ORIGINAL ARTICLE

# Colorectal cancer in Spain: Temporary disability and preventive occupational strategies

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**Abstract**

*Background:* Colorectal cancer is one of the most frequent cancers in both sexes and the most frequent in the developed countries, if men and women are considered together as a group. It has an important associated morbidity and mortality in all countries and constitutes a public health problem with a high direct and indirect economic cost. The number of workdays lost due to temporary disability (TD) is one of the quantifiable references of these indirect costs.

*Aims:* To determine the indirect cost associated with TD due to colorectal cancer in Spain during the year 2011, a cost that aids in the prevention cost/benefit estimation.

*Methods:* The number of TD processes, the number of workdays lost due to TD, and the mean duration of those processes, based on the CIE 9-MC codes related to this pathology, as well as the calculated cost, using the Spanish minimum wage as a reference, during the period of January to December 2011, were all reviewed.

*Results:* Colorectal cancer in Spain during 2011 represented 1,046 TD processes, 202,784 workdays lost, and a mean process duration of 194 days/year. The resulting cost of the pathology due to TD was 4,335,521.92 euros.

*Conclusions:* These results are beneficial for evaluating the usefulness of implementing public health support strategies for a greater reduction in colorectal cancer prevalence and mortality, and an improvement in quality of life of the affected individuals and their families, together with an economic savings resulting from a reduction in TD as a consequence of this disease.

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**El cáncer colorrectal en España. Costes por incapacidad temporal y opciones preventivas desde las empresas**

**Resumen**

*Introducción:* El cáncer colorrectal es uno de los más frecuentes en ambos sexos y el más frecuente en los países desarrollados cuando se consideran hombres y mujeres conjuntamente. Conlleva una importante morbimortalidad asociada en todos los países y constituye un problema de salud pública con elevados costes económicos, directos e indirectos. El número de días perdidos por incapacidad temporal (IT) es una de las referencias cuantificables en estos costes indirectos.

*Objetivos:* Determinar el coste indirecto asociado a IT por cáncer colorrectal en España durante el año 2011 por cáncer colorrectal, coste que apoye la estimación del coste/beneficio de la prevención.

*Métodos:* Se revisarán en este trabajo el número de procesos, los días perdidos por IT y la duración media de los procesos, partiendo de los códigos CIE 9-MC relacionados con esta afección y el coste calculado tomando como referencia el salario mínimo interprofesional en España, durante el periodo enero-diciembre de 2011.

*Resultados:* En cáncer colorrectal ha supuesto en España durante 2011 por incapacidad temporal 1,046 procesos, 202,784 días de trabajo perdidos y una duración media de los procesos de 194 días/año. El coste derivado de la patología por IT ha sido de 4,335,521.92 euros.

*Conclusiones:* Sirvan los resultados para valorar la utilidad de la implantación de estrategias de apoyo a la sanidad pública para una mayor reducción de la prevalencia, mortalidad y mejora de la calidad de vida de los afectados y sus familias, junto con un ahorro económico derivado de la reducción de la IT derivada del cáncer colorrectal.

## Introduction

Colorectal cancer (CRC) is one of the cancers with the highest incidence in the developed countries, when the cases in men and women are combined. It has important associated morbidity and mortality in all countries, with the highest incidence rates detected in Australia, North America, and Europe, practically duplicating those found in Asia and South America. In Spain, CRC represents one out of every 7 cancer-related deaths, behind lung cancer in men and breast cancer in women.[1] Despite its significant treatment advances, CRC continues to be the third cause of death by cancer in the countries of the European Union and the second in Spain.

The growing increase in this type of tumor is basically related to modifications in the dietary habits of the population (an increase in the consumption of sugar and processed meats and a low consumption of fiber) and changes in lifestyle, with a decrease in physical activity.[2,3] Other causes, independent from those associated with dietary and hygiene habits, are a genetic predisposition (non-polypoid hereditary cancer, hereditary polyposis, and polymorphisms of other enzyme systems) or ulcerous colitis and other inflammatory bowel diseases.[4]

Up to the present, very few studies have analyzed occupational risk factors and environmental and occupational contaminants as factors involved in these tumors and related them to an increase in the incidence of this pathology. Some studies have established parallel relations with certain substances, even though in many cases the results are not conclusive: asbestos, metalworking fluids, and industrial contaminants from the metalworking sector, among others.[5-13]

The most recent studies on the occupational and environmental risks related to CRC in the Spanish working population are from the year 2012 and they associate this pathology with proximity to the mining industry and exposure to industrial contaminants.[14,15]

The importance of this theme is reflected in the IPPC European directive referring to the study of the consequences of industrial contaminants[16] that was incorporated into the Spanish legislation for the purpose of taking preventive action against the morbidity and mortality derived from risk exposure.[17,18]

Study aims: to quantify the loss of workdays associated with temporary disability (TD) due to CRC and to carry out an estimation of the economic costs of these lost shifts adjusted to minimums.

## Methods

A review of the official data on the ICD codes in Spain was carried out within the time frame of January to December

2011. These ICD9CM codes name the pathologies according to the international disease classification of the World Health Organization. Those directly related to CRC were selected, quantifying the number of disease processes, the duration of each one and the mean duration of each process throughout the year. The following ICD codes associated with this pathology were included: 153 (malignant neoplasm of colon), 153.3 (malignant neoplasm of sigmoid colon), 153.9 (malignant neoplasm of colon, unspecified site), 154 (malignant neoplasm of rectum, rectosigmoid junction, and anus), 154.0 (malignant neoplasm of rectosigmoid junction), 154.1 (malignant neoplasm of rectum), 154.2 (malignant neoplasm of anal canal), and 154.3 (malignant neoplasm of anus, unspecified site).

For the cost calculation, a calculation of minimums was carried out, using the Spanish minimum wage (SMW) for 2011 as a reference. This minimum wage was fixed at 641.40 euros monthly and was 1.3% more than in 2010. It was equivalent to 21.38 euros per day and 8979.60 euros per year, in the understanding that any approximation to more realistic figures would always be higher than those of the SMW. The SMW fixes the minimum compensation rate the worker will receive for a legal workday, regardless of sex or age, or whether the job is full-time, part-time, or temporary. The SMW value is fixed by the Government every year through Royal Decree, and factors such as the Consumer Price Index, the national productivity rate, or the increase in labor's share in the national income are taken into account.

Because of the characteristics of this descriptive study, a statistical analysis was not necessary.

## Results

In 2011, a total of 1046 processes of cancer of the colon and the rectum, identified by their corresponding ICD codes and resulting in TD, were reported. A total of 202,784 workdays were lost and the mean duration of the processes was 194 days/year. Table 1 shows the overall data by individualized code.

Upon detailed review, the highest number of processes was accumulated by two codes: the ICD 153.9 (malignant neoplasia
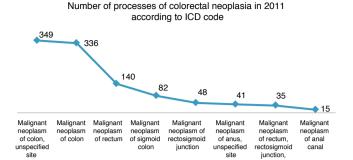


**Figure 1** Number of processes of colorectal neoplasia in 2011 according to ICD code.

of colon, unspecified site), with a total of 349 processes, and the ICD 153 (malignant neoplasia of colon), with 336 processes. In addition, they both represented the greatest number of workdays lost due to TD. In contrast, the ICD 154.2 code (malignant neoplasia of anal canal) had the least number of processes, as well as the lowest number of workdays lost due to TD. Despite having only 35 processes in 2011, the ICD 154 code (malignant neoplasm of rectum, rectosigmoid junction, and anus) had the longest mean duration, with 246 TD days, surpassing the overall mean of this pathology, which was the abovementioned 194 TD days (Figs. 1-3).

The cost per day was determined from the SMW established for 2011 and represents a total cost of 4,335,521.92 euros/year for all ICD codes related to CRC (Table 2).

If a reduction in the number of processes or the duration of the processes, or both, could be achieved through health campaigns carried out in the workplace and through primary and secondary prevention campaigns, for every 10% decrease in the total, the following results would be obtained:

1) With a 10% reduction in the number of processes (104 processes less), there would be 941 processes × × 194 TD days = 182,554 TD days, with a cost of 3,903,004 euros, representing a savings of 432,517.4 euros, based on the 2011 SMW cost/day (at 21.38 euros/day).

**Table 1** Colorectal cancer in Spain. Temporary disability repercussion in 2011.

| ICD code | Process denomination | Number of processes | Total duration year (TD days) | Mean duration per process (TD days) |
|---|---|---|---|---|
| Total 153 | Malignant neoplasm of colon | 336 | 64,033 | 191 |
| Total 153.3 | Malignant neoplasm of sigmoid colon | 82 | 16,269 | 198 |
| Total 153.9 | Malignant neoplasm of colon, unspecified site | 349 | 62,097 | 178 |
| Total 154 | Malignant neoplasm of rectum, rectosigmoid junction, and anus | 35 | 8610 | 246 |
| Total 154.0 | Malignant neoplasm of rectosigmoid junction | 48 | 9104 | 190 |
| Total 154.1 | Malignant neoplasm of rectum | 140 | 33,476 | 239 |
| Total 154.2 | Malignant neoplasm of anal canal | 15 | 2059 | 137 |
| Total 154.3 | Malignant neoplasm of anus, unspecified site | 41 | 7136 | 174 |
| Total processes related to neoplasia of the colon and rectum in 2011 | | 1046 | 202,784 | 194 |

TD: temporary disability.

**Table 2** Calculation of costs and potential savings.

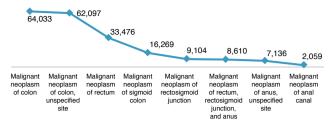| Number of processes | Total duration year (TD days) | Mean duration per process (TD days) | Cost | 10% process reduction | Cost | 10% process duration reduction | Cost | 10% reduction in number of processes and duration of each process | Cost |
|---|---|---|---|---|---|---|---|---|---|
| 1046 | 202,784 | 194 | 4,335,521.92€ | 182,554 TD days 432,517.4€ | 3,903,004.52€ | 182,631 TD days 430,871.14€ | 3,904,650.78€ | 164,299 TD days 822,809.3€ | 3,512,712.62 € |
| Potential savings (10%) | | | | | | | | | |



**Figure 2** Total duration (in days) of the processes of colon neoplasia in 2011 according to ICD code.
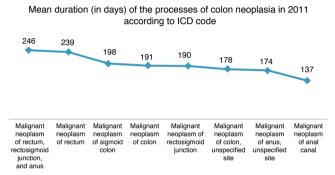


**Figure 3** Mean duration (in days) of the processes of colon neoplasia in 2011 according to ICD code.

2) With a 10% reduction in the mean duration of each process (19.4 fewer days each one), 1046 processes × 174.6 mean TD days each one = 182,631 TD days, with a cost of 3,904,650.78 euros, representing a savings of 430,871.14 euros, based on the SMW cost/day.

3) If both the number of processes and the mean duration of each process were able to be reduced by 10%, there would be 941 processes × 174.6 mean TD days per process = 164,298.6 TD days, representing an annual cost of 3,512,704 euros, with a savings of 822,809.3 euros, based on the SMW cost/day.

## Discussion

The work environment in Spain provides an excellent platform for carrying out preventive and promotional health campaigns dealing with this pathology. Some authors have pointed out different options aimed at achieving greater participation in screening programs, in different contexts, and with a minimal repercussion in health service costs and resources.[19]

Other authors recommend demonstrated cost-effectiveness action through colonoscopy/sigmoidoscopy every 10 years in all persons over 50 years of age, within a program specifically directed at women,[20] or preventive action through CRC prevention programs every 5-10 years, of similar effectiveness according to the participation response of the population as it increases.[21]

However, the basic topic of debate is the cost-effectiveness of the techniques to be used on the general population. The best cost/benefit results found by some authors in their comparative studies on different techniques support the fecal immunochemical test (FIT) over the fecal occult blood test (FOBT), and flexible sigmoidoscopy (FSIG), or colonoscopy, that imply greater expense and more adverse effects. However, all the techniques to be used are subject to the prevailing health policies of each country or of each autonomous community, as is the case in Spain.[22]

The FOBT, done yearly or every two years, has been evaluated in 4 randomized clinical trials on a total of 327,043 participants in Denmark (Funen), Sweden (Goteborg), the United States (Minnesota), and England (Nottingham), and they showed a reduction in CRC mortality. A Cochrane systematic review[23] estimated a 16% reduction (RR: 0.84; 95%CI: 0.78-0.90). In addition, the results of the Minnesota study[24] have also shown a 20% reduction in CRC incidence with annual screening (RR: 0.80; 95%CI: 0.70-0.90) and a 17% reduction with biennial screening (RR: 0.83; 95%CI: 0.73-0.94).

The FIT should be used when high levels of hemoglobin have been obtained through the FOBT and when there is limited capacity for performing colonoscopy. Colonoscopy considerably increases detection capacity, but at a higher economic cost.[25]

The majority of the Spanish autonomous communities have begun, or plan to begin, short-term CRC screening in the population. The feasibility of implementing CRC screening programs in Spain has been demonstrated, and 9 autonomous communities already have such programs. Their coverage in the population between 50 and 69 years of age is still low and it is precisely in this group of patients where there could be an active collaboration on the part of company prevention services, headed by occupational physicians, with the programs that have been started by the public health service. These campaigns are progressively expanding in conjunction with the target populations in those communities in which the programs had already been started and in the rest of the autonomous communities in which they had not yet begun.

Screening programs in Spain follow the European guidelines for the assurance of quality in CRC screening[26] and they are coordinated through the cancer screening network (www.cribadocancer.org), which facilitates the following of common criteria in relation to methodology and availability of compatible information systems so that results can be evaluated and compared.[27]

All the authors agree upon the importance of CRC prevention, despite the discrepancies in their proposals as to which technique should be employed, and even more so in relation to their cost-effectiveness. For this reason in our study we examined the indirect cost associated with the TD derived from these pathologies, enabling quantifiable arguments supporting this balance between prevention costs and some of the potential and measurable benefits to be obtained, when dealing with workday loss due to TD.

Prevention *per se* implies an investment and at times it is difficult to determine its cost-effectiveness, especially when parameters that are difficult to measure and analyze intervene in the overall disease cost. *Direct costs* are generically defined as those that are directly

**Table 3** Employment figures for 2011 (both sexes, absolute values) by age group for CRC prevention. NSI 2011 data.

| Age groups | 2011 Trimesters | | | | Sum total of all 2011 trimesters | Means for 2011 |
| --- | --- | --- | --- | --- | --- | --- |
| | 2011 TIV | 2011 TIII | 2011 TII | 2011 TI | | |
| 50-54 years | 2,053,000.90 | 2,057,000.00 | 2,065,000.70 | 2,037,000.40 | 8,214,000.00 | 2,053,000.500 |
| 55-59 years | 1,472,000.50 | 1,478,000.60 | 1,486,000.00 | 1,446,000.60 | 5,883,000.70 | 1,470,000.925 |
| 60-64 years | 796,000.20 | 803,000.70 | 798,000.90 | 789,000.90 | 3,188,000.70 | 797,000.175 |
| 65-69 years | 796,000.20 | 803,000.70 | 798,000.90 | 789,000.90 | 3,188,000.70 | 797,000.175 |
| Totals | 4,439,002.20 | 4,442,001.70 | 4,457,001.70 | 4,378,002.30 | 17,723,000.90 | 4,429,001.98 |

**Table 4** Employment figures for 2011 (both sexes, absolute values). NSI 2011 data.

| Dates | 2011 trimesters | | | | Sum total of all 2011 trimesters | Means for 2011 |
|---|---|---|---|---|---|---|
| | 2011 TIV | 2011 TIII | 2011 TII | 2011 TI | | |
| Worker total | 17,807,000.50 | 18,156,000.30 | 18,303,000.00 | 18,151,000.70 | 72,418,000.50 | 18,104,500 |

related to: health intervention, the technique employed, consultation personnel cost, the cost of hospital stay, or the pharmaceutical cost of a patient. *Indirect cost* is understood as all the loss in the production of goods and services caused by a disease, of which the most substantial is labor cost. Apart from these are the *intangible costs* associated with a disease, but they cannot be evaluated in monetary terms because of the difficulty in rendering concepts related to degrees of pain and anxiety, familiar and social repercussions, loss of quality of life, etc. The indirect costs generally are greater than the direct ones; the figures for indirect costs are between 60-70%, and those for direct costs are between 30-40%. However, these proportions vary depending on the pathology and the resources used for its diagnosis, treatment, and follow-up.

This is highly imprecise terrain, and therefore our study tries to focus on a quantifiable concept, albeit subject to the biases derived from the economic cost/day model chosen - the interprofessional minimum wage[28] - through which it was attempted to avoid much higher figures that could induce overestimation errors.

The effectiveness of the preventive campaigns carried out by the Spanish public health system would be favored by coordinated action with company risk prevention services, specifically by the integrated development of work with occupational physicians and nurses, and with options resulting in greater campaign participation on the part of the population in general. Effectiveness would also be increased through training the occupational health professionals, providing them with information about the pathology. This would enable a thorough abdominal palpation to be carried out on all the workers undergoing any type of health surveillance (initial, periodic, after prolonged TD, etc.) and on those whose clinical-occupational medical history placed them in any of the established risk groups for workers having had occupational exposure to substances related to CRC.

Health promotion, which is an indispensible part of the work of the occupational physician, involves the reduction of general risks through healthy living habits, with company-promoted campaigns against obesity, smoking, alcoholism, defective nutrition, sedentary lifestyle, etc.

Finally, the option of determining fecal occult blood in risk by means of the most precise immunologic methods accessible to all laboratories, would signify a much more extensive detection of lesions at their beginning stages, resulting in the abovementioned savings in personal, health, and occupational-social costs.

Many autonomous communities in Spain are now carrying out important campaigns in this sense and the occupational physician has access to a significant segment of the at-risk population. According to the National Statistics Institute

(NSI) 2011 data, from a total of 18,104,500 employed workers in that year, 4,429,001.98 individuals of both sexes were between the ages of 50-69 years, giving them access to occupational medicine and including them in the age group with the highest risk for CRC[29] (Tables 3 and 4).

Assuming the biases and limitations inherent in a study such as the present one, focusing exclusively on the calculation of TD, it was the aim of the authors to provide complementary economic information supporting the health professionals and institutions in relation to preventive proposals coordinated with occupational medicine in order to take full advantage of the social and health resources and to establish priorities among the different health problems and necessities. This preventive-economistic proposal would help to strengthen preventive actions in Spain, as well as in the other European and Latin American countries that are equally aware of this topic.

In conclusion, we underline the following:

1) In Spain, CRC represents a loss of 202,784 workdays associated with TD and the overall mean process duration is 194 days.
2) Due to the impossibility of approximating the actual figures with objective data, in this study we used a calculation of minimums adjusted to the cost/day of the 2011 interprofessional minimum wage of 21.38 euros.
3) For every 10% reduction in the number of processes and their mean TD duration, there could be a minimum savings of 822,809.3 euros.
4) The employment figure in Spain for workers above the age of 50 (that are included in the CRC prevention campaigns) was 4,429,001.98 persons in 2011. Carrying out screening in relation to risk every 5/10 years with a varying cost according to the technique employed, would enable comparative cost/benefit strategies to be established, evaluating the terms managed in this study, together with the other quantified direct and indirect costs of this pathology.
5) Company prevention campaigns can be carried out in coordination with the public health services in order to obtain the best results and facilitate the participation of the indicated persons.

## Financial disclosure

## Conflict of interests

The authors declare that there is no conflict of interest.

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