Original Research

Estimating the Cost of Illness of Prostate Cancer in Iran

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ABSTRACT

Purpose: Prostate cancer is the second most common cancer among men worldwide. In the past 10 years in Iran, prostate cancer has increased and become more common among hormone-related cancers. As the percentage of seniors in the population increases, the economic burden of this cancer will likely increase significantly. This study aims to estimate direct and indirect costs of treatment at different stages of prostate cancer in Iran.

Methods: This cross-sectional study was conducted on 263 patients diagnosed with prostate cancer who were referred to prostate treatment centers in 2016. Data on direct medical costs were collected by face-to-face interviews with patients and from health care files and medical and financial documents available in the educational or referral centers. Direct nonmedical costs and indirect costs were based on self-reports by patients through face-to-face interview.

Findings: The results indicate that mean (SD) direct medical costs for low-risk metastatic prostate cancer, local nonmetastatic prostate cancer, local regionalized nonmetastatic prostate cancer nonresistant metastatic prostate cancer, and resistant metastatic prostate cancer were $102.79 ($33.03), US$2673.43 ($87.42), $2210.51 ($306.92), $4133.15 ($650.87), and $7747.89 ($455.80), respectively. The results indicate that mean (SD) direct nonmedical costs for low-risk, local, local regionalized, nonresistant, and resistant cancers were $97.06 ($45.00), $339.71 ($58.02), $485.29 ($36.77), $776.47 ($99.25), and $1067.65 ($600.92), respectively, and mean (SD) indirect costs for these categories were $23.85 ($20.44), $83.49 ($65.06), $119.27 ($32.59), $238.54 ($87.35), and $357.81 ($73.00), respectively.

Implications: The findings of this research indicate that patients diagnosed with prostate cancer must bear high costs at advanced stages of the disease, whereas in the early stages of the disease, the medical costs are relatively low. The health system of Iran should work to prevent patients from reaching the metastatic stages of the disease by implementing a suitable screening system for timely diagnosis of the disease and its effective treatment. (*Clin Ther*. 2019;41:50–58) © 2018 Published by Elsevier Inc.

Keywords: cost of illness, direct medical costs, direct nonmedical costs, indirect costs, Iran, prostate cancer.

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INTRODUCTION

Prostate cancer is the second most common cancer among men worldwide. An estimated 1,100,000 cases of prostate cancer were diagnosed in 2012, with 307,000 deaths. This disease is a major health problem and is the second highest cause of death from cancer in men after lung cancer.[1] In North America, at 180,000 cases per year, it accounts for approximately one-third of cancer (31.2%) in men.[2] Prostate cancer is an age-related disease, with >75% of new cases diagnosed in men >65 years of age.[3] Prostate cancer represents 7% to 9% of all cancers in Iranian men.[4] In the past 10 years in Iran, prostate cancer has increased among the hormone-related cancers, and the current prevalence of the disease is estimated to be 11%, which is the eighth highest cause of death from cancer in Iran.[5,6]

The precise cause of the disease is unknown, although genetic and environmental factors are involved.[7] Among the most important risk factors for prostate cancer are family history, race, hormonal changes associated with aging, infection, inflammation, genetic predisposition, improper nutrition, smoking, and alcohol consumption.[8,9]

Globally, the cost of health care in recent decades has increased significantly. The Iranian health care system has experienced serious increases in these costs. These costs are caused directly by increases in diagnostic and therapeutic services or indirectly because of diminished productivity and quality of life.[10] Economists have reported that the cost of new cases of cancer was US $286 in 2009. They also report that productivity decreases by 24% in response to cancer. For prostate cancer, the usual hospital stay is 5–10 days, which accrues high costs.[11] However, the usual hospital stay for patients with prostate cancer in Western countries is only 1 day because of new surgical techniques, such as radical prostatectomy.[12] It has been predicted that with the estimated global increase in aging of the population from 962 million people >60 years of age in 2017 to 1.4 billion in 2030 and the evident growth during 10 years in the relative survival of men diagnosed with prostate cancer, the economic burden of this cancer will increase significantly.[13,14]

No study has been conducted in Iran thus far regarding the comprehensive medical costs of prostate cancer that takes into account both direct and indirect costs to patients at the different stages of the disease. Direct costs include direct medical costs (visit by specialist, laboratory tests, diagnostic services, major medications) and direct nonmedical costs (travel, accommodation, and meals when receiving medical services). Indirect costs include earnings lost by patients and their companions during treatment.[15] Estimation of medical costs based on disease stage is valuable for economic evaluation studies because it provides insight into how the costs are affected by preventive or screening strategies.[16] In cost-of-illness studies, the medical costs of the stages are explained in monetary terms, and the key costs of treatment are specified. This information is of great help to policymakers and planners of the health care system for optimal allocation of resources.[17] It is evident that sufficient scientific evidence associated with medical costs of prostate cancer in Iran is lacking.

Given the variability of the clinical period and various stages of the disease and unsuitable treatment (such as late diagnosis of patients), this disease can incur high costs to the health care system and to patients. Determination of the medical costs of prostate cancer, given the limitation of resources, is essential. Presentation of accurate data about economic cost will allow informed decision making by health care policymakers in Iran about the prevention and treatment of the disease. Accordingly, this study aims to estimate the direct and indirect costs of prostate cancer treatment in Iran.

METHODS

Patients and Methods

This cross-sectional study was conducted on patients diagnosed with prostate cancer who were referred to treatment centers at Sina, Shohada-ye Tajrish, and Imam Khomeini hospitals in Tehran and Shahid Faghihi hospital in Shiraz in Iran from September 2016 to April 2017. These centers are the main educational hospitals in Iran and treat approximately 2000 patients with prostate cancer per year. This study is a partial economic evaluation and cost analysis. It was a descriptive-analytical study, and the costs were calculated for the society. All expenses computed include out-of-pocket expenses and government and insurance payments.

Because of the extensive statistical population, the available sampling method was used. First, in a pilot

study, a minimum number of 20 patients with existing files were chosen randomly. The sample volume was determined to be 226 patients for estimation of the quality of life and costs of patients based on SD, variance, and Cronbach α as well as the size of the research population, The sample volume was then elevated to 300 patients to enrich the study. The inclusion criteria were patients with prostate cancer that had medical documentation in the mentioned centers. A total of 300 patients with medical documentation were randomly selected for further consideration. The information registered in the medical documentation of the patients as well as the information resulting from interview about the costs incurred by patients in the past were also used. Information was collected from a family member for deceased patients.

On the basis of the opinions of urologists and radiotherapists, the patients with prostate cancer were classified into 5 groups in terms of treatment stages (Table I). The demographic information was extracted using a data collection form. The patients were classified according to the variables of income, age, place of residence, educational level, occupational status, marital status, and insurance.

Direct Medical Costs

The data associated with direct medical costs were collected retrospectively and simultaneously from several avenues for greater accuracy: through face-to-face interview with patients as well as interviews with specialists and through investigation of health care files and medical and financial documents of the patients. The main items included in direct medical costs included visits by a specialist (outpatient and inpatient), laboratory tests, diagnostic services, major medications, other prescribed drugs, surgery, and hospital stay. The mean number of each service for inpatients was extracted from medical records and for outpatients collected by face-to-face interview with patients. Finally, the mean number of each service confirmed by specialists and multiplied with tariff for each service announced by the Ministry of Health was also extracted. For a more accurate estimation of cost analysis for patients, attempts were made to calculate direct medical costs individually.

The mean total annual direct medical costs per patient in each stage of the disease was calculated as follows: total annual cost per patient at each stage = (mean number of visits per year × visit fee) + (mean number of tests per year × fee for each test) + (mean number of diagnostic services per year × fee for each diagnostic service) + (mean number of treatment method [surgery or radiotherapy] per year × fee for each treatment method) + (the cost of every unit of medicine [hormone therapy or chemotherapy] × the number of prescribed medicines on a course of treatment) + (mean hospital stay per year × fee per day).

To estimate the direct medical costs of patients with prostate cancer, the files and opinions of the patients as well as specialists have been taken into account. The costs of different items were examined and estimated individually.

Table I. Classification of patients with prostate cancer.

Group	Definition
Low risk	Patients who had prostate inflammation and underwent periodic medical examinations to prevent prostate cancer
Local nonmetastatic prostate cancer	Patients with nonmetastatic prostate cancer in whom only the prostate was involved
Local regionalized nonmetastatic prostate cancer	Patients with nonmetastatic prostate cancer in whom the organs around the prostate, including the prostate capsule and its surrounding lymph nodes, were also affected
Nonresistant metastatic prostate cancer	Patients with metastatic prostate cancer who were not resistant to hormone therapy
Resistant metastatic prostate cancer	Patients with metastatic prostate cancer who were also resistant to hormone therapy

Direct Nonmedical Costs

Estimation of direct nonmedical costs in patients with prostate cancer was performed using information self-reported by patients through face-to-face or telephone interviews. The information required for outpatient and hospital cases was collected throughout the study. These costs include the cost of intracity and intercity travel to receive services, hotel stays, and food consumed during the travel. The costs of intracity trips, such as by charter taxi, line taxi, and buses, have been included in the cost of extracity trips. The direct nonmedical costs were calculated using information from the collection forms provided by patients themselves or their companions. The cost for 1 year was calculated by multiplying the costs reported for a 3-month period by 4.[18]

Indirect Costs

Indirect costs derive from diminished productivity of patients or family members in response to disease, death, or treatment. These costs include lost productivity because of absence from work as incurred by the patient or the companion. Calculation of indirect costs that result from prostate cancer was performed using existing methods. These costs were calculated from information received by questionnaires or by asking the patient or a companion and are based on monthly income. These data were calculated using the human capital approach as were the direct nonmedical costs.

Because most patients with prostate cancer in the present study were >65 years of age (mean age, 69 years), there is typically no need to estimate indirect costs for patients. Accordingly, the indirect costs of this group of patients were considered to be zero. However, the costs of the companion (usually a member of the patient's family) were identified and calculated because they are usually in the generative ages of society. The mean national salary was calculated as US $11.61 per day, and this number was multiplied by the number of lost days.

RESULTS

Demographic Information of Patients

Of the 300 patients initially selected, 263 accepted the interview invitation and were included in the study. Descriptive results based on the variables of educational level, occupational status, and insurance associated with patients is summarized in Table II, which also gives the mean age, time of diagnosis, and monthly income of patients. The prevalence in the different stages of the disease, according to specialists, was estimated as detailed in Table III.

Table II. Demographic characteristics of patients with prostate cancer.

Characteristic	Finding (N = 300)
Educational level, %	
Illiterate	26.2
Nonacademic	54.8
Academic	19.0
Health insurance status, %	
Social insurance	45.2
Health care insurance	44.9
Other insurance	5.6
Noninsurance	4.3
Occupational status, %	
Employed	5.9
Retired	46.6
Nonemployed	32.3
Self-employed	15.2
Age, mean (SD), y	69 (4.2)
Time of diagnosis, mean (SD), y	3.6 (3.5)
Month income, mean (SD), $	426.74 (108.14)

Table III. Prevalence of each stage in patients with prostate cancer in Iran.

Stage	Prevalence, %
Low risk	5
Local nonmetastatic	49
Local regionalized nonmetastatic	21
Nonresistant metastatic	16.75
Resistant metastatic	8.25

Direct Medical Costs

The results of direct medical costs for the low-risk, local, local regionalized, nonresistant, and resistant stages are given in Table IV. Depending on the stage

Table IV. All direct medical costs of patients in different treatment states.

Type of Service	Low Risk		Local		Local Regionalized		Nonresistant		Resistant	
	Costs, US $	Indicence, %	Costs, US $	Incidence, %	Costs, US $	Incidence, %	Costs, US $	Incidence, %	Costs, US $	Incidence, %
Specialist visit	37.59	37	45.24	2	57.47	3	106.41	3	152.29	2
Tests	31.93	31	43.79	2	72.35	3	79.93	2	79.93	1
Hormone therapy	33.27	32	0.00	0	0.00	0	0.00	0	0.00	0
Diagnostic services	0.00	0	260.68	10	330.47	15	573.33	14	956.69	12
Surgery and hormone therapy (LH)	0.00	0	116.54	4	85.62	4	0.00	0	0.00	0
Radiotherapy and surgery	0.00	0	626.91	23	134.32	6	0.00	0	0.00	0
Surgery	0.00	0	198.16	7	3.31	0	0.00	0	0.00	0
Radiotherapy and hormone therapy	0.00	0	459.86	17	919.73	42	0.00	0	0.00	0
Radiotherapy	0.00	0	370.59	14	0.00	—	0.00	0	0.00	0
Hoteling	0.00	0	178.13	7	233.71	10	749.63	18	970.10	13
Other health services	0.00	0	373.53	14	373.53	17	407.35	10	407.35	5
Usual anti androgen and LH agonist	0.00	0	0.00	0	0.00	0	263.38	6	8.53	0
New antiandrogen and LH agonist	0.00	0	0.00	0	0.00	0	184.40	4	2157.08	28
Radiotherapy and chemotherapy	0.00	0	0.00	0	0.00	0	1768.72	43	3015.92	39
Total mean (SD)	102.79 (33.03)	100	2673.43 (87.42)	100	2210.51 (306.92)	100	4133.15 (650.87)	100	7747.89 (455.86)	100

LH = luteinizing hormone.

of treatment, in addition to cost of visits, medication, tests, imaging, and hospitalization, costs may accrue for diapers, specialized diet, catheters, toilet seats, electric mattresses, and supplements. These additional expenses can produce a mean (SD) cost of US $373.53 ($11.64) and $407.35 ($45.12) per patient for patients with nonmetastatic and metastatic disease, respectively.

The results indicate that annual direct medical costs increased as the disease progressed. The cost of radiotherapy plus surgery (23%) in patients with local nonmetastatic disease formed the greatest share of medical costs, followed by radiotherapy plus hormone therapy (17%). For patients with nonmetastatic local regionalized disease, radiotherapy plus hormone therapy (42%) was the largest portion of medical costs followed by other medical services (17%) and diagnostic services (15%). For patients with metastatic nonresistant disease, the largest share of medical costs was for radiotherapy plus chemotherapy (43%), followed by hotel stay (18%) and diagnostic services (14%). For patients with metastatic resistant disease, the largest share of medical costs was for radiotherapy plus chemotherapy (39%) followed by hormone therapy plus antiandrogens (28%).

Direct Nonmedical Costs

Because it was not possible to extract and calculate the cost of travel by personal car, these costs were excluded from the study. The costs of commuting, residence, intracity and inter-city trips, and food, which have been accrued during each visit to the health care center, as self-reported by patients, were considered. The direct nonmedical costs calculated for patients while receiving medical services are given in Table V according to the stage of the disease.

Indirect Costs

The total sum of days lost for the companion of a patient was estimated to be 3669 days, which equals approximately 17 days lost per patient. Taking the income lost by the companion into account, the total lost income (indirect cost for companions) was estimated to be US $42,579. The mean indirect cost of all stages of the disease per patient is US $197. Table V gives the mean indirect costs at each stage of the disease. Estimation of the total cost per patient

Table V. Total costs of patients with prostate cancer in different states.

Type of Service	Low Risk	Local	Local Regionalized	Nonresistant	Resistant
Direct medical costs					
Mean (SD), US $	102.79 (33.03)	2673.43 (87.42)	2210.51 (306.92)	4133.15 (650.87)	7747.89 (455.86)
Incidence, %	46	86	79	80	84
Direct nonmedical costs					
Mean (SD), US $	97.06 (45.00)	339.71 (58.02)	485.29 (36.77)	776.47 (99.25)	1067.65 (600.92)
Incidence, %	43	11	17	15	12
Indirect costs					
Mean (SD), US $	23.85 (20.44)	83.49 (65.06)	119.27 (32.59)	238.54 (87.35)	357.81 (73.00)
Incidence, %	11	3	4	5	4
Total costs					
Mean (SD), US $	223.71 (67.55)	3096.63 (278.65)	2815.08 (155.07)	5148.15 (576.88)	9173.34 (433.72)
Incidence, %	100	100	100	100	100

based on the costs at the different stages is summarized in Table V.

The results of the study indicate that the annual indirect cost of treatment increased as the disease progressed and that direct and indirect costs for patients with metastatic resistant disease claimed the largest share of medical and nonmedical costs. The smallest share was for low-risk patients. Table V indicates that, as the disease progressed, the share of direct medical costs increased from 46% for low-risk patients to 84% for patients with metastatic resistant disease. By contrast, the indirect costs decreased from 11% for low-risk patients to 4% for disease-resistant patients.

DISCUSSION

This comprehensive and thorough study of the cost of prostate cancer treatment in Iran was conducted to investigate the direct and indirect costs of the disease at the different stages of prostate cancer. As reported, the cost per patient differed according to disease stage. Patients in the metastatic nonresistant stage incurred the largest cost for the health system and society and the local stage incurred the minimum cost. Furthermore, direct medical costs claimed the largest share for treatment of this disease across stages. The findings of this study and in consideration of the prevalence (9%) of this disease in Iran indicate that prostate cancer incurs a considerable financial burden on the Iranian health system and society. The results of this research are in line with the results of studies conducted in other countries for estimation of the economic burden of disease.[16,19–28]

On the basis of the prevalence and cost of each stage, the total annual cost for the prostate cancer population in Iran is estimated to be approximately US $2900 million, of which >80% is spent on direct costs. The mean direct cost for each patient in Iran was estimated to be US $3420. This figure is in line with the results of a study by Fourcade et al,[24] which found that the mean direct cost for each patient was €3698 in Germany, €3256 in Spain, €3682 in England, €5226 in Italy, and €5851 in France.[24] Patients with either nonresistant or resistant metastatic disease had the largest portion of direct costs in the Iranian health care system (43% and 42%, respectively). Although a patient with metastatic disease incurs medical costs that are far larger than for a patient with local disease, the high number of patients with local disease (approximately 49%) compared with patients with metastatic disease means that the share of direct costs to society of this stage of the disease is high.

Although no relevant study has been conducted in this regard on patients with prostate cancer, this research is in line with the results of studies on other diseases, including the study by Ong et a1[29] in Singapore. In addition, when estimating costs, radiotherapy, chemotherapy, and hormone therapy claimed the largest share of direct medical costs at different stages. Receiving these services is a major problem for such patients. In studies performed on the cost of prostate cancer in other countries, these items have been identified as costly when receiving medical services. Overall, the current results are in line with those reported by other countries regarding the increase in direct cost with progression of the stages of the disease. These mark a considerable increase on the economic burden of the disease with increased life expectancy.[16,19–28,30,31]

Because many patients with prostate cancer, especially at advanced stages of the disease, are compelled to visit centers far from their place of residence to receive treatment, the direct and indirect nonmedical costs are increased. The indirect costs for the patients at different stages accounted for approximately 20% of the total costs. In milder cases, this share increased, whereas in more extreme cases it decreased. These results suggest that indirect costs can also be considered an important cost element in estimation of the total cost developed by the patient because these costs are paid by the patient themselves.[32] This finding is concerning and important. Because most patients with prostate cancer in the current study were >65 years of age, the indirect costs of this group of patients were considered zero. From society's perspective, these patients are inactive people. This assumption may be the limitation of our study.

Our study found that prostate cancer is the second most common malignant tumor in men, with an incidence of >9% (a population of approximately 800,000). The increased life expectancy in men on one hand and improper management of the disease on the other mean that most people in the primary or at-risk stages can transition to more advanced stages, thereby increasing the cost of illness. A significant economic burden is incurred to the health care

system and society. Screening as well as effective and timely treatment of the disease that halts or slows its progression can be very cost-effective.

The results obtained from the estimation of costs are in accordance with the results of similar studies[16] and indicate that the more severe stages of the disease can be very expensive to patients. On the questionnaire dealing with the expense of treatment and financial pressure on families, patients stated that, in most cases, they were compelled to use their savings or that of their family members or borrow money to cover their medical costs. This problem arose for most people in the more severe stages of the disease and caused a high financial burden on the patients and their family. The provision of medical costs was very difficult for most of them. This problem was aggravated for services not covered by insurance, including some medications or services received in nongovernmental centers.[33]

CONCLUSION

The findings of this research indicate that, in Iran, patients with prostate cancer bear high costs in the advanced stages of the disease, whereas in the early stages of the disease medical costs are relatively low. The health care system of Iran should work to prevent patients from reaching the metastatic stages of the disease by implementing suitable screening systems for timely diagnosis of the disease and its effective treatment.

Considering the chronic nature of the disease and the high incidence in Iran, management of the different stages can relieve a considerable economic burden and be considered a therapeutic challenge. This study communicates an important message to the authorities and policymakers of the health care system to plan ways to control and prevent this disease or at least treat patients in the primary stages of the disease.

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Dr Mojahedian wrote the first version of the manuscript and made contribution in project administration also reviewed and revised the manuscript. Mr Toroski and Dr Keshavarz collected data for the manuscript. Dr Nikfar supervised the project and designed the study. All authors had equal roles in analysis and interpretation of data. All authors approved the final manuscript as submitted.

CONFLICTS OF INTEREST

The authors have indicated that they have no conflicts of interest regarding the content of this article.

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