

# Assessment of quality-of-care indicators for colorectal cancer surgery at a single centre in a developing country

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**Background:** The implementation of quality-of-care indicators aiming to improve colorectal cancer (CRC) outcomes has been previously described by Cancer Care Ontario. The aim of this study was to assess the quality-of-care indicators in CRC at a referral centre in a developing country and to determine whether improvement occurred over time.

**Methods:** We performed a retrospective study of our prospectively collected database of patients after CRC surgery from 2001 to 2016. We excluded patients who underwent local transanal excision, pelvic exenteration or palliative procedures. We evaluated trends over time using the Cochran–Armitage test for trend.

**Results:** A total of 343 patients underwent surgical resection of CRC over the study period. There was improvement of the following indicators over time: the proportion of patients detected by screening ( $p = 0.03$ ), the proportion of patients with preoperative liver imaging ( $p = 0.001$ ), the proportion of patients with stage II or III rectal cancer who received neoadjuvant chemotherapy ( $p = 0.03$ ), the proportion of patients with pathology reports that indicated the number of lymph nodes examined and the number of positive nodes ( $p = 0.001$ ), and the proportion of patients with pathology reports describing the details on margin status ( $p = 0.001$ ).

**Conclusion:** This study showed the feasibility of applying the Cancer Care Ontario indicators for evaluating outcomes in CRC treatment at a single centre in a developing country. Although there was an improvement of some of the quality-of-care indicators over time, policies and interventions must be implemented to improve the fulfillment of all indicators.

**Contexte :** Action Cancer Ontario a déjà décrit l'application d'indicateurs de la qualité des soins dans le but d'améliorer l'issue du cancer colorectal (CCR). Le but de cette étude était d'évaluer les indicateurs de la qualité de soins pour le CCR dans un centre de référence d'un pays en voie de développement et de déterminer si des améliorations ont pu être observées avec le temps.

**Méthodes :** Nous avons procédé à une étude rétrospective de notre base de données recueillies prospectivement auprès de patients ayant subi une chirurgie pour CCR entre 2001 et 2016. Nous avons exclu les patients qui ont subi une exérèse transanale locale, une exentération pelvienne ou des traitements palliatifs. Nous avons évalué les tendances au fil du temps à l'aide du test Cochran–Armitage pour dégager les tendances.

**Résultats :** En tout, 343 patients ont subi une résection chirurgicale de CCR au cours de la période de l'étude. On a noté une amélioration des indicateurs suivants au fil du temps : proportion de patients ayant subi un dépistage ( $p = 0,03$ ), proportion de patients ayant subi des épreuves d'imagerie hépatique préopératoires ( $p = 0,001$ ), proportion de patients atteints d'un cancer rectal de stade II ou III ayant reçu une chimiothérapie néoadjuvante ( $p = 0,03$ ), proportion de patients dont les rapports d'anatomopathologie indiquaient le nombre de ganglions lymphatiques examinés et le nombre de ganglions positifs ( $p = 0,001$ ) et proportion de patients dont les rapports d'anatomopathologie décrivaient le statut des marges ( $p = 0,001$ ).

**Conclusion :** Cette étude a démontré l'applicabilité des indicateurs d'Action Cancer Ontario pour évaluer les résultats du traitement pour CCR dans un seul centre d'un pays en voie de développement. Même si certains des indicateurs de la qualité des soins se sont améliorés au fil du temps, il faut appliquer des politiques et des interventions pour améliorer tous les indicateurs.

**C**olorectal cancer (CRC) is the third most common cancer diagnosed worldwide.<sup>1</sup> According to information provided by the World Health Organization (GLOBOCAN) in 2012, there were 8651 new cases of CRC in Mexico, representing the fourth most common type of cancer in that country.<sup>2</sup> Because people in Mexico have a lower life expectancy, less education and less money, and women have higher fertility and pregnancy rates, Mexico is considered to be a developing country.<sup>3</sup>

In a national survey in which researchers assessed the perception of Mexican users of health care services regarding the quality of the services that they received, public hospitals were rated worst in measures of health care quality.<sup>4</sup>

Surgical resection remains the main treatment for CRC. Several groups have published guidelines and recommendations with the aim of improving the treatment outcome for CRC.<sup>5–11</sup> Several organizations worldwide have evaluated adherence to established guidelines to identify areas of improvement.<sup>12–17</sup> One of these groups is Cancer Care Ontario. In 2005, a multidisciplinary expert panel proposed 15 indicators of quality of care for evaluating outcomes in CRC treatment.<sup>17</sup> To date, there is a lack of information regarding application of these quality-of-care indicators in outcomes of CRC treatment in developing countries.<sup>13,18</sup>

The aim of the present study was to assess CRC outcomes using the Cancer Care Ontario quality-of-care indicators at a public referral centre in a developing country and to determine whether there was improvement of these indicators over time.

## METHODS

We performed a retrospective analysis of our prospectively collected database of patients with CRC who received oncologic treatment at a referral centre in Mexico City. Patients who underwent surgery between January 2001 and December 2016 were included. Colorectal cancer operations were performed or supervised by colorectal surgeons certified by the Mexican Board of Colorectal Surgery. Patients were referred to our hospital after a confirmed CRC diagnosis. Patients who underwent transanal local excision of rectal cancer, pelvic exenteration or only a palliative procedure (e.g., derivative ostomy) were excluded from the analysis, as were patients with incomplete data (missing chart information, incomplete medical records).

For each patient, we collected information regarding a modified version of the 15 quality-of-care indicators proposed by Cancer Care Ontario. These indicators included data regarding patient presentation, screening, preoperative evaluation, quality of surgical and pathology reports, postoperative complications, long-term outcomes and follow-up (Table 1).<sup>13,18</sup>

The study was in accordance with the ethical standards of our institutional research committee.

## Statistical analysis

We analyzed the proportion of patients for whom each of the quality-of-care indicators was fulfilled in each study year and then compared the proportions in 2-year periods. For testing trends of increasing or decreasing proportions of patients for whom the indicators were met, we used the Cochran–Armitage test for trend, which analyzed whether there were differences between proportions over time. We analyzed cancer recurrence rates using Kaplan–Meier curves and performed survival analysis via nonparametric survival analysis using the log-rank test. Two-sided  $p$  values of  $< 0.05$  were considered statistically significant. We conducted analyses using SPSS version 21.0 for Windows.

## RESULTS

A total of 343 patients with CRC were included, of whom 180 (52.5%) were men; the mean age was 62.5 (range 19–97) years. Table 2 summarizes the patients' clinical presentation (tumour location, clinical stage and site of metastasis). The median follow-up duration was 42.6 (range 1–173) months; 260 patients (75.8%) had at least 12 months of follow-up, with 212 (61.8%) reaching 3 years of follow-up.

A compliance rate of 60% or greater was observed for 11 of the 15 indicators (Table 3). The exceptions were proportion of patients detected by screening (3.8%), in-hospital/30-day mortality (3.2%) and 2-year local recurrence rate (6.7%).

Over the study period, there was a statistically significant improvement in the proportion of patients who had CRC detected by screening ( $p = 0.03$ ), the proportion of patients with preoperative liver imaging studies ( $p = 0.001$ ), the rate of patients with stage II or III rectal cancer who received neoadjuvant chemotherapy ( $p = 0.03$ ), the proportion of patients with pathology reports that described the number of lymph nodes per specimen and the number of positive lymph nodes ( $p = 0.001$ ) and the proportion of patients with pathology reports describing the details on margin status ( $p = 0.001$ ) (Table 4).

We also analyzed the proportion of patients with pathology reports in which 12 or more lymph nodes were identified, which improved from 41.7% to 89.6% over the study period ( $p = 0.001$ ). The proportion of patients with pathology reports that evaluated the distal margin improved from 40.0% to 91.2% over time ( $p = 0.001$ ).

Anastomotic leaks occurred in 21 patients (6.1%) overall. They occurred in 16/248 patients (6.4%) with colon cancer and 5/95 (5.3%) of those with rectal cancer; none of these patients died. The anastomotic leak rate did not vary over time.

**Table 1. Modified Cancer Care Ontario quality-of-care indicators for evaluating outcomes in colorectal cancer treatment<sup>17</sup>**

Indicator	Definition
1. Patients diagnosed by screening	Proportion of patients diagnosed symptom free by any screening method
2. Adequate colon evaluation	Proportion of patients with complete colon imaging (colonoscopy or barium enema + sigmoidoscopy) 3 months before surgery or within 6 months after surgery
3. Preoperative liver imaging (CT, MRI, ultrasonography)	Proportion of patients with complete preoperative imaging of liver with ultrasonography, CT or MRI
4. Preoperative pelvis imaging in patients with rectal cancer (CT, MRI)	Proportion of patients with rectal cancer who had preoperative imaging of the pelvis with CT or MRI
5. Patients with rectal cancer who received NEORT	Proportion of patients with rectal cancer who saw a medical oncologist preoperatively, or of patients with stage II/III rectal cancer who saw a medical oncologist within 8 weeks of surgery or received preoperative radiotherapy
6. Patients with rectal cancer who received NEOCT	Proportion of patients with rectal cancer who saw a radiation oncologist preoperatively, or patients with stage II/III rectal cancer who saw a radiation oncologist within 8 weeks of surgery or received preoperative chemotherapy
7. Completeness of the operative report	Completeness of the surgical report of patients who underwent surgery for rectal cancer; 2 points assigned for each of the following aspects: total mesorectal excision, tumour location, tumour extension, lymphadenectomy, degree of nerve sparing (maximum score possible = 10)
8. Pathology report completeness: lymph nodes	Proportion of patients whose pathology report indicates the number of lymph nodes examined and the number of positive lymph nodes
9. Pathology report completeness: distal and circumferential margin	Proportion of patients whose pathology report indicates distal and circumferential margins quantitatively
10. Pathology report completeness: rectal cancer distal margin $\geq$ 1 cm	Proportion of patients who underwent surgery for rectal cancer whose distal margin was $\geq$ 1 cm
11. Anastomotic leak	Proportion of patients who underwent surgery for rectal cancer who experienced anastomotic leak
12. In-hospital/30-day mortality	Death in hospital or within 30 days of discharge after colon or rectal cancer surgery
13. Local recurrence	Proportion of patients with local recurrence within the pelvis confirmed by histologic examination, diagnostic imaging, colonoscopy and/or biopsy at reoperation
14. Survival rate	3- or 5-year overall survival rate
15. Surveillance colonoscopy	Proportion of patients who underwent surveillance colonoscopy within 1 year after surgery

CT = computed tomography; MRI = magnetic resonance imaging; NEOCT = neoadjuvant chemotherapy; NEORT = neoadjuvant radiotherapy.

The overall in-hospital/30-day mortality was 3.2%, with a nonsignificant decrease from 6.7% to 1.5% over the study period. The postoperative mortality rate was 2.1% (2/95) for patients who underwent rectal resection and 3.6% (9/248) for those who underwent colonic resection.

The overall survival rate was 83.4%, with an overall cancer-specific survival rate of 89.2%. The 3-year survival rate was 84.3%. The survival rate by cancer stage was 100.0% for patients with stage I disease, 91.4% for those with stage II disease, 85.4% for those with stage III disease and 18.2% for those with stage IV disease. There were no changes in mortality rates over time. The overall rate of 2-year local recurrence was 6.7%; for patients with rectal cancer, the rate was 7.4%.

**DISCUSSION**

In this retrospective study evaluating CRC treatment at a single institution in a developing country, we found that there was an improvement of the following Cancer Care Ontario quality-of-care indicators between 2001 and 2016: the proportion of patients with CRC detected by screening, the proportion with

**Table 2. Summary of clinical presentation of patients who underwent surgery for colorectal cancer**

Characteristic	No. (%) of patients <i>n</i> = 343
Tumour location	
Right colon	122 (35.6)
Transverse colon	24 (7.0)
Left colon	17 (5.0)
Sigmoid colon	85 (24.8)
Rectum	95 (27.7)
Synchronous tumour	5 (1.5)
Clinical stage (TNM)	
I	38 (11.1)
II	133 (38.8)
III	123 (35.9)
IV	49 (14.3)
Site of metastasis ( <i>n</i> = 49)	
Liver	20 (40.8)
Lung	7 (14.3)
Peritoneum	12 (24.5)
Multiple sites	10 (20.4)

**Table 3. Overall proportion of patients who met the quality-of-care indicators**

Indicator	No. (%) of patients* n = 343
Cases detected by screening	13 (3.8)
Adequate colon evaluation	324 (94.5)
Preoperative liver imaging	313 (91.2)
Preoperative pelvis imaging in patients with rectal cancer (n = 95)	91 (95.8)
Patients with rectal cancer who received NEORT (n = 75)	47 (62.7)
Patients with rectal cancer who received NEOCT (n = 75)	45 (60.0)
Completeness of operative report, mean score $\pm$ SD†	4.04 $\pm$ 2.9
Completeness of pathology report	
Reported no. of lymph nodes examined	322 (93.9)
Reported $\geq$ 12 lymph nodes examined (n = 322)	265 (82.3)
Reported positive lymph nodes (n = 322)	115 (35.7)
No. of lymph nodes collected, mean $\pm$ SD	18.3 $\pm$ 10.0
Reported quantitative distal margin status	271 (79.0)
Reported quantitative circumferential margin status	36 (10.5)
Reported distal margin $\geq$ 1 cm in patients with rectal cancer (n = 68)	66 (97.0)
Anastomotic leak in patients with rectal cancer (n = 95)	5 (5.3)
In-hospital/30-d mortality	11 (3.2)
Local recurrence	
Within 2 yr after surgery for rectal cancer and colon cancer	23 (6.7)
Following rectal cancer	7 (7.4)
Surveillance colonoscopy within 1 yr after surgery (n = 260)	154 (59.2)

NEOCT = neoadjuvant chemotherapy; NEORT = neoadjuvant radiotherapy; SD = standard deviation.  
\*Except where noted otherwise.  
†Maximum possible score: 10.

preoperative liver imaging, the proportion with stage II or III rectal cancer who received neoadjuvant radiotherapy, the proportion with pathology reports that described the number of lymph nodes examined and the number of positive nodes, and the proportion with pathology reports describing the margin status. We observed an alarmingly low overall rate of CRC detected by screening, although this showed a tendency of improvement over time. Based on these results, policies must be implemented to improve the fulfillment of all quality-of-care indicators in order to provide the best care to our patients with CRC.

The evaluation of care performance and outcomes, which seeks to improve the quality of medical care, has become an important practice worldwide, particularly at large academic centres in developed countries. Many groups worldwide have described their experience in this matter, showing that implementation of and adherence to guidelines is possible.<sup>12–18</sup> Our study includes the experience of a public referral hospital in Mexico (tertiary care centre), with patients from different areas from this country, especially from central and south Mexico.

We used a modified version of the CRC indicators of quality of care described by Cancer Care Ontario, since it is a practical and easy-to-use tool to evaluate quality-of-care parameters and because it is consistent with international guidelines.<sup>13–18</sup>

Interaction between the pathologist and surgeons, a continuum evaluation of reports and the use of synoptic reports improves the quality of pathology data.<sup>19,20</sup> We noticed that the most evident improvements were shown in pathology reports over time, with an increase in the mean number of lymph nodes examined from 80.0% to 98.5% and improvement in the proportion of patients who had a pathology specimen in which 12 lymph nodes or more were identified (41.7% to 89.6%). Although there is room for improvement, we attribute these favourable changes to the implementation of a CRC multidisciplinary management team, international training of attending physicians (medical oncologists, colorectal surgeons, radiation oncologists and pathologists) and a synoptic pathology report at our institution, which is consistent with previous publications.<sup>13,17</sup> The adoption of a multidisciplinary team or multimodality care at our institution started in 2008. It was formed by a group of specialists (medical and radiation oncologists, radiologists, pathologists, interventional radiologists and colorectal surgeons), and cases were regularly presented at a multidisciplinary conference where we reviewed relevant patient information and discussed treatment plans.

In the present study, suboptimal proportions of patients who underwent surgery for rectal cancer received neoadjuvant radiotherapy (62.7%) and neoadjuvant chemotherapy (60.0%). Before 2004,<sup>21</sup> these treatments were administered at the discretion of the radiation and medical oncologist at our institution.<sup>22–25</sup> In 2014, Monson and colleagues,<sup>26</sup> using data from the US National Cancer Data Base from 2006 to 2011, concluded that 74% of 30 994 patients with stage II or III rectal cancer received neoadjuvant chemoradiotherapy. Hospital volume was an important factor in predicting which patients would receive neoadjuvant treatment, with the proportion ranging from 78.1% in centres performing more than 30 rectal cancer resection procedures annually to 69.4% in centres performing 10 or fewer resection procedures.

One of the most important and most worrisome findings of our study was the low proportion of patients diagnosed by screening colonoscopy, 3.8%. Although the rate increased from 0.0% to 7.4% over the study period, it remained unacceptably low. It is worrisome that there are no ongoing strategies aimed at evaluating or improving this situation in our country. According to the Centers for Disease Control and Prevention, 62.4% of CRC cases were diagnosed through screening in the United States in 2015.<sup>27</sup>

**Table 4. Rates of compliance with quality-of-care indicators by 2-year period**

Indicator	Period; % of patients*								p value†
	2001–2002 n = 15	2003–2004 n = 20	2005–2006 n = 26	2007–2008 n = 63	2009–2010 n = 38	2011–2012 n = 44	2013–2014 n = 69	2015–2016 n = 68	
Cases detected by screening	0.0	0.0	0.0	3.2	2.6	4.5	4.3	7.4	0.03
Adequate colon evaluation before surgery	93.3	100.0	92.3	92.1	89.5	93.2	97.1	97.1	0.33
Preoperative liver imaging	73.3	75	84.6	90.5	86.6	93.2	98.6	97.1	0.001
Preoperative pelvis imaging for rectal cancer	100.0	87.5	100	87.5	92.3	100.0	100.0	100.0	0.1
Patients with rectal cancer who received NEORT	100.0	75.0	33.3	50.0	50.0	100.0	62.5	84.6	0.2
Patients with rectal cancer who received NEOCT	100.0	50.0	33.3	50.0	50.0	100.0	62.5	84.6	0.03
Completeness of operative report, mean score ± SD‡	4 ± 4	2 ± 0.9	3.5 ± 0.9	3.6 ± 0.8	3.8 ± 0.6	4.2 ± 1.0	5 ± 0.5	4.8 ± 0.5	0.4§
Completeness of pathology report									
Reported no. of lymph nodes examined	80.0	85.0	88.5	90.5	94.7	95.5	98.6	98.5	0.001
Reported ≥ 12 lymph nodes examined	41.7	58.8	60.9	82.5	86.1	88.1	89.7	89.6	0.001
Reported positive lymph nodes	33.3	52.9	30.4	35.1	38.9	35.7	29.4	38.8	0.7
No. of lymph nodes collected, mean ± SD	10.5 ± 4	16.5 ± 13	15 ± 9	17 ± 7	23.6 ± 14	18.5 ± 7	19.9 ± 9	20.2 ± 11	0.001§
Reported quantitative distal margin status	40.0	45.0	46.2	82.5	86.8	86.4	85.5	91.2	0.001
Reported quantitative circumferential margin status	13.3	5.0	3.8	9.5	28.9	9.1	5.8	10.3	0.9
Reported distal margin ≥ 1 cm in patients with rectal cancer	—	50.0	100.0	100.0	100.0	100.0	100.0	93.8	0.6
Anastomotic leak in patients with rectal cancer	0.0	0.0	0.0	6.3	7.7	0.0	6.3	10.5	0.2
In-hospital/30-day mortality	6.7	0.0	3.8	3.2	5.3	2.3	4.3	1.5	0.7
Local recurrence									
Within 2 yr after surgery for rectal cancer and colon cancer	0.0	5.0	3.8	1.6	10.5	4.5	7.2	1.5	0.3
Following rectal cancer	0.0	0.0	0.0	31.3	15.4	0.0	0.0	0.0	0.2
Surveillance colonoscopy within 1 yr after surgery	71.4	50.0	63.6	59.6	33.3	60.5	79.6	50.0	0.8

NEOCT = neoadjuvant chemotherapy; NEORT = neoadjuvant radiotherapy; SD = standard deviation.  
 \*Except where noted otherwise.  
 †Cochran–Armitage test for trend.  
 ‡Maximum possible score: 10.  
 §Analysis of variance.

In Mexico, it is estimated that nearly 70% of cancer cases are diagnosed at advanced stages.<sup>28,29</sup> Mexico does not have a single coordinating body for cancer prevention, no national policy or national cancer registry exists, and there are no complete and accurate data on the extent and social impact of cancer.<sup>28</sup> There is no mass population screening strategy for CRC in the country.

It has been previously shown by multiple Western institutions that centralized centres of excellence, a multidisciplinary team approach and adherence to quality standards improve short- and long-term outcomes in CRC treatment.<sup>30–34</sup> Despite these international recommenda-

tions, there is a lack of data about the quality of CRC care in developing countries, and the results of cancer care need to be audited and urgently be considered a priority for the health care systems in these countries. We observed in our study a tendency toward improvement over time, but a change of policy should be applied in our institution and in our country in order to provide our patients the best of care. Based on the results of the present study, a strategic plan is being revised and will be implemented at our institution to improve screening strategies, early referral of patients and overall compliance with all the present quality-of-care indicators.

## Limitations

The limitations of our study are largely attributable to its retrospective and single-centre design. Given the nature of the study, it is not possible to generalize the results to a national population. The fact that this study was based on retrospective data from a single centre predisposes to various types of bias (selection bias, information bias) inherent to the design.

A large population-based study could provide more data about quality of care; however, national databases and CRC registries are not available in our country.<sup>28,35</sup> In addition, Mexico has a fragmented health care system. The public system is composed of 3 subsystems: the Ministry of Health, or federal health system (serving the uninsured population), the Mexican Institute for Social Security (serving private sector employees), and the Institute of Social Security and Services for Civil Servants (serving public sector employees).<sup>36</sup> Our hospital is part of the Ministry of Health, so we mainly see uninsured patients. The results of our study should be applied only to this population.

The fragmentation of the health care system also makes it difficult to evaluate CRC epidemiologically across the country, assess CRC outcomes, unify treatment guidelines, and implement screening and treatment strategies. Therefore, implementation of a national cancer registry program is of utmost importance to understand the burden of CRC and treatment outcomes in Mexico.<sup>35</sup>

Another important limitation of our study was the fact that only 75.8% of patients had more than 12 months of follow-up. This short follow-up allowed us to calculate only 3-year survival rates instead of 5-year survival rates. This lack of follow-up also reflects the need for a local policy to improve care and follow-up.

## CONCLUSION

Our study shows the feasibility of applying the Cancer Care Ontario quality-of-care indicators at a single centre in a developing country. Despite the generally good compliance with 9 of the 15 indicators (with a tendency to improvement over time observed for 5), policies must be implemented to increase the fulfillment of all quality-of-care indicators in order to provide the best care to our patients with CRC.

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**Competing interests:** None declared.

**Data sharing:** The data sets used or analyzed in the current study are available from the corresponding author on reasonable request.

**Contributors:** O. Vergara-Fernández, H. Rangel-Ríos, M. Trejo-Avila and E. Sanchez-Garcia Ramos acquired the data and drafted the manu-

script. D. Velazquez-Fernandez analyzed the data. All authors designed the study, critically revised the manuscript and gave final approval of the article to be published.

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