

The Direct Medical Costs of Colorectal Cancer in Iran; Analyzing the Patient's Level Data from a Cancer Specific Hospital in Isfahan

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ABSTRACT

Background: The Immense cost of cancer treatment is one of the main challenges of health care systems all over the world including Iran. The aim of this study was to analyze the direct treatment costs of colorectal cancer patients in Isfahan, Iran.

Methods: In this cross sectional study, the medical records of colorectal cancer (CRC) patients admitted to the Seyyed-al-Shohada Hospital "SSH" from 2005-2010 were reviewed. The profiles of 452 patients were examined. However based on inclusion, exclusion criteria a total number of 432 profiles were analyzed. All records including age, sex, treatment processes and treatment costs were extracted from the patients' profiles and analyzed using Kruskal-Wallis test.

Findings: The results showed that 56.1% of CRC patients were male. The mean age of patients suffering from CRC was 56 ± 13.4 . More than Thirty-six percent of the patients were in stages 1-3 of CRC and more than half of them (64.4%) were in the 4th stage. The higher the stage of the cancer the higher the percentage of treatments used. 5-Fluorouracil and Leucovorin (5FU/LV) was the most common used chemical treatment protocol. The mean treatment cost for stage one was 10715 (± 4927), for stage two 15920 (± 3440), stage three 16452 (± 2828) and for stage four was 16723 (± 2555) US Dollars. The cost of drug treatment was the first cost driven between the medical services.

Conclusion: CRC in Iranian population starts in younger age than people in western countries. This imposed considerable direct and indirect economic cost to the society. The direct medical cost of colorectal cancer in Iran is very higher than 38 million \$. Screening programs could reduce the economic cost of CRC significantly.

Key words: Colorectal cancer, cost analysis, Iran

INTRODUCTION

The treatment of cancers and their immense expenses are one of the main challenges of health care systems all over the world including Iran.^[1]

Colorectal cancer (CRC) in Western Countries is known as the most prevailed disease in gastro-intestinal disease and is ranked second in cancerous diseases based on incidence and death rate.^[2,3] This cancer is also known as the third type of cancer in Iranian men and the fourth in Iranian women.^[4]

Issues regarding limited available resources in providing health care have been paid a lot of attention in recent years.^[5] It is obvious that the treatment of cancer leads to significant direct expenses for the patients, and the health care system. Direct medical costs are expenses, which provide patients with health services such as, doctors' visit, medicines, inpatient and outpatient surveillances.^[6] Also, a decrease in income due to disability and early deaths because of cancer lead to heavy damage and high expenses to the society.^[7] Keeping in mind that the medical resources are limited, precise planning seems to be needed for the use of these resources. This will let the authorities to decide more clearly between the alternative use of limited resources.^[8]

With the everyday increase in the prevalence of colorectal cancer in Iran and the decrease in the age of the CRC patients compared to western countries, the treatment expenses of the cancer are also increasing.^[9] The purpose of cost studies is to estimate and obtain the direct and/or indirect costs of treatment programs for managing disease.^[6]

The aim of this study was to calculate and analyze direct medical costs for treating CRC in Iran.

METHODS

This cross sectional study was conducted in Isfahan in 2011. The study samples were made up of all patients suffering from CRC, (435 patients) which were admitted to the SSH in Isfahan between 2005 and 2010 and whose medical records were in the archives of the SSH (Inclusion criteria). Patients with other diagnosis and without medical records in the SSH were excluded from the study.

The medical records of the patients and the information related to the stage of the cancer, age, sex, treatment processes, and expenses were extracted from the patients' profiles. Direct costs and expenses of the patients were including; hospitalization, doctors and counselor visits, medical tests, diagnosis tests, medicines,

radiotherapy and surgery. Since the results were scattered highly, the Kruskal-Wallis test was used to analyze the data more accurately.

For diagnosing the stage of the disease a digital camera was used to take a picture from every pathology records of the patients. These with clinical records of the patients were analyzed and confirmed by our pathologist (D.T) to determine the disease stages. For the photos which were not clear enough the patients records were rechecked. Finally, the pathologic stage of the patients was determined based on the TNM staging system.^[10]

To consider the impact of inflation rate on the results of this study we adjusted the costs using the discounting equation; $F_n = P(1+r)^n$. In this equation F_n indicates future costs in year n , P is the current Price and r is annual discount rate.^[8] It is stated that the growth rate in health expenditure is usually higher than the general inflation rate in a country, sometimes 2.5 times,^[11] Also it is stated that the inflation rate in health expenditure in Iran is more than 50 percent.^[12] Therefore we used 2.5 fold of the mean of general inflation rate of Iran during the five-year study as discount rate for health care expenditures in Iran. Based on the Iranian Central Bank database the mean general inflation in Iran was 16.4 percent for the study period and thus the discount rate was determined as 41 percent.

Since the state and official private medical tariffs are the same across the country, we generalized the results to the whole country with care.

RESULTS

Two hundred and forty-four (56.1%) of the patients were male. The disease stage of 115 patients could not be determined because of uncompleted medical records, or the patient having left the hospital. These patients were excluded for analysis. The mean age of the patients was 56 ± 13.4 years. The youngest and the oldest patients were 20 and 86 years old, respectively. Also, 33% of the patients were aged less than 50 years old. 33.6% of the CRC patients were in stages 1-3 and more than half of them (64.4%) were in the stage 4 of the disease. The mean and median of the treatment cost of CRC patients are increasing with the stage of the disease. Though this increase was not statistically significant for median based on the Kruskal-Wallis test ($P > 0.05$), it is statistically significant for mean ($P < 0.05$).

The results show that the cost of drug treatment was the main cost component in all stages of CRC in Isfahan. A summary of the results are shown in Tables 1 and 2. Table 1 shows that the direct medical cost of CRC treatment for each patient was 16143.18\$.

DISCUSSION

The findings of this study showed that, the mean age of the people suffering from CRC was 56; which is very lower than this age in western countries. For example in a study conducted in 2008 in America the median and mean age of CRC patients was signified as 64 and 63, respectively.^[13] The results of Karimi Zarchi study^[14] in Tehran with the mean age of 59.7 years also is very close to the results of our study. Some previous studies^[15,16] are also concluded that the age of people suffering from CRC in Iran is lower than what it is in western countries. These all confirm that the lower age CRC in Iran with increasing in age loss would result in early death and high cost of treatment, which has considerable impact on the economic growth and development of the societies.^[17] In a worldwide population-based study, the economic cost of cancer in 2008 is estimated to be 845 billion \$, which was approximately equal to 1.5% of the international gross income.^[18]

While the findings of this study show that 33% of the patients were under 50 years old, the statistics given in the second international digestive cancer congress stated that 45-47% of the CRC patients in Iran are under 50 years old.^[19] This is while this ratio in European countries was below 20% in 2004.^[20] These findings suggest that the burden of CRC in Iran would be larger than European countries.

In the United Kingdom after 3 years of exercising the new screening policies 71% of the colon cancers were diagnosed at the early stages and the death rate was decreased by 16%.^[21] These may imply that a national screening program from a lower age in Iran may reduce the economic burden of the disease even more than European countries. However, cost-effectiveness analysis of various screening programs could provide stronger evidence about the result of screening programs.

Our results show that 56.1% of the CRC patients are male. This result is supported by the national

Table 1: Summarize distribution of type of treatments and central indicators of cost of treatments based on stage of colorectal cancer patients*

Stage of cancer	Patients no (%)	Type of treatments no (% of patients in each stages)		Cost of treatment (\$)							Mean per patient (US \$)		
		Radio therapy	Surgery	Chemotherapy	Mean±SD	Minimum	Quarter1	Median	Quarter3	Maximum			
0	1 (0.3)	0	0	0	510	-	-	-	-	-	-	-	-
1	18 (5.6)	3 (16.7)	0	14 (77.8)	10715 (±4927)	295	2404	4657	17247	33783	600.04		
2	31 (9.7)	6 (19.7)	1 (3.2)	31 (100)	15290 (±3440)	702	2685	6725	23677	67004	1483.13		
3	64 (20)	26 (40.6)	3 (4.7)	54 (84.4)	16452 (±2828)	1297	3769	8566	21797	62126	3290.4		
4	206 (64.4)	130 (63.1)	10 (4.8)	159 (77.2)	16723 (±2555)	3614	6384	10637	22764	76717	10769.61		
Total	320	165	14	258	60320 (±2309)	5908	15242	30587	85484	239630	16143.18		

*The costs are converted to the US dollar based on the exchange rate of central bank of Iran at December 13, 2011

Table 2: Ratio of the mean of received service expenses to all of the expenses based on disease stage

Disease stage/Type of service	Pharmacotherapy	Radiotherapy	Surgery	Other	Sum
0	0	0	0	100	100
1	87.5	4.1	0	8.4	100
2	71.7	6.6	6.8	14.9	100
3	67.9	11.9	2.4	17.8	100
4	49.2	20.5	2.5	22.8	100

cancer reports in 2005.^[22] This ratio in the USA in 2008 with 55.3% was very close to our results;^[13] and shows that males are at relatively higher risk of CRC than females.

The findings of this study show that 35.6% of the CRC patients were in the 1st to 3rd stages of the disease and more than half of them (64.4%) were in the 4th stage. This is while in Ferro study^[13] approximately half of the patients were between stages 1-3 of the disease. This might be due to the late referring of the patients for receiving treatments. But, regardless of the cause of the problem, the diagnosis of patients in the final stage of the disease leads to difficult prognosis and treatment and consequently higher treatment cost. Educating the society about cancer with the intention of being able to diagnose the disease in early stages can help patients refer to hospitals for treatment in time with higher success rate and then with lower cost.

Although in all of the stages the most of the costs shown in Table 2 were related to the medication, but comparing the medication costs in various disease stages show that as the disease stage increase, the percentage of medication cost decrease. This has happened because of the increase in the cost of radiotherapy and the other services.

Table 2 shows that the 4th stage of the disease has the highest mean of the direct cost, but the median of the treatment cost of CRC patients is increasing with the stage of the disease; Though this increase was not statistically significant based on the Kruskal-Wallis test ($P > 0.05$). Nonetheless this increase may resulted from the high frequency use of all 3 services in the stages.

The reason that most of the costs are related to the 3rd stage is probably because of higher 5-year life expectancy in this stage, which is reported to be up to 60%, comparing with stage 4, which is only 5%.^[3] This would imply that the patients in the stage 3 had more chance to receive more services.

Tilson study^[23] conducted in Ireland also showed similar results.

In addition to this fact the review of the patients' profile confirmed that some of the patients in stage IV had left the hospital and refused to receive treatment services. Dissatisfaction from the quality of services, unlikelihood of treatment success, and difficulties in paying the cost of treatment were the main reasons for leaving the SSH and left the treatment protocols before completing them. Nonetheless the direct medical cost of CRC treatment for each patient was more than 16 thousands dollar, which is considerably too high for Iranian population.

Considering the mean of the direct medical costs of CRC [Table 1] and its prevalence in Iranian population, which is 3.1%,^[16] it is obvious that the direct medical cost of CRC in Iran is at least 38 million \$. However, it seems that the direct medical costs of CRC calculated by this study are far less than the actual costs. The following factors could explain this discrepancy:

Defects in the information records of the patient

Since the data used in this study was extracted from the medical records of the patients, any missed out information about the processes and the records of the treatment can cause mistakes in the calculation of the cost. This fact was obviously visible in radiotherapy records. The information was hand written and kept in patients' protocols.

Public medical tariffs

SSH is a public and teaching hospital in Isfahan and its prices are based on the official public tariffs. The public tariffs are significantly lower than private tariffs and actual costs. On the other hand the government is paying hidden subsidies to public and teaching hospitals.^[24] This could suggest that the cost of treatment in SSH have been lower than actual cost considerably.

Prescribing cheaper protocols

As shown in Table 2 the main cost driver in all of the stages of disease was the cost of chemical therapy. 5FU/LV and FOLFOX were the most frequently used protocols with 42.5% and 19.1%, respectively. Ferro^[13] showed that the most frequent prescribed protocols were 5FU/LV with 34.9% and FOLFOX with 24.5% in the US. The cost of 5FU/LV and FOLFOX for every cycle was determined as 171 and 6338\$ respectively.^[13] This means that 5FU/LV regimen, 42.5% of our prescribed regimen, is 37 times cheaper than FOLFOX. Nonetheless the treatment costs of the two mentioned protocols are much cheaper than the rest of the treatment protocols.^[13,25] For example in a recent study in Iran^[25] the treatment costs of FOLFOX protocol for metastatic patients and for every cycle was calculated as 754\$ and with the addition of Cetoximab to this protocol the costs were calculated as 4267\$, which is significantly higher than the recorded cost of chemotherapy in this study [Table 1].

Partial services implementation

Since the SSH is a public and teaching hospital, a lot of patients continued their treatments in other hospitals. Dissatisfaction from the quality of services, doctors' advice, and psychological status of the patients may explain this behavior of the patients. The fact that only 14 surgeries took place in the SSH is a good example which support this suggestion. This is while surgery is the main treatment for CRC.^[26,27]

Fluctuations in foreign exchange rate in Iran

The costs of services in SHH are recorded in Iranian Rial and the value of Iranian Rial versus the US dollar has decreased in past years noticeably. This change could also illustrate the cost of CRC in Iran lower than its true cost to the Iranian society.

CONCLUSION

CRC in Iranian population starts in younger age than people in western countries. The late diagnosis of the disease in Iranian patients has imposed considerable direct and indirect economic cost to the patients, government and the society. The mean direct medical cost of CRC per patient in Iran is more than 16000\$ which

resulted 38 million \$ for total CRC patients in Iran. Screening programs could reduce the economic cost of CRC significantly. But, limitations were also considerable.

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