

ANALYSIS OF COLORECTAL CANCER HOSPITALIZED MORBIDITY AND ESTIMATES OF THEIR FINANCIAL IMPLICATIONS AT NATIONAL LEVEL, 2016-2018

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INTRODUCTION, CONTEXT

Colorectal cancer (CRC) is currently a major challenge for populations and healthcare systems from both high human development countries and transition economies. CRC is third most frequently diagnosed cancer as new cases worldwide, after lung and breast cancer, but is the second among deceases caused by cancer.

Colorectal cancer occurrence, aggravation and death are mainly associated with prevalence of behavioral risk factors that are changing, such as smoking, alcohol use, sedentary and obesity, diet - especially red meat consumption [1], and with genetic factors to a smaller extent. Significant variations of global and European CRC incidence, prevalence and mortality, are also related to the access to timely screening and treatment, even between the EU countries [2]. Several studies attested that CRC organized screening is associated with reduction of CRC-related mortality in populations, at both population-based and opportunistic scale [3-7].

In 2012, colorectal cancer is a leading cause of cancer incidence in Europe with 471,000 new cases and general mortality of 28.2/100,000 inhabitants (8), while global reports indicate that CRC summed up approx. 10% of total cancer types, and global CRC mortality represented 9% of all cancer deaths.

Latest GLOBOCAN report, recently published, estimated about 1.84 million of new CRC cases at global level in 2018, representing 10.2% of all cancer sites, but incidence increased with 29.5% compared to data registered six years ago, while mortality reached 881,000 deceases (9.2%), with 27% more than in 2012.

Abstract

Colorectal cancer is third most frequently diagnosed cancer as new cases worldwide. There is no national screening program for colorectal cancer in Romania, although estimated CRC incidence and mortality here are among the highest in Europe.

Given the importance, severity, frequency and burden of this disease, several measures are to be considered in Romania: introducing the National CRC Patient Registry; periodical review and update of the national clinical guidelines related to colon, rectum and colorectal cancer adopted in our country by MoH orders, considering the relevant recommendations based on scientific evidences, as made at European and international level by the experts; introducing, implementing and financing a national program for CRC screening and surveillance, as this recommendation was communicated to Romania since 2010; ensure the access of target population to timely screening program, organized by specialists; involving family doctors in early diagnosing and surveillance of CRC cases; study the main CRC determinants in Romanian population today; IEC campaigns (information-education-communication) to fight against CRC, aiming to raise awareness in general population regarding the high and increasing frequency of this deadly disease, its major risk factors and especially the preventive actions needed, as proved to be effective.

Key words: colorectal cancer, hospitalized morbidity, financiar impact Romania

The highest CRC incidence rates are reported in regions Australia - New Zealand (36.7/100,000), followed by Northern Europe (32.1/100,000), and the lowest values are registered in Central - South Asia (4.9/100,000) and West Africa (6.4/100,000). In Europe, there were approx. 500,000 new CRC cases and 245,000 deceases in 2018. Hungary ranked first in the world on both CRC incidence and mortality in 2012, as well as in 2018. In Eastern European Region in general, incidence is 20.3/100,000 inhabitants in men, and 13.8/100,000 in women, but the authors mention the lack of data and statistics in some Eastern European countries, such as Romania [9-11].

There is no national screening program for colorectal cancer in Romania, although estimated CRC incidence and mortality here are among the highest in Europe, and the European Commission Report 584/2014 for fight against cancer and Recommendation CE/878/2003 on screening for cancer detection require compulsory screening within the EU [12].

Most recent Romanian data published on this subject were since 2008 [2], in the report sent to European Union. Data reported at that time indicated incidence and mortality levels comparable with those in Hungary (ranking first in the world), and CE formulated a strong recommendation to implement CRC screening in the member states. →

As far as there is no National Colorectal Cancer Patient Registry yet, Romania cannot have accurate and complete data reports up to date, therefore it is unknown in international statistics.

As for the clinical approach of this cancer type at national level by the Medical Specialty Commissions of the Ministry of Health, the following clinical guidelines have been adopted years ago:

- MoH Order no. 1059/2009, Annex 11: Treatment guideline for colorectal carcinoma;
- MoH Order no. 1216/2010 for approval of the medical practice guideline for gastroenterology specialty, Annex 2: Colorectal Cancer;
- MoH Order no. 1221/2010 for approval of the medical practice guideline for medical oncology specialty, sections: Colon Cancer, Rectal Cancer, advanced Colorectal Cancer.

The *purpose* of this paper was to identify all the hospital episodes of the patients diagnosed with CRC at national level, during the period 2016-2018, their characteristics, estimated CRC incidence in hospitalized morbidity, as well as to estimate the amounts reimbursed by the National Social Health Insurance Fund for these continues hospitalizations, based on data reported by the hospitals within DRG system to the National School of Public Health, Management and Professional Development (NSPHMPD), given the lack of recent data on CRC burden in Romania.

DATA SOURCE AND METHODOLOGY

As there is no clear evidence of the number of colorectal cancer patients, within a national specific registry, an interrogation of the national DRG database have been accomplished by NSPHMPD experts, in order to identify all the hospital episodes of the patients diagnosed with CRC, during 2016-2018. The patient dataset extracted for analysis included the following: principal diagnostic at discharge, secondary diagnostic/s, clinical procedures, length of stay (hospital days), DRG code/name, patient gender, patient age, patient residence county, hospital county, patient status at discharge, patient encrypted code. Diagnostics selected for the study according to the International Classification of Diseases, 10th edition (ICD-10) are: C18.2 (Malignant neoplasm of ascending colon), C18.3 (Malignant neoplasm of hepatic flexure), C18.4 (Malignant neoplasm of transverse colon), C18.5 Malignant neoplasm of splenic flexure), C18.7 (Malignant neoplasm of sigmoid colon), C18.8 (Malignant neoplasm of overlapping sites of colon), C18.9 (Malignant neoplasm of colon, unspecified), C19 (Malignant neoplasm of rectosigmoid junction), C20 (Malignant neoplasm of rectum).

Then relative values have been associated for each DRG according to the Framework Contract norms, in order to calculate the Case-mix Index corresponding to selected cases and, implicitly, the amounts reimbursed by the Social Health Insurance Fund, given the national weighted case-based rate of 1475 lei (TCP), in DRG system.

According to Order no. 1782/576/2006 (regarding registration and statistic reporting of patients receiving hospital

continuous and day care services, up to date), all the public and private hospitals send to NSPHMPD the patient minimum clinical dataset, following the legal requirements on personal data protection. Therefore, hospitalized patient and their physician names are automatically erased, while their PIC and MD stamp codes are simultaneously encrypted. Encryption mechanism, also used in HIIP (Health Insurance Information Technology Platform), assigns one unique alpha-numeric Identification Code (IDC), to each personal identification code (PIC). By convention, patients with no PIC are reported with 13 "0" digits. Thus, all the patients in this situation will have the same ICD, which is a limit of this study when calculating the number of persons.

Because data were extracted from the national DRG database at hospital episode information level, an additional, double data anonymization has been performed: one unique numeric correspondent has been assigned to each ID case, and one unique alpha-numeric correspondent has been assigned to each ICD.

Our analysis included all the patients with CRC as principal or/and secondary diagnostic, as discharged from hospitals during 2016-2018 at national level. Data has been extracted and processed in an Access database. *R Program - version 3.5.3/ Platform x86_64-pc-linux-gnu* has been used for statistical analysis.

This study refers exclusively to those cases admitted in hospital with continuous care and diagnosed with colorectal cancer as principally or secondary diagnosis, at national level, during the period 2016-218, without knowing when these patients were diagnosed with cancer, neither what other health services and resources have used ever since, nor the cases detected outside the hospital. Estimated reimbursements for these hospitalized CRC cases do not include considerable amounts sent to public hospitals for increasing salaries of medical personnel since 2018; and these estimates are not the costs incurred or registered by the hospitals with the studied CRC cases.

RESULTS AND DISCUSSIONS

During the period January 1st, 2016 – December 31st, 2018 a total of 50,890 patients diagnosed with colorectal cancer have been discharged at national level, cumulating 143,266 hospital episodes (2.81 in average per person) and a corresponding total of 968,624 hospitalization days, resulting in a general average length of stay (ALOS) of 6.76 days [13]. And the number of patients diagnosed with CRC and their hospital episodes is increasing at national level. Annual situation of CRC cases hospitalized during the latest three years is presented in table 1.

As for county distribution of CRC patients, most frequent hospital episodes are for those from Bucharest (4611 per year in average), Prahova county (1980) and Cluj county (1847), while the less frequent are from Bistrița-Năsăud (497), Giurgiu (503) and Covasna (512) counties.

In terms of patient status at hospital discharge – table 2, between 3.7%-4% of CRC cases die in the hospital, 0.6-0.7% are aggravated, approx. 36% of patients go stationary, while most of them (44-45%) are ameliorated, and 14-15% are even „cured” in relation to the

Table 1. CRC patients admitted in hospital at national level, period 2016-2018

Year	Number of patients	Number of hospital episodes	% in total national hospital episodes	Length of stay (days)	ALOS (days)
2016	21,389	44,957	1.10%	316,723	7.05
2017	22,212	47,986	1.17%	322,707	6.73
2018	22,807	50,323	1.36%	329,194	6.54

Data source: NSPHMPD, national DRG database (13)

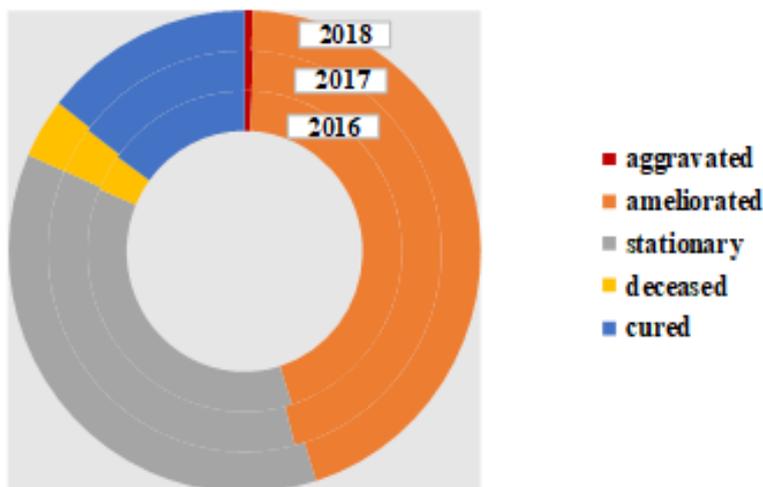
Table 2. Distribution of CRC cases according to their status at hospital discharge, national level, 2016-2018

Year	No. of discharges cured*	No. of discharges ameliorated	Nr. of discharges stationary	Nr. of discharges aggravated	Nr. of discharges deceased	Total no. of hospital episodes
2016	6734	19974	16255	329	1665	44.957
2017	7045	21674	17119	342	1806	47.986
2018	7269	22416	18337	279	2022	50.323

Data source: NSPHMPD, national DRG database (13)

* "Cured" state is related to the principal diagnostic, not CRC

Figure 1. Distribution of patients diagnosed with colorectal cancer according to their state at hospital discharge, national level, 2016-2018



principal diagnostic at discharge – the main cause of hospital episode (not CRC) (Figure 1).

It is known the fact that CRC is most frequent in men. A masculine predominance was registered for our cohort also, with a ratio of 1.32/1 males versus females. Average age calculated for the patients studied was 68.23 years in men, and 68.83 years in women. Although in general statistics and, especially when no screening is organized, age of CRC patients tends to decrease, only 6.24% of our group were aged under 50 years old. Average age of CRC hospitalized patients varied between 67.96 years in 2016, to 69.89 years in 2017, and to 68.97 years old in 2018.

Given the demographic reports, we calculated a prevalence of the hospitalized CRC morbidity of 108.24 per 100,000 inhabitants in 2016, 113.09/100,000 in 2017, and 116.83/100,000 inhabitants in 2018. Because our study began with data since year 2016, the number of new cases in 2016 could not be determined, but the calculated incidence of CRC cases admitted in hospital in 2017 was 55.05/100,000 and 72.15/100,000 inhabitants in 2018. We noted that incidence calculated on basis of hospitalized morbidity at national level in 2018 was above the GLOBOCAN estimate for CRC incidence in Romania, of 49.18/100,000. (In this Report, CRC in our country ranked second among cancer incidence and mortality, after the lung cancer).

Although CRC hospitalized morbidity is classified in over 380 diagnostic groups (DRG) annually, the most frequent groups, representing approx. 79% of total, are presented in table 3. The first three DRGs, cumulating aprox.55% cases, are: Malign digestive status with and without catastrophic or severe complications (CC), and Major procedures on small and large intestine with catastrophic CC. (Figure 2).

As for the CRC site (C18 Malignant neoplasm of colon, C19 Malignant neoplasm of rectosigmoid junction, and C20 Malignant neoplasm of rectum) as principal diagnostics, our DRG data analysis on hospitalized cases indicated the following situation (table 4).

Gender distribution of cases studied indicates masculine predominance also at level of the three CRC sites, as following: 56.44% of patients admitted because of Malignant neoplasm of rectosigmoid junction (C19), 57.07% of patients hospitalized for Malignant neoplasm of colon (C18), and 58.16% in case of patients with Malignant neoplasm of rectum (C20), are males. Average age of those patients admitted in hospital during the period of study varied between 67.9 years for C20, 67.95 years for C18, and 70.99 years in case of C19.

In order to reach the financial impact of hospital episodes registered by CRC patients at level national during the period of our study, at first we calculated the annual corresponding case-mix index (CMI), based on the relative values of DRGs used for classification of each case studied, according to the Framework Contract norms. Given the hospital financing mechanism based on weighted-case type (DRG system), at national average rate per weighted case (RWC), of 1475 Romanian Lei [14], the following amounts resulted to be spent with hospitalized CRC cases by the National Health Insurance Fund, as presented in table 5.

Number of CRC patients admitted in hospital as well as number of their hospital episodes and corresponding complexity of cases (CMI) have increased during the last three years, resulting in higher amounts reimbursed. The CMI of these cases exceeds the national average (for example, CMI in 2018 was 1.7044 compared to the national average of 1.3852).

Table 3. Most frequent DRGs used to classify CRC cases studied

Nr	DRG Name	DRG type	Relative value	No. of cases 2016	Nr. of cases 2017	Nr. of cases 2018
1	Malignant digestive status with catastrophic /severe complications	M	0.9766	13557	15341	17754
2	Malignant digestive status without cat/severe CC	M	0.5041	6903	6486	5413
3	Major procedures on small and large intestine with cat CC	C	4.4356	4031	4280	4341
4	Major procedures on small and large intestine without cat CC	C	2.1359	1779	1776	1698
5	Rectal resection with cat CC	C	4.6940	1501	1603	1680
6	Other colonoscopies cu cat/severe CC	A	1.5437	1340	1367	1350
7	Rectal resection without cat CC	C	2.6841	1063	1066	942
8	Other neoplastic disorders with CC	M	1.1656	1050	1488	1831
9	Other colonoscopies without cat/severe CC	A	0.6364	753	683	662
10	Malignant status of hepatobiliary system and pancreas (age >69 without cat/severe CC) or without cat. CC	M	0.6301	543	600	461
11	Severe nutritional disturbance	M	2.3060	496	542	470
12	Liver disorders, except for malignant status, cirrhosis, alcoholic hepatitis with cat/severe CC	M	1.4996	471	542	544
13	Peritoneal adhesences age >49 with CC	C	2.8920	428	473	530
14	Intestinal occlusion with CC	M	0.9703	406	449	451
15	Malignant status of hepatobiliary system and pancreas (age >69 with cat/severe CC) or with cat. CC	M	1.3987	397	586	723
16	Complex gastroscopy with CC cat/severe	A	1.8335	386	437	404
17	Minor procedures on small and large intestine with CC	C	1.9532	281	314	345

Data source: NSPHMPD, national DRG database (13)

Table 4. Distribution of patients and their hospital episodes according to CRC site (C18, C19, C20), as principal diagnostic, 2016-2018

Indicator	2016	2017	2018
C18 number of patients	8421	4299	5955
C18 number of episodes	16700	6380	10537
C19 number of patients	1792	4190	1189
C19 number of episodes	838	1305	2352
C20 number of patients	4767	1932	3480
C20 number of episodes	11816	2879	6513

Data source: NSPHMPD, national DRG database (13)

Estimated amount paid in average per hospital episode, according to the current DRG financing system, is low for CRC cases, each year of study. Amounts reimbursed to the hospitals by the social health insurance funds for these cases were estimated in this paper, while the corresponding costs registered by hospitals are not known, but costs most likely exceed these amounts per DRG, because hospital RWCs were not updated in years despite the fact that many expenses have increased.

On the other hand, hospitals treating and operating CRC cases usually have RWCs over the national average of a475 Lei, another reason why the amounts actually paid to the hospitals for these types of cases could be higher. Currently 156 town, municipal and clinical hospitals are financed at national average RWC of 147 Lei for the acute care patients treated, reported and validated, according to their contracts.

Significant salary increases approved for medical personal working in public hospitals in 2018 are paid separately, and not included in the amounts reimbursed for the medical services provided, however they should be reflected in hospital RWCs and tariffs as the highest direct cost for any hospital.

Another aspect to be taken into account is the subsidies given by local public authorities to the hospitals administrated, especially for investments and utilities, which is another financial contribution not considered in our estimates.

In order to adjust and augment the financial estimation of amounts paid from the National Social Health Insurance Fund for CRC patients, reimbursements for their ambulatory and day care provided in the hospital, should also be added.

Figure 2. DRG Distribution of the average CRC hospitalizations

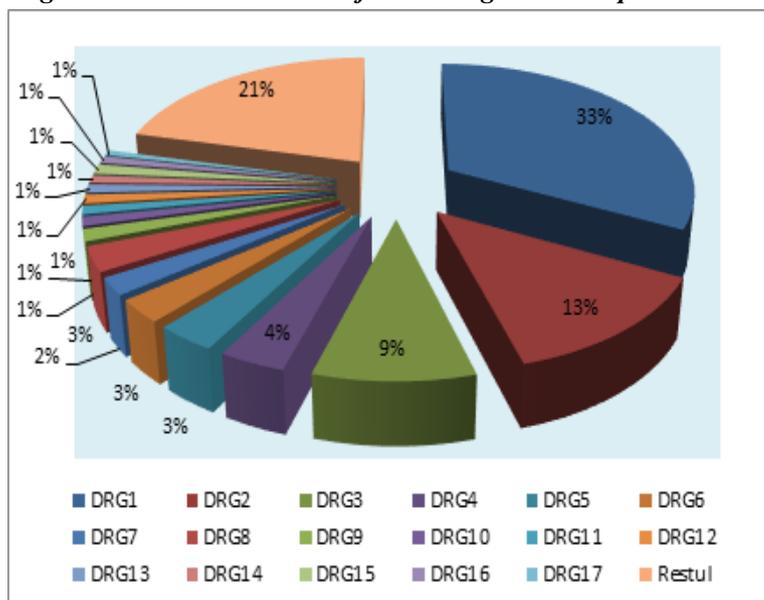


Table 5. Estimated amounts reimbursed for continuous hospital episodes of CRC patients at national level, 2016-2018

Year	No. of hospital episodes	Calculated CMI	Estimated amount spent - Lei	Estimated amount spent - Euro**	Average amount per patient - Lei	Average amount per episode - Lei
2016	44,957	1.6850	111,735,003.9	24,880,868.4	5224.0	2485.4
2017	47,986	1.7008	120,381,518.5	26,352,645.2	5419.7	2508.7
2018	50,323	1.7044	126,511,518.8	27,186,315.4	5547.1	2514.0

Clinical data source: NSPHMPD, national DRG database (13); Framework Contract Norms (14)

** Amounts calculated using the annual average exchange rate published by Romanian National Bank

CONCLUSIONS

Cancer is a major concern and a priority for the EU public health policies, because of its high and increasing frequency, general burden and impact on populations. While in Romania there is no recent data on prevalence and burden of CRC, WHO estimates high incidence and mortality rates, thus CRC ranks second common cancer. DRG data analysis of hospitalized morbidity at national level resulted in a CRC incidence of 72.15/100,000 inhabitants in year 2018, considerably higher than the Globocan Report estimate of 49.18/100,000 for the same year. Most frequent diagnostic-related groups used to classify CRC cases at national level, representing almost 60% of the hospital episodes, are Malignant digestive status with and without catastrophic /severe complications, and Major procedures on small and large intestine with and without catastrophic CC.

Given the importance, severity, frequency and burden of this disease, several measures are to be considered in Romania: introducing the National CRC Patient Registry; periodical review and update of the national clinical guidelines related to colon, rectum and colorectal cancer adopted in our country by MoH orders, considering the relevant recommendations based on scientific evidences, as made at European and international level by the experts; introducing, implementing and financing a national program for CRC screening and surveillance, as this recommendation was communicated to Romania since 2010; ensure the access of target population to timely screening program, organized by specialists; involving family doctors in early diagnosing and surveillance of CRC cases; study the main CRC determinants in Romanian population today; IEC campaigns (information-education-communication) to fight against CRC, aiming to raise awareness in general population regarding the high and increasing frequency of this deadly disease, its major risk factors and especially the preventive actions needed, as proved to be effective.

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