



## Economic Burden of Colorectal Cancer in Korea

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**Objectives:** The incidence and survival rate of colorectal cancer in Korea are increasing because of improved screening, treatment technologies, and lifestyle changes. In this aging population, increases in economic cost result. This study was conducted to estimate the economic burden of colorectal cancer utilizing claims data from the Health Insurance Review and Assessment Service.

**Methods:** Economic burdens of colorectal cancer were estimated using prevalence data and patients were defined as those who received ambulatory treatment from medical institutions or who had been hospitalized due to colorectal cancer under the International Classification of Disease 10th revision codes from C18-C21. The economic burdens of colorectal cancer were calculated as direct costs and indirect costs.

**Results:** The prevalence rate (per 100 000 people) of those who were treated for colorectal cancer during 2010 was 165.48. The economic burdens of colorectal cancer in 2010 were 3 trillion and 100 billion Korean won (KRW), respectively. Direct costs included 1 trillion and 960 billion KRW (62.85%), respectively and indirect costs were 1 trillion and 160 billion (37.15%), respectively.

**Conclusions:** Colorectal cancer has a large economic burden. Efforts should be made to reduce the economic burden of the disease through primary and secondary prevention.

**Key words:** Cost of illness, Economic burden, Colorectal neoplasms, Prevalence

### INTRODUCTION

Based on data from 2010, cancer ranks number one as the most fatal disease in Korea [1]; thus, it poses a significant threat to the lives of Koreans. According to the Journal of the Korean Cancer Association, the incidence rate of cancer increased

4.0% in 2010 with 202 053 new cancer diagnoses compared to 194 359 new cancer diagnoses in 2009 [1]. Moreover, the incidence rate among males was 1.04 times higher than that of females [1]. In 2009, 190 000 people were diagnosed with cancer (99 224 males and 93 337 females), and this constituted a 6.7% increase compared to the 180 465 new diagnoses in 2008 [1]. Since 2002, there has been a 98.5% increase in cancer diagnoses in the Korea [1].

Cancer mortality has increased steadily over the last 10 years. The total number of Korean cancer-related deaths has increased 1.3 times from 53 845 people in 1999 to 72 046 people in 2010 [2]. The increase in both the incidence and mortality rate is a global phenomenon. For example, the incidence of cancer in the USA has steadily increased between 1999 and 2008 [3].

Colorectal cancer involves a malignant tumor in the colon (colon cancer) or rectum (rectum cancer). These cancers are designated as colorectal cancer and/or colorectal carcinoma

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[4]. In the 2012 cancer incidence report by the Korea Ministry of Health and Welfare, the crude incidence rate of colorectal cancer in 2010 was 62.5 in males (per 100 000 people) and 20.8 in females (per 100 000 people). Among all people diagnosed with cancer, 15.2% of males and 10.3% of females had colorectal cancer [1]. In data from 2010, colorectal cancer ranked third among all incident types of cancer. Among men, colorectal cancer ranked second behind stomach cancer, whereas in women, it ranked third following thyroid cancer and breast cancer [5,6]. These values are high relative to other countries. In September 2011, the International Agency for Research on Cancer, an affiliate of the World Health Organization, announced 184 countries as targets to reduce the world's incidence of colorectal cancer in 2008. The incidence of colorectal cancer among Korean men in 2008 was 46.9 per 100 000 people and ranked first among all Asian countries and fourth worldwide. The incidence of colorectal cancer in the Korea followed the incidence rates of Slovakia, Hungary, and the Czech Republic, which were 60.6, 56.4, and 54.4 per 100 000 people, respectively. The incidence among Korean females per 100 000 people was ranked 19th out of the 184 countries and was higher than that of England (25.3), America (25.0), and Japan (22.8) [7].

Patients with cancer require high-level treatment and care. Patients and their families carry the burden of treatment expenses due to the long fight against the disease. Thus, financial loss may prevent ultimate recovery. Cancer incidence and survival rates are both increasing and cancer-related costs for families worldwide are predicted to continue to increase.

For example, it was reported in 2002 that the economic burdens of stomach cancer and liver cancer in the Korea were 2.2 trillion won each Korean won (KRW) each, the highest among all cancers. Lung cancer and colorectal cancer had an economic burden of 1.5 trillion KRW and 1 trillion KRW, respectively. In 2005, the economic burden of liver cancer, stomach cancer, and colorectal cancer was estimated at 2.46 trillion KRW, 2.4 trillion KRW, and 1.38 trillion KRW, respectively. Although the burden of cancer was similar to that of 2002, the expenses substantially increased. Thus, the economic burden of cancer in the Korea is increasing substantially every year [8-10].

Many studies have investigated the economic burden of cancers in the Korea. However, rapid increases in the incidence of disease and relative survival rates have caused changes in the burden of disease. This is particularly apparent in cancers such as colorectal cancer that have demonstrated rapidly increasing incidence rates. Thus, this study used nationally rep-

resentative data to investigate the increasing economic burden of colorectal cancer.

## METHODS

To estimate the economic burden of colorectal cancer, a prevalence-based approach was employed that targeted existing and newly diagnosed patients [11]. Data from the 2010 cross-sectional study was used to include existing and newly diagnosed colorectal cancer patients to measure the expenses related to colorectal cancer medical treatment in the Korea.

Colorectal cancer was defined according to the International Classification of Disease 10th revision (ICD-10) codes from C18-C21 [12]. Data on salary demands, health insurance reviews, and assessment services were used to calculate the economic expenses for complete medical treatment of both inpatients and outpatients based on reported medical treatments and the prevalence of colorectal cancer patients.

The target participants of this study were patients who had visited clinics primarily for the treatment of colorectal cancer and who had been hospitalized or had claimed health insurance benefits. To improve the accuracy of the selection process, patients with more than three hospital visits were considered prevalent cases [13,14].

To estimate economic burden, expenses were broadly classified as direct expenses or indirect expenses. Direct expenses were considered costs that were incurred during treatment and included direct medical and non-medical care costs. Direct medical care costs were paid by the insurer of inpatients and outpatients. Moreover, the medical expenses incurred during medical treatment were classified as paid by patients (out of pocket), meal costs, upper ward differences, specialized treatments, non-covered care costs, and prescribed pharmaceutical costs (Supplemental Table 1).

For direct non-medical care costs, the cost of transportation for the patient and guardian were included, such as costs incurred when visiting care facilities or during hospitalization.

To estimate loss of productivity, indirect costs were classified as the cost of premature death and loss of productivity as time consumed during outpatient visits to hospital or total time hospitalized.

To measure the direct care costs, we requested the 2010 data from the Health Insurance Review and Assessment Service (HIRA). Colorectal cancer disease codes were used to search for outpatients or inpatients who received colorectal cancer

treatments. Moreover, data on non-insured costs compiled by the HIRA were also used [15]. The non-insured costs paid by colorectal patients were identified to be 25% for hospitalized patients and 14.2% for outpatients. All the direct care costs in this study were calculated using this information [15].

Pharmaceutical costs were calculated for patients who had claimed benefits for treatment of colorectal cancer which is main diagnoses, using the 2010 HIRA data. Medications for unrelated diseases such as hypertension were excluded using the ICD-10 codes and drug classification numbers to isolate medications related to colorectal cancer only (Supplemental Table 2).

Direct non-medical care costs were calculated as the sum of transportation expenses incurred when the patient and guardian visited the clinic. Based on 2008 Korea Health Panel, the average one-way cost of transportation among cancer inpatients and their guardians was 12 719.9 KRW. For outpatients and their guardians, the average one-way cost of transportation cost was 4687.3 KRW in 2008 [16]. The 2008 price was converted to the 2010 price index by multiplying by the inflation rate of 113.4.

No determined fixed costs were calculated for the guardians. Costs were applied differently across institutions. According to the Guardian Association, the average cost incurred by guardians was 56 809 KRW (average cost of one day) in 2005, and this cost was multiplied by the number of days guardians cared for their patients in the final calculation [17].

Among outpatients in our study population, those aged 0 to 9 and over 60 years were assumed to be accompanied by a guardian. Therefore, the daily average cost of guardian care in 2005 was applied (56 809 KRW [average cost of one day]), and this number was multiplied by the total number of days at outpatient visits to calculate the total cost. Then, the 2010 inflation rate of 117.1 (price index) was applied for the final calculation. In addition, the estimated time spent visiting the outpatient clinic was calculated by multiplying the number of working hours in the day by one third for the total number of days the patient visited the outpatient clinic.

The 2010 price index was used as the reference year for comparison with that of 2005, and a 115 (price index) adjustment was multiplied by transportation and guardian cost calculations [18].

Indirect cost was defined as medical care costs or the cost of premature death. Thus, indirect cost was estimated according to the loss of productivity calculation based on the human-capi-

tal approach [19].

To measure productivity loss for hospitalized patients, the monthly average labor hours, according to the 2007 investigation of labor according to the type of employment, and the monthly average wage by age were applied. Further, 2007 labor statistics data were used to divide the total average monthly wage of laborers by the total labor hours to calculate the average wage per hour [20].

The price index of 117.1 was multiplied to costs calculated for 2010 (reference year). Participants aged 0 to 19 and over 60 were assumed to not participate in actual economic activities; thus, productivity loss was calculated for patients aged 20 to 65. Further, to measure the monthly average cost of productivity loss due to outpatient visits, the total number of days the patient visited the outpatient clinic was multiplied by one-third for the final calculation.

In the case of premature death, cause-of-death statistics from the National Statistical Office were used to calculate the colorectal cancer mortality. Moreover, the premature cost of death was measured for those who worked until the age of 65, and a 5% rate was used to calculate productivity loss due to premature death.

SAS version 9.1 (SAS Inc., Cary, NC, USA) was used for statistical analyses.

## RESULTS

### Prevalence of Treatment for Colorectal Cancer

The prevalence of treatment (per 100 000 people) among males and females diagnosed with cancer in 2010 were 195.71 and 135.1, respectively. Treatment was more likely in adults than that in children and increased with adult age. Men and women between 70 to 79 years old had the highest prevalence of treatment (Table 1).

### Economic Burden

The total economic burden of colorectal cancer in 2010 was 3.1 trillion KRW. The direct cost was 1.97 trillion KRW (62.85%), and the indirect cost was 1.16 trillion KRW (37.15%). The ratio of direct-to-indirect cost was 1.69:1, indicating that the direct cost was about 1.7 times higher than the indirect cost. The direct medical care cost was 774.6 million KRW, and the direct non-medical care cost was 1.19 trillion KRW. For indirect costs, productivity loss was 132.3 million KRW and the cost of premature death was 1.27 trillion KRW (Table 2).

For outpatients who visited clinics in 2010, the direct medical care cost for colorectal cancer was 307.2 million KRW. This cost was further divided as 211.8 million KRW (69.0%), 47.5 million KRW (15.4%), 33.7 million KRW (11.0%), and 14.2 million KRW (5.0%) for the cost of health insurance, non-insured fees, pharmaceutical cost, and out-of-pocket fees, respectively.

In addition, the direct medical care cost for inpatients in 2010 was 467.4 million KRW. Of this total cost, 341.5 million KRW (73.1%), 102.6 million KRW (21.9%), and 23.3 million KRW (5.0%) was estimated as the cost of insurance, non-insured

fees, and out-of-pocket fees, respectively.

A total of 1.183 trillion KRW in economic expenses was spent by women compared to 1.94 trillion KRW by men. The direct medical care costs for men and women were 394.4 and 380.2 billion KRW, respectively; thus, the cost for men was 1.04 times higher than that of women. Moreover, among those aged 20 to 69, women and men spent 238.9 and 281.5 billion KRW, respectively, indicating that men spent 1.18 times more than did women. According to the gender-specific results, the direct medical care cost (women, 99.8 billion KRW vs. men, 129.9 billion KRW) and the average cost per person (women, 35 million KRW vs. men, 39 million) were highest in men (Table 3). The direct medical care cost of outpatients was around 300 billion KRW, whereas the direct medical care cost for hospitalized patients was approximately 470 billion KRW.

For pharmaceutical costs, the total treatment cost for medical prescriptions was 33.7 billion KRW (excluding the cost of treatment from the direct medical treatment cost data). Per day, an average of 3859.7 KRW was spent on pharmaceuticals at the clinic.

Transportation fees for outpatients, a direct non-medical care cost for outpatients, were estimated to be 559.1 billion KRW. Furthermore, the direct non-medical care cost of hospitalization was 500.3 billion KRW for transportation fees. The guardian cost for both outpatients and inpatients was 125.4 billion KRW.

The indirect cost was calculated as the loss of income due to either premature death or loss of productivity from outpatient visits or hospitalization. The total costs of productivity loss and premature death were 132.3 billion KRW and 1.23 trillion KRW, respectively.

**Table 1.** Treated prevalence of CRC in 2010

Age (y)	Characteristics				Period prevalence of CRC	
	Total male population <sup>1</sup>	Total female population <sup>2</sup>	No. of men with CRC <sup>3</sup>	No of women with CRC <sup>4</sup>	Male	Female
Total	25 310 385	25 205 281	49 535	34 059	195.710	135.13
0-9	2 463 577	2 293 947	-	2	-	0.09
10-19	3 598 726	3 228 149	20	11	0.56	0.34
20-29	3 565 624	3 301 332	148	123	4.15	3.73
30-39	4 272 740	4 097 809	1038	868	24.29	21.18
40-49	4 513 652	4 330 700	4260	3292	94.38	76.02
50-59	3 543 441	3 523 382	11 356	7362	320.48	208.95
60-69	1 999 523	2 191 806	16 460	9610	823.20	438.45
70-79	1 070 720	1 547 805	13 271	9226	1239.45	596.07
80-89	253 899	597 869	2791	3297	1099.26	551.46
90-100	28 483	92 482	191	268	670.58	289.79

Unit: per 100 000 people.

CRC, colorectal cancer.

<sup>1</sup>Total male population [1].

<sup>2</sup>Total female population [1].

<sup>3</sup>Total male population with CRC.

<sup>4</sup>Total female population with CRC.

**Table 2.** Economic burden of colorectal cancer in Korea, 2010

Service	Days of care	Direct costs (①) <sup>1</sup>					Indirect costs (②) <sup>2</sup>		Total costs (①+②)	
		Direct medical care costs					Direct non-medical care costs			
		Paid by insurer (1)	Paid by patients (2)	Non covered (3)	Prescribed pharmaceuticals (4)	Sub total (1)+(2)+(3)+(4)	Transportation (5)	Guardian's costs (6)		Lost productivity (7)
Out	874 408	211 840	14 192	47 450	33 748	307 231	559 056	20 302	24 635	(male) 755 318
In	1 508 545	341 528	23 269	102 592		467 388	503 310	105 078	107 713	(female) 271 993
Total	2 382 953	553 368	37 461	150 042	33 748	774 618	1 062 366	125 381	132 348	1 027 311

Unit: 1 000 000 Korean won.

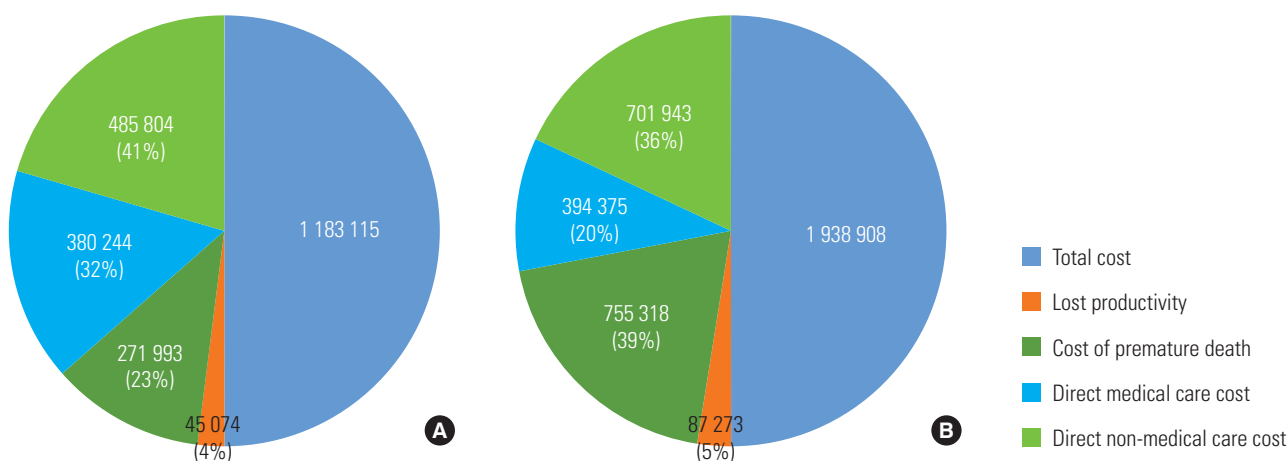
<sup>1</sup>Direct costs=(1)+(2)+(3)+(4)+(5)+(6).

<sup>2</sup>Indirect costs=(7)+(8).

**Table 3.** Medical/non-medical care expenses by gender

Age (y)	Male						Female					
	Total cost	Per capita cost	Direct medical care cost	Direct non-medical care cost	Lost productivity	Cost of premature death	Total cost	Per capita cost	Direct medical care cost	Direct non-medical care cost	Lost productivity	Cost of premature death
0-9	0	0	0	0	0	0	1	0	0	1	0	0
10-19	1713	86	301	485	0	927	360	33	173	19	0	168
20-29	11 555	78	1727	2707	356	6764	7218	59	1821	240	254	4902
30-39	69 927	67	9868	16 111	3005	40 943	50 180	58	11411	15 238	4341	19 191
40-49	286 817	67	38 990	68 096	16 242	163 489	168 160	51	42 088	54 750	6623	64 698
50-59	616 287	54	101 000	174 845	36 365	304 077	320 271	44	83 717	111 869	23 097	101 588
60-69	633 057	38	129 893	232 741	31 304	239 118	327 191	34	99 846	135 140	10 759	81 445
70-79	265 987	20	94 159	171 828	0	0	220 356	24	99 576	120 779	0	0
80-89	50 514	18	17 371	33 143	0	0	82 472	25	38 473	43 999	0	0
90-100	3053	16	1066	1987	0	0	6906	26	3138	3768	0	0
Total	1 938 908	39	394 375	701 943	87 273	755 318	1 183 115	35	380 244	485 804	45 074	271 993

Unit: 1 000 000 Korean won.



**Figure 1.** The proportion of medical/non-medical expenses by gender (unit: 1 000 000 Korean won). (A) Female and (B) male.

For indirect costs, the loss to labor among outpatients was 24.6 billion KRW, and men incurred 2.05 times more of a loss than women did (men, 16.6 billion KRW vs. women, 8.1 billion KRW). The loss to labor among inpatients was 107.7 billion KRW, and men incurred 1.91 times more of a loss than women did (men, 70.7 billion KRW vs. women, 37.0 billion KRW). The loss of opportunity due to premature death was 755.3 billion KRW for men and 272.0 billion KRW for women; men incurred 2.78 times more of a loss than women did (Figure 1).

The total direct and indirect economic burden of colorectal cancer was calculated to be 3.1 trillion KRW.

## DISCUSSION

In this study, the HIRA health insurance claims data were used to estimate the economic burden and prevalence of treatment in the Korea. According to the National Statistical Office, approximately 83 594 patients of the total Korean population (n=50 515 666) were treated for colorectal cancer in 2010; thus, the treatment prevalence for colorectal cancer was 165.48 (per 100 000 people). Among the total female population in the Korea (n=25 205 281), approximately 34 059 females were diagnosed with colorectal cancer at a prevalence of 135.13 (per 100 000 people). Among the total Korean male population (n=25 310 385), 49 535 were diagnosed with

colorectal cancer with a prevalence rate of 195.71 (per 100 000 people). Therefore, a 1.45 times higher prevalence rate was found in men than that of women.

In a study from 2009, the total number of patients with colorectal cancer was 81 769 with a 164.7 prevalence per 100 000 people, and the age-standardized prevalence rate was 122.0 per 100 000 people. The prevalence of treatment in this study was 165.48, which is similar to the prevalence in 2009, which were based on the National Cancer Registration data [21]. Our study used data from insurance claims reported by the HIRA for inpatients and outpatients treated for colorectal cancer in 2010. As a result, the calculated prevalence rates were similar for the two datasets.

The economic burden of colorectal cancer was 3.1 trillion KRW. The direct cost was 1.97 trillion KRW (62.85%), and the indirect cost was 1.16 trillion KRW. The direct-to-indirect cost ratio was approximately 1.7. Furthermore, when looking at age- and gender-specific distributions, the total cost increased with age. The economic burden of colorectal cancer was 1.94 and 1.12 trillion KRW for men and women, respectively. The direct medical care cost of men and women were 394.4 billion KRW and 380.2 billion KRW, respectively, which are approximately equal. However, loss to labor was 842.6 billion KRW for men and 317.1 billion KRW for women, indicating that men experienced a 2.7 times greater loss than did women. Men and women aged 60 to 69 years incurred the most costs for direct medical care (women, 99.8 billion KRW; men, 129.9 billion KRW).

In 2002 the estimated socioeconomic burden due to cancer in the Korea was 11.3 trillion KRW. In 2005, the cost increased by 1.25 times to 14.1 trillion KRW [10,21]. In 2002 and 2005, colorectal cancer's economic burden was 1 trillion KRW and 1.4 trillion KRW, respectively. The economic burden of colorectal cancer in this study was estimated at 3.1 trillion KRW. Thus, a 2.23-fold increase in socioeconomic burden due to colorectal cancer was noted in 2005 [10]. In this study, the direct medical care cost was 774.6 billion KRW (24.81% of the total cost), the direct non-medical care cost was 1.10 trillion KRW (38.04% of the total cost), and the indirect cost was 1.16 trillion KRW (37.14% of the total cost). In the previous study from 2005, the direct and indirect costs were 79.6% and 20.4%, respectively. Thus, in 2005, the direct cost was 3.9 times more than indirect cost. However, in the present study, the direct cost (1.97 trillion KRW) was 1.7 times greater than the indirect cost (1.16 trillion KRW). The different methods used in this study, including the transportation fees, costs related to guardian care, and

the increased price index, likely contributed to this difference. For example, data on the use of complementary and alternative medicine for were included in the 2005 study on direct medical care costs. However, when calculating indirect cost, the loss of productivity among cancer patients was calculated according to the rate of economic activity. Thus, the rate of indirect cost was compared to direct cost.

To investigate the socioeconomic burden of colorectal patients, this study utilized the 2010 data from HIRA to calculate the prevalence of cancer. Moreover, health insurance claims data were used to estimate costs. The Korea has a single, national insurance system; therefore, the national prevalence of colorectal could be estimated [22]. This method has the added advantage of maintaining internal consistency. Although we used health insurance claims data, the prevalence rates reported here were similar to data from cancer registries. The direct cost of 1.9624 trillion KRW reported here corresponded to approximately 4.09% of the 2010 medical care costs in the Korea (total medical costs in the public sector in 2010=48.293577 trillion KRW) [23]. In addition, the health insurance guarantee rate for colorectal cancer was 68.9%, which was lower than lung cancer at 74.6% and lower than liver cancer at 70.9%. However, in the non-insured cost per patient for colorectal cancer ranked first among all main cancers at 25.0% [15]. According to data from the National Health Insurance Corporation in 2010, deductibles for the treatment of target diseases decreased from 10% to 5%, and the health insurance guarantee rate for these diseases improved from 71.4% compared to the rate of the previous year 67.8%. The guarantee rate does not include non-covered costs, thus is insufficient at estimating total costs.

Colorectal cancer was one of the cancers that demonstrated an increase in socioeconomic cost. When examining the changes to medical care costs from 2001 to 2009 for the main types cancers, prostate cancer increased 9.9-fold (9.4 to 93.2 billion KRW), breast cancer increased 5.0-fold (63.6 to 316.2 billion KRW), and colorectal cancer increased 4.5-fold (101 to 453 billion KRW). Thus, colorectal cancer showed the most drastic increase with a difference of 357.1 billion KRW, with stomach cancer ranking second. Therefore, colorectal cancer consumes a substantial amount of economic burden and available finances [15]. To lessen the socioeconomic burden of colorectal cancer, early treatment and early examinations along with altering lifestyle behaviors should be emphasized [8,24]. Moreover, the national estimated rate of cancer examinations was 36.0%

in 2008, 22.9% among medical payment recipients, and 8.8% among patients with registered health insurance, which indicates a tendency to increase each year. However, for each type of cancer, breast cancer had the highest participation rate in 2008 at 43.5% followed by liver cancer (42.5%), stomach cancer (37.3%), and colorectal cancer (30.7%). When considering the socioeconomic burden of colorectal cancer, increasing the examination rate of colorectal cancer may decrease the economic burden of colorectal cancer [25]. Moreover, the rapidly aging population, with increased life expectancy, increases the relative survival rate of cancer. Thus, increased prevention and training about the risk factors for colorectal cancer as well as changes to health care policy are needed [26].

This study has important limitations. First, the human-capital method was used to estimate productivity loss, which uses the differences in wages according to the financial market [27]. The friction-cost method estimates the employer's expenses rather than the patient's expenses. Therefore, the human-capital method can identify a greater difference in cost than the friction-cost method can, and this can lead to an overestimation of productivity loss. Second, costs related to medical care for specific diseases and the exact classification of colorectal cancer patients is needed. In this study, patients were classified as having colorectal cancer if they were hospitalized or visited the outpatient clinic three times for colorectal cancer treatment. Thus, we may not have included all patients with colorectal cancer because not all patients visit the outpatient clinic or become hospitalized. This may have led to an underestimation of economic burden. Nonetheless, we estimated transportation fees, guardian costs, and time lost for guardians and patients, which may have led to an overestimation. Third, costs related to cancer treatment and comorbidities were not included, and medications not related to colorectal cancer were excluded. These exclusion criteria improved the accuracy of our measures; however, treatment costs from accompanying diseases may have also been included. Fourth, the cost of complementary and alternative medicine must be considered in future studies. Last, loss related to psychological pain endured by patients and family members and other self-sterilization tools and medicine required after colorectal cancer treatment/surgery could not be estimated.

This study utilized insurance claims data for colorectal cancer according to the 2010 data by the HIRA to estimate the economic burden of the disease. The prevalence of treatment among patients diagnosed with colorectal cancer (per 100 000

people) was 195.71 for men and 135.1 for women; men had an approximately 1.45 times higher prevalence than that of women. The economic burden of colorectal cancer was 3.122 trillion KRW, representing a 2.23-fold increase compared to the 2005 socioeconomic burden of 1.4 trillion KRW. In a review of the 2005 economic cost of cancer from previous research (Table 2), the number of colorectal cancer patients increased nearly 2-fold from 2010 to 2005 (97.3%), which may be due to an increase in the economic burden of the disease. Furthermore, the prevalence with patient age, with men and women age 60 to 69 consuming most of the direct medical care costs (females, 99.8 billion KRW; males, 129.9 billion KRW).

To reduce the economic burden of colorectal cancer, primary and secondary prevention must be promoted [28,29]. Participation rates in colorectal cancer examinations must be increased along with the development of healthy behaviors [30] to lessen the economic burden of colorectal cancer. Future studies should address these areas.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest with the material presented in this paper.

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**Supplemental Table 1.** Description of the sources of data used in this study

<b>Costs</b>		<b>Source (2007-2010)</b>	
Direct costs	Direct medical care costs	Paid by insurer	Claims Health Insurance Review and Assessment Service
		Paid by patients	Claims Health Insurance Review and Assessment Service
		Non-covered costs	Patient Health Care Survey Data (pocket payments) [15]
		Prescribed pharmaceuticals	Claims Health Insurance Review and Assessment Service
	Direct non-medical care costs	Transportation	Korea Health Panel (2010) [16]
		Guardian's fees	The Guardian Association [17]
Indirect costs	Lost productivity	Lost productivity (inpatients)	Survey on Wage Structure of the Ministry of Labor [19]
		Lost productivity (outpatients)	National Statistical Office: raw survey data on death (2007-2010)
			Survey on the Structure of Wages by the Ministry of Labor [20]

**Supplemental Table 2.** Colorectal cancer is considered to have few comorbidities in patients who are taking certain pharmaceuticals for diabetes, hypertension, hyperlipidemia, and depression

Depression	Hypertension	Diabetes	Hyperlipidemia	Etc.
Amitriptyline	Alacepril	Imidapril	Acarbose	Cholestyramine
Amoxapine	Amiloridee	Indapamide	Chlorpropamide	Ezetimibe
Bupropion	Amineptine	Indapamide	Chlorpropamide	Fibrate
Citalopram	Amlodipine	Irbesartan	Glibenclamide	Lipitor
Clomipramine	Arotinolol	Isradipine	Gliclazide	Nicotinic acid
Dothiepin	Atenolol	Labetalol	Glimepiride	Omega-3 fatty acid
Escitalopram	Barnidipine	Lacidipine	Glimepiride	Ramipril
Fluoxetine	Benazepril	Lercanidipine	Glipizide	
Fluvoxamine	Benidipine	Lisinopril	Glipizide	
Imipramine	Betaxolol	Losartan	Gliquidone	
Maprotiline	Bevantolol	Manidipine	Insulin Lispro	
Medifoxamine	Bisoprolol	Metoprolol	Miglitol	
Mianserine	BunazosinW	Moexipril	Nateglinide	
Milnacipran	Candesartan	Nadolol	Pioglitazone	
Mirtazapine	Captopril	Nicardipine	Repaglinide	
Moclobemide	Carteolol	Nifedipine	Rosiglitazone	
Nefazodone	Carvedilol	Perindopril	Voglibose	
Paroxetine	Celiprolol	Prazosin		
Quinupramine	Chlorthalidon	Propranolol		
Sertraline	Cilazapril	Quinapril		
Tianeptine	Cilnidipine	Rosiglitazone		
Toloxatone	Delapril	Spirolactone		
Venlafaxine	Diltiazem	Telmisartan		
	Doxazosin	Temicapril		
	Doxepin	Terazosin		
	Efonidipine	Torasemide		
	Enalapril	Trazodone		
	Eprosartan	Tripamide		
	Felodipine	Valsartan		
	Fosinopril	Verapamil		
	Hydrochlorothiazide			