

Masterthesis:

Endoscopies of the colorectal area: the current situation in the East of the Netherlands

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Abstract

INTRODUCTION Colorectal cancer (CRC) is the second most occurring type of cancer in the Netherlands. In 2008, a total of 12,417 patients were diagnosed with CRC. Survival of patients with CRC is the highest in the lowest stages, therefore it is suitable for screening. Screening for CRC can lead to early detection of the disease in less advanced stages and prevention of the disease by means of removing pre-malignant adenomas. The Dutch Health Council recommended screening for CRC, but the decision to implement a screening program is postponed to 2019, because of insufficient capacity, means and finance. To get prepared for future screening, it is necessary to have insight in the capacity and workload in the current daily practice without screening.

AIM The primary aim of this research is gaining insight in the amount of endoscopies of the colorectal area in the East of the Netherlands, including the distribution and localization of deviations that are found. Furthermore, the current patient flow within a hospital for patients who underwent an endoscopy is defined including current throughput times. In view of the introduction of a national screening program for CRC, this research can be seen as a baseline measurement for further research and evaluation.

METHODS Two patient groups were selected. First, a total population was obtained from the pathology laboratory 'Oost Nederland' to give insight in the performed endoscopies and associated results and localization of deviations. Second, a random sample was derived from that total population including only patients from one hospital, MST. We stratified on the result of the endoscopy; adenocarcinoma, high-grade dysplasia, low-grade dysplasia and benign. By means of the random sample, the patient flow and throughput times within MST were examined.

RESULTS The total population consisted of 9398 cases. Mean age at diagnosis was 59.3 years. Of the total, 11% was a malignancy and the majority had a benign pathology result (40%). Most deviations were found within the rectum and sigmoid (respectively 24% and 22%). A large variability was found in the patient flow and throughput times for patients who underwent an endoscopy of the colorectal area.

DISCUSSION This study gives a realistic view about the current situation regarding endoscopies of the colorectal area in the East of the Netherlands. In preparation of the introduction of a national screening program for CRC, the results show that improvements can be made regarding the efficiency and effectiveness of the current process. Benefits can be gained by means of optimizing throughput times through clinical pathways and exoneration of the workload for gastroenterologists. Until and after a national screening program for CRC is implemented it is important to keep monitoring the process as in this study, to evaluate, make adjustments and examine the future impact on capacity and workload of a national screening program for CRC.

Introduction

Colorectal cancer (CRC) is the second most occurring type of cancer in the Netherlands and involves cancer of the colon, sigmoid and rectum. In 2008, a total of 12,417 patients were diagnosed with CRC, 6,686 men and 5,731 women (NCR, 2010).

The incidence of CRC is increasing. The age-standardized incidence rate (European Standard Population, ESR) was 52.8 per 100,000 person-years in 1989 and 67.7 per 100,000 person-years in 2008. (NCR, 2010). This is related to the aging population and trends in lifestyle. Risk factors for the development of CRC can be of both genetic nature and lifestyle related. Based on recent trends, the expected increase in the period of 2005-2025 will be 41.7% (Kampman, Cats & Nagengast, 2010).

At time of diagnosis, 40% of the CRC patients is diagnosed with cancer in a more advanced stage, stage III or IV (Janssen- Heijnen, 2005), which makes prognosis relatively unfavorable. Five-year relative survival for patients with stage I disease is 93% whereas this is 9% for patients with stage IV disease (NCR, 2010).

CRC has a relatively long precursor stage without symptoms in which early detection is easy and which can be treated properly. This makes CRC suitable for a national screening program (Gezondheidsraad, 2009). Screening for CRC can lead to early detection of the disease in less advanced stages and prevention of the disease by means of removing pre-malignant adenomas. Eventually, this will lead to a decrease in CRC related mortality.

In 2008, CRC related mortality in the Netherlands was 4810, 2466 men and 2344 women (NCR, 2010).

According to the criteria for responsible population based screening (Wilson & Jungner, 1986), the Dutch Health Council recommended in January 2010 that screening should be done every two years in the Dutch population with age 55 to 75 years by means of a Faecal Occult Blood Test (FOBT) at home. Persons with a positive test result will be examined further by means of a colonoscopy to analyze what caused the deviating test result. According to the Dutch Health Council, annually 1400 deaths caused by colorectal cancer could be avoided, based on an estimated attendance of 60%.

Next to this health gain, the introduction of a national screening program has several consequences for the current healthcare system, such as an increase in workload for the existing screening areas, pathology laboratories, gastroenterology- and endoscopy departments. (Gezondheidsraad, 2009). Although a phased implementation was recommended to avoid problems and build capacity, in February 2010 the Minister of Health, Wellbeing and Sports decided to postpone the decision to implement a screening program to 2019, because of insufficient capacity, means and finance to perform extra colonoscopies.

In the Netherlands, data about cancer patients is collected nationally by the Netherlands Cancer Registry (NCR). However, hardly any data is available about the distribution and localization of precursor or very early stages of CRC. In addition, data about the pathology result of patients who underwent an endoscopy of the colorectal area is, except from the patients finally diagnosed with CRC, often not registered (Terhaar sive Droste, *et al.*, 2009).

The aim of this research is gaining insight in the current situation regarding endoscopies of the colorectal area in the East of the Netherlands by providing an overview of performed endoscopies including the distribution and localization of deviations that are found. Furthermore, the current patient flow within a hospital for patients who underwent an endoscopy is defined including current throughput times.

In view of the future introduction of a national screening program for CRC this study can be helpful, because complete knowledge about the amount of performed endoscopies of the colorectal area can help in making correct predictions about the capacity needs that are expected when a national screening program for CRC is implemented. Because little knowledge is available, this research can be seen as an explorative baseline measurement with which the foundation is set for further research and evaluation of care programs.

Methods

The purpose is gaining insight in the current situation regarding endoscopies of the colorectal area in the East of the Netherlands. Therefore we selected two patient groups. First, a total population is obtained from the pathology laboratory 'Oost Nederland'. Second, a random sample is derived from that total population including only patients from one hospital, 'Medisch Spectrum Twente' (MST).

Patient group: PALGA database

Data on biopsies of endoscopies were obtained from the pathology laboratory 'Oost Nederland' selected in the *Pathologisch, Anatomisch Landelijk Geautomatiseerd Archief* (PALGA). This is the nationwide network and registry of histo- and cytopathology in the Netherlands which contains general information including age, gender and residence of the patient, as well as information about the material being analyzed (Casparie *et al.*, 2007).

The pathology laboratory 'Oost Nederland' analyses material for four hospitals within the catchment area; Medisch Spectrum Twente (MST), Ziekenhuisgroep Twente location Hengelo (ZGT-H), Ziekenhuisgroep Twente location Almelo (ZGT-A) and Streekiekenhuis Koningin Beatrix (SKB).

A search was done to obtain a list of all biopsies of the intestines in 2008 and 2009, based on the Snomed codes 'T67 Colon' and 'T68 Rectum' (n=11,116 cases). Relevant cases in which the biopsy was taken during an endoscopy were selected using the following exclusion criteria: biopsies of the small intestines and biopsies obtained during surgery. In total, 1718 cases were excluded, resulting in the inclusion of 9398 cases being a biopsy of the colon or rectum taken during an endoscopy. The cases were divided into the pathology results malignant, high-grade dysplasia, low-grade dysplasia, benign and other.

Patient group: random sample

To examine the clinical pathway of patients who had an endoscopy of the colorectal area including throughput times, a random sample of 200 cases was taken out of the 3228 patients from MST. MST is a local top clinical teaching hospital. With a capacity of 1070 beds, it is one of the largest non-academic hospitals in the Netherlands and almost all specializations are available. The catchment area consist of approximately 264,000 residents.

Random selection was performed using the statistical program STATA version 10. A stratification was performed by 'year' and 'result' of the endoscopy to get an equal distribution between 2008 and 2009 and between the endoscopy results adenocarcinoma, high-grade dysplasia, low-grade dysplasia, and benign. Two cases were excluded afterwards because during data collection it appeared not to be an endoscopy of the colorectal area (n=198).

Data collection

The total database derived from PALGA included the t-number (number with which biopsies in the pathology laboratory are coded), name of the patient, gender, date of birth, hospital, residence, pathology result of the endoscopy, localization of deviations, date of arrival and date of submission within the pathology laboratory.

Within MST several variables were collected to give insight in the patient flow and calculate average throughput times between different steps in the process. The variables that were collected: date of application of the endoscopy, urgency code of the application, date of consults with specialists or nurses, date of endoscopy, date of multidisciplinary meetings, type of treatments, start date of treatments and end date of treatments.

To obtain treatment data of the patients from the random sample with an adenocarcinoma, these patients were linked with the cancer registry of the Comprehensive Cancer Centre North East (CCCNE). This cancer registry is part of the nationwide population-based Netherlands Cancer Registry (NCR). Characteristics about the patient,

the tumour, diagnosis, treatment and follow-up are collected from patient files within the hospital by special trained registration employees. Topography and morphology are coded conform the International Classification of Diseases for Oncology, ICD-O (Fritz *et al.*, 2000) and staging of the tumour is done conform the TNM classification (Wittekind *et al.*, 2004).

Patient flow

In order to give insight in the actual patient flow and calculate average throughput times between different steps in the process, the general process within MST needs to be explained.

Patients who need to undergo an endoscopy of the colorectal area within MST can enter the pathway via different ways: via the general practitioner, the gastroenterology department or the internal medicine department. Before endoscopy, the patient could have a preliminary consult with a medical specialist or nurse. During this consult it is judged if endoscopy is necessary, the condition of the patient is judged regarding the prescription of sleep medication and the patient is informed and prepared for endoscopy. When an endoscopy is requested, the serving gastroenterologist notes the date of entry on an application form and rates the urgency of planning the endoscopy through a code (1= within 24 hours, 2= within a week, 3=within 3 weeks, 4=within 4 to 6 weeks and 5= no urgency, which means the first possibility for no urgent endoscopies). Then the endoscopy is performed. If a biopsy is taken, the material will be send to the pathology laboratory 'Oost Nederland' were the material is analyzed. After a certain days, the result of the analysis is send back to the hospital. Treatment is dependent of the result of the endoscopy. There are different multidisciplinary meetings in which the involved specialists discuss about which treatment is most suitable. The 'GERA meeting' is a meeting between gastroenterologists and surgeons. The aim of the meeting is arranging agreement about whether or not to perform surgery and if so, which type of surgery is preferred. This meeting always takes place before surgery is performed. The 'MDO meeting' is a multidisciplinary oncology meeting in which different disciplines involved in oncology care are represented, such as the medical oncologist and radiotherapist. This meeting can be planned before surgery, but also afterwards when further treatment or follow up needs to be specified. In other cases, a multidisciplinary meeting is not necessary, because the deviation can be removed through an endoscopy or no further actions need to be taken. Before surgery, a preoperative screening consult is done by an anesthesiologist to judge the conditions of the patients regarding anesthesia. After surgery, patients can receive adjuvant therapy, dependent of the seriousness of the deviation.

Results

Population characteristics

In table 1 the characteristics of the total study population (n=9398) and random sample (n=198) are shown. In the total study population, 4339 biopsies of endoscopies (46%) were taken and analyzed in 2008 and 5059 (54%) in 2009. The distribution between male and female was equal. The majority of persons (55%) was between 50 and 74 years old and mean age at diagnosis was 59.3 years (SD 16.7). Mean age at diagnosis of the random sample was 64.3 years (SD 12.3). In the total study population, most endoscopies were performed within the MST (34%).

Table 1. Characteristics of study population

Parameter	Total (n=9398)		Sample (n=198)	
	n	%	n	%
Year				
2008	4339	46%	98	49%
2009	5059	54%	100	51%
Gender				
Male	4653	49%	106	54%
Female	4745	51%	92	46%
Age at diagnosis				
< 50 years	2464	26%	25	12%
50 -74 years	5203	55%	134	68%
> 75 years	1731	18%	39	20%
Hospital				
MST	3228	34%	198	100%
ZGT-H	2346	25%	-	-
ZGT-A	2150	23%	-	-
SKB	1658	18%	-	-
Unknown	16	0%	-	-

Distribution and localization of the deviations

The results of the performed endoscopies of the colorectal area are presented in table 2. In total, 12% was a malignancy. High-grade dysplasia accounted for 3%, and low-grade dysplasia for 31%. The majority had a benign result (40%) and 15% was categorized as 'other' having no deviations, or not being assessable.

Table 2. Result of the performed endoscopies

Parameter	Total (n=9398)		Sample (n=198)	
	n	%	n	%
Malignancies				
Adenocarcinoma	942	10%	49	25%
Squamous cell carcinoma	3	0%	-	-
Other malignancy	35	0.5%	-	-
Suspicious	107	1%	-	-
High-grade dysplasia	295	3%	50	25%
Low-grade dysplasia	2939	31%	49	25%
Benign				
Inflammation	1461	15%	1	0.5%
Hyperplasia	1180	13%	23	12%
Reactive changes	628	7%	17	8%
Pseudomelanosis coli	105	1%	2	1%
Inflammation rest	93	1%	1	0.5%
Additional	251	3%	6	3%
Other				
No deviations	1328	14%	-	-
Not assessable	31	0.5%	-	-
Total	9398	100%	198	100%

Table 3 shows the localizations of the deviations found during endoscopy. Most deviations were found within the rectum and sigmoid (respectively 24% and 22%). Least deviations were found within the coecum. In 5% of the cases, the localization was unknown.

Table 3. Localization of results found in the performed endoscopies

Parameter	Total (n=9398)		Sample (n=198)	
	n	%	n	%
Localization				
Coecum	692	8%	18	9%
Colon	1896	20%	37	19%
Sigmoid	2111	22%	59	30%
Rectum	2216	24%	60	30%
At several places	1996	21%	17	9%
Unknown	487	5%	7	3%
Total	9398	100%	198	100%

Patient flow

Patients who underwent an endoscopy of the colorectal area within MST had different ways of entering the pathway. In figure 1 the complete patient flow is shown including diagnosis and treatment as well as the associated throughput times.

Entrance

Patients who needed endoscopy of the colorectal area entered the hospital through different ways. The mainstream of persons entered the hospital via the gastroenterology department (n=100). They had a preliminary consult with a medical specialist or nurse before the endoscopy was performed. In 2008 there were 7 patients who had a screening consult with a nurse, in 2009 this were 24 patients. When the patient entered the hospital via the surgery department (n=4), the surgeon requested the endoscopy. These patients already underwent a proctoscopy. Patients who entered the hospital via the internal medicine department (n=28) had a preliminary consult with a medical specialist in internal medicine. When patients entered the hospital via the emergency

department (n=30), they were always seen by a medical specialist. In some cases the patient is admitted to the gastroenterology ward and endoscopy is performed during hospital admission, but in other situations, an endoscopy is requested and the patient is sent home. There are a lot of cases in which the patient does not have a preliminary consult. For example when the general practitioner requested an endoscopy (n=33) of the colorectal area directly, when a malignancy is found per accident at an oncology department (n=3) during PET-scan (n=1), CT-scan (n=1), exclusion of metastasis (n=1), or when the patient is already known at the gastroenterology department or internal medicine department and an endoscopy of the colorectal area is done for periodic check or follow-up (n=37).

Urgency

In total, 98 of the 198 application forms were found, leading to 98 application dates and 93 urgency codes. In table 4, the urgency codes are combined with the final pathology result of the endoscopy. The most frequent appearing code is 3 (15%). Of the patients diagnosed with an adenocarcinoma, 54% had the endoscopy within 3 weeks, and there were 4 patients (8%) with an urgency code of 4 or 5. Of the patients who had a benign result, 24% of the endoscopies took place within 3 weeks and there were 3 patients (6%) with urgency code 1 or 2.

Table 4 Urgency codes compared to final result of endoscopy

Parameter	Adenocarcinoma		High-grade dysplasia		Low-grade dysplasia		Benign		Total	
	n	%	n	%	n	%	n	%	n	%
Urgency-code										
1	1	2%	0	0%	0	0%	1	2%	2	1%
1 – 2	1	2%	0	0%	0	0%	0	0%	1	0.5%
2	11	22%	3	6%	2	4%	2	4%	18	9%
2 – 3	3	6%	1	2%	3	6%	2	4%	9	5%
3	11	22%	7	14%	4	8%	7	14%	29	15%
3 – 4	0	0%	3	6%	2	4%	1	2%	6	3%
4	1	2%	4	8%	4	8%	6	12%	15	7%
4 – 5	1	2%	0	0%	4	8%	1	2%	6	3%
5	2	4%	2	4%	2	4%	1	2%	7	3.5%
Missing	18	38%	30	60%	28	58%	29	58%	105	53%
Total	49	100%	50	100%	49	100%	50	100%	198	100%

Pathology laboratory

When an endoscopy of the colorectal area is performed and a biopsy is taken, it takes 0.6 days on average for the biopsy to arrive at the pathology laboratory with a minimum of 0 and a maximum of 3 days. Analysis within the pathology laboratory takes on average 4 days with a minimum of 1 day and a maximum of 13 days.

Adenocarcinoma

Of the 49 adenocarcinomas included in the random sample, 18 were rectum carcinomas and 31 were colon carcinomas. Two carcinomas were located in the rectosigmoid. They were included within the colon carcinomas. Most of the malignancies were diagnosed with stage II (29%). In total, 43% of the malignancies were diagnosed in a more advanced stage (stage III or IV).

Rectum carcinoma

Of the patients diagnosed with rectum cancer, 15 were discussed in one or more meetings, 5 in the 'GERA meeting' and 15 during the 'MDO meeting'. Three patients were not discussed at any meeting at all. Ten of the 18 persons with a rectum carcinoma received preoperative radiotherapy, in 3 cases this was short track radiotherapy, with a length of 4 days. Seven people received long track radiotherapy with an average of 34.8 days (minimum 32 days and maximum 36 days). In 5 patients, long track radiotherapy was combined with chemotherapy. After that, surgery was performed in 9 of the 10 cases. One patient was referred to an academic hospital for treatment. Of the patients who underwent surgery, one did not have a preoperative screening consult. For patients who received preoperative short track radiotherapy, the mean hospital stay was 44 days. One of the patients had an extreme long hospital stay of 105 days because of different complications. If this patient was excluded, the average hospital stay was 13.5 days. For patients who received preoperative long track radiotherapy or who had surgery immediately, the average hospital stay was 10.5 days. After preoperative long track radiotherapy and surgery, there were 2 patients who received adjuvant chemotherapy. Of the patients with a rectum carcinoma, 6 did not have preoperative radiotherapy, but received surgery immediately. Of them, 2 received adjuvant chemotherapy afterwards. One patient only had chemotherapy and 1 patient did not have any therapy at all, because of complete removal of the malignancy during the endoscopy. The median time between plan of treatment (determined during the multidisciplinary meeting) and actual start of radiotherapy treatment for patients with rectum cancer was 32 days. The patients with rectum cancer who received surgery had a median time from plan of treatment to surgery of 26 days.

Colon carcinoma

Of the patients diagnosed with colon cancer, 25 patients were discussed in one or more meetings, 14 in the 'GERA meeting' and 22 in the 'MDO meeting'. Six patients diagnosed with a colon carcinoma were not discussed at any meeting at all.

The majority of persons (n=28) underwent surgery of which one person did not have a preoperative screening consult with the anesthesiologist. The average hospital stay was 11.6 days.

After surgery, there were 12 patients who received adjuvant chemotherapy and one patient received chemotherapy immediately. Two patients did not have a curative treatment at all because of the physical conditions of the patients.

In this random sample, the median time between plan of treatment and actual treatment for colon cancer was 20 days.

High-grade dysplasia

Of the patients with high-grade dysplasia, 9 patients were discussed in one or more meetings, 8 in the 'GERA meeting' and 1 in the 'MDO meeting'. Of the patients discussed during the 'GERA meeting', 4 underwent surgery. In most cases, the deviations were removed during the endoscopy itself, so no further actions were taken (n=30). Sometimes follow up was planned in a few months, or in 1, 3 or 6 years. In 8 patients, the deviations were removed later on during a new endoscopy of the colorectal area. Eight patients underwent surgery with an average hospital stay of 8.8 days. Four patients were referred to another hospital, three to the ZGT hospital in Hengelo for a transanal endoscopic microsurgery procedure (TEM procedure), and one to an academic hospital.

Low-grade dysplasia

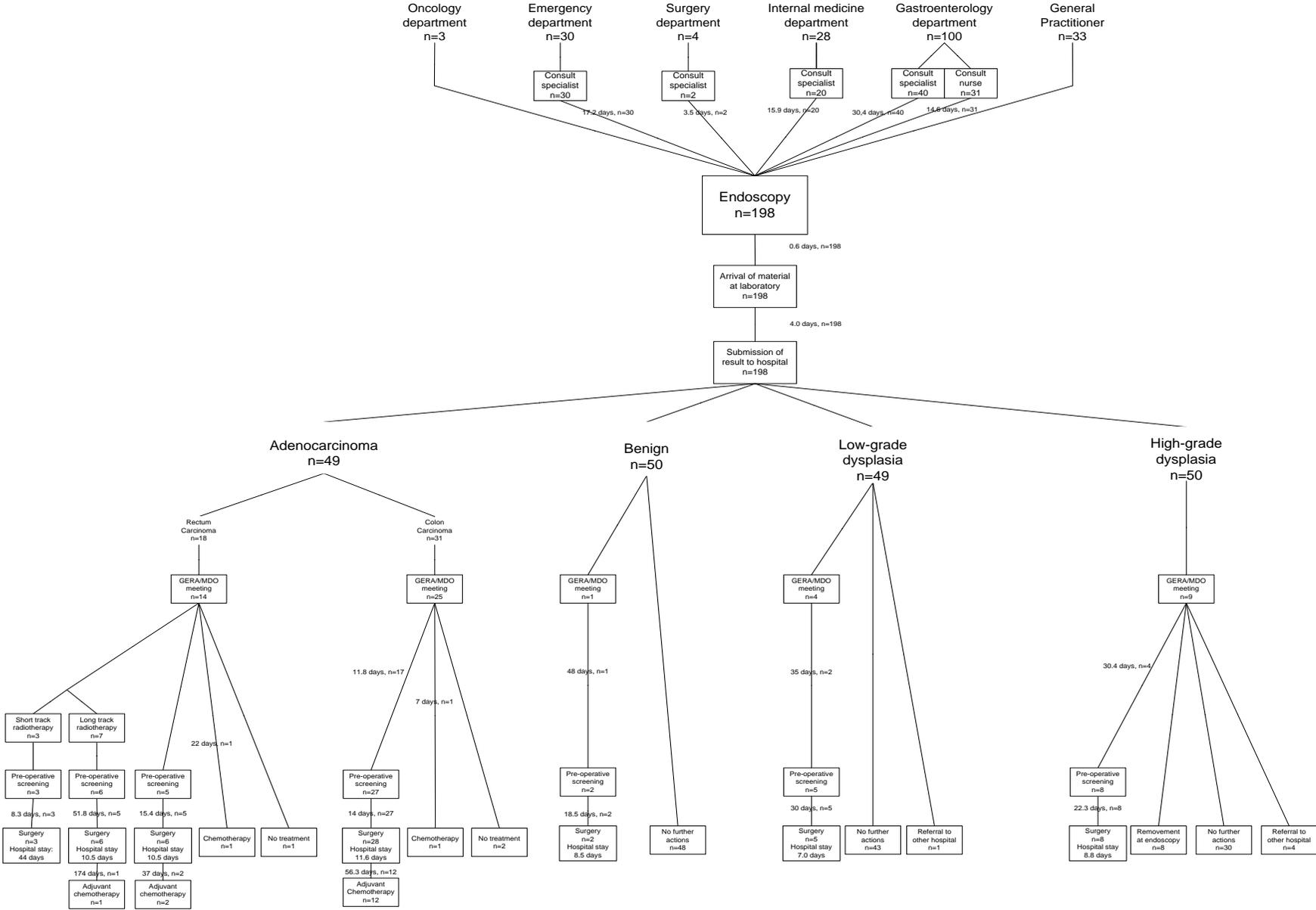
Four of the 49 patients with low-grade dysplasia were discussed in one or more meetings, 3 within the 'GERA meeting' and 1 within the 'MDO meeting'.

In most cases removal of the deviations was not necessary, or removal was done during the endoscopy itself, so no further actions were taken (n=43), only follow up was planned in 1, 3 or 6 years. Five patients underwent surgery. In 2 patients who underwent surgery. The material in the biopsy of the endoscopy was not a correct representation, because the biopsy of the resection resulted in an adenocarcinoma, so. One person had a genetic predisposition regarding CRC, so a part of the colon was removed to prevent the polyps of becoming malignant. The 2 remaining persons had a transanal resection of polyps. Average hospital stay was 7.0 days. One patient was referred to the ZGT hospital in Hengelo for a TEM procedure.

Benign

In most cases (n=48) no further actions were taken in patients with a benign pathology. This meant that further actions were not necessary because of benign pathology, or that the deviations were removed during the endoscopy itself. Although the result of the endoscopy was benign, 2 patients underwent surgery. In one case during the endoscopy a suspicious process was seen. After discussion at the 'GERA meeting', surgery was planned. This resulted in the removal of a cyst adenoma. The other person had an infiltration process in the pelvic area with growth into the colon. Surgery was done to remove the process and to construct a temporary colon stoma.

Figure 1 Patient flow for patients who underwent an endoscopy of the colorectal area (including throughput times)



Discussion

This study can be seen as an explorative baseline measurement of the current situation, which can be helpful in future evaluation. In view of the future introduction of a national screening program for CRC, this research can be useful to make predictions about the capacity needs that are necessary and the changes that are expected. Besides this use, this project is a starting point towards future research.

The results of this study show that 11% of the performed endoscopies of the colorectal area resulted in a malignancy. In addition, a large variability was found in the patient flow and throughput times for patients who underwent an endoscopy of the colorectal area.

Based on the results that are found, new questions came up. For example the difference in results in hospitals in which a clinical pathway for CRC is implemented. The implementation of clinical pathways within healthcare is rising. Clinical pathways are different from guidelines. Guidelines often advise to fasten the process of diagnosis and treatment, but they barely give concrete information about acceptable waiting times and throughput times. Clinical pathways are more detailed programs that, besides the care that should be given, also provide information about the sequence and responsibility of that care. (Ouwens *et al.*, 2009). By means of clinical pathways care can be organized, quality can be managed and costs can be controlled. The development of clinical pathways is emerging and results from non-cancer branches in medicine show evidence for the improvement of quality and healthcare outcomes (Smith & Hillner, 2001). Right now, MST is working on the implementation of a clinical pathway. Although the introduction of a clinical pathway for CRC within the MST will be helpful in managing the process, this will never lead to complete structuring of the patient flow. Every patient is different and diseases can act in different ways. This makes healthcare a complex and in some ways unpredictable branch. Because this study can be seen as a baseline measurement, it is recommended for MST to repeat this measurement after a few years to see the effect of implementing a clinical pathway for CRC.

The aim of this research was gaining insight in the current situation regarding endoscopies of the colorectal area in the East of the Netherlands by means of providing an overview of performed endoscopies including the distribution and localization of deviations that are found. Little is known about the percentage of malignancies found as a result of an endoscopy of the colorectal area. The results of this study show that in approximately 11% the endoscopy resulted in CRC. In the study of Terhaar sive Droste *et al.* (2009), the prevalence of malignancies was 6%. The difference found between this study and the study of Terhaar sive Droste *et al.* (2009) may be explained by the difference in inclusion and exclusion criteria. The study of Terhaar sive Droste *et al.* (2009) included only colonoscopies in which the complete colon was reached. While in this study, no difference was made between the type of endoscopy and between complete or incomplete colonoscopies. This can also explain the amount of deviations found within the caecum. In the study of Terhaar sive Droste (2009), the percentage of deviations found within the caecum was 13%. In this study the percentage of deviations found in the caecum is 7%, because the caecum is not always reached. Our study gives a more realistic view on the current capacity that is needed, because all performed endoscopies of the colorectal area are included.

Besides providing an overview of performed endoscopies, this study gained insight in the current clinical pathway for patients who underwent an endoscopy, including the associated throughput times. There are not much standards available regarding the throughput times of specific CRC care, but there are more general guidelines regarding the quality of general cancer care. An important indicator is the time between plan of treatment and the actual treatment. The Dutch Cancer Society suggested in 2005 that the interval between plan of treatment and the actual treatment within cancer care should be less than 21 days, or 15 working days (Dutch Cancer Society, 2006). This study showed that, for patients with colon cancer, median time between plan of treatment and actual treatment was 20 days, which means that it stays within the border of the guideline. For patients with rectum cancer who receive radiotherapy or surgery, the results are less advantageous, because the median time was respectively 32 and 26 days. In Southern

Netherlands, the median time for colon patients was 17 working days in 2008. For patients with rectal cancer, median time to radiotherapy was 30 working days and median time to surgery was 18 working days (Steenbergen *et al.*, 2010). The differences between the two studies might be explained by the fact that in the study of Steenbergen *et al.* (2010) the date of diagnosis was used instead of the time of treatment plan. An other factor that can play a role is the fact that the numbers stated in this research are based on small populations, which might not be completely representative.

A relatively remarkable result is that, although our study used numbers of a shorter period than the study of Steenbergen *et al.* (2010), the times found in our study are longer. Overall, our study showed that the median time from treatment plan to actual start of the treatment was 25 days and that 42% of the patients were treated within the 21 days. We can conclude that improvements can be made, and attention should be paid to shorten those times. In view of the current capacity mentioned before, it should be questioned if times mentioned in the guidelines are feasible. Another point of discussion is the fact that the guidelines are general guidelines, involving all types of cancer. It is doubtful if those times are applicable for rectal cancer as well, because of the inclusion of preoperative radiotherapy within the treatment for rectal cancer.

The Dutch minister of Health, Wellbeing and sports postponed the decision of implementing a national screening program for CRC to 2019. Main reason for this is the absence of current Dutch healthcare capacity. In the last 15 years, the amount of gastroenterologists in the Netherlands was increasing, despite this increase, the amount of vacancies is increasing faster and there is a national shortcoming of gastroenterologists. In 2008, 22% of the need for gastroenterologists was vacant. This trend is caused by an increase in gastroenterology pathology like CRC, and Crohn's disease as well as a growth and development of (new) diagnostic possibilities (Telleman *et al.*, 2009). On average, two days are spent performing endoscopies which shows the large proportion of diagnostics. Taking the future implementation of a national screening for CRC into account, this shortage will become even larger if no measures are taken. Exoneration of the workload for gastroenterologists is necessary. More endoscopists need to be trained to meet the issue of insufficient capacity, since a large proportion of work consists of performing endoscopies and the future national screening program asks for more colonoscopy capacity. A solution can be the employment of non medical personnel for endoscopic procedures, for example nurse endoscopists, physician assistants or nurse practitioners. Studies demonstrated that nonmedical practitioners can perform endoscopy procedures as good as medical endoscopists (Meaden *et al.*, 2006) and that training nurses to perform gastrointestinal endoscopies is feasible and can be done in an effective way (Koornstra *et al.*, 2009). Another way of exonerate the workload for gastroenterologists is the use of nurses during a consult instead of a gastroenterologist. MST implemented the screening consult with a nurse in 2008, but at that time it was not a compulsory procedure. Since 2010 all persons who get an endoscopy of the colorectal area have to visit the nurse before, and after endoscopy. The throughput times presented in our study already showed the gain in time: after having a consult with a gastroenterologist, it took approximately 1 month to have the endoscopy. In addition, it took half of the time after having a screening consult with a nurse of the gastroenterology department. In this study we only examined throughput times, but besides that it has benefits related to information delivery, patient centeredness, quality and safety. It should be studied to which extent this accounts for MST. Other benefits can be gained in the area of triage. Our study showed that in some cases wrong estimations are made regarding the urgency of performing an endoscopy. Wrong estimations lead to wrong use of healthcare. The distribution of burden in healthcare is not well divided which can lead to capacity problems and therefore workload problems.

The random sample used in this report is derived from the PALGA file of the pathology laboratory 'Oost Nederland'. In this way individual biopsies of endoscopies are selected and analyzed further. This approach has advantages and disadvantages. The advantage is that beforehand it is known that a biopsy is taken and that the pathology result is known. Important disadvantages are the fact that it is not known which actions are taken within MST. It is for example

not known if all information is available and if the patient went through the general pathway. Therefore, not all variables within the random sample are equal for every patient. On the other hand, every patient is different and although it is desirable to have the same amount of variables for everybody, this is not feasible.

Another point to mention is that the number of biopsies analyzed within the laboratory does not reflect the total amount of endoscopies of the colorectal area within the catchment area, because only in 45% of the total endoscopies of the colorectal area a biopsy is taken. All endoscopies in which a biopsy is taken were included. This means that, besides an overview about the performed endoscopies and associated results, indirectly insight is gained in the workload for the pathology laboratory 'Oost Nederland' regarding endoscopies of the colorectal area. In view of the future implementation of a national screening program for CRC we can conclude that this will lead to an increase in workload. As said before, a large amount of endoscopies are performed in which no biopsy is taken. This results in the statement that, for the endoscopy department within MST (including the gastroenterology department and department for internal medicine) the workload therefore is higher and will become even larger when a national screening program for CRC is implemented. Another loss lies within the fact that the PALGA file sometimes contained minimal reporting regarding the clinical information. For the pathologist this is not detrimental during analysis of the biopsy, but because this research used PALGA as the foundation, this is a disadvantage. Relevant cases were obtained from the basic file and were excluded when the biopsy was obtained in the small intestines, or when the biopsy was not taken during an endoscopy. Due to minimal reporting it was sometimes unknown what type of endoscopy was performed and what the exact localization was of the biopsy that was taken. This resulted in the fact that, regarding the localization, the possibility "unknown" was included. The results of this study show that the "unknown" localization accounted for 5% of the total, which lead to the assumption that the minimal reporting probably did not had a large influence on the data used in this study.

In conclusion, our study gives a realistic view about the current situation regarding endoscopies of the colorectal area in the East of the Netherlands. The current process needs to be as optimal as possible to adapt to the new situation.

In preparation of the introduction of a national screening program for CRC this means that improvements can be made regarding the efficiency and effectiveness. First of all, benefits can be gained by means of optimizing the current throughput times. A good example is structuring the patient flow through the implementing of a clinical pathway for CRC. Second, benefits can be gained by means of exoneration of the workload for gastroenterologists. For example through the allocation of tasks (performing endoscopies and having consults with patients) towards other nonmedical disciplines in the gastroenterology department, like nurses, nurse practitioners or physician assistants.

Until a national screening program for CRC is implemented, it is important to keep monitoring the process like we did in this study. In this way, the process is evaluated and intermediate adjustments can be made. This will lead to an increased awareness about the current situation regarding capacity and workload, which will help in better accommodation during the implementation of a national screening program for CRC in the future. Even if a national screening program for CRC is present, monitoring the situation at that time through a study like this is an important mean to examine the impact of the program.

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