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Management of colon cancer patients: a comprehensive analysis of the absence of multidisciplinary team meetings in two French departments

Anne-Sophie FOUCAN ^{1,2*}, Pascale GROSCLAUDE ^{3,4}, Véronique BOUSSER ⁵, Eric BAUVIN ^{4,6}, Denis SMITH⁷, Céline ANDRE-FARDEAU ¹, Laetitia DAUBISSE-MARLIAC ^{3,4}, Simone MATHOULIN-PELISSIER ^{2,8}, Brice AMADEO ^{1,2}, Gaëlle COUREAU ^{1,2,9}

1-Gironde General Cancer Registry, F-33000 Bordeaux, France;

2-University of Bordeaux, INSERM Bordeaux Population Health, Research Center U1219, Epicene Team, F-33000 Bordeaux, France;

3-Claudius Regaud Institute, Regional Cancer Center, IUCT-O, Tarn Cancer Registry, F-31059 Toulouse, France;

4-LEASP, INSERM U1027, University of Toulouse III, F-31000, France;

5- Aquitaine Regional Cancer network, F-33000 Bordeaux, France;

6-Occitanie Regional Cancer network (Onco-Occitanie), F-31059 Toulouse, France;

7-University Hospital of Haut-Lévêque, F-33000 Bordeaux, France

8-INSERM CIC1401, Clinical and Epidemiological Research Unit, Bergonie Institute, Comprehensive Cancer Center, F-33000 Bordeaux, France;

9-Medical Information Service, Public Health Department, University Bordeaux Hospital, F-33000 Bordeaux, France;

*** Corresponding author:**

Anne-Sophie FOUCAN

University of Bordeaux, INSERM Bordeaux Population Health, Research Center U1219, Epicene Team,
Gironde General Cancer Registry, 146 rue Léo Saignat, 33076, BORDEAUX, France

Email: anne-sophie.foucan@u-bordeaux.fr

Phone: +33 5 57 57 48 13

Abstract

Background: The care management of colorectal cancers has evolved, particularly since the implementation of multidisciplinary team meetings (MDTm). The aim of this study was to identify factors associated with the non-presentation of colon cancer patients in MDTm (no-MDTm) and to assess the association between no-MDTm and the diagnostic and therapeutic care management, in two areas in France, in 2010.

Methods: Patients over 18 years diagnosed for invasive colon cancer in Gironde and Tarn during 2010 were included from the cancer registries of these two departments. We used five indicators to evaluate the care management of colon cancer patients (about diagnosis, treatment and selection of patients for chemotherapy).

Results: No-MDTm patients were more likely to die early after diagnosis (OR=2.94, 95% CI=[1.52-5.66]). Elderly patients and those living in more disadvantaged areas were less often presented in MDTm (OR_{≥85years}=2.10, 95% CI=[1.06-4.18] ; OR_{EDI Q4-Q5}=1.96, 95% CI=[1.23-3.14]) . After adjusting for patient-related variables (age, comorbidities, deprivation) and tumor (stage at diagnosis), we found that thoracic CT scan was less often performed among no-MDTm patients (OR=0.40, 95% CI=[0.24-0.65]). There was no association between the absence of MDTm and the therapeutic care management indicators.

Conclusion: In conclusion, therapeutic care management was not associated with the absence of MDTm but with patient and tumor characteristics, including age, comorbidities and level of deprivation, that influence the non-presentation in MDTm.

Keywords: *Colon cancer, Multidisciplinary team meeting, Therapeutic care management, European Deprivation Index, cancer registry*

Abbreviations

- CI: Confidence Interval
- EDI: European Deprivation Index
- HAS: Haute Autorité de Santé
- IRIS: Ilots Regroupés pour l'Information Statistique
- MDTm: Multidisciplinary Team Meeting
- MI: Management Indicator
- OR: Odds Ratio
- PO: Post-operative
- TNM: "Tumor, Nodes, Metastasis"

Background

With 43 336 new cases and 17 117 deaths in 2018, colorectal cancer represents a major public health issue in France. It is the third most commonly diagnosed cancer after prostate and breast cancers [1]. Most cases occur in people aged 50 years or over.

The French National Authority for Health (HAS) published guidelines for the prevention and the screening of colorectal cancer (June 2013) and for the management and care of patients (January 2012). In order to reduce mortality rates due to colorectal cancer, a mass screening program was implemented at the national level in 2009 and improved since [2]. Multidisciplinary team meetings (MDTm) ensure high-quality decision-making by a range of experts from different disciplines on the care management of new patients diagnosed with cancer, and facilitate the optimal strategy to be adopted. The presentation of the medical records of colorectal cancer patients in MDTm has become more and more common in recent years. Since 2010, the presentation rate in the Gironde and Tarn departments is around 80%¹ [3].

However, the implementation and use of the recommendations in current practice are poorly studied, and few data are available on the potential heterogeneity in the care management of colorectal cancer patients in France. Some studies have revealed that the therapeutic care management of colorectal cancer patients is influenced by age, comorbidities, tumor stage and care center [4–8]. In addition, socio-economic and socio-demographic factors, as well as the presentation in MDTm have been found to influence care management [4–7,9,10]. In this context, the EvaCCoR observational study [11] was conducted to evaluate the care management of colorectal cancer patients diagnosed in 2010 and presented in MDTm in two southwest areas in France (Aquitaine and

¹ Data from Gironde General Cancers Registry

Midi-Pyrénées). For this, 50% of the patients presented in MDTm in these two regions were randomly selected.

The presentation rate in MDTm has increased during the 2000s [12] and, in 2007, *Bouvier et al.* highlighted that the presentation was influenced by factors such as age, cancer and type of structure [13]. However, few data were found in the literature on the characteristics of patients not presented in MDTm. There is also very limited information on the factors associated with the non-presentation in MDTm, as well as the consequences of this non-presentation on patient care management.

The first objective of our study was to evaluate the factors associated with the non-presentation in MDTm of colon cancer patients in two southwest areas in 2010. Our second objective was to assess the association between the non-presentation in MDTm and the care management of those patients.

Patients and Methods

This was an observational retrospective multicenter study conducted in two southwest areas in France.

Study population

Our study involved colon cancer patients (C18 codes of the IDC-10th edition [14]) newly diagnosed in 2010, aged over 18 and living in the Gironde and the Tarn departments at the time of diagnosis. Patients with sarcomas, lymphomas and in situ colon cancers were excluded from the study as well as those with a relapse of colon cancer recorded in 2010.

Patients were classified into two groups:

- **“no MDTm” group:** all colon cancer patients recorded in the cancer registries of the Gironde and Tarn departments and not presented in MDTm. All patients in this group were included due to the low numbers.

- **“MDTm” (comparison) group:** a random selection of 50% of the patients presented in MDTm in Gironde and 75% in Tarn (from study population of the first EvaCCoR study in the Aquitaine and Midi-Pyrénées regions and completed with specific inclusion for Tarn). After verification of the register of the Gironde for all cases diagnosed in 2010, this group was representative of colon cancer patients presented in MDTm.

Data collected

Data were obtained from the cancer registries of the Gironde and Tarn departments and from a standardized questionnaire used in the previous EvaCCoR study [11], and completed by trained research assistants from both registries.

Owing to the routine collaboration between registries and regional cancer networks, the information about MDTm presentation was available in the registries and the patients not presented in MDTm could be identified. The presentation in MDTm was treated as a dichotomous variable, “absence of presentation in MDTm” versus “presentation in MDTm” and was the main explanatory variable of our study in order to compare the care management of colon cancer patients not presented in MDTm with that of patients presented (comparison group).

Tumors were staged using the TNM classification system and then condensed into 0, I, II, III and IV. Patient comorbidities were measured using the Charlson Comorbidity Index [15]. This index was developed using a scoring system based on nineteen weighted comorbid conditions. In this study, the comorbidity score was calculated based on the severity of each present comorbidity for a patient, without age adjustment because age was already taken into account in our analyses.

The socio-economic status was estimated using a deprivation indicator measured by the European deprivation index (EDI) created for France. This indicator is based on the identification of the basic

needs related to deprivation and the variables associated with each of these needs. Each IRIS² (smallest geographical units in France) receives a score and, according to the distribution of this score, is ranked depending on the quintiles of the EDI score (quintile 1 represents the least disadvantaged areas and quintile 5 represents the most disadvantaged areas) [16].

The data collected allowed using five care management indicators (MI) concerning three aspects of care (diagnosis, treatment and selection of patients for chemotherapy). These indicators were selected among those developed during the first EvaCCoR study in order to assess the role of the MDTm (**Table 1**):

- Diagnosis indicator (MI1): it evaluates whether a diagnostic thoracic scanner has been performed or not,
- Therapeutic care management indicators (MI2-MI5): MI2 and MI3 evaluate whether a postoperative chemotherapy among stage II or III operated patients has been administered; MI4 assesses whether the 8-week delay between surgery and post-operative chemotherapy had been respected; and selection indicator for treatment (MI5) evaluates the selection of patients for chemotherapy by looking at the patients who died during postoperative chemotherapy.

All of these indicators were coded into dichotomous variables with “yes/no” modalities.

² Aggregated Units for Statistical Information

Table 1 Description of care management indicators for colon cancer patients

Role of the MDTm	Care management indicators	
1-To allow complete diagnosis care management	MI1	Implementation of a thoracic scanner (Yes/No)
2-To allow adapted therapeutic care	MI2³	Implementation of a postoperative chemotherapy among stage II operated patients (Yes/No)
	MI3	Implementation of a postoperative chemotherapy among stage III operated patients (Yes/No)
	MI4	Compliance with the maximum 8-week delay between the operation and the postoperative chemotherapy among all stage operated patients (Yes/No)
3-To allow a good selection of patients for a chemotherapy	MI5	Patients who died between 3 and 9 months after the beginning of the postoperative chemotherapy (Yes/No)

Statistical analysis

For the first objective of this study, a description of the stratified total population on MDTm status was performed to compare the characteristics of patients in the “no MDTm” group and those in the “MDTm” group. The Chi-2, the Fisher exact and the Student tests were used in univariate analysis.

To evaluate the factors associated with the non-presentation in MDTm, a case-control analysis (no MDTm vs MDTm) was conducted. For multivariate analysis, a logistic regression model was built. The following variables were considered: age at diagnosis, comorbidities, EDI score, socio-demographic status, place of diagnosis, and TNM stage at diagnosis.

For the second objective, the association between the non-presentation in MDTm and the diagnostic and therapeutic care management of these patients was studied using an exposed/not exposed analysis (no MDTm vs MDTm). Patients who died in the month following diagnosis were excluded from the analysis because presentation in MDTm was not possible (description of the population, **Appendix A**).

The association between each indicator and the absence of presentation in MDTm was studied using multivariate logistic regression model. After studying the literature [6–8,10], univariate

³ This indicator should be interpreted with caution because the recommendation itself is dependent on risk factors.

analyses were performed in order to highlight the variables of interest for the multivariate models and the adjustment. The models were adjusted for age at diagnosis, comorbidities, EDI score, and TNM stage at diagnosis.

All results of logistic regression models are expressed as odds ratio (OR) with 95% confidence interval (CI). All analyses were performed using SAS 9.2 software.

Results

Description of the population

Figure 1 Flowchart of patients with incident colon cancer in 2010 included in the study.

In this study, 142 colon cancer patients not presented in MDTm (“no MDTm” group) and 431 presented in MDTm (“MDTm” comparison group) were included, corresponding to a study population of 573 patients (**Figure 1**).

The characteristics of patients in the “no MDTm” group and in the “MDTm” group are presented in **Table 2**. Patients in the “no MDTm” group were older than those in the “MDTm” group (78.9 years vs 72.5 years respectively, $p < 0.0001$) and were more likely to live in disadvantaged areas (quintiles 4 and 5) (52.5% vs 35.6%).

Diagnostic circumstances were also different between the two groups. Patients in the “No MDTm” group were more often diagnosed with surgical urgency (21.1% vs 13.0%), and their tumor condensed stage was more often missing (37.3% vs 8.4%), in situ (7.9% vs 0.3% of the available stages) or metastatic (40.4% vs 31.4% of the available stages).

Fewer “No MDTm” patients underwent surgery (61.3% vs 86.8%) and more of them died (62.0% vs. 19.0%), almost half of them during the month following diagnosis (27.5% vs. 7.7%).

Table 2 Characteristics of colon cancer patients according to MDTm presentation in the two departments in 2010 (n=573)

	No MDTm (n=142)		MDTm (n=431)		P*
Diagnosis-MDTm delay (days) (n)	-		430		-
<i>Mean (Standard Deviation)</i>	-		48.9	(76.0)	
<i>Median (Min-Max)</i>	-		31.0	(-3.0-694.0)	
Age at diagnosis (years)					<0.0001
<i>Mean (Standard Deviation)</i>	78.9	(11.4)	72.5	(12.3)	
<i>Median (Min-Max)</i>	81.5	(50.7-102.1)	74.4	(23.2-94.6)	
Gender, n (%)					0.0621
<i>Male</i>	82	(57.7)	221	(51.3)	
<i>Female</i>	60	(42.3)	210	(48.7)	
Comorbidities, n (%)					0.0529
<i>0</i>	91	(64.1)	239	(55.5)	
<i>1</i>	24	(16.9)	116	(26.9)	
<i>≥ 2</i>	27	(19.0)	76	(17.6)	
Level of deprivation, n (%)					0.0004
<i>Quintile 1 – Less disadvantaged</i>	30	(21.1)	80	(18.6)	
<i>Quintile 2</i>	24	(16.9)	89	(20.7)	
<i>Quintile 3</i>	13	(9.2)	106	(24.6)	
<i>Quintile 4</i>	34	(23.9)	75	(17.4)	
<i>Quintile 5 – More disadvantaged</i>	39	(27.5)	77	(17.9)	
<i>Missing</i>	2	(1.4)	4	(0.9)	
Circumstances of diagnosis, n (%)					0.0448
<i>Emergency surgery</i>	30	(21.1)	56	(13.0)	
<i>Symptoms</i>	88	(62.0)	290	(67.3)	
<i>Others</i>	22	(15.5)	85	(19.7)	
<i>Missing</i>	2	(1.4)	-	-	
Condensed TNM Stage, n (%)					<0.0001
<i>0</i>	7	(4.9)	1	(0.2)	
<i>I</i>	6	(4.2)	37	(8.6)	
<i>II</i>	21	(14.8)	118	(27.4)	
<i>III</i>	19	(13.4)	107	(24.8)	
<i>IV</i>	36	(25.4)	132	(30.6)	
<i>Unknown</i>	53	(37.3)	36	(8.4)	
Metastases, n (%)					<0.0001
<i>Yes</i>	36	(25.4)	124	(28.8)	
<i>No</i>	73	(51.4)	286	(66.4)	
<i>Missing</i>	33	(23.2)	21	(4.8)	
Surgery, n (%)					0.0040
<i>Yes</i>	87	(61.3)	374	(86.8)	
<i>No</i>	44	(31.0)	54	(12.5)	
<i>Missing</i>	11	(7.7)	3	(0.7)	
Dead, n (%)	88	(62.0)	82	(19.0)	<0.0001
Dead in the month following the diagnosis, n (%)	39	(27.5)	33	(7.7)	<0.0001
Histological report (in early deaths, n=72), n (%)					
Oui	13	(33.3)	13	(39.4)	0.5937
Non	26	(66.7)	20	(60.6)	
Surgery report (in early deaths, n=72), n (%)					
Oui	21	(53.9)	20	(60.6)	0.5638
Non	18	(46.2)	13	(39.4)	

* Chi-2, Fisher and Student tests

MDTm: multidisciplinary team meeting

Missing: missing data

Factors associated with non-presentation in MDTm

The factors associated with the non-presentation in MDTm after adjusting for sex, comorbidities, condensed TNM stage of the tumor, and the type of healthcare structure and circumstances of diagnosis, were advanced age ($OR_{\geq 85 \text{ years}}=2.10$, 95% CI=[1.06-4.18]) and living in disadvantaged areas ($OR_{\text{EDI Q4-Q5}}=1.96$, 95% CI=[1.23-3.14], **Table 3**).

In our population, the median delay from diagnosis to MDTm (**Table 2**) was 31 days (mean: 49 days). We therefore considered that patients who died within 30 days of diagnosis had a loss of opportunity to present in MDTm, due to organizational context, considering median delays and means of presentation, regardless of other conditions, and therefore we excluded them. In addition, patients who died within one month of diagnosis were less frequently presented in MDTm ($OR=2.94$, 95% CI=[1.52-5.66]).

Table 3 Determinants associated with non-presentation in MDTm of colon cancer patients in the two departments in 2010 (n=573)

Variables	No MDTm (n=137)		MDTm (n=426)		OR*	95% CI	p
	n	%	n	%			
Age at diagnostic (years)							0.0149
[23 ; 66[	25	18.2	123	28.9	1.00	-	
[66 ; 77[	25	18.2	123	28.9	0.72	0.36 – 1.46	
[77 ; 85[	37	27.0	111	26.0	1.02	0.52 – 2.01	
≥ 85	50	36.5	69	16.2	2.10	1.06 – 4.18	
Level of deprivation							0.0049
Less disadvantaged (Q1-Q3)	65	47.4	274	64.3	1.00	-	
More disadvantaged (Q4-Q5)	72	52.6	152	35.7	1.96	1.23 – 3.14	
Death in the month following diagnosis							0.0028
No	99	72.8	383	92.3	1.00	-	
Yes	37	27.2	32	7.7	2.94	1.52 – 5.66	

*Model adjusted for sex, comorbidities, condensed TNM stage of the tumor, diagnostic structure and circumstances of diagnosis

CI: confidence interval

MDTm: multidisciplinary team meeting

OR: odds ratio

Q: quintiles

Association between the non-presentation in MDTm and the care management

Patients who died within one month of diagnosis did not have enough time for being presented in MDTm, and were therefore excluded from subsequent analyses. Overall, 501 colon cancer patients were included in the analysis, 398 “MDTm” patients and 103 “no MDTm” patients (**Appendix A**).

Extension examinations such as thoracic CT scans were less frequently performed in “no MDTm” patients (46.6% vs 66.6%, $p=0.0005$, **Appendix B**).

Patients diagnosed with advanced stages (III and IV) received different treatments depending on their MDTm status ($p=0.0419$ for stage III and $p<0.0001$ for stage IV), unlike patients with earlier stages (**Appendix B**). The most common treatment received by stage III and IV patients not presented in MDTm was surgery alone (57.1% and 36.4%, respectively), whereas those in the MDTm group had mostly surgery followed by chemotherapy (67.0% and 44.1%, respectively).

Delay between diagnosis and care also differed between the two groups (**Appendix C**). The delay between diagnosis and surgery was shorter in “no MDTm” patients (21.7 days vs 34.6 days). We found that, in both emergency or non-emergency groups, the delay from diagnosis to surgery was consistently shorter in “no MDT” patients in the population : emergency surgery (8.0 days vs 10.1 days) and in the population with surgery but not in emergency (26.2 days vs 38.7 days). Thus this result is not dependent on the emergency surgery but on the surgery in general. Patients in the “no MDTm” group died earlier than patients in the “MDTm” group, with a shorter delay between diagnosis and death (264.9 days vs 338.0 days; $p=0.0144$) and between surgery and death (252.1 days vs 312.2 days; $p=0.0676$).

Figure 2 shows the association between the non-presentation in MDTm and the indicators, adjusted for age at diagnosis, comorbidities, level of deprivation (EDI quintiles) and the condensed TNM tumor stage.

Absence of presentation in MDTm was only significantly associated with fewer thoracic CT scans performed (OR=0.40, 95% CI=[0.24-0.65]). On the contrary, the non-presentation in MDTm was not associated with the other indicators like chemotherapy adjusted for the other factors.

Figure 2 Association of the non-presentation in MDTm with care management indicators in colon cancer patients in the two departments in 2010

**Model adjusted for age at diagnosis, comorbidities, level of deprivation (EDI quintiles), and the condensed TNM stage of the tumor if necessary.*

Chemo: chemotherapy

MDT: multidisciplinary team meeting

PO: post-operative

The multivariate models showed that, among stage III patients, the odds of receiving post-operative chemotherapy were significantly lower with increased age and more comorbidities (OR_{77-85years}=0.24, 95% CI=[0.06-0.91], OR_{85-103years}=0.01, 95% CI=[0.001-0.10] and OR_{comorbidities}=0.39, 95% CI=[0.18-0.88], **Table 4**). In addition, patients living in more disadvantaged areas were more likely to die during post-operative chemotherapy (OR_{EDI Q4-Q5}=2.08, 95% CI=[1.02-4.25], **Table 5**).

Table 4 Factors associated with post-operative chemotherapy in stage III operated colon cancer patients, in 2010, in the two French departments (n=111)

Variables	Post-operative chemotherapy (n=73)		No post-operative chemotherapy (n=37)		OR*	95% CI	P*
	n	%	n	%			
MDTm							0.6237
Yes	67	91.8	30	81.1	1.00	-	
No	6	8.2	7	18.9	0.65	0.12 – 3.59	
Age (years)							<0.0001
[23 ; 66[	26	35.6	5	13.5	1.00	-	
[66 ; 77[	33	45.2	2	5.4	3.29	0.56 – 19.32	
[77 ; 85[	13	17.8	11	29.7	0.24	0.06 – 0.91	
[85 ; 103[	1	1.4	19	51.4	0.01	0.001 – 0.10	
Comorbidities					0.39	0.18 – 0.88	0.0230
Mean (Standard deviation)	0.4	(0.7)	0.9	(1.1)			
Median (Min-Max)	0.0	0.0-3.0	1.0	(0.0-5.0)			

** Adjusted for the level of deprivation (EDI quintiles)
CI: confidence interval*

*MDTm: multidisciplinary team meeting
OR: odds ratio*

Table 5 Factors associated with death during post-operative chemotherapy in colon cancer patients, in 2010, in the two French departments (n=184)

Variables	Death in PO chemotherapy (n=46)		No death in PO chemotherapy (n=137)		OR*	95% CI	P*
	n	%	n	%			
	MDTm						
Yes	45	91.8	126	81.1	1.00	-	
No	1	8.2	11	18.9	0.19	0.02 – 1.62	
Level of deprivation							0.0434
Less disadvantaged (Q1-Q3)	23	50.0	89	65.0	1.00	-	
More disadvantaged (Q4-Q5)	23	50.0	48	35.0	2.08	1.02 – 4.25	

* Adjusted for age at diagnosis, comorbidities and the condensed TNM stage of the tumor

CI: confidence interval

MDTm: multidisciplinary team meeting

OR: odds ratio

PO: post-operative

Q: quintiles

Discussion

This study allowed to look at the factors associated with the non-presentation in MDTm, as well as the consequences of this non-presentation on colon cancer patient care management in two French southwest areas in 2010. To date, few studies have examined how the presentation of medical record of colon cancer patients in MDTm determines their diagnosis and therapeutic care management. In addition, the situation has evolved significantly since these studies [17]. *Bouvier et al.* reported a 32% rate of presentation in MDTm in 2000 in France [13]. However, in France, the presentation in MDTm has progressively increased. In 2010, in Gironde, 80% of colorectal cancer patients were presented in MDTm. This is one of the first French studies assessing the non-presentation in MDTm, in a context where MDTm for colon cancer cases is widely implemented.

Factors associated with no-MDTm

In our study, medical records of patients with advanced stage cancer were less often presented in MDTm, contrary to what was described by *Bouvier et al.* in 2000 [13]. This can be explained by the

generalization of MDTm, which at the beginning were reserved for complex situations. In 2010, the majority of patients were presented in MDTm except mainly those with in situ tumors or very extensive that are not subject to multidisciplinary meetings.

In adjusted analyses, factors associated with no MDTm were advanced age at diagnosis (over 85 years), a high level of deprivation (quintiles 4 and 5) and early death of patients (within one month of diagnosis). These results are in part consistent with those of *Munro et al.*, one of the few population-based studies describing colorectal cancer and MDTm, in 2006-2007 [18]. In their study, only 12% of patients were not presented in MDTm, and these patients were older, with very early or very advanced stage of cancer, and more frequently died within 6 weeks of diagnosis. In this study, no MDTm patients had more comorbidities but there was no association with the deprivation score.

The early death of patients in the month following the diagnosis prevented their medical record from being presented in MDTm and from receiving therapeutic care. Therefore, patients who died early were removed from our analyses of association of MDTm presentation and care management.

Diagnostic and therapeutic care management

Among the care management criteria studied, only thoracic CT scan was significantly less frequent in no-MDT subjects taking into account other factors.

Postoperative chemotherapy and death during this chemotherapy were not associated with no MDTm adjusted analyses, by age, comorbidities, stage and level of deprivation. This could partly be explained by the small numbers but also by other preponderant factors.

So this study has highlighted in multivariate analyses that the practice of postoperative chemotherapy strongly decreased for older patients, with a stage III and having comorbidities. These findings are consistent with those from *Hamaker et al.*'s 2015 study [19], which showed that the age of colorectal cancer patients and the presence of comorbidities were risk factors for non-treatment by chemotherapy.

Similarly, we found that deaths during chemotherapy were more frequent among people living in more disadvantaged areas. These findings are in line with those reported by *Munro et al.*, which showed no association between presentation in MDTm and survival, when taking into account age, sex, stage of cancer, comorbidity, deprivation, and after exclusion of early deaths (HR = 1; 95% CI=[0.70-1.42]) [18]. Other studies have shown an association between deprivation and survival, but did not take into consideration MDTm [20,21].

Limitations

The first limitation of our study is related to the study population. The selection of the “MDTm” group did not allow calculating the frequency of MDTm in the global population and thus prevented an overall description of the care management of colon cancer patients. However, based on the data in the Population cancer registry of Gironde, patients in the “MDTm” group included in our study were representative of all patients presented in MDTm in this areas, for sociodemographic and tumor characteristics.

The small sample size for some analyses resulted in large confidence intervals for associations and a low power. In addition, we used the EDI deprivation index, based on the IRIS areas, to estimate the deprivation level for each patient. The application of this aggregate index can lead to an ecological bias and introduces an intra-IRIS correlation. This bias may lead to an error in estimating the degree of association found in this study between EDI and its effect on presentation in MDTm or on the care management of colon cancer patients. This risk of error can occur when individuals are assigned characteristics based on aggregate data on the residential area. However, this index is frequently used and allows taking into account this important factor in the absence of individual data.

Strengths

This is a population-based study that allows to describe the real situation of care and MDTm, to ensure the representativeness of the groups, especially the patients not presented in MDTm (more

rare in the hospital studies), and to limit selection bias, unlike before-and-after studies that have been regularly used [22].

This study used high quality data from regional cancer networks and from the cancer registries of the Gironde and Tarn departments. These data were collected by trained research assistants through standardized questionnaires, thus decreasing the information bias.

In addition, we excluded early deaths in the care management analysis. This method has already been used by *Munro et al.* [18]. In a context where over 80% of patients are presented in MDTm, non-presented subjects are often older and have more comorbidities and advanced (or unknown) stage of cancer. Excluding early deaths avoids a reverse causality effect that would attribute incomplete care or earlier death to the absence of MDTm, while the patient's condition or death may explain the absence of MDTm. Moreover, in the group of early deceased patients that we excluded, we found that there was no significant difference between the two groups (NoMDTm and MDTm) for obtaining or not obtaining histological data. This supports the idea that it is not the wait for histological results that prevents the patient from being presented in MDTm but, indeed, the lack of time for the patient after diagnosis.

Finally, while few studies have considered deprivation, we found that it was an important factor to interpret our results.

Conclusion

In conclusion, in 2010, in these two French departments, presentation in MDTm was the most common approach for the care management of colon cancer patients. In this context, patients not presented in MDTm represent a particular population, more complicated and with little time for diagnosis and care. The therapeutic care management did not seem to be influenced by the absence of MDTm in these specific patients but rather by the characteristics of the patients and the tumor, especially age at diagnosis, comorbidities and the level of deprivation.

Further efforts should focus in ensuring presentation of patient cases in MDTm in the most disadvantaged areas to reduce deaths in this population.

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Authors' contribution

GC, PG, VB, EB, SM-P and BA were involved in the study conception and design. CA-F and LD-M collected data for analysis. A-SF and GC performed statistical analysis and drafted the paper. GC, BA, SM-P and VB critically revised the draft manuscript. DS was a consultant for the study, he helped to select care management indicators.

All authors read and approved the final manuscript.

Competing interests

The Authors declare that they have no conflicts of interest to disclose.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and material

Not applicable.

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Appendices

Appendix A

Characteristics of colon cancer groups (no MDTm/MDTm) in newly diagnosed patients in 2010, in the Gironde and Tarn departments (France), after the exclusion of early deaths (n=501)

	No MDTm (n=103)		MDTm (n=398)		P*
Age at diagnosis (years)					<0.0001
<i>Mean (Standard Deviation)</i>	78.0	(12.2)	71.7	(12.2)	
<i>Median (Min-Max)</i>	80.4	(50.7-99.9)	73.6	(23.2-92.5)	
Gender, n (%)					0.0717
<i>Male</i>	62	(60.2)	200	(50.3)	
<i>Female</i>	41	(39.8)	198	(49.7)	
Comorbidities, n (%)					0.0158
<i>0</i>	71	(68.9)	221	(55.5)	
<i>1</i>	15	(14.6)	111	(27.9)	
<i>≥ 2</i>	17	(16.5)	66	(16.6)	
Level of deprivation, n (%)					0.0308
<i>Quintile 1 – Less disadvantaged</i>	26	(25.2)	73	(18.3)	
<i>Quintile 2</i>	19	(18.4)	84	(21.1)	
<i>Quintile 3</i>	11	(10.7)	95	(23.9)	
<i>Quintile 4</i>	23	(22.3)	71	(17.8)	
<i>Quintile 5 – More disadvantaged</i>	23	(22.3)	72	(18.1)	
<i>Missing</i>	1	(1.0)	3	(0.8)	
Circumstances of diagnosis, n (%)					0.3814
<i>Emergency surgery</i>	18	(17.5)	51	(12.8)	
<i>Symptoms</i>	62	(60.2)	268	(67.3)	
<i>Others</i>	21	(20.4)	79	(19.8)	
<i>Missing</i>	2	(1.9)	-	-	
Condensed TNM Stages, n (%)					<0.0001
<i>0</i>	7	(6.8)	1	(0.3)	
<i>I</i>	5	(4.9)	36	(9.0)	
<i>II</i>	16	(15.5)	112	(28.1)	
<i>III</i>	14	(13.6)	100	(25.1)	
<i>IV</i>	22	(21.4)	118	(29.6)	
<i>Unknown</i>	39	(37.9)	31	(7.8)	
Metastases, n (%)					<0.0001
<i>Yes</i>	22	(21.4)	110	(27.6)	
<i>No</i>	58	(56.3)	269	(67.6)	
<i>Missing</i>	23	(22.3)	19	(4.8)	
Operated, n (%)					<0.0001
<i>Yes</i>	66	(64.1)	354	(88.9)	
<i>No</i>	29	(28.2)	42	(10.6)	
<i>Missing</i>	8	(7.8)	2	(0.5)	
Dead, n (%)					<0.0001
	49	(47.6)	48	(12.1)	

* *Khi-2, Fisher and Student tests*

MDTm: multidisciplinary team meeting

Missing: missing data

Appendix B

Management of colon cancer groups (no MDTm/MDTm) in newly diagnosed patients in 2010, in the Gironde and Tarn departments (France) (n=501)

	No MDTm (n=103)		MDTm (n=398)		P*
	n	%	n	%	
Thoracic CT scan					0.0005
Yes	48	46.6	265	66.6	
No	35	34.0	74	78.6	
Missing	20	19.4	59	14.8	
Stage 0 (n=7/1)					-
Surgery alone	7	100.0	1	100.0	
Stage I (n=5/36)					1.0000
Surgery alone	5	100.0	35	97.2	
Surgery and radiotherapy	-	-	1	2.8	
Stage II (n=18/112)					0.8691
Surgery alone	12	75.0	85	75.9	
Surgery and radiotherapy	1	6.3	4	3.6	
Surgery and post-operative chemotherapy	3	18.7	23	20.5	
Stage III (n=14/100)					0.0419
Surgery alone	8	57.1	32	32.0	
Surgery and radiotherapy	-	-	1	1.0	
Surgery and post-operative chemotherapy	6	42.9	67	67.0	
Stage IV (n=22/118)					<0.0001
Surgery alone	8	36.4	20	17.0	
Chemotherapy alone	2	9.1	19	16.1	
Surgery and pre-operative chemotherapy	-	-	17	14.4	
Surgery and post-operative chemotherapy	4	18.2	52	44.1	
Surgery and radiotherapy	-	-	5	4.2	
Missing	8	36.4	5	4.2	

* Chi-2, Fisher and Student tests

CT: computerized tomography

MDTm: multidisciplinary team meeting

Missing: missing data

Appendix C

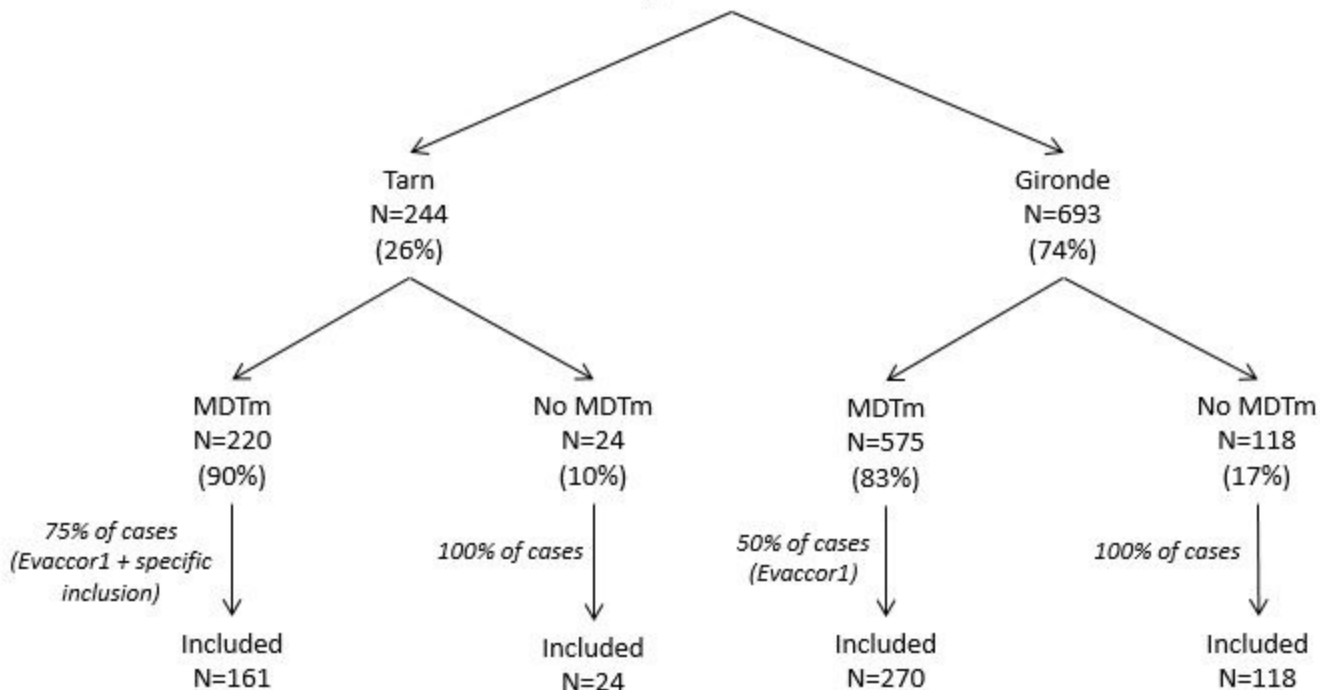
Description of management delay in groups (no MDTm/MDTm) of colon cancer patients in 2010, in the Gironde and Tarn departments (France)

	n	No MDTm	MDTm	P*
Diagnosis-death delay (days) (n)	97	49	48	0.0144
<i>Mean (Standard Deviation)</i>		264.9 (276.7)	338.0 (237.7)	
<i>Median (Min-Max)</i>		127.0 (31.0-1209.0)	316.5 (31.0-1055.0)	
Diagnosis-Surgery delay (days) (n)	422	68	354	0.0045
<i>Mean (Standard Deviation)</i>		21.7 (34.4)	34.6 (70.3)	
<i>Median (Min-Max)</i>		6.5 (0.0-163.0)	18.0 (0.0-679.0)	
Diagnosis-Emergency surgery delay (days) (n)	67	17	50	0.1718
<i>Mean (Standard Deviation)</i>		8.0 (30.5)	10.1 (26.1)	
<i>Median (Min-Max)</i>		0.0 (0.0-126.0)	0.0 (0.0-132.0)	
Diagnosis- Surgery delay (without emergency) (days) (n)	355	51	304	0.0941
<i>Mean (Standard Deviation)</i>		26.2 34.7	38.7 74.4	
<i>Median (Min-Max)</i>		11.0 (0.0-163.0)	20.0 (0.0-679.0)	
Surgery-Chemotherapy delay (weeks) (n)	184	12	172	0.6277
<i>Mean (Standard Deviation)</i>		8.8 (8.9)	7.3 (4.3)	
<i>Median (Min-Max)</i>		7.4 (0.1-35.9)	6.4 (0.6-33.4)	
Surgery-Death delay (days) (n)	88	48	40	0.0676
<i>Mean (Standard Deviation)</i>		252.1 (310.5)	312.2 (247.9)	
<i>Median (Min-Max)</i>		112.0 (4.0-1199.0)	248.0 (0.0-1051.0)	

* Wilcoxon test

MDTm: multidisciplinary team meeting

Colon Cancer in Tarn and Gironde Registries in 2010



Numbers:**Thoracic CT scan**

Scan: 48 NoMDT/263

No scan: 54 NoMDT/131

Stage II

Chemo: 3 NoMDT/27

No chemo: 12 NoMDT/83

Stage III

Chemo: 6 NoMDT/67

No chemo: 7 NoMDT/30

After surgery

Chemo: 6 NoMDT/122

No chemo: 4 NoMDT/46

During PO chemo

Death: 1 NoMDT/45

No death: 11 NoMDT/126

