Developing a Decision-making Model Based on an Interdisciplinary Oncological Care Group for the Management of Colorectal Cancer

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Abstract. *Aim: To report our experience on implementation and preliminary results of a decision-making model based on the recommendations of an Interdisciplinary Oncological Care Group developed for the management of colorectal cancer. Patients and Methods: The multidisciplinary team identified a reference guideline using appraisal of guidelines for research and evaluation (AGREE) tool based on a sequential assessment of the guideline quality. Thereafter, internal guidelines with diagnostic and therapeutic management for early, locally advanced and metastatic colonic and rectal cancer were drafted; organizational aspects, responsibility matrices, protocol actions for each area of specialty involved and indicators for performing audits were also defined. Results: The National Institute for Health and Care Excellence (NICE) UK guideline was the reference for drafting the internal guideline document; from February to November 2013, 125 patients with colorectal cancer were discussed by and taken under the care of the Interdisciplinary Oncological Care Group. The first audit performed in December 2013 revealed optimal adherence to the internal guideline, mainly in terms of uniformity and accuracy of perioperative staging, coordination and timing of multi-modal therapies. To date, all patients under observation are within the diagnostic and therapeutic course, no patient came out from the multidisciplinary "path" and only in 14% of cases have the first recommendations proposed been changed. The selected indicators appear effective and reliable, while at the moment, it is not yet possible to assess the impact of the multidisciplinary team on clinical outcome. Conclusion: Although having a short observation period, our model seems capable of determining optimal uniformity of diagnostic and therapeutic management, to a high degree of patient satisfaction. A longer observation period is necessary in order to confirm these observations and for assessing the impact on clinical outcome.*

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Colorectal cancer (CRC) was the most frequent type of cancer in Italy in 2012, with over 54,000 new diagnoses in both sexes and a mortality rate of 11,035 per 100,000 and 8,582 per 100,000 persons in males and females, respectively (1).

Up to one-third of patients presenting with advanced disease at diagnosis and about 40% of those with early-stage disease experience relapse during the disease course (2). In the past 20 years, numerous studies have demonstrated the importance of accurate staging and combination therapy in achieving an optimal outcome, especially for those with advanced disease (3, 4). However, considerable variation still exists in cancer management and outcome across Institutions and a large variability is also evident between guidelines and patterns of cancer care in clinical practice (4).

The establishment of a multidisciplinary team (MDT) has become an increasingly popular approach over the past two decades. In this model, patient care is coordinated in a

synchronous fashion. Specialists from multiple disciplines are involved in a decision-making process based on evidence-based treatment (5, 6). Potential advantages include increased clinical outcome, patient satisfaction and compliance, and an enhanced educational experience for all participants, with increased recruitment into clinical trials (6).

However, there is little evidence to support the existence of survival benefit under this approach. Studies are limited, generally retrospective and often compare outcomes by MDT to historical data (7-9). Therefore, implementing a multidisciplinary program and demonstrating its effectiveness remains challenging.

This report addresses our experience on implementation and preliminary results of a decision-making model based on an Interdisciplinary Oncological Care Group (GICO) developed for the management of CRC.

Materials and Methods

A GICO for CRC was established under the coordination of the Clinical Governance Staff of the Chieti Hospital Managership in September 2012 and included gastroenterological surgeons, radiologists, radiation therapists, medical oncologists, gastroenterologists, histopathologists, anesthesiologists and emergency physicians.

From September 2012 to January 2013, the Group used the following methodology for the drafting of an internal document with diagnostic and therapeutic guidelines.

Firstly, a reference guideline was selected from amongst those of the Italian Association of Medical Oncology (AIOM), European Society of Medical Oncology (ESMO), National Institute for Health and Care Excellence (NICE, UK), Scottish Intercollegiate Guidelines Network (SIGN) and National Comprehensive Cancer Network (NCCN, USA).

To achieve this, the Appraisal of Guidelines for Research and Evaluation (AGREE) instrument was used, based on sequential assessment of the quality of evidence and judgment about the strength of recommendations (10,11). The guidelines selected were assessed with AGREE independently by four physicians of different specialties (surgeon, medical oncologist, radiation oncologist and gastroenterologist) with more than 10 years' experience in CRC. The AGREE instrument consists of 23 items grouped into six areas. Each area is addressed to a specific aspect of the quality of a guideline (Table I). A 4-point Likert scale is used to score each item (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree). A 3-point scale is used to score an overall judgement on whether the guideline ought to be recommended for use (1=not recommend, 2=recommend with provisos or modifications, 3=strongly recommend). Scores for each area were by averaging and summing the scores for individual items of each area and standardizing the total as a percentage of maximum possible score for that area. Secondly, a multidisciplinary internal report (GICO document) was drafted with a flowchart of clinical reasoning, and the reporting of the organizational route elaborated. Thirdly, the matrix of responsibility for each area of specialty was defined and, finally, the indicators for audit evaluations were developed. The indicators selected for the planned audits are derived from evidence-based guidelines (12, 13) and the quality indicators were selected by representatives from all medical disciplines involved (surgery, radiotherapy, medical oncology, gastroenterology, pathology and radiology) using a Delphi method (14). All process indicators are listed in Table II.

Results

AIOM, ESMO, NICE, SIGN and NCCN guidelines were assessed with AGREE and scores for each area were calculated. The overall results of the four physicians indicated the UK NICE guideline as being the most complete (Table III), with a final score of 3 (strong recommendation) (15). Therefore, it was identified as the reference guideline for the preparation of a GICO document integrating NICE components with both the most relevant aspects emerging from the analysis of all the guidelines evaluated and with local organizational resources.

Thus, the multidisciplinary team drafted the GICO document reporting the sequential behaviors and defining the process of working both in emergencies and in the routine cases.

During patient management, diagnostic and therapeutic options have been described for early, locally advanced and metastatic CRC according to the highest levels of evidence and applicability to the organizational reality of the hospital network. Moreover, through a specific addendum to the document radiological, endoscopic, surgical, pathological, radiotherapy, medical oncology and anesthesiological protocols and procedures have been described. The flow-chart of the clinical reasoning that summarizes the whole work performed is shown in Figure 1.

From an organizational point of view, the matrix of responsibility for each area of specialty involved has been defined, not only for physicians but also for nurses, technicians and administrative staff.

The complete GICO document is available on the official hospital website: www.asl2abruzzo.it and includes all therapeutic algorithms and the addendum on protocols and procedures specific for each medical discipline.

A key role was the establishment of a Case Manager, a highly skilled professional nurse who takes care of every relationship between physicians and patients in terms of appointments, collection of medical tests and planning for each type of therapeutic intervention. A Case Manager follows the patient at every step of the diagnostic and therapeutic course and coordinates all activities of the MDT. Patients come to the Colorectal MDT through the Case Manager by out-patient medical services (endoscopy, radiology, radiotherapy, oncology), hospital departments and hospital emergency.

The MDT meets weekly at the Hospital and begins with an approximately two hour-long Tumor Board where cases are discussed. This conference is usually attended by colorectal surgeons, radiation and medical oncologists, radiologists, pathologists, gastroenterologist and the Case Manager. The Tumor Board allows the group to review imaging studies,

Table I. *Areas and items of the appraisal of guidelines for research and evaluation (AGREE) tool.*

Area 1. Scope and purpose
The overall objective(s) of the guideline is (are) specifically described
The clinical question(s) covered by the guideline is (are) specifically described
The patients to whom the guideline is meant to apply are specifically described
Area 2: Stakeholder involvement
The guideline development group includes individuals from all the relevant professional groups
The patients' views and preferences have been sought
The target users of the guideline are clearly defined
The guideline has been piloted among end users
Area 3: Rigor of development
Systematic methods were used to search for evidence
The criteria for selecting the evidence are clearly described
The methods for formulating the recommendations are clearly described
The health benefits, side-effects and risks have been considered in formulating the recommendations
There is an explicit link between the recommendations and the supporting evidence
The guideline has been externally reviewed by experts prior to its publication
A procedure for updating the guideline is provided
Area 4: Clarity of presentation
The recommendation are specific and unambiguous
The different options for management of the condition are clearly presented
Key recommendations are easily identifiable
Area 5: Applicability
The guideline is supported with tools for application
The potential organizational barriers in applying the recommendations have been discussed
The potential cost implications of applying the recommendations have been considered
The guideline presents key review criteria for monitoring or audit purposes
Area 6: Editorial independence
The guideline is editorially independent from the funding body
Conflicts of interest of members of the guideline development group have been recorded

discuss treatment alternatives, and determine the appropriate diagnostic and therapeutic management, focusing on evidence-based best practice guidelines from the GICO document. Thereby, each patient comes to the hospital following the Tumor Board discussion and has sequential appointments with each specialist on the basis of the defined diagnostic and therapeutic strategy.

Audits were scheduled annually, and in December 2013, the Clinical Governance staff performed the first audit.

From February to November 2013, 125 cases of patients with CRC, 97 with colonic cancer and 28 with rectal cancer, were discussed and taken under the care of the GICO. A total of 81/125 patients (65%) underwent staging work-up inside the Hospital Radiology Department, while 44/125 patients (35%) had already undergone radiological examinations outside the hospital and, therefore, were then reviewed by radiologists of the GICO. In both cases, a constant uniformity of staging was reached. Moreover, all patients with rectal cancer underwent integrated computed tomographic staging with magnetic resonance imaging.

As a first therapeutic approach for colonic cancer, 69 patients were submitted to surgery, 21 to primary chemotherapy, and for 7 patients, a stent was endoscopically placed.

As a first therapeutic approach for rectal cancer, 14 patients were submitted to neoadjuvant radiochemotherapy, 8 to surgery and 6 patients to palliative radiotherapy.

Eighteen decisions were changed after GICO meeting: due to comorbidities in 10 patients, new clinical information in 4 cases, and non-acceptance of the first therapeutic option proposed in 4 cases.

Therefore, in 86% of cases, the first recommendations proposed were complied with, while in 14% of cases, the first recommendations proposed were changed but used alternative treatment options expected from the GICO document.

To date, all patients under observation are within the diagnostic/therapeutic course and no patient has come out from the multidisciplinary "path".

Although with a short MDT working period of only 10 months, all the selected indicators have been met. Moreover, there was a high degree of patient satisfaction, but at the

Table II. *Indicators selected for audit (all values assessed as percentages).*

Colonoscopy performed inside the hospital and waiting time ≤10 days and within 24 hours in urgency
CT in emergency inside the hospital and waiting time within one hour of request
CT for staging inside the hospital and waiting time ≤7 days
MRI for staging inside the hospital and waiting time ≤21 days
Patients submitted to surgery inside the hospital and waiting time ≤30 days
Patients submitted to neoadjuvant radio-chemotherapy and waiting time ≤30 days
Patients submitted to adjuvant radio-chemotherapy and waiting time ≤84 days from chemotherapy starting
Patients submitted to adjuvant chemotherapy inside the hospital and waiting time ≤42 days
Patients submitted to chemotherapy for metastatic diseaseinside the hospital and waiting time ≤10 days
Biopsies inside the hospital and waiting time ≤7 days
Histopathological specimen inside the hospital and waiting time ≤21 days
Patients with time between first hospital visit and the start of the first treatmentwithin 30 days
Patients dropped out of the GICO program
Decisions changed after MDT meeting and motivations

CT: Computed tomography; MRI: magnetic resonance imaging; GICO: interdisciplinary group of oncological care; MDT: multidisciplinary team.

Table III. *Overall results in percentage for each area for each Guideline.*

	Guideline				
Areas	NCCN	NICE	SIGN	ESMO	AIOM
Scope and purpose	86,66667	100	88,88889	35,55556	48,88889
Stakeholder involvement	80	85	78,33333	23,33333	36,66667
Rigour of development	81,90476	92,38095	72,38095	38,09524	35,2381
Clarity of presentation	90	81,66667	73,33333	46,66667	46,66667
Applicability	42,22222	71,11111	71,11111	4,444444	6,666667
Editorial independence	80	86,66667	86,66667	23,33333	6,666667
Avearge:	76,8	86,1	78,4	28,6	30,1

NCCN: National comprehensive cancer network; NICE: national institute for health and care excellence; SIGN: scottish intercollegiate guidelines network; ESMO: european society for medical oncology; AIOM: italian association of medical oncology.

moment, it is not possible to assess the impact of the MDT on clinical outcome due to the short duration of operation of the GICO.

Discussion

The rationale for the establishment of an MDT in cancer care is represented by the need for coordinated diagnostic and therapeutic management in which specialists from multiple disciplines are involved in a decision-making process based on evidence-based treatment.

Potential benefits include greater uniformity in management, increased clinical outcome, patient satisfaction and compliance, and an enhanced educational experience for all participants, with increased recruitment into clinical trials (6, 7, 8, 16).

CRC is also being increasingly managed in a multidisciplinary fashion as diagnostic technologies expand and the importance of carefully-timed multimodality therapy is recognized. However, there is little evidence to support the existence of any benefit with an MDT approach and, therefore, implementing a multidisciplinary program and demonstrating its effectiveness remains challenging.

Our experience of a decision-making model based on a GICO for management of CRC first selected the NICE guideline reference through AGREE, an instrument which provides an assessment for the validity of a guideline in terms of probability that it really reaches the desired objectives (15). To our knowledge this is the first experience on the application of this method to detect a reference guideline aimed at the preparation of a multidisciplinary internal report (the GICO document). However, the AGREE method has been extensively tested and was rated by users as appropriate, easy and helpful in differentiating guidelines of varying quality (11).

The preliminary results of our MDT put to work showed optimal adherence to the GICO document, mainly in terms of uniformity and accuracy of perioperative staging and re-

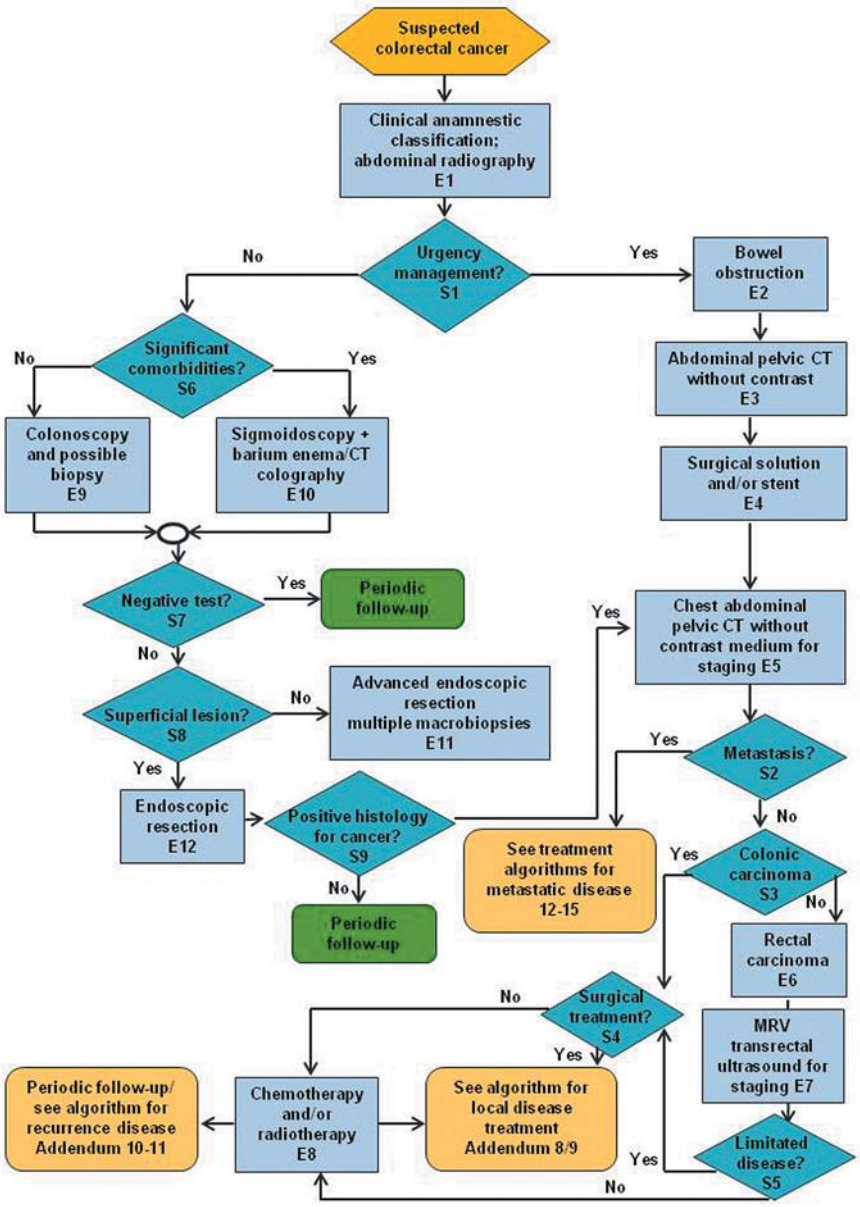

Figure 1. *Flowchart of clinical reasoning of the Interdisciplinary Oncological Care Group (GICO) model for management of colorectal cancer. CT: computed tomography; MRI: magnetic resonance imaging.*

staging, coordination and timing of multimodal therapies, while at present it is not possible to assess the impact of the MDT on clinical outcome due to the short time of GICO activity. In addition, to date, all patients are so far within the diagnostic/therapeutic course and none patient came out from the multidisciplinary "path".

Levine and co-workers prospectively collecting data of patients with CRC diagnosis referred to an MDT, and comparing the results to a control group of patients managed outside an MDT using the NCCN guideline as reference, showed better results for patients referred to an MDT in terms of improved adherence to the NCCN guideline, preoperative work-up, synchronization of multimodal therapies, frequency of perioperative treatment and advanced pathology testing (17).

In a population-based study, Swellengrebel and co-workers evaluated the additional value of discussing patients with rectal cancer in an MDT compared to patients not discussed in au MDT, with the occurrence of a positive circumferential resection margin as the primary end-point. Additional aims were to audit preoperative and histopathological staging and

treatment according to Dutch guidelines (18). Although no difference in the positive margin rate was found, clinical staging was more complete and a magnetic resonance imaging study was also performed more often in the MDT group; patients receiving preoperative chemoradiotherapy were also discussed more often by the MDT than those undergoing total mesorectal excision only and patients with distal tumors were more likely to be discussed by the MDT.

Overall, only half of the patients diagnosed with rectal cancer were discussed by an MDT (18). Ying-jiang and co-workers assessed the effect on management of CRC in two groups of patients stratified into those managed before and those after the introduction of the MDT (19). The accuracy of TNM staging by computed tomography and the number of examined lymph nodes in the MDT group were significantly more than those in pre-MDT group. The rate of tumor recurrence in the MDT group was lower than in the pre-MDT group and in multivariate analysis, the management after MDT was an important factor that independently influenced overall survival, together with age, degree of tumor differentiation, number of examined lymph nodes and TNM stage. The authors concluded that the MDT improved the diagnostic accuracy and overall survival of patients with CRC and promoted communication and cooperation between disciplines, ensuring high quality diagnosis, evidence-based decision-making and optimal treatment planning.

Maskell (20) and Taylor *et al*. (21) also claimed that from the introduction of MDTs in the UK, the main benefit was the greater accuracy of radiology from staging to restaging and follow-up.

Our audits are planned annually and the first audit performed in December 2013 seems to have proven the effectiveness of the selected indicators using a Delphi method and NICE guideline (14, 15). The timing of the audits and the effectiveness of the indicators used are recognized aspects of fundamental importance in assessing the quality of MDT working. In fact, performing an audit of the multidisciplinary diagnosis and treatment of patients with CRC from 2006 to 2008 to evaluate whether compliance with guidelines were improved, Van der Geest and co-workers used a limited set of quality indicators derived from the Netherlands evidence-based guidelines and selected with the Delphi method (22). The authors found a considerable improvement in the compliance with guideline recommendations for non-metastatic CRC and emphasized the key role of audit and indicators in identifying quality concerns and tracking changes over time, as was confirmed by Wood and co-workers (23).

In our case, 18 decisions were changed after the GICO meeting: due to comorbidities in 10 cases, new clinical information in four and non-acceptance of the first therapeutic option in four; consequently 86% of first recommendations were accepted, and 14% of first recommendations were changed using alternative treatment options expected from the GICO document.

Our results are similar to findings of Wood and co-workers, who found only 10% of decisions were not implemented and main reasons for non-implementation were in order of frequency mostly related to patient factors: comorbidity, patient choice and new clinical information acquired (23).

Conversely, evaluating the clinical impact and cost-effectiveness of MDTs meeting over a 3-month period and in a sample of 47 random cases, Chinai *et al*. found that the costs of MDT meetings are very high, producing a small clinical impact because of the many changes in decision recorded (24). Similarly, Keating and co-workers reported little association between the MDT project and measures of use, with several problems on quality and survival (25).

In our GICO experience, the organizational aspects, planned with the responsibility matrices and the coordinating role of the Case Manager centralized on a highly skilled professional nurse, are proving to be crucial in maintaining the schedule of weekly meetings, in making available all clinical material useful for discussion, in defining appointments for patients and in treatment timing. Together with the expertise, constancy and routinary use, these issues could prove to be very important over time. Moreover, these issues could be a response to concerns highlighted by the survey of Sharma and co-workers, in which many surgeons and nurses consider that attendance at MDTs is not taken into account adequately in terms of career plans, and to concerns raised by Kane and Luz who, investigating MDT activity in November 2005 and in November 2012, have shown that work rhythms changed over time as a function of the volume of work and technological progress, and maintaining cohesive teamwork with roles and responsibilities is challenging in terms of time spent, organization, resources and updating the reference guideline (26, 27).

Conclusion

Coordination, communication and decision-making between healthcare team members and patients are aspects of cancer care that could be improved by MDT working. Implementing a multidisciplinary program and demonstrating its effectiveness in cancer care management remains challenging. Although with a short observation period, the methodology applied in implementing and checking organizational aspects and decision-making of our MDT model for CRC management led to a comprehensive adherence to the internal guideline produced, with an optimal uniformity of diagnostic and therapeutic management and a high degree of patient satisfaction.

A longer observation time is necessary for confirming these observations and for assessing the impact on clinical outcome.

References

1 Rossi S, Crocetti E, Capocaccia R, Gatta G and the AIRTUM Working Group: Estimates of cancer burden in Italy. Tumori *99*: 416-424, 2013.

2 Casado-Saenz E, Feliu J, Gomez-Espana MA, Sanchez-Gastaldo A and Garcia-Carbonero R: SEOM Clinical guidelines for the treatment of advanced colorectal cancer 2013. Clin Transl Oncol *15*: 996-1003, 2013.

3 Sargent D, Sobrero A, Grothey A, O'Connell MJ, Buyse M, Andre T, Zheng Y, Green E, Labianca R, O'Callaghan C, Seitz JF, Francini G, Haller D, Yothers G, Goldberg R and de Gramont A: Evidence for cure by adjuvant therapy in colon cancer: observations based on individual patient data from 20,898 patients on 18 randomized trials. J Clin Oncol *27*: 872-877, 2009.

4 van de Velde CJ, Boelens PG, Borras JM, Coebergh JW, Cervantes A, Blomqvist L, Beets-Tan RG, van den Broek CB, Brown G, Van Cutsem E, Espin E, Haustermans K, Glimelius B, Iversen LH, van Krieken JH, Marijnen CA, Henning G, Gore-Booth J, Meldolesi E, Mroczkowski P, Nagtegaal I, Naredi P, Ortiz H, Påhlman L, Quirke P, Rödel C, Roth A, Rutten H, Schmoll HJ, Smith JJ, Tanis PJ, Taylor C, Wibe A, Wiggers T,Gambacorta MA, Aristei C and Valentini V: EURECCA Colorectal: Multidisciplinary management: European Consensus Conference colon & rectum. Eur J of Cancer *50*: 1-34, 2014.

5 Fleissig A, Jenkins V, Catt S and Fallowfield L: Multidisciplinary teams in cancer care: Are they effective in the UK? Lancet Oncol *7*: 935-943, 2006.

6 Valicenti RK, Gomella LG, El-Gabry EA, Myers R, Nathan F, Strup S, Dicker A, McGinnis DE, Cardi G, Baltish M, Simirgliano M, Vizzard A and Mulholland SG: The multidisciplinary clinic approach to prostate cancer counseling and treatment. Semin Urol Oncol *18*: 188-191, 2000.

7 Khani MH and Smedh K: Centralization of rectal cancer surgery improves long-term survival. Colorectal Dis *12*: 874-879, 2010.

8 Morris E, Haward RA, Gilthorpe MS, Craigs C and Forman D: The impact of the Calman-Hine report on the processes and outcomes of care for Yorkshire's colorectal cancer patients. Br J Cancer *95*: 979-985, 2006.

9 Wilks JA, Liebig C, Tasleem SH, Haderxhanaj K, Lee L, Farrow B, Awad S, Berger D and Albo D: Rectal cancer patients benefit from implementation of a dedicated colorectal cancer center in a Veterans Affairs medical center. Am J Surg *198*: 100-104, 2009.

10 AGREE Collaboration: Development and validation of an international appraisal instrument for assessing the quality of clinical practice guidelines: the AGREE project. Qual Saf Health Care *12*: 18-23, 2003.

11 Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, Fervers B, Graham ID, Grimshaw J, Hanna SE, Littlejohns P, Makarski J, Zitzelsberger L; AGREE Next Steps Consortium: AGREE II: advanced guideline development, reporting and evaluation in health care. CMAJ *182*: E839-842, 2010.

12 Oncoline, Utrecht: Dutch Association of Comprehensive Cancer Centres (ACCC) National evidence-based guideline for colon cancer 2008; National evidence-based guideline for rectal cancer 2008; National consensusbased guideline for colon cancer 2005; National consensus based guideline for rectal cancer 2005. http://www.oncoline.nl

13 Bianchi V, Spitale, Ortelli L, Mazzucchelli L, Bordoni A, and the QC3 CRC Working Group: Quality indicators of clinical cancer care (QC3) in colorectal cancer. BMJ Open *3*: e002818, 2013.

14 Wollersheim H, Hermens R, Hulscher M, Braspenning J, Ouwens M, Schouten J, Marres H, Dijkstra R and Grol R: Clinical indicators: Development and applications. Neth J Med *65*: 15-22, 2007.

15 National Institute for Clinical Excellence (NICE) 2011: The diagnosis and management of colorectal cancer: full guideline. http://www.nice.org.uk

16 Dillman RO and Chico SD: Cancer patient survival improvement is correlated with the opening of a community cancer center: comparisons with intramural and extramural benchmarks. J Oncol Pract *1*: 84-92, 2005.

17 Levine RA, Chawla B, Bergeron S and Wasvary H: Multidisciplinary management of colorectal cancer enhances access to multimodal therapy and compliance with National Comprehensive Cancer Network (NCCN) guidelines.Int J Colorectal Dis *27*: 1531-1538, 2012.

18 Swellengrebel HAM, Peters EG, Cats A, Visser O, Blaauwgeers HGT, Verwaal VJ, van Velthuysen ML, Cense HA, Bruin SC and Marijnen CAM: Multidisciplinary Discussion and Management of Rectal Cancer: a population-based Study. World J Surg *35*: 2125-2133, 2011.

19 Ye YJ, Shen ZL, Sun XT, Wang ZF, Shen DH, Liu HJ, Zhang WL, Chen YL, Zhou J, Poston GJ and Wang S: Impact of multidisciplinary team working on the management of colorectal cancer. Chin Med J *125*: 172-177, 2012.

20 Maskell G: Commentary on: Does every patient need to be discussed at a multidisciplinary team meeting? Clinical Radiology *68*: 760-761, 2013.

21 Taylor C, Munro AJ, Glynne-Jones R, Griffith C, Trevatt P, Richards M and Ramirez AJ: Multidisciplinary team working in cancer: What is the evidence? BMJ *340*: c951, 2010.

22 van der Geest LG, Krijnen P, Wouters MW, Erkelens WG, Marinelli AW, Nortier HJ, Tollenaar RA and Struikmans H; Comprehensive Cancer Centre the Netherlands (CCCNL), Location Leiden: Improved guideline compliance after 3-year audit of Multidisciplinary Colorectal cancer care in the Western Part of the Netherlands. J Surg Oncol *106*: 1-9, 2012.

23 Wood JJ, Metcalfe C, Paes A, Sylvester P, Durdey P, Thomas MG and Blazeby JM: An evaluation of treatment decisions at a colorectal cancer multi-disciplinary team. Colorectal Disease *10*: 769-772, 2008.

24 Chinai N, Bintcliffe F, Armstrong EM, Teape J, Jones BM and Hosie KB: Does every patient need to be discussed at a multidisciplinary team meeting? Clinical Radiology *68*: 780-784, 2013.

25 Keating NL, Landrum MB, Lamont EB, Bozeman SR, Shulman LN and McNeil BJ: Tumor boards and the quality of cancer care. J Natl Cancer Inst *105*: 113-121, 2013.

26 Sharma A, Sharp DM, Walker LG and Monson JR: Colorectal MDTs: the team's perspective. Colorectal Disease *10*: 63-68, 2007.

27 Kane B and Luz S: "Do no harm": Fortifying MDT collaboration in changing technological times. Int J Med Informatics *82*: 613-625, 2013.

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