic services, and major medications) and nonmedical personnel, such as patients and their families (e.g., home care costs). Indirect costs are caused by the productivity loss resulting from disease or treatment side effects, which also affect patient's family and those who care about them. Although the costs of cancer have been reported in different countries around the world (8-10), still to the best of the researcher's knowledge, there has been no study measuring the economic burden of cancer in Iran, and most of the reported studies have focused on the cost of only one type

of cancer. Therefore, the current study was conducted to review and summarize the existing data obtained from studies on cancer from 1995 to 2019 to provide about the economic burden of cancer in Iran.

Methods

This systematic literature search was conducted on nine electronic databases (Web of science, Scopus, EMBASE, Pubmed/Medline, IranMedex, SID, Magiran). Reference lists of all included citations were hand-searched for further relevant articles, so the study covered all registered and certified life sciences and medical journals at national level too. For electronic and hand searching, the words: "Neoplasm", "cancer", "cost", "cost of illness", "cost analysis", "economics", and "Iran" (or the names of its provinces) were searched as keywords in titles and/or abstracts in a MESH database. Different text words (specifically in searching national databases) were used to increase the sensitivity of the search; however, all sources were searched with the same strategy and keywords. As for the Persian keywords, their English equivalents and all probable combinations were considered.

In this study, the inclusion criteria was English and Persian language Studies, publication date between 1995-2019; Studies that consider the costs of cancer from either the individual's, the health services, and/or society's perspective. Exclusion criteria included: Economic evaluations (cost-effectiveness, cost-utility, and cost-minimization studies), Studies that did not quote costs in the results section, Studies that have considered the costs of other diseases (other than cancers) and conference abstracts, case reports, letters, comments to editor and review papers.

The recovered articles were imported into End-Note, and after the removal of duplicates, the remainders were independently studied by two field experts. At this stage, PRISMA guidelines were followed to retrieve the final articles.

To this end, titles and abstracts were screened and articles meeting all inclusion criteria were retained for full-text review. As for data extraction, selected

studies were fully reviewed by two experts. The data were entered into excel data sheets based on key features (Table 1). In order to avoid data extraction bias, disagreements between reviewers were evaluated and resolved by a third reviewer. Totally, we extracted information on the perspective and date of the study, date of the reported

costs, study population, total sample size, types of cost. Figure 1 provides an overview of the search steps based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines (11).

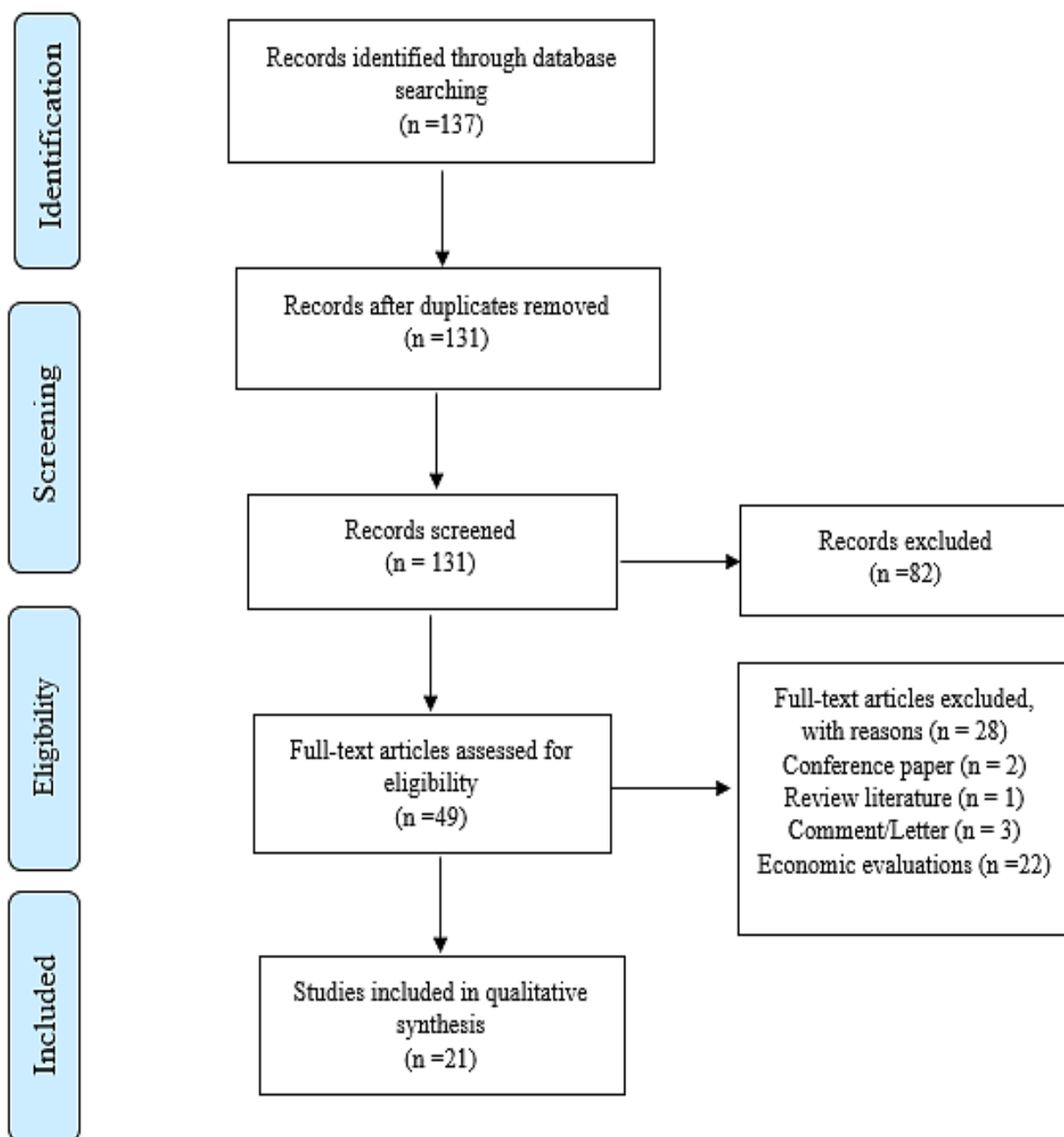


Fig. 1: PRISMA diagram

Table 1 : The main characteristics of the reviewed articles

| <i>Refer- ence</i> | <i>Sample size</i> | <i>Mean age</i> | <i>Objective</i> | <i>Indirect Cost</i> | <i>Direct Non Medical Cost</i> | <i>Direct Medical Cost</i> |
|------------------------|------------------------|---------------------|--|----------------------|------------------------------------|--------------------------------|
| (12) | 263 | 69 | Estimating the Economic Burden of Prostate Cancer | 872.76 | 2933.59 | 17888.59 |
| (13) | 149 | 72 | Measuring Costs and Quality of Life of Prostate Cancer | 13359632.25 | 963195.76 | 13426837.27 |
| (14) | 250 | 15-75 | Estimating the Economic Burden of Colorectal Cancer | 194385260.93 | 32911740.75 | 107658175.56 |
| (15) | 100 | 20-70 | Estimating the Economic Burden of Breast Cancer | 852680746.35 | 49149814.76 | 205565022.67 |
| (16) | 10000 | - | Estimating the Financial Burden Calculation of primary Diagnostic and Therapeutic Measures of non-metastatic breast cancer | - | - | 17224262.75 |
| (17) | 114 | 55 | Estimating the economic burden of oral cancer | 5346136.42 | 5573505.02 | 29564788.43 |
| (18) | 200 | 61.4 | Estimating the Economic Burden of Lung Cancer | 36801443.95 | 11467480.84 | 46112016.99 |
| (19) | 99 | 56 | Cost of Care of Lung Cancer in the First Year after Diagnosis | - | - | 13318099.82 |
| (20) | 941 | - | Estimating the Prevalence and Direct Medical Costs of Chronic Myeloid Leukemia | - | - | 25019000.70 |
| (21) | 93 | 3±8.5 | Cost-Analysis of Treatment of Childhood Acute Lymphoblastic Leukemia Based on UKALL Protocol | 899.94 | 1503.68 | 9680.90 |
| (22) | 203 | 9±3.4 | Cost-Analysis of Treatment of pediatrics Acute Lymphoblastic Leukemia Based on ALL-BFM Protocol | 999.53 | 1810.68 | 16109.80 |
| (23) | 170 | 52 | Evaluating the Direct Medical and non-Therapeutic Costs of Cancer Patients Admitted to Imam Khomeini hospital | - | 745.31 | 7936.28 |
| (24) | 320 | 56 ± 13.4 | Estimating the Direct Medical Costs of Colorectal Cancer | - | - | 44418536.90 |
| (25) | 393 | 49 | Estimating the Direct Medical Costs of Breast Cancer | - | - | 2337817732.40 |
| (26) | 106 | 1-15 | Estimating the Direct Costs of Treating Acute Lymphocytic Leukemia | - | - | 455198.16 |
| (27) | 160 | 65 | Evaluating the Direct Costs of Gastric Cancer Treatment | - | - | 139422.29 |
| (28) | 250 | 53 | Cost Analysis for Cancer Subgroups | - | 6084.19 | 9126.28 |
| (29) | 34 | 43.50 | Analyzing and Estimating the Direct and Indirect Costs of Breast Cancer in Women | 368.79 | 784.95 | 35387.93 |
| (30) | 110 | 55-65 | Estimating the economic Burden of Gastric Cancer | 127622.83 | 60906.66 | 274108.06 |
| (31) | 115 | - | Estimating the Direct Cure Costs of Lung Cancer | - | - | 1621.97 |
| (32) | 201 | 20-80 | Investigation the Direct Medical and non -medical Costs of Inpatient and Outpatient Cancer Patients | - | 36.12 | 3730.20 |

Systematic review registration

This Systematic review was recorded in the International Prospective Register of Systematic Reviews (PROSPERO) database (registration code PROSPERO CRD42019124292).

Results

In total, we identified 137 studies six of which were duplicated; therefore, they were removed from the study. Moreover, 82 more articles (out of 131 remaining ones) were excluded from the study since they were not relevant to the keywords, titles and abstracts. Finally, 49 relevant articles were identified. The articles were reviewed and 23 of them were found to meet the inclusion criteria, 2 articles were excluded due to inaccessibility. In general, 21 related articles on direct and indirect medical costs, economic burden, and indirect costs of cancers, such as prostate, breast, gastrointestinal, blood, and lung cancers in Iran were reviewed. The main characteristics of the articles are summarized in Table 1.

In 12 articles, the national cost of cancer was calculated for different provinces in Iran(12-23), for example, Isfahan (n=3)(24-26), Kerman (n=2)(27,28), Tabriz (n=1)(29), Kohgiluyeh and Boyerahmad (n=1)(30), Mashhad (n=1) (31), and Shiraz (n=1) (32). Moreover, the articles reviewed different types of cancer, such as prostate cancer (n=2)(12, 13), colorectal cancer (n=2)(14, 24), breast cancer (n=4)(15, 16, 25, 29), gastric cancer (n=2)(27, 30), oral and pharyngeal cancer (n=1)(17), lung cancer (n=3)(18, 19, 31), and blood cancer (n=4)(20-22, 26). All common cancers were reviewed in three articles (23, 28, 32), and most articles focused on breast, lung and blood cancers.

These studies were conducted on patients from 3 to 80 years old. More than half of the studies were published in the last five years. There were 13 cross-sectional and 9 retrospective studies. To estimate the economic burden of cancer in Iran, 7 studies used a prevalence-based approach on social perspectives (12-15, 18, 20, 22), 4 studies were on health care system perspectives (16, 24-26), 3 studies were on patients' view about the costs (28-30) and 8 studies used human capital approach to estimate the indirect costs (12, 14, 15, 17, 18, 21, 22, 30).

Furthermore, 10 articles (out of 21) calculated all costs including direct and indirect medical costs,

indirect costs, and ultimately their economic burden (12-15, 17, 18, 20, 21, 29, 30), 8 studies calculated only direct medical costs(16, 19, 20, 25-27, 31), and 3 studies calculated direct and indirect medical costs (23, 28, 32). In these studies, the direct and indirect costs were separately described for every type of cancer. There were also seven studies which calculated the number of days that patients lost due to oral cancer (174 days) (17), breast cancer (23.63 days) (15), lung cancer (11-22 days) (18, 19), prostate cancer (17 days) (12), leukemia (15.96 days) (21), and colorectal cancer (9 days) (14).

Costs of prostate cancer

According to the latest global cancer data, although prostate cancer is the fourth (7.1%) common cancer in the world in terms of incidence, its mortality rate is not categorized within the top ones. In Iran, prostate cancer is the second common cancer in men with 6004 new cases and 3071 deaths in 2018 (4).

Two studies estimated the direct medical costs, non-medical direct costs, and indirect costs of treatment of prostate cancer (12, 13).

The results of a study by Mojahedian et al indicated that the annual indirect cost of treatment elevated along with the disease progression and the largest share of medical and nonmedical costs included the direct and indirect costs for patients with metastatic resistant disease (12). On the other hand, the smallest share was allocated to low-risk patients; however, the share of direct medical costs also increased from 46% to 84% when the disease progressed. The cost of radiotherapy plus surgery (23%) in patients with local non-metastatic disease formed the greatest share of medical costs, followed by radiotherapy plus hormone therapy (17%). As for patients with non-metastatic regionalized disease, radiotherapy plus hormone therapy (42%) accounted for the largest percentage of medical costs followed by other medical (17%) and diagnostic services (15%). For patients with metastatic nonresistant disease, the largest share of medical costs was related to radiotherapy plus chemotherapy (43%), followed by hotel stay (18%) and diagnostic services (14%), while in the

case of patients with metastatic resistant disease, the huge part of medical costs was related to radiotherapy plus chemotherapy (39%) followed by hormone therapy (28%). On the contrary, there was a decrease in indirect costs from 11% for low-risk patients to 4% for disease-resistant patients. Over 80% of the economic burden of prostate cancer has been directly related to costs. The mean direct cost for each patient in Iran was estimated to be \$3420 (12).

In the study of Foroughi Moghadam et al (13), the treatment groups were divided into five main groups including those who had undergone radical prostatectomy or received radiation therapy, hormone therapy, orchiectomy and chemotherapy. The most of patients (54.3%) received medicinal or surgical hormone therapy. Radical prostatectomy was the basic treatment for 31.7% of patients, while 10.2% of patients received radiation therapy, and 3.8% underwent chemotherapy. The highest average direct medical cost per capita was related to chemotherapy patients. The orchiectomy group had the higher number of patients in treatment category, percentage of patients with productivity loss, and amount of average indirect cost for each patient (13).

Costs of breast cancer

Breast cancer is ranked as the second (11.6%) prevalent cancer type in the world. It is the fifth leading cause of death (6.6%) (33). In Iran, Breast cancer is the most common cancer type. The new cases in Iran were 13776 with the 3526 death numbers (4).

Moreover, four studies examined the costs of breast cancer including two studies on direct medical costs, one study on direct and indirect costs, and one on the economic burden of breast cancer. The results of the study by Yavari et al (16) showed that the 14% of patients were in the first stage, while 42% and 32% were in the second and third stages of the disease, respectively. The cost of treatment in stage 3 was higher than the other stages. Surgery, radiotherapy, chemotherapy, and hormone therapy accounted for 26, 34, 23, and 5% of the costs of breast cancer treatment in stage 1 of the disease as well as 11, 22, 56, and 5% of the

costs in stage II and 10, 23, 57 and 4% in stage three, in that order. The highest costs were related to chemotherapy in the second and third stages (56 and 57%, respectively) and the least cost was associated with radiotherapy (34 %) for stage first (16).

The 41% of patients were in the fourth stage and 59% were in the first to third stages (25). The fourth stage accounted for the highest direct medical costs compared with the others. In addition, the medicine costs were responsible for more than 87.8% of direct medical costs. The cost of surgery in the first and second stages as well as the cost of drugs in the third and fourth stages were categorized as the highest costs (25).

The average direct medical costs of the first and second stages were higher than the others (29). Therapeutic costs, on the one hand, and outpatient care and visit costs, on the other, accounted for the highest and lowest direct medical costs, respectively. Direct and indirect costs represented 81.1 and 18.2% of the total cost, in that order (29). Productivity loss due to mortality was the main economic burden of breast cancer (77%) in addition to direct (18.56%) and indirect medical costs (4.44%) (15). A total cost due to chemotherapy and continuing care costs of direct medical costs in breast cancer patients was estimated at 43.65% and 31.36% , respectively (15).

Costs of lung cancer

Lung cancer, due to poor prognosis, accounts for the main burden of cancer worldwide (2.1 million) and the largest number of deaths (18.4%). In Iran, lung cancer is the fifth common cancer in both sexes with 6695 new cases and 6124 deaths (4).

The cost of lung cancer in Iran has been studied in three studies as follows; 2 studies investigated the direct medical costs and one explored the study of direct and indirect costs.

Mortality and hospitalization costs comprised 81.9% and 7.6% of the total costs, respectively (18). Direct medical and nonmedical costs and disease period accounted for 10.8%, 2.7%, and 4.5% of the total costs, in that order. The total cost of hospitalization for men was higher than that of for women. The main cause of hospitalization costs

for men (30.9%) and women (33.4%) was due to medication (26.3%) and hoteling costs (25.2%). The cost of mortality and time loss due to illness was higher in men than in women (18).

Akbarzadeh Baghban et al, estimated direct medical costs of lung cancer by investigating the direct costs of treatment provided by services, such as hospitalization costs, special hospital beds, physician visits, consultant visits, drugs, radiology, laboratory tests, ECG, echocardiography, and nursing costs. The shortest hospitalization times was 1 day and the longest was 47 days. The contribution of hospitalization costs, medication use, and physician visit cost for pulmonary cancer patients was 35%, 21%, and 14%, respectively (31).

Eighty six percent of patients received surgery, 36% received radiotherapy and 45% received chemotherapy as the first-line therapy (19). Moreover, 14% of patients needed physiotherapy and 11.5% needed preoperative consultation Surgery accounted for 28%, and radiotherapy alongside drugs made up 38% of the total costs (19).

Costs of colorectal cancer

According to the latest global cancer data, colorectal cancer is the third (10.2%) most frequently reported cancer types in the world. It is also the second cause of death (9.2%) following lung cancer. In Iran, colorectal cancer is the second common cancer in women and the third one in men. Cancer statistics showed that the number of new cases in Iran in 2018 was 3085 with 452 death numbers (4). According to the results of this study, two studies investigated the economic burden of colorectal cancer in Iran; one paper examined all direct and indirect costs and the other one assessed only direct medical costs.

50.43% of direct medical costs was related to the cost of chemotherapy and 30.12% to the cost of surgery (14). Indirect costs included the cost of mortality and time loss due to illness. Totally, the cost of mortality and direct medical costs were reported for 58.3% and 32.14% of the economic burden of colorectal cancer, respectively (14).

In the study of Davari et al, Treatment was classified into four stages. Direct medical costs included

hospitalization, physician visits, medical tests, diagnostic tests, medications, radiotherapy, and surgery. The cost of chemotherapy was a major cost in all stages of treatment for colorectal cancer; however, at the final stages of treatment, the cost of medication and other services decrease. The highest mean medical cost was related to the fourth stage (24).

Costs of Leukemia

Leukemia ranked the fourteen cancer type around the world (2). However, it ranks seventh in cancer incidence in Iran. New cases of leukemia were 5437 with 3711 death numbers (4).

Four papers explored the costs of leukemia in Iran. Two of the selected studies assessed direct medical costs, and two studies presented both direct and indirect costs.

The prevalence and direct medical costs of chronic leukemia were estimated (20). Direct medical costs included the cost of medications, outpatient visits, CBC, bone marrow tests, and other laboratory tests, such as liver and kidney function tests. Over 97% of direct medical costs were related to pharmaceutical costs. The results showed that the costs increased substantially if patients took the new drug, i.e., Nilotinib, in the second-line therapy (20).

The direct treatment costs of acute lymphocytic was estimated (26). Hospital care costs (hospitalization) ranked the highest direct medical costs and accounted for 90% of the total costs. However, the major parts of hospitalization (45%) and diagnostic costs (90%) were related to pharmaceuticals and the laboratory tests, and outpatient costs were almost 100% related to pharmaceutical costs (26). Based on ALL-BFM protocol, 80.2% of the total cost was associated with direct medical expenses, 36.2% and 36.4% were related to hospitalization and medical expenses, respectively. Transportation costs accounted for the largest part (39.9%) of direct non-medical costs. Indirect costs also accounted for the least (5.2%) of the total cost (21). The results of the study by Hayati et al showed that the costly direct medical charge was 40.3% for hospitalization and 26.1% for medication. The major share of direct non-medical costs was due

to transportation costs (39.9%). The direct medical cost share was 80.1% of the total economic burden of lymphocytic leukemia in children followed by the non-medical direct cost share (12.5%) and the indirect cost share (7.4%) (22).

Costs of Oropharynx cancer

Oropharynx cancer is categorized as an uncommon cancer types with the worldwide incidence rate of 92 887 and the mortality rate of 51 005 cases in 2018. In Iran, the number of new cases were 112 followed by the 63 death numbers in 2018(4).

The cost of treatment in the third and fourth stages accounted for 70% of the total cost, followed by the relapse cost (16.5%), the cost of treatment in the first and second stages (9.9%), the follow-up cost (3.1%), and the cost of diagnosis (0.5%) (17). Non-medical direct costs included travel and home care costs, which were greater than travel costs. Productivity loss costs accounted for over 50% of the economic burden 62% of which was due to productivity lost resulted from male deaths. The share of the direct medical cost and the non-medical direct cost was estimated to be 42% and 8% of the total cost, in that order. Furthermore, the treatment cost in advanced stages was 5 times greater than those of the early stages. They also found that 53% of patients' diagnoses occurred in advanced stages (17).

Costs of stomach cancer

Stomach cancer is the fifth (5.7%) common cancer in terms of incidence and the third cause of death (8.2%) worldwide (33). In Iran, it is the second common cancer in both sexes as well as the most prevalent in men. The new cases in 2018 were 11644 with the 8965 death numbers (4).

Articles review showed that two papers assessed gastric cancer costs in Iran. The highest cost was related to the cost of surgery in the first stage followed by the drug in the second, third and fourth stages (27). The lowest cost of treatment was associated with the first stage in the public and private sectors. The total cost of the medication was \$42059004, i.e., \$ 902.84 for chemotherapy, \$163.88 for surgery, \$677.13 for radiotherapy,

\$578.99 for radiology, and \$490.67 for doctor visit. The public sector share of the total direct medical cost was US \$2596.26 and the private sector \$390401 (27).

Fifty nine percent of the economic burden of gastric cancer was due to direct medical costs, 28% due to indirect costs and 13% due to direct medical costs (30). Medication (35%), transportation (31%), and the absence of patients' families from job and daily activities due to patient care (56%) were the main causes of direct medical costs, direct non-medical costs, and indirect costs, in that order. The average cost was calculated at US \$ 3966 per patient and 35.32% of the total direct medical costs were related to drug costs, 14% to chemotherapy, and 11% to laboratory tests (30).

Bazyar et al evaluated the direct therapeutic and non-therapeutic costs of patients over 18 year old with head, neck, and gastrointestinal cancer. On average, 91% of total patient costs were related to direct medical costs, and the share of non-medical direct costs was only 9% of the total costs (23).

Breast cancer was the most expensive cancer, while the least expensive cancer was prostate cancer (28). The highest average cost per month was related to diagnosis and treatment of lung cancer in the outpatient department. The highest average of the monthly travel cost was related to prostate cancer patients. The most expensive groups were breast, lung, peripheral nerve, prostate, blood, and genital cancers, and the least expensive ones were gastrointestinal cancers and men's genital cancers (28).

The largest share of total costs was associated with chemotherapy (31%), radiotherapy (15%), surgery (12%), laboratory (11.5%), bone marrow transplantation (11.2%), medication (5.8%) and MRI (3.5%). Blood and colon cancers were the most prevalent and the least common cancers, respectively (32).

Discussion

The present systematic review aimed to evaluate the economic burden of cancer in Iran through reviewing 21 articles from different regions. All

costs were reported in US dollars for 2019. Cancer is one of the major health problems in the country, it wastes human and financial resources and causes huge costs to the country's health system and patients (34). The purposes of such studies are mainly to evaluate the costs of cancer to identify and estimate the costs of include direct, indirect and intangible costs. The results of these studies are expressed in monetary terms and determine the total financial burden and costs of a particular disease for the community.

The available resources to provide health care requirements are limited and cancer treatment requires significant costs from managers and the community health care system. In addition, the community suffers from significant damages due to the cancer complications, such as low income due to the decline in efficiency, disability, and sudden death, which imposes huge costs on society. Considering the limited resources available to meet health requirements, careful planning for using these resources seems necessary. Dissemination of information about the costs of illnesses and their complications enables decision-makers to make a proper comparison between different uses of resources. The present study provided a precise estimation of the economic costs of cancer; therefore, it can be used to determine the priorities of health resources consumption in Iran. Most of the studies estimated the economic burden of breast, colorectal, gastric, lung, blood, and prostate cancers due to their high prevalence and high cost in Iran. Studies in the US and Spain also assessed the economic burden of breast, prostate, colorectal, lung, cervical, and skin cancers due to their high mortality and direct costs. The gastrointestinal (gastric and colorectal), breast, oral, lung, prostate, and blood cancers account for a significant share of the economic burden, respectively (8,10). According to the results, the higher incidence and mortality of cancer results in a higher cost. Gastrointestinal cancers were the most expensive types of cancer, followed by breast cancer mostly prevalent in women. It is noteworthy that Gastrointestinal and breast cancers were also the most expensive cancers in England and Spain (8, 9). Furthermore, in agreement with our results, these

studies showed that prostate cancer accounted for the least economic burden of cancer. In addition, the economic burden of leukemia in Iran is estimated to be higher than that of prostate cancer; however, since the reviewed studies in our country have not examined all types of leukemia, the estimated cost cannot reflect the total economic burden of leukemia. Different viewpoints and time frames in studies, different numbers of patients, diverse cost estimation methods, and several approaches to estimate lost productivity costs, types of costs, and different cost calculation periods were the limitation of our study that make it difficult to compare the obtained results.

Moreover, our estimations of costs are limited since not all types of cancers have been evaluated. On the other hand, none of the studies evaluated the economic burden of pain, while it is possible to calculate their economic burden. However, it is not a common practice in cost of illness due to insufficient data.

Several studies used the human capital approach to calculate indirect costs (12, 14, 15, 17, 18, 21, 22, 30), which is not a valid criterion for some groups, such as women and children, and retirees who do not have a definite income. Although the human capital approach is still used in most cost studies and provides valuable information, its limitations still need to be considered in the result interpretation.

In this systematic review, most of the studies have examined the cost of cancer for patient. It seems that further studies considering other types of cancer and the views of society and the health care services and in other provinces can help policy makers in deciding the treatment and care of cancer patients. It also seems that conducting other systematic review studies to examine the economic burden of other diseases in Iran can help policymakers and planners in better understanding the costs of infectious and non-communicable diseases and to better allocate resources.

This study has some limitations. First, we could not done a meta-analysis, since different form of cost values, as the primary existed. Second, it is very difficult to outline a standard costing methodology because of inconsistency of objectives

and designs in different studies. Third, missing data and selection bias resulting from the retrospective type of studies may occurred. In addition, most of studies just considered direct cost, so more investigations for prospective design, and societal cost are demanded.

Conclusion

The cost of cancer in Iran is significant and is predicted to rise considerably because of the growing new diagnosed cases, which necessitates the implementation of preventive and screening programs in the national cancer control program or at least in treating patients in the primary stages of the disease. The results of this study provided useful information for healthcare providers and decision makers to consider the economic burden of cancer in Iran. In order to utilize resources more effectively, cost-effectiveness studies can be considered as one of the best strategies to examine the trends of costs and economic burden of cancers in the community and identify the impact of a single intervention or multiple interventions on a particular outcome.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

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