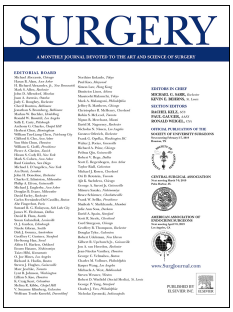


DElayed COloRectal Cancer Care during COVID-19 Pandemic: Global Perspective from an International Survey (DECOR-19)

Giulio A. Santoro, MD, PhD, Ugo Grossi, MD, PhD, Sthela Murad-Regadas, MD, PhD;, Joseph W. Nunoo-Mensah, BM BS, LLM, Anders Mellgren, MD, PhD, Gian Luca Di Tanna, PhD, Gaetano Gallo, MD, Charles Tsang, MBS, FRCS (Ed.), FACS, Steven D. Wexner, MD, PhD, on behalf of DECOR-19 Collaborative Group

PII: S0039-6060(20)30778-9

DOI: https://doi.org/10.1016/j.surg.2020.11.008

Reference: YMSY 6713

To appear in: *Surgery*

Received Date: 29 August 2020

Revised Date: 6 November 2020

Accepted Date: 9 November 2020

Please cite this article as: Santoro GA, Grossi U, Murad-Regadas S, Nunoo-Mensah JW, Mellgren A, Di Tanna GL, Gallo G, Tsang C, Wexner SD, on behalf of DECOR-19 Collaborative Group, DElayed COloRectal Cancer Care during COVID-19 Pandemic: Global Perspective from an International Survey (DECOR-19), *Surgery* (2020), doi: https://doi.org/10.1016/j.surg.2020.11.008.

DElayed COloRectal Cancer Care during COVID-19 Pandemic: Global Perspective from an International Survey (DECOR-19)

Giulio A Santoro, MD, PhD;[1]* Ugo Grossi, MD, PhD;[1]* Sthela Murad-Regadas, MD, PhD;[2] Joseph W Nunoo-Mensah, BM BS, LLM;[3] Anders Mellgren, MD, PhD;[4] Gian Luca Di Tanna, PhD;[5] Gaetano Gallo, MD;[6] Charles Tsang, MBS, FRCS (Ed.), FACS;[7] Steven D Wexner, MD, PhD;[8] on behalf of DECOR-19 Collaborative Group**

[1]Tertiary Referral Colorectal and Pelvic Floor Center, 4th Surgery Unit, Treviso Regional Hospital, DISCOG, University of Padua, Italy

[2]Department of Surgery. School of Medicine. Federal University of Ceará, Brazil

[3]Department of Colorectal Surgery, King's College Hospital Foundation NHS Trust, & Department of Colorectal Surgery, Cleveland Clinic London, London, UK

[4]Division of Colon and Rectal Surgery, University of Illinois, Chicago, USA

[5]The George Institute for Global Health, Faculty of Medicine, University of New South Wales, NSW, Australia

[6]Department of Medical and Surgical Sciences, University of Catanzaro, Catanzaro, Italy

[7]Department of Surgery, Yong Loo Lin School of Medicine, National University of Singapore, Singapore

[8]Digestive Disease Institute, Department of Colorectal Surgery, Cleveland Clinic Florida, Fort Lauderdale, USA

** Equally contributed to this article*

*** Listed in Appendix 1*

Keywords: SARS-CoV-2, COVID-19, delayed surgery, colorectal cancer

Endorsement: This Survey was endorsed by the following International Societies: American Society of Colon and Rectal Surgeons (ASCRS), Asia-Pacific Federation of Coloproctology (APFCP), Chinese Society of Coloproctology, Egyptian Society of Colon and Rectal Surgeons (ESCRS), European Society of Coloproctology (ESCP), German Society for Coloproctology (DGK), International Society of University Colon and Rectal Surgeons (ISUCRS), Italian Society of Colorectal Surgery (SICCR), Korean Society of Coloproctology, LatinAmerican Association of Coloproctology (ALACP), Malaysian Society of Colorectal Surgeons (MSCRS), Philippine Society of Colon and Rectal Surgeons (PSCRS), Philippine Society of General Surgeons (PSGS), Portuguese Society of Coloproctology, Portuguese Society of Surgery (SPCIR), Russian Association of Coloproctology, South African Colorectal Society (SACRS), Swedish Society of Colorectal Surgery, Turkish Society of Colon and Rectal Surgery (TKRCD) and Venezuelan Coloproctology Society. The Societies had no role in study design, data collection, analysis and interpretation, or in the writing of this report. The views expressed are those of the authors and not necessarily those of the Societies.

Corresponding author: Giulio A. Santoro, Tertiary Referral Colorectal and Pelvic Floor Center, 4th Surgery Unit, Treviso Regional Hospital, DISCOG, University of Padua, Italy. E-mail: giulioasantoro@yahoo.com

Article Summary

Global changes in both diagnostic and therapeutic practices in colorectal cancer care were evident in this survey conducted to analyze the impact of COVID-19 outbreak. The importance of this finding is that changes were associated with differences in health care delivery systems, hospital's preparedness, resources availability, and local COVID-19 prevalence rather than geographical variations. ~~These findings may help adopting preventing measures during future virus surges.~~

ABSTRACT

Background: The widespread nature of coronavirus disease 2019 (COVID-19) has been unprecedented. We sought to analyze its global impact with a survey on colorectal cancer (CRC) care during the pandemic.

Methods: The impact of COVID-19 on preoperative assessment, elective surgery, and postoperative management of CRC patients was explored by a 35-item survey, which was distributed worldwide to members of surgical societies with an interest in CRC care. Respondents were divided into two comparator groups: 1) 'delay' group: CRC care affected by the pandemic; 2) 'no delay' group: unaltered CRC practice.

Results: A total of 1,051 respondents from 84 countries completed the survey. No substantial differences in demographics were found between the 'delay' (745, 70.9%) and 'no delay' (306, 29.1%) groups. Suspension of multidisciplinary team meetings, staff members quarantined or relocated to COVID-19 units, units fully dedicated to COVID-19 care, personal protective equipment not readily available were factors significantly associated to delays in endoscopy, radiology, surgery, histopathology and prolonged chemoradiation therapy-to-surgery intervals. In the 'delay' group, 48.9% of respondents reported a change in the initial surgical plan and 26.3% reported a shift from elective to urgent operations. Recovery of CRC care was associated with the status of the outbreak. Practicing in COVID-free units, no change in operative slots and staff members not relocated to COVID-19 units were statistically associated with unaltered CRC care in the 'no delay' group, while the geographical distribution was not.

Conclusions: Global changes in diagnostic and therapeutic CRC practices were evident. Changes were associated with differences in health-care delivery systems, hospital's preparedness, resources availability, and local COVID-19 prevalence rather than geographical factors. Strategic planning is required to optimize CRC care.

INTRODUCTION

The widespread nature and impact of the coronavirus disease 2019 (COVID-19) pandemic has been unprecedented.[1] The global transmission of the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) has been rapid because of the high infectivity and a relatively high rate of asymptomatic carriers in a highly mobile and interconnected global world.[2] As of August 20th 2020, the World Health Organization (WHO) confirmed 22,256,220 cases of COVID-19 globally, including 782,456 deaths.[3]

A lack of preparedness and a lack of appreciation of the gravity of the pandemic have led to significant strains on health care systems around the world. In the first half of 2020, most nation's health care resources were overwhelmed by the COVID-19 and many hospitals essentially became coronavirus accepting hospitals during the emergency phase.[4, 5] The impact of COVID-19 on global oncological care has been profound.[6-8] COVIDSurg Collaborative estimated that 28,404,603 elective operations were cancelled or postponed worldwide during the 12 weeks of peak disruption, with 38% being for cancer.[4] Colorectal cancer (CRC) is the third leading cause of cancer related deaths globally. The pandemic has led to major disruptions and delays in CRC practice, which may adversely affect survival outcomes for several years to come.[8]

The primary aim of our survey was to analyze the global impact of the COVID-19 outbreak on both diagnosis and treatment of CRC. The secondary aim was to explore which factors were associated with changes in CRC care or with unaffected practice.

METHODS

Surgical divisions treating CRC across the world were eligible to participate, including those in countries that did not ~~currently~~ have COVID-19 outbreaks during the study-period. Only one collaborator per surgical division was eligible to take part, although multiple divisions from the same hospital could participate in the survey. To obtain a representative sample of participants, national and international surgical societies with interest in CRC care from six geographical regions were asked to endorse the study and disseminate the survey by e-mail to their members. The societies had no role in study design, data collection, analysis and interpretation, or in the writing of the report. To overcome the temporal bias of distribution, the link to the online survey was made available for three weeks, from May 20-June 10, 2020. A newsletter with a reminder was sent every week. Informed consent was obtained by voluntary participation and no compensation was offered. The study was registered at ClinicalTrials.gov (NCT 04488549).

Survey

A 35-item survey on DElayed COloRectal cancer care during COVID-19 pandemic (DECOR-19) (Appendix 2) was designed by the steering committees formed by the principal investigators. Meetings were conducted via teleconference to define the appropriateness, feasibility and preliminary validity of the questions to include. Further validation of the survey was achieved by pilot testing on 10 surgery residents to ensure adequate sentence construction and correct interpretation of the questions. We elected not to delay the survey process by performing a formal full validation to glean insights from the results in an expeditious manner in this critical period.

The platform 'Online surveys' (formerly BOS – Bristol Online Survey), developed by the University of Bristol, in accordance with the COnsolidated criteria for Reporting Qualitative Research (COREQ) and the CHEcklist for Reporting Results of Internet E-Surveys (CHERRIES statement)[9] (Appendix 3) was used. Proprietary survey software and local servers were used to ensure data protection. The fully de-identified dataset was kept on password protected computers. Responses were single or multiple choice, numeric, and open text. All questions were set as mandatory fields with real-time validation and automated skip logic to prevent missing data and avoid illogical or incompatible responses. No randomization of items was used. Quantitative data were automatically collected by the software and exported to a tabulated format. Estimated mean time to complete the survey was 10-15 minutes.

The survey was structured in the following four sections:

1. ***Demographics and personal practice*** *(Q.1-Q.13)*: including respondents' gender, country, hospital-level, total number of hospital beds, specialty-specific (*Q.8*: general surgery/ colorectal surgery) division, annual volume of CRC surgery and laparoscopic CRC resections in the division, and average long-course chemoradiation therapy (CRT)-to-surgery interval ~~in~~ for rectal cancer.

After demographics, respondents were asked if they experienced any delay in CRC care (*Q.14*). There were two comparator groups: 1) 'no delay': respondents were redirected to a single question (*Q.35*) investigating the reasons of unaffected practice; 2) 'delay': respondents continued the survey with the following sections:

2. ***Hospital response to COVID-19 emergency*** *(Q.15-Q.22)*: to capture the current status of CRC care, exploring the overall changes in term of resources allocation. The section

included: hospital's preparedness to COVID-19, readily availability of external facilities for CRC surgery, presence of cancer care coordinator, personal protective equipment (PPE) availability, status of elective CRC surgery, elective CRC patients needing urgent surgery, CRC patients status, staff members status;

3. ***Delay in CRC care*** *(Q.23-Q.33)*: investigating any delays across the various fields of practice (i.e. endoscopy, radiology, surgery, radiotherapy, oncology, histopathology, multidisciplinary team [MDT] meetings) and the relative reasons, any change in the original management plan and types of complication determining a shift from elective to emergency surgery;
4. ***Recovery of CRC care*** *(Q.34)*: assessing the recovery of CRC practice at the date of the survey completion (fully recovered, improved, persistently limited).

Statistical analysis

Continuous variables were summarized by means and standard deviations (SD), and categorical variables by proportions. Comparisons of categorical variables across groups were made by Pearson's chi-square tests. A series of hierarchical binary and ordinal logistic regression models were performed to assess the association between respondents' preferences and their characteristics, with geographical area as random effect. The Brant test was performed to assess the proportional odds assumption in the ordinal logistic model. Uni- and multivariable hierarchical logistic models were fitted to explore the association between delay and a pre-defined set of covariates (demographics, hospital characteristics and respondents' personal practice in CRC care). To assess the factors associated with the

recovery of practice, it was first calculated the time interval in days between the date of achievement of the 100th COVID-19 positive case in the respondent's country and the date of recovery (fully recovered or improved) or the date of persistently limited CRC care and then fitted a zero inflated negative binomial regression.[10] Adjustments to the *P*-values for multiple testing were not performed, and statistical significance was assessed using alpha=0.05. All analyses were performed using Stata 16 (StataCorp LLC, College Station, TX, USA).

RESULTS

Twenty national and international surgical societies from six geographical regions endorsed the study and disseminated the survey to their members in the time frame (May 20-June 10, 2020) (Figure 1).

Demographics and Personal Practice

A total of 1,051 respondents, representing 1,051 colorectal or surgical divisions, from 84 countries (Figure 1) completed the survey and were included in the final analysis: Europe 603 respondents (57.4%), Asia 218 (20.7%), North America 120 (11.4%), South America 68 (6.5%), Africa 27 (2.6%) and Oceania 15 (1.4%). The mean interval between the achievement of the 100th COVID-19 case in each respondent's country and the date of survey completion was higher for respondents from North America (70 days) and Europe (64 days) (Figure 2). Mean time spent to complete the survey was 10.8 (SD, 3.8) minutes.

Respondents were mostly men (78.7%), practicing in general surgery divisions (76.3%) and academic hospitals (61.1%) with mid to high bed volume (>250 beds, 89.2%,) (Table 1). A large majority of divisions (78.8%) performed >50 colon cancer surgeries per year, with 31.5%

reporting this case volume for rectal cancer. Thirty-five percent of respondents reported regular use of laparoscopy in >75% of cases in CRC surgery (Table 1). Most respondents (70.7%) indicated 8-12 weeks as the optimal long-course CRT-to-surgery interval in rectal cancer. Demographics and personal practice were consistent across the geographical regions and the only difference in this proportional distribution was found in the annual number of surgeries for rectal cancer more frequent in Asia (Table 1).

Overall, 745 respondents (70.9%) experienced some delays in CRC care ('delay' group) and 306 respondents (29.1%) did not ('no delay' group). These two groups were substantially homogeneous for all demographics, and personal practices (Table 2). The geographical distribution between the two groups was also similar and proportionally consistent with the overall population of 1,051 respondents.

Hospital Response to COVID-19 Emergency

Among 745 respondents in the 'delay group', 694 (93.2%) reported that their hospitals had participated in the emergency ~~with~~ by either providing fully dedicated support (16.8%) or partially dedicating (76.4%) clinical activities to the management of SARS-CoV-2 patients (Table 3): 1) 97.3% (725 respondents) reported that elective surgery was affected by COVID-19. Three hundreds and seventy-six (50.5%) respondents reported that surgical capacity was reduced (>50% according to 186 respondents) and 349 (46.8%) stated that elective surgery was temporarily suspended (≥5 weeks according to 296 respondents); 2) 85.6% (638 respondents) reported that PPE was readily available; 3) 64.3% (479 respondents) reported that their hospitals relocated resources to COVID-19 free external facilities for elective CRC surgery; 4) 52.1% (388 respondents) reported that staff members were diagnosed with SARS-

CoV-2 and were quarantined; 5) 45.4% (338 respondents) reported that staff members were relocated from surgical divisions to COVID-19 units (>40% of staff in 94 divisions). The geographical distribution of the respondents did not significantly impact on hospitals' organization.

COVID-19 significantly affected CRC care. Among the 745 respondents of the 'delay' group (Table 3): 1) 48.9% (365 respondents) reported a change of the initial surgical plan; 2) 48.5% (364 respondents) stated that MDT meetings were suspended; 3) 40.3% (300 respondents) referred that CRC patients refused surgery during the COVID-19 emergency phase; 4) 26.6% (198 respondents) reported that they had patients who developed COVID-19 post-operatively; 5) 26.3% (196 respondents) reported that CRC patients originally planned for elective operations needed urgent surgery; 6) 26.2% (195 respondents) performed CRC surgery in COVID-19 patients.

Delay in CRC care

Multivariable hierarchical logistic regression model (Table 4) showed a 38% lower risk (OR=0.62, 95%CI 0.45-0.85, *P*=0.003) of delay among respondents from non-academic teaching vs. academic hospitals and a 72% higher risk (OR=1.72, 95%CI 1.07-2.76,*P*=0.026) among those reporting high vs. low case volume of colon cancer surgeries (Table 4).

Overall in the 'delay group' (745 respondents), the original surgical management plan was changed according to 365 (48.9%) respondents and the original protocol of neoadjuvant therapy was changed according to 157 (21.1%) respondents. Changes were more likely to occur among respondents reporting staff members quarantined (OR 1.38, 95%CI 1.01-1.90, *P*=0.045) or relocated to COVID-19 units (OR 1.55, 95%CI 1.13-2-13, *P*=0.006).

Endoscopy and Radiology

Endoscopic procedures for CRC were the most affected diagnostic techniques by COVID-19 emergency (73.7% [549/745] of respondents). The delay in radiology was reported by 45% (335/745) of respondents (Table 5). Multivariable hierarchical logistic regression model (Table 6) demonstrated the following effects on the risk of delay in endoscopy: 1) 82% higher risk ~~for delays~~ (OR=1.82, 95%CI 1.26-2.62, *P*=0.001) in divisions where staff members were relocated to COVID-19 units; 2) 58% higher risk ~~for delays~~ (OR=1.58, 95%CI 1.10-2.27, *P*=0.013) in divisions where staff members were quarantined; 2) 64% lower risk ~~for delays~~ (OR=0.36, 95%CI 0.15-0.84, *P*=0.017) in high volume hospitals (vs. low volume hospitals); 3) 42% lower risk ~~for delays~~ (OR=0.58, 95%CI 0.36-0.99, *P*=0.045) in divisions partially dedicated to SARS-CoV-2 (vs. fully dedicated).

Multivariable hierarchical logistic regression model (Table 7) demonstrated the following effects on the risk of delay in radiology: 1) 69% higher risk ~~for delays~~ (OR=1.69, 95%CI 1.23-2.33, *P*=0.001) in divisions where staff members were relocated to COVID-19 units; 2) 56% higher risk ~~for delays~~ (OR=1.56, 95%CI 1.01-2.40, *P*=0.045) in divisions with medium volume of annual rectal cancer surgeries (vs. low volume); 3) 39% higher risk ~~for delays~~ (OR=1.39, 95%CI 1.01-1.90, *P*=0.042) in divisions where MDT meetings were suspended; 4) 48% lower risk ~~for delays~~ (OR=0.52, 95%CI 0.24-0.81, *P*=0.003) when PPE was readily available.

Delays in diagnostics for CRC beyond 4 weeks were more prevalent in North America,~~:~~ with 53 out of 64 respondents (83%) reporting delay~~s~~ in the endoscopic procedures and 22 out of 32 respondents (69%) reporting delay~~s~~ in the radiological investigations (Figure 3).

Surgery

Colorectal cancer surgery was delayed in 58.3% (434/745) of divisions. For the majority of respondents (90.1% [391/434]), the delay was 5-8 weeks beyond normal wait time, exceeding 8 weeks for 43 respondents (9.9%) (Table 5, Figure 3). Multivariable hierarchical logistic regression model (Table 6) demonstrated the following effects on the risk of delay in surgery: 1) 40% higher risk ~~for delays~~ (OR-1.40, 95%CI 1.02-1.92, *P*=0.039) in divisions where MDT meetings were suspended; 2) 51% lower risk ~~for delays~~ (OR=0.49, 95%CI 0.36-0.77, *P*=0.002) in divisions partially dedicated to COVID-19 (vs. fully dedicated); 3) 41% lower risk ~~for delays~~ (OR=0.59, 95%CI 0.37-0.93, *P*=0.023) when PPE was readily available, and 4) 33% lower risk ~~for delays~~ (OR=0.67, 95%CI 0.45-0.99, *P*=0.045) among respondents from general surgery divisions (vs. colorectal divisions).

Overall, 48.9% (365/745) of respondents changed the original surgical plan (multiple alternatives): from laparoscopic to open (37.3%, 136/365); from colorectal resections to CRT (28.2%, 103/365); from Transanal Minimally Invasive Surgery (TAMIS)/ Transanal Endoscopic Microsurgery (TEM) to neoadjuvant radiotherapy (19%, 69/365); from colorectal resections to stenting (10%, 37/365); from robotic to open (8.0%, 29/365); from robotic to laparoscopic (6.0%, 22/365) and from TAMIS/TEM to abdominal surgery (4.2%, 15/365). The reported reasons for changes in surgical plans (multiple alternatives) were: shortage of theatre slots (52%, 190/365 respondents), shortage of staff members and personnel (30%, 111/365), disease progression (28%, 103/365) and concerns over aerosolization in laparoscopic/robotic surgery (18%, 64/365).

Overall, 26.3% (196/745) of respondents reported that CRC patients scheduled for elective surgery needed urgent surgery due to (multiple alternatives): bowel obstruction (73%), bowel perforation (28%) or bleeding (18%) (Suppl. Fig. 1).

Neoadjuvant CRT

One hundred and ninety-six of 745 respondents (26.3%) reported that neoadjuvant CRT was postponed for rectal cancer patients (Table 5, Figure 3). The delay was ≤4 weeks for 61.7% (121/196) of respondents and ≥5 weeks for 38.3% (75/196) of respondents.

Overall, 21.1% (157/745) of respondents changed the original oncological plan for rectal cancer patients from neoadjuvant CRT and surgery to surgery only (86%, 135/157) and from long-course CRT to short-course CRT (13%, 22/157).

In addition, 43.5% (324/745) of respondents also reported that the long-course neoadjuvant CRT-to-surgery interval for rectal cancer patients was prolonged beyond the optimal 8-12 weeks interval (43.2% [140/324] of respondents ≥5 weeks) (Table 5). A factor statistically associated to this delay was the suspension of MDT meetings (OR 1.64, 95%CI 1.20-2.24, *P*=0.002).

Histopathology

Histopathological assessment was affected for 17.6% (131/745) of respondents. The delay was more prevalent in South America (19/57, 33.3%; *P*<0.001) (Table 5, Figure 3). Multivariable hierarchical logistic regression model (Table 6) demonstrated the following effects on the risk of delay in histopathology: 1) 77% lower risk ~~for delays~~ (OR=0.63, 95%CI 0.08-0.62, *P*=0.004) in non-teaching hospitals (vs. academic hospitals); 2) 66% lower risk ~~for delays~~ (OR=0.44, 95%CI

0.26-0.75, *P*=0.002) when PPE was readily available; 3) 64% lower risk ~~for delays~~ (OR=0.36, 95%CI 0.15-0.83, *P*=0.017) in mid-high bed volume hospitals (vs. low bed volume); and 4) 206% higher risk ~~for delays~~ in divisions where MDT meetings were suspended (OR=2.06, 95%CI 1.23-2.26, *P*=0.001).

Recovery of CRC care

Recovery of CRC care at the date of the survey completion (May 20-June 10, 2020) (Appendices 4-5) mirrors the status of the outbreak throughout the geographical regions. Overall, CRC care was 'improved but not fully recovered' to pre-COVID status for 56.4% (420/745) of respondents. The highest prevalence was in Europe (65.9%, 278/422) and North America (58.5%, 48/82). At the time of survey, in these two regions there were nations both at the peak and at the transition phase of the emergency. CRC care status was 'persistently limited' for 26% (194/745) of respondents. The highest prevalence was in Africa (75%, 12/16) and South America (72%, 41/57), two regions where most nations were at the initial phase of the emergency at the time of the study. A 'fully recovered' CRC practice was reported by 17.6% (131/745) of respondents. The highest prevalence was in Asia (25.3%, 40/158), where some nations were at the end of the emergency phase at the time of the survey. These data are consistent with the zero-inflated negative binomial regression model (Table 7) exploring the interval (days) between the date of achievement of the 100th COVID-19 case and the date of recovery of CRC care. 'Persistently limited' practice was significantly associated with a shorter interval (mean interval ratio 0.41 [95%CI 0.35-0.47]; P<0.001) compared to 'fully recovered' practice.

Multivariable hierarchical logistic regression model (Table 7) demonstrated the following effects on recovery of CRC practice: 66% higher risk of 'persistently limited' practice (OR=1.66, 95%CI 1.22-2.45, *P*=0.001) in divisions ~~units~~ where staff members were quarantined and 35% lower risk of 'persistently limited' practice (OR=0.65, 95%CI 0.43-0.97, *P*=0.036) in divisions ~~units~~ with medium volume of annual rectal cancer surgeries (vs. low volume).

Analysis of the 'no delay' group

The 'no delay' group included 29% (306/1,051) of respondents. The reasons reported for unaltered CRC practice were (more than one factor could be reported): 1) preservation of resources for CRC care (62%, 190/306); 2) no changes in operative slots (47%, 144/306); 3) no delay in diagnostics (42%, 129/306); 3) surgical staff not redeployed from surgical divisions to COVID-19 units (41%, 125/306); 4) no change in ICU bed capacity for CRC patients (32%, 98/306); and 5) no change in surgical bed capacity for CRC patients (29%, 89/306). A combination of ≥3 of factors was reported by 64% (196/306) of respondents (Figure 4).

Three main statistically significant reasons for unaltered CRC care comparing the 'no delay' to the 'delay' group were identified: 1) practicing in COVID-free divisions (16% *vs.* 7%, *P*<0.001); 2) no change in operative slots (47% *vs.* 3%, *P*<0.001) and 3) staff members not redeployed from surgical divisions to COVID-19 units (59% *vs.*45%, *P*=0.037) (Suppl. Fig. 2).

DISCUSSION

COVID-19 introduced a global challenge for the management of CRC. In our survey, changes in both diagnostic and therapeutic practices were reported by 71% (745/1,051: 'delay' group) of respondents. Endoscopic and radiologic procedures were highly affected by the COVID-19

emergency. Elective CRC surgery was impacted for almost all respondents (97.3%), with planned procedures being temporarily suspended (46.8%) or capacity reduced (50.5%). Our results are consistent with an earlier survey on the global impact of COVID-19 in CRC patients, completed by 289 surgeons in April 2020 during the emergency phase.[11] This study showed that outpatients services, cancer screening, diagnostics and treatment were all transiently suspended. Another study on elective oncological surgery in Italy during the COVID-19 emergency phase, demonstrated that 70% of surgical divisions had a reduction of hospital beds with an associated 76% reduction of surgical activity due to the relocation of resources.[12] Evidence is limited regarding the effect of diagnostic or surgical delays on CRC specific outcomes.[12-13] Maringe et al.[8] estimated a 17% increase in the number of deaths of CRC patients up to year 5 as a result of diagnostic delays due to the COVID-19 pandemic in United Kingdom. In a retrospective cohort study, Lee et al.[14] reported that the diagnosis-to-treatment interval (DTI) for all CRC, regardless of cancer staging, should not exceed 30 days. In another cohort study, Kucejko et al.[15] reported that the ideal timing of definitive resection in colon cancer is between 3 and 6 weeks after initial diagnosis to achieve a modest but significant improvement in overall survival. The COVID-19 pandemic has increased the DTI for CRC. Turaga and Girotra[16] reported that CRC surgery can be safely delayed beyond the normal wait time up to 4 weeks without having a significant impact on patient survival or cancer progression. However, in our survey, 58.3% of respondents in the 'delay group' reported that COVID-19 prolonged DTI to ≥5 weeks beyond normal wait time. Moreover, 43.5% of respondents reported a prolonged long-course CRT-to-surgery interval for ~~in~~ rectal cancer patients to ≥5 weeks beyond the optimal 8-12 weeks interval. Indeed, according to Turaga and

Girotra[16], this delay is less likely to cause harm. They reported that a postponement period of 6 weeks beyond the optimal long-course CRT-to-surgery interval for rectal cancers patients may be considered safe. Nevertheless, it remains unclear whether a prolonged time interval to surgery beyond the current recommended interval of 8 to 12 weeks results in increased morbidity or better pathological response.[17-20]

COVID-19 also increased the risk of urgent surgery or changing the decision-making process.[21,22] In this survey, 26.3% (196/745) of respondents reported that CRC patients scheduled for elective surgery needed urgent surgery. Moreover, 49% (365/475) of responders changed the original surgical plan and 21% (157/745) changed the original oncologic plan. Reasons for the changes were shortage of theatre slots, shortage of staff members and personnel, disease progression and concerns over aerosolization in laparoscopic/robotic surgery. Regarding this last factor, however, a number of Societies (Society of American Gastrointestinal and Endoscopic Surgeons, European Association of Endoscopic Surgery and Australian College of Surgeons) reported that laparoscopy may be appropriate.[13] The closed cavity in laparoscopy enables smoke control and airborne particles in the abdomen can be safely eliminated through filtered evacuation systems.[23-26] Although there is no compelling evidence that laparoscopy increases the risk of airborne transmission, appropriate safety measures are recommended. All members of the surgical team should wear appropriate PPE,[14] and the pneumoperitoneum should be slowly released in a controlled manner to minimize the spread of airborne particles.[26,27] Despite these guidelines, 45.2% of respondents in the current study changed their surgical approach from laparoscopic/robotic to open.

The COVID-19 pandemic changed the functioning and organization of hospitals around the world. During the surge, restrictive measures were adopted to reduce COVID-19 exposure and to preserve human and material resources.[28-31] In our survey, we found that delays in CRC care were associated with differences in health care delivery systems, hospital's preparedness, resources availability, and local COVID-19 prevalence, while the geographical distribution of the respondents did not impact significantly. Important factors included hospitals dedicating their services to COVID-19 care, quarantine and/or redeployment of staff, MDT meetings suspension, and the lack of readily available PPE (Table 8). These factors mirror the statistically significant reason for unaffected CRC practice in the 'no delay' group: practicing in COVID-free divisions, no change in number of operative slots, and staff members not redeployed from surgical divisions to COVID-19 units.

The recovery of health care systems is a complex process due to the impact of cancelled and postponed operations. Recommended principles for rescheduling have been outlined by the American College of Surgeons (ACS), American Hospital Association, American Society of Anesthesiologists, and the Association of Perioperative Nurses.[15] ACS also provided principles for the safe resumption of elective surgery organized in two parts: core facility checklist items (general facility policies, structures and processes, outcomes reporting) and surgery-specific checklist items (policies, structures and processes, outcomes reporting) including measures to protect the patient and protocols in place for safe protection of medical first line teams.[15] In our survey, recovery of CRC care was associated to the stage of the virus outbreak at the time of study completion. Independent of the geographical region, the likelihood of reduced CRC

practice was 66% higher among respondents reporting staff members quarantined (*P*=0.001) and 35% lower among those working in divisions with medium volume of rectal cancer surgeries (compared to low volume; *P*=0.036).

Our results indicate that cancer pathways need to swiftly be re-established and maintained at a near normal throughput, with attention to the backlog of patients, in order to reduce the impact of the COVID-19 pandemic.[33] Hospitals need to assume standard-of-care when the benefits exceed COVID-related mortality.[34,35] However, Caricato et al.[36] reported that oncological programs proposed in Italy to guarantee elective surgical activity were only successful in 19% of the regions. In the current study, we identified a crucial role of MDT meetings in ~~on~~ CRC care. Meetings suspension was associated with delays in radiology, surgery and histopathology and prolonged the CRT-to-surgery interval (Table 8).

In our survey, the relative homogeneity of delays seemed to reflect the lack of any absolute relation to either the geographical location or the status of the outbreak. Specifically, even within geographical regions at the same time points, some hospitals had delays while others did not. Thus, delays or lack thereof appeared to be more due to individual hospital's organization and preparedness. The plans implemented at hospitals at which no delays were experienced could be shared as 'best practices' so that other facilities could avail themselves of avoiding delays during future virus surges. Conversely, the geographical distribution was important if we consider the recovery of CRC care, because the status of the outbreak was associated with the recovery of standard clinical activities in those hospitals who were most affected by the COVID19 emergency.

Our study has several limitations inherent in surveys, including voluntary participation and recall and selections bias. The respondents included a preponderance of male general surgeons from large academic centers in Europe, Asia and North America (Figure 1). Therefore, data from all global regions ~~is~~ are not equally distributed or robust. This geographic distribution mirrored the areas of highest prevalence of COVID-19 at the time of survey distribution (https://www.who.int/docs/default-source/coronaviruse/situationreports/20200530-covid19- sitrep131.pdf?sfvrsn=d31ba4b3_2) (Figure 2). It is therefore reasonable to assume that surgeons from countries with low COVID-19 case-prevalence were less motivated to take part.

Another limitation is the lack of a formal full validation process of the survey, which was elected to obtain results in an expeditious manner in this critical period. The impact of subsequent surges is also unknown, as the long-term effect of the delays on diagnosis and/or treatment. Despite these limitations, our data provide important insights regarding the impact of COVID-19 pandemic in CRC care.

CONCLUSION

During the COVID-19 pandemic, global changes in both diagnostic and therapeutic CRC practices were evident. This problem cannot be solved by sharing best practices as the inability to render CRC care was directly related to the hospital's preparedness and availability of resources rather than to geographical factors. Future surges may again challenge human and material resources. Therefore, a solution to this disparity could potentially be addressed

by sharing resources and/or transfer of patients among institutions. The implementation of such practices may nevertheless be challenging because of differences in health care systems.

Conflict of interest: GAS, UG, SMR, JWNM, AM, GLDT, GG, CT have no relevant financial disclosures. SDW receives consulting fees for consulting from Karl Storz, Medtronic, Intuitive, Takeda and Stryker, and royalties for intellectual property license from Karl Storz, Medtronic, and Intuitive.

Financial support: none.

REFERENCES

1. Lango MN. How did we get here? A short history of COVID-19 and other coronavirus-related epidemics. Head Neck. 2020; 42:1535-8.
2. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, et al. Presumed asymptomatic carrier transmission of COVID-19. Jama. 2020;323:1406-7.
3. https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed june 29th, 2020.
4. CovidSurg C, Nepogodiev D, Bhangu A. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. Br J Surg. 2020. https://doi.org/10.1002/bjs.11746
5. Sud A, Jones ME, Broggio J, Loveday C, Torr B, Garrett A, et al. Collateral damage: the impact on outcomes from cancer surgery of the COVID-19 pandemic. Ann Oncol. 2020;31:1065-74.
6. Nunoo-Mensah JW, Rizk M, Caushaj PF, Giordano P, Fortunato R, Dulskas A, et al. COVID-19 and the Global Impact on Colorectal Practice and Surgery. Clin Colorectal Cancer. 2020;19:178-90 e1.

7. Kuderer NM, Choueiri TK, Shah DP, Shyr Y, Rubinstein SM, Rivera DR, et al. Clinical impact of COVID-19 on patients with cancer (CCC19): a cohort study. Lancet. 2020;395:1907-18.
8. Maringe C, Spicer J, Morris M, Purushotham A, Nolte E, Sullivan E, Rachet B, Aggarwal A. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. Lancet Oncol. 2020;21:1023-34.
9. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-Surveys (CHERRIES). J Med Internet Res. 2004;6:e34.
10. https://www.worldometers.info/coronavirus/
11. Bagaria S.P., Heckman M.G., Diehl N.N., Parker A., Wasif N. Delay to colectomy and survival for patients diagnosed with colon cancer. J Invest Surg. 2019;32:350–357.
12. Torzilli G, Vigano L, Galvanin J, Castoro C, Quagliuolo V, Spinelli A, et al. A snapshot of elective oncological surgery in Italy during COVID-19 emergency: pearls, pitfalls, and perspectives. Ann Surg. 2020;272:e112-e7.
13. Hangaard Hansen C., Gögenur M., Tvilling Madsen M., Gögenur I. The effect of time from diagnosis to surgery on oncological outcomes in patients undergoing surgery for colon cancer: a systematic review. Eur J Surg Oncol. 2018;44:1479–1485.
14. Lee YH, Kung PT, Wang YH, Kuo WY, Kao SL, Tsai WC. Effect of length of time from diagnosis to treatment on colorectal cancer survival: a population-based study. PLoS ONE 2019;14:e0210465
15. Kucejko RJ, Holleran TJ, Stein DE, Poggio JL. How soon should patients with colon cancer undergo definitive resection? Dis Colon Rectum. 2020;63:172-82.
16. Turaga K.K., Girotra S. Are we harming cancer patients by delaying their cancer surgery during the COVID-19 pandemic? https://doi.org/10.1097/SLA.0000000000003967 [e-pub ahead of print]. Ann Surg. accessed May 17, 2020.
17. Sloothaak D.A.M., Geijsen D.E., van Leersum N.J. Optimal time interval between neoadjuvant chemoradiotherapy and surgery for rectal cancer. Br J Surg. 2013;100:933–939.
18. Habr-Gama A., São Julião G.P., Fernandez L.M. Achieving a complete clinical response after neoadjuvant chemoradiation that does not require surgical resection: it may take longer than you think! Dis Colon Rectum. 2019;62:802–808.
19. Lichthardt S, Wagner J, Löb S, Matthes N, Kastner C, Anger F, Germer CT, Wiegering A. Pathological complete response due to a prolonged time interval between preoperative chemoradiation and surgery in locally advanced rectal cancer: analysis from the German StuDoQ|Rectal carcinoma registry. BMC Cancer 2020 Jan 20;20(1):49. doi: 10.1186/s12885-020-6538-8.
20. Lefèvre JH, Mineur L, Cachanado M, et al. Does a longer waiting period after neoadjuvant radio-chemotherapy improve the oncological prognosis of rectal

cancer?: three years' follow-up results of the Greccar-6 randomized multicenter trial. Ann Surg. 2019;270:747-754.
21. Zanus G, Romano M, Santoro GA, Rossi S, Grossi U. Imapct of COVID-19 on urgent surgical activity. Br J Surg 2020; DOI: 10.1002/bjs.11856
22. Zheng MH, Boni L, Fingerhut A. Minimally Invasive Surgery and the Novel Coronavirus Outbreak: Lessons Learned in China and Italy. Ann Surg. 2020;272:e5-e6.
23. Mintz Y, Arezzo A, Boni L, Chand M, Brodie R, Fingerhut A, et al. A Low-cost, Safe, and Effective Method for Smoke Evacuation in Laparoscopic Surgery for Suspected Coronavirus Patients. Ann Surg. 2020;272:e7-e8.
24. Mintz Y, Arezzo A, Boni L, Baldari L, Cassinotti E, Brodie R, et al. The risk of COVID-19 transmission by laparoscopic smoke may be lower than for laparotomy: a narrative review. Surg Endosc. 2020;34:3298-305.
25. Davies CG, Khan MN, Ghauri AS, Ranaboldo CJ. Blood and body fluid splashes during surgery--the need for eye protection and masks. Ann R Coll Surg Engl. 2007;89:770-2.
26. Bianco F, Incollingo P, Grossi U, Gallo G. Preventing transmission among operating room staff during COVID-19 pandemic: the role of the Aerosol Box and other personal protective equipment. Updates Surg. 2020;72:907-10.
27. Gallo G, La Torre M, Pietroletti R, Bianco F, Altomare DF, Pucciarelli S, et al. Italian society of colorectal surgery recommendations for good clinical practice in colorectal surgery during the novel coronavirus pandemic. Tech Coloproctol. 2020;24:501-5.
28. Spinelli A, Pellino G. COVID-19 pandemic: perspectives on an unfolding crisis. Br J Surg. 2020;107:785-7.
29. Elizabeth Brindle M, Gawande A. Managing COVID-19 in Surgical Systems. Ann Surg. 2020;272:e1-e2.
30. Englehardt RK, Nowak BM, Seger MV, Duperier FD. Contamination resulting from aerosolized fluid during laparoscopic surgery. JSLS. 2014;18.
31. Hojaij FC, Chinelatto LA, Boog GHP, Kasmirski JA, Lopes JVZ, Sacramento FM. Surgical Practice in the Current COVID-19 Pandemic: A Rapid Systematic Review. Clinics (Sao Paulo). 2020;75:e1923.
32. https://www.facs.org/covid-19/checklist. Accessed July 1st 2020.
33. https://www.clinical-colorectal-cancer.com/article/S1533-0028(20)30103-1/pdf
34. Coccolini F, Perrone G, Chiarugi M, Di Marzo F, Ansaloni L, Scandroglio I, et al. Surgery in COVID-19 patients: operational directives. World J Emerg Surg. 2020;15:25.
35. Di Saverio S, Pata F, Gallo G, Carrano F, Scorza A, Sileri P, et al. Coronavirus pandemic and Colorectal surgery: practical advice based on the Italian experience. Colorectal Dis. 2020;22:625-34.

36. Caricato M, Baiocchi GL, Crafa F, Scabini S, Brisinda G, Clementi M, et al. Colorectal surgery in Italy during the Covid19 outbreak: a survey from the iCral study group. Updates Surg. 2020;72:249-57.

Table 1. Demographics across six geographical regions (N.1,051 global respondents)

		N=1,051 (100%)	**Asia** 218 (20.7)	**Europe** 603 (57.4)	**N.America** 120 (11.4)	**S.America** 68 (6.5)	**Africa** 27 (2.6)	**Oceania** 15 (1.4)
Gender	Males	827 (78.7)	183 (83.9)	459 (76.1)	93 (77.5)	56 (82.4)	24 (88.9)	12 (80.0)
	Females	224 (21.3)	35 (16.1)	144 (23.9)	27 (22.5)	12 (17.6)	3 (11.1)	3 (20.0)
Type of hospital	Academic	642 (61.1)	165 (75.7)	337 (55.9)	57 (47.5)	52 (76.5)	23 (85.2)	8 (53.3)
	Non-academic teaching	312 (29.7)	34 (15.6)	213 (35.3)	46 (38.3)	14 (20.6)	0.0 (0)	5 (33.4)
	Non-teaching	97 (9.2)	19 (8.7)	53 (8.8)	17 (14.2)	2 (2.9)	4 (14.8)	2 (13.3)
Number of beds	≤250	113 (10.8)	19 (8.7)	55 (9.5)	17 (14.2)	12 (17.6)	8 (29.6)	2 (13.3)
	251-750	535 (50.9)	80 (36.7)	322 (53.3)	74 (61.7)	47 (69.2)	4 (14.8)	8 (53.3)
	751-1250	242 (23.0)	66 (30.3)	136 (21.8)	22 (18.3)	6 (8.8)	8 (29.6)	4 (26.7)
	>1250	161 (15.3)	53 (24.3)	90 (15.4)	7 (5.8)	3 (4.4)	7 (26.0)	1 (6.7)
Type of division	Colorectal	248 (23.7)	60 (27.5)	111 (18.4)	42 (35.0)	19 (27.9)	11 (40.7)	5 (33.4)
	General surgery	803 (76.3)	158 (72.5)	492 (81.6)	78 (65.0)	49 (72.1)	16 (59.3)	10 (66.6)
Annual number of colon cancer surgery	≤50	223 (21.2)	52 (23.8)	111 (18.4)	26 (21.7)	19 (27.9)	13 (48.2)	2 (13.3)
	51-150	516 (49.1)	81 (37.2)	334 (55.4)	51 (42.5)	34 (50.0)	9 (33.3)	7 (46.7)
	>150	312 (29.7)	85 (39.0)	158 (26.2)	43 (35.8)	15 (22.1)	5 (18.5)	6 (40.0)
Laparoscopy (%)	<25	221 (21.0)	78 (35.8)	89 (14.8)	18 (15.0)	22 (32.4)	14 (51.9)	0 (0)
	25-50	172 (16.4)	45 (20.6)	86 (14.3)	17 (14.2)	17 (25.0)	4 (14.8)	3 (20.0)
	50-75	286 (27.2)	37 (17.0)	194 (32.2)	32 (26.6)	7 (10.2)	7 (25.9)	9 (60.0)
	>75	372 (35.4)	58 (26.6)	234 (38.8)	53 (44.2)	22 (32.4)	2 (7.4)	3 (20.0)
Annual number of rectal cancer surgery	≤50	720 (68.5)	106 (48.6)	455 (75.5)	75 (62.5)	51 (75.0)	23 (85.2)	10 (66.6)
	51-150	252 (24.0)	73 (33.5)	125 (20.7)	36 (30.0)	12 (17.6)	2 (7.4)	4 (26.7)
	>150	79 (7.5)	39 (17.9)	23 (3.8)	9 (7.5)	5 (7.4)	2 (7.4)	1 (6.7)
Laparoscopy (%)	<25	277 (26.4)	81 (37.2)	123 (20.4)	21 (17.5)	32 (47.1)	15 (57.6)	5 (33.4)
	25-50	171 (16.3)	42 (19.3)	92 (15.3)	26 (21.7)	6 (8.8)	2 (7.4)	3 (20.0)
	50-75	239 (22.7)	30 (13.8)	166 (27.5)	25 (20.8)	7 (10.2)	7 (25.9)	4 (26.6)
	>75	364 (34.6)	65 (29.7)	222 (36.8)	48 (40.0)	23 (33.9)	3 (11.1)	3 (20.0)
Long-course CRT-surgery interval	≤8	271 (25.8)	62 (28.4)	172 (28.5)	19 (15.7)	6 (8.8)	11 (40.7)	1 (6.7)
	8-12	743 (70.7)	152 (69.7)	407 (67.5)	100 (83.4)	54 (79.4)	16 (59.3)	14 (93.3)
	>12	37 (3.5)	4 (1.9)	24 (4.0)	1 (0.9)	8 (11.8)	0.0 (0)	0.0 (0)

Table 2. Characteristics of the two groups of "delay" and "no delay" colorectal cancer practice (N.1,051 global respondents)

		Delay N=745 (70.9%)	**No delay N= 306 (29.1%)**	***P***
Geographical region	Europe	422 (56.6)	181 (59.2)	*0.141*
	Asia	158 (21.3)	60 (19.6)	
	North America	82 (11.0)	38 (12.4)	
	South America	57 (7.7)	11 (3.6)	
	Africa	16 (2.1)	11 (3.6)	
	Oceania	10 (1.3)	5 (1.6)	
Peak reached	Yes	617 (82.8)	253 (82.7)	*0.957*
	No	128 (17.2)	53 (17.3)	
Gender	Males	586 (78.7)	241 (78.8)	*0.971*
	Females	159 (21.3)	65 (21.2)	
Type of hospital	Academic	482 (64.7)	160 (52.3)	*0.001*
	Non-academic teaching	199 (26.7)	113 (36.9)	
	Non-teaching	64 (8.6)	33 (10.8)	
Number of beds	≤250	74 (9.9)	39 (12.7)	*0.156*
	251-750	370 (49.7)	165 (53.9)	
	751-1250	180 (24.2)	62 (20.3)	
	>1250	121 (16.2)	40 (13.1)	
Type of division	Colorectal	182 (24.4)	66 (21.6)	*0.362*
	General surgery	563 (75.6)	240 (78.4)	
Annual number of colon cancer surgery	≤50	150 (20.1)	73 (23.8)	*0.001*
	51-150	348 (46.7)	167 (54.6)	
	>150	247 (33.2)	66 (21.6)	
Laparoscopy (%)	<25	168 (22.6)	53 (17.3)	*0.136*
	25-50	125 (16.7)	47 (15.3)	
	50-75	202(27.1)	84 (27.5)	
	>75	250 (33.6)	122 (39.9)	
Annual number of rectal cancer surgery	≤50	494 (66.3)	226 (73.9)	*0.054*
	51-150	190 (25.5)	62 (20.3)	
	>150	61 (8.2)	18 (5.9)	
Laparoscopy (%)	<25	205 (27.5)	72 (23.5)	*0.114*
	25-50	119(16.0)	52 (17.0)	
	50-75	178(23.9)	61 (19.9)	
	>75	243 (32.6)	121 (39.6)	
Long-course CRT-surgery interval	<8	494 (66.3)	226 (73.8)	*0.413*
	8-12	190 (25.5)	62 (20.3)	
	>12	61 (8.2)	18 (5.9)	

CRT: chemoradiation theraphy

Table 3. Characteristics of respondents reporting delays in colorectal cancer (CRC) care across six geographical regions (N=745 reporting delayed care)

		N=745 (100%)	**Asia** 158 (21.2)	**Europe** 422 (56.6)	**N. America** 82 (11.0)	**S. America** 57 (7.8)	**Africa** 16 (2.1)	**Oceania** 10 (1.3)
Hospital involvement in COVID-19 care	Fully dedicated	125 (16.8)	38 (24.1)	68 (16.1)	13 (15.9)	4 (7.0)	2 (12.5)	0.0 (0)
	Partially dedicated	569 (76.4)	102 (64.5)	326 (77.3)	68 (82.9)	53 (93.0)	11 (68.7)	9 (90.0)
	Not involved	51 (6.8)	18 (11.4)	28 (6.6)	1 (1.2)	0.0 (0)	3 (18.8)	1 (10.0)
Readily availability	External facilities for CRC surgery	479 (64.3)	103 (65.2)	291 (69.0)	26 (31.7)	42 (73.7)	10 (62.5)	7 (70.0)
	Cancer care coordinator	420 (56.4)	80 (50.6)	238 (56.4)	57 (69.5)	32 (56.1)	7 (43.7)	6 (60.0)
	Personal protective equipment	638 (85.6)	146 (92.4)	357 (84.6)	70 (85.4)	44 (77.2)	12 (75.0)	9 (90.0)
Status of elective CRC surgery	Temporary put on hold	349 (46.8)	73 (46.2)	182 (43.1)	60 (73.2)	21 (36.8)	8 (50.0)	5 (50.0)
	≤4 weeks	53 (15.2)	8 (11.0)	29 (15.9)	7 (11.7)	5 (23.8)	4 (50.0)	0.0 (0)
	5-8 weeks	170 (48.7)	37 (50.7)	89 (48.9)	33 (55.0)	5 (23.8)	3 (37.5)	3 (60.0)
	>8 weeks	126 (36.1)	28 (38.3)	64 (35.2)	20 (33.3)	11 (52.4)	1 (12.5)	2 (40.0)
	Temporary reduced	376 (50.5)	83 (52.5)	222 (52.6)	22 (26.8)	36 (63.2)	8 (50.0)	5 (50.0)
	≤50%	190 (50.5)	45 (54.2)	114 (51.4)	9 (50.9)	17 (47.2)	2 (25.0)	3 (60.0)
	>50%	186 (49.5)	38 (45.8)	108 (48.6)	13 (59.1)	19 (52.8)	6 (75.0)	2 (40.0)
	Unaffected	20 (2.7)	2 (1.3)	18 (4.3)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Elective CRC patients	Needing urgent surgery	196 (26.3)	37 (23.4)	122 (28.9)	17 (20.7)	15 (26.3)	3 (18.8)	2 (20.0)
Initial CRC care plan	Changed	365 (49.0)	86 (54.4)	206 (48.8)	31 (37.8)	30 (52.6)	9 (56.3)	3 (30.0)
CRC patients	Refusing surgery	300 (40.3)	70 (44.3)	154 (36.5)	46 (56.1)	25 (49.3)	3 (18.8)	2 (20.0)
	Being COVID-19 + on surgery	145 (19.5)	19 (12.0)	109 (25.8)	9 (11.0)	7 (12.3)	0.0 (0)	1 (10.0)
	Becoming COVID-19 postop.	198 (26.6)	28 (17.7)	146 (34.6)	8 (9.8)	13 (22.8)	2 (12.5)	1 (10.0)
Staff members	Quarantined	388 (52.1)	74 (46.8)	245 (58.1)	40 (48.8)	23 (40.4)	4 (25.0)	2 (20.0)
	<10%	179 (46.1)	40 (54.1)	104 (42.5)	27 (67.5)	7 (30.4)	0.0 (0)	1 (50.0)
	10-20%	153 (39.5)	28 (37.8)	100 (40.8)	11 (27.5)	10 (43.5)	3 (75.0)	1 (50.0)
	>20%	56 (14.4)	6 (8.1)	41 (16.7)	2 (5.0)	6 (26.1)	1 (25.0)	0.0 (0)
	Relocated to COVID units	338 (45.4)	66 (41.8)	215 (50.9)	39 (47.6)	13 (22.8)	3 (18.8)	2 (20.0)
	<20%	190 (56.2)	49 (74.2)	109 (50.7)	23 (59.0)	7 (53.8)	1 (33.3)	1 (50.0)
	20-40%	54 (16.0)	6 (9.1)	33 (15.3)	8 (20.5)	4 (30.8)	2 (66.7)	1 (50.0)
	>40%	94 (27.8)	11 (16.7)	73 (34.0)	8 (20.5)	2 (15.4)	0.0 (0)	0.0 (0)
MDT meetings	Suspended	364 (48.9)	102 (64.6)	192 (45.5)	31 (37.8)	31 (54.4)	7 (43.8)	1 (10.0)

Table 4. Multivariable hierarchical logistic regression model exploring the association between delay and a pre-selected covariate set in colorectal cancer care (N.1,051 global respondents)

	Adjusted Odds Ratio	95% CI Lower	Upper	*P*
Gender				
Female (*reference*)				
Males	1.01	0.73	1.41	*0.948*
Type of hospital				
Academic (*reference*)				
Non-academic teaching	0.62	0.45	0.85	*0.003*
Non-teaching	0.72	0.44	1.19	*0.203*
Number of beds				
<250 (*reference*)				
251-750	1.06	0.67	1.70	*0.797*
751-1250	1.11	0.64	1.92	*0.708*
>1250	1.03	0.56	1.91	*0.922*
Type of division				
Colorectal (*reference*)				
General surgery	1.02	0.73	1.44	*0.903*
Colon cancer surgeries per year				
≤50 (*reference*)				
51-150	0.98	0.68	1.40	*0.905*
>150	1.72	1.07	2.76	*0.026*
Rectal cancer surgeries per year				
≤50 (*reference*)				
51-150	0.95	0.64	1.41	*0.790*
>150	0.87	0.45	1.67	*0.680*

CI: confidence interval

Table 5. Delays in colorectal cancer care across six geographical regions (N=745 reporting delayed care)

	N=745 (100%)	**Asia** 158 (21.2)	**Europe** 422 (56.6)	**N.America** 82 (11.0)	**S.America** 57 (7.7)	**Africa** 16 (2.1)	**Oceania** 10 (1.3)	***P***
Endoscopy	549 (73.7)	109 (69.0)	310 (73.5)	64 (78.0)	47 (82.5)	12 (75.0)	7 (70.0)	*0.421*
Radiology	335 (45.0)	69 (43.7)	199 (47.2)	32 (39.0)	21 (36.8)	10 (62.5)	4 (40.0)	*0.336*
Neoadjuvant CRT	196 (26.3)	47 (29.7)	106 (25.1)	16 (19.5)	22 (38.6)	2 (12.5)	3 (30.0)	*0.097*
Prolonged CRT interval	324 (43.5)	83 (52.5)	175 (41.5)	26 (31.7)	31 (54.4)	7 (43.8)	2 (20.0)	*0.008*
Surgery	434 (58.3)	90 (57.0)	257 (60.9)	43 (52.4)	34 (59.6)	7 (43.8)	3 (30.0)	*0.208*
Histopathology	131 (17.6)	43 (27.2)	55 (13.0)	9 (11.0)	19 (33.3)	4 (25.0)	1(10.0)	*<0.001*

CRT: chemoradiotherapy

Table 6. Multivariable hierarchical logistic regression model assessing delays in colorectal cancer (CRC) care (N=745 reporting delayed care)

	Endoscopy (N.549)			**Radiology (N.335)**			**Surgery (N.434)**			**Histopathology (N.131)**		
	OR	95%CI	*P*	OR	95%CI	*P*	OR	95%CI	*P*	OR	95%CI	*P*
Type of hospital												
Academic (*reference*)												
Non-academic teaching	0.90	0.58-1.39	*0.638*	0.70	0.48-1.02	*0.065*	0.95	0.65-1.39	*0.808*	0.63	0.37-1.07	*0.089*
Non-teaching	0.64	0.33-1.23	*0.179*	0.57	0.30-1.08	*0.083*	0.91	0.50-1.67	*0.758*	0.23	0.08-0.62	*0.004*
Number of beds												
≤250 (*reference*)												
251-750	0.75	0.38-1.46	*0.398*	0.86	0.48-1.56	*0.627*	1.11	0.61-1.98	*0.737*	0.52	0.26-1.05	*0.068*
751-1250	0.76	0.35-1.65	*0.485*	0.91	0.46-1.79	*0.785*	1.30	0.66-2.54	*0.452*	0.36	0.15-0.83	*0.017*
>1250	0.36	0.15-0.84	*0.017*	0.54	0.26-1.15	*0.110*	1.00	0.47-2.11	*0.996*	0.54	0.22-1.35	*0.186*
Type of division												
Colorectal (*reference*)												
General surgery	0.83	0.55-1.30	*0.413*	0.78	0.53-1.15	*0.208*	0.67	0.45-0.99	*0.045*	1.49	0.87-2.54	*0.149*
Colon cancer surgery per year												
≤50 (*reference*)												
51-150	1.51	0.94-2.42	*0.087*	1.13	0.73-1.75	*0.572*	1.42	0.92-2.18	*0.114*	0.78	0.45-1.33	*0.356*
>150	1.77	0.97-3.22	*0.061*	0.96	0.57-1.64	*0.888*	1.51	0.89-2.56	*0.126*	0.73	0.36-1.44	*0.360*
Rectal cancer surgery per year												
≤50(*reference*)												
51-150	1.12	0.68-1.87	*0.652*	1.56	1.01-2.40	*0.045*	0.75	0.49-1.16	*0.200*	0.70	0.38-1.29	*0.247*
>150	1.17	0.52-2.64	*0.705*	1.86	0.93-3.71	*0.079*	1.34	0.65-2.74	*0.426*	1.30	0.55-3.06	*0.547*
Hospital response to COVID-19												
Fully dedicated (*reference*)												
Partially dedicated	0.58	0.36-0.99	*0.045*	0.80	0.52-1.22	*0.295*	0.49	0.36-0.77	*0.002*	0.71	0.41-1.22	*0.211*
Not involved	1.04	0.43-2.51	*0.934*	0.87	0.42-1.79	*0.698*	0.62	0.29-1.31	*0.208*	1.77	0.75-4.14	*0.190*
External facilities for CRC surgery	0.68	0.46-1.00	*0.052*	0.89	0.63-1.24	*0.477*	0.98	0.70-1.38	*0.918*	0.87	0.56-1.37	*0.556*
Cancer care coordinator	1.03	0.72-1.47	*0.874*	0.92	0.67-1.26	*0.605*	1.07	0.78-1.47	*0.681*	1.47	0.96-2.26	*0.077*
PPE readily available	0.70	0.41-1.21	*0.206*	0.52	0.24-0.81	*0.003*	0.59	0.37-0.93	*0.023*	0.44	0.26-0.75	*0.002*
Staff members quarantined	1.58	1.10-2.27	*0.013*	0.79	0.57-1.10	*0.148*	1.34	0.97-1.84	*0.074*	0.99	0.64-1.53	*0.971*
Staff members relocated	1.82	1.26.2.62	*0.001*	1.69	1.23-2.33	*0.001*	1.34	0.97-1.85	*0.075*	1.05	0.68-1.63	*0.826*

MDT meetings suspended	0.81	0.57-1.16	*0.250*	1.39	1.01-1.90	*0.042*	1.40	1.02-1.92	*0.039*	2.06	1.23-2.26	*0.001*

Table 7. Multivariable ordinal logistic regression model assessing the recovery of colorectal cancer (CRC) care (N=745 reporting delayed care)

	Fully recovered *vs*. Improved *vs*. Persistently limited			
	Adjusted Odds Ratio	**95% CI Lower**	**Upper**	***P***
Gender				
Female (*reference*)				
Males	0.91	0.64	1.30	*0.611*
Type of hospital				
Academic (*reference*)				
Non-academic teaching	0.81	0.57	1.16	*0.257*
Non-teaching	0.65	0.37	1.15	*0.140*
Number of beds				
<250 (*reference*)				
251-750	0.59	0.34	1.04	*0.066*
751-1250	0.62	0.33	1.17	*0.138*
>1250	0.58	0.29	1.18	*0.135*
Type of division				
Colorectal (*reference*)				
General surgery	0.89	0.62	1.27	*0.514*
Colon cancer surgeries per year				
≤50 (*reference*)				
51-150	1.06	0.70	1.59	*0.797*
>150	1.72	0.61	1.64	*0.990*
Rectal cancer surgeries per year				
≤50 (*reference*)				
51-150	0.65	0.43	0.97	*0.036*
>150	0.97	0.50	1.87	*0.926*
Hospital response to COVID-19				
Fully dedicated (*reference*)				
Partially dedicated	1.05	0.70	1.59	*0.798*
Not involved	0.75	0.38	1.50	*0.418*
External facilities for CRC surgery	0.81	0.59	1.11	*0.183*
Cancer care coordinator	0.76	0.57	1.03	*0.073*
PPE readily available	0.81	0.54	1.22	*0.318*
Staff members quarantined	1.66	1.22	2.45	*0.001*
Staff members relocated	1.09	0.81	1.47	*0.572*
MDT meetings suspended	0.77	0.57	1.04	*0.086*

CI: confidence interval; MDT: mutlidisciplinary team: PPE: personal protective equipment

Table 8. Reasons of delay in colorectal cancer care (N=745 reporting delayed care)

	Delays				Prolonged CRT-surgery interval	Change of original plan
	Endoscopy	Radiology	Surgery	Histopathology		
Academic hospitals				X		
Colorectal divisions			X			
High-volume hospitals	X			X		
Medium-volume of rectal cancer surgery		X				
Units fully dedicated to COVID-19 care	X		X			
PPE not readily available		X	X	X		
Staff members quarantined	X					X
Staff members redeployed to COVID-19 units	X	X				X
MDT meetings suspended		X	X	X	X	

CRT: chemoradiotherapy; MDT: multidisciplinary team; PPE: personal protective equipment

LEGEND FOR FIGURES

Figure 1. Geographic distribution with country of origin of respondents (N.1,051)

Figure 2. Geographic distribution of respondents by the interval (days) between the date of achievement of the 100th COVID-19 case in their own country and the date of survey completion

Figure 3. Delay (weeks) in colorectal cancer care across the various fields of practice (745 respondents)

Figure 4. Reported reasons of "no delay" in colorectal cancer care (306 respondents)

Supplementary Figure 1. Types for complication determining a shift from elective to emergency surgery

Supplementary Figure 2. Comparison between “delay” and "no delay" groups in colorectal cancer care (1,051 respondents)

Appendix 1. DECOR-19 Collaborative Group

Abary Ryan Rainiel A, Philippines; Abdelwahab Khaled M, Egypt; Abellán Antonio M, Spain; Abraham Ned, Australia; Achkasov Sergey I, Russia; Adamina Michel, Switzerland; Adamo Vincenzo, Italy; Agapov Mikhail, Russia; Agarwal Amit, USA; Aguado López Héctor, Spain; Aguilar Werner, Chile; Aguilar-Martínez María Del Mar AM, Spain; Aguilera Asuncion, Spain; Ahmed Jamil, UK; Aiello Domenico, Italy; Akagi Tomonori, Japan; Akcakaya Adem, Turkey; Akhtar Khalid I, Pakistan; Akiba Ricardo, Brazil; Akrami Majid, Iran; Akyol Cihangir, Turkey; Alaamer Ohood H, Saudi Arabia; Alapati Kishore, India; Alasari Sami, Saudi Arabia; Albastaki Sara, UAE; Albergaria Diogo, Portugal; Alconchel Felipe, Spain; Alerta-Torre Andrea J, Philippines; Alex Ochsner, Switzerland; Alexander Herold, Germany; Alfaro Samuel, El Salvador; Ali Jehangir F, Pakistan; Aliyazicioglu Tolga, Turkey; Almgla Naser, South Africa; Alonsopoza Alfredo, Spain; Al-Radjid Jamiri, Philippines; Alselaim Nahar A, Saudi Arabia; Altaf Kiran K, UK; Althebaity Rasha, Saudi Arabia; Altinel Yuksel, Turkey; Altiparmak Basak, Turkey; Altomare Donato F, Italy; Alvandipour Mina, Iran; Alvarez-Gallego Mario, Spain; Alyami Mohammad, Saudi Arabia; Amado Sandra, Portugal; Amato Antonio, Italy; Amodio Pietro M, Italy; Ana-Maria Mușină, Romania; Andrade Luis, Chile; Andreas Kohler, Switzerland; Angelini Giulio, Italy; Angenete Eva, Sweden; Annicchiarico Alfredo, Italy; Antelo Galarza Renan, Bolivia; Anwer Mariyah, Pakistan; Aparício David J, Portugal; Arciniega Jose A, Mexico; Arezzo Alberto, Italy; Argenio Giulio, Italy; Arenas Mara, Belgium; Arnaud Alves AA, France; Arredondo Jorge, Spain; Arslan Baha,Turkey; Arya Shobhit, UK; Aselmann Heiko, Germany; Aumann Georg, Germany; Avanzolini Andrea, Italy; Avendano Rodolfo, Chile; Awedew Atalel F, Ethiopia; Ayantunde Abraham, UK; Aycan Ilker, Turkey; Aytac Erman, Turkey; Azevedo Constança TM, Portugal; Ba Am, Iraq; Bader Fg, Germany; Baehrle Markus, Germany; Bagaglini Giulia, Italy; Balaban Vladimir, Russia; Balciscueta Zutoia, Spain; Balciscueta Izaskun, Spain; Baldazzi Gianandrea, Italy; Balik Emre, Turkey; Bandolon Robert, Philippines; Barberis Andrea, Italy; Barisic Goran I, Serbia; Barrera Alejandro, Chile; Barros Inês MSF, Portugal; Basaran Betul, Turkey; Basilio Pedro C, Brazil; Bech Flemming, Denmark; Behboo Roubik, Iran; Behboudi Behnam, Iran; Beitia Ivan E, Panama; Bellato Vittoria, Italy; Bellolio Felipe, Chile; Benli Sami, Turkey; Bernal Jc, Spain; Bernante Paolo, Italy; Berrospi Francisco E, Peru; Bertelson Noelle, USA; Bevan Katharine, UK; Bhama Anuradha, USA; Bianco Francesco, Italy; Bievel Radulescu Raluca, Romania; Bintraiki Thamer, Saudi Arabia; Bisgin Tayfun, Turkey; Bislenghi Gabriele, Belgium; Blaslaina Juanluis, Spain; Bloom Itm, UK; Boehm Gabriele, Germany; Bogoni Selene, Italy; Bohlooli Mehrdad, Iran; Bondurri Andrea, Italy; Boni Luigi, Italy; Bonomi Alessandro Michele, Italy; Booning Nitikun, Thailand; Boonpipattanapong Teeranut, Thailand; Bordeianou Liliana, USA; Bossard Kerrie, USA; Botelho Maria, Portugal; Boto Carlos, Portugal; Bottini Corrado, Italy; Bouchagier Konstantinos, Greece; Boutall Adam, South Africa; Bowers Dan, USA; Bozbiyik Osman, Turkey; Brambilla Eduardo, Brazil; Brisinda Giuseppe, Italy; Brizzi Maria Pia, Italy; Brizzolari Marco, Italy; Brusciano Luigi, Italy; Bucci Luigi, Italy; Buchwald Pam, Sweden; Bugra Dursun, Turkey; Bui Andrew, Australia; Buldanlı Mehmet Zeki, Turkey; Bulut Orhan, Denmark; Cagigas Fernandez Carmen, Spain; Cai Yuankun, China; Calcerrada Alises Enrique, Spain; Caldes Pedro, Portugal; Calussi Marco, Italy; Calvo Espino Pablo, Spain; Campanelli Michela, Italy; Campbell Ken, UK; Campennì Paola, Italy; Canda Arasemre, Turkey; Capolupo Gabriella T, Italy; Caravana Jorge, Portugal; Carballo Federico HE, Argentina; Carbone Fabio, Italy; Carcamo Leonardo C, Chile; Cardoso Paulo, Portugal; Cariati Maria, Italy; Caricato Marco, Italy; Carmona Maria, Spain; Carpelan Holmstrom Monika, Finland; Carrié Augusto J, Argentina; Carrino Francesco, Italy; Cartucho Daniel DF, Portugal; Carvalho Marcia, Portugal; Carvas João M, Portugal; Casagranda Biagio, Italy; Casimiro Carlos, Portugal; Castro Anyely, Dominican Republic; Catiwala-An Michael T, Philippines; Caushaj Philip F, USA; Cavallo Debora, Italy; Cedermas Mariela, Argentina; Celayir Fevzi, Turkey; Celentano Valerio, UK; Cengiz Fevzi, Turkey; Chaisomboon Nopdanai, Thailand; Chenghua Luo, China; Cherepenin Mikhail, Russia; Chessa Antonella, Italy; Chierici Andrea, France; Chok Aikyong, Singapore; Chouliaras Christos, Greece; Chowchankit Irin, Thailand; Christou Niki, France; Chun Hokyung, South Korea; Cillara Nicola, Italy; Cinza Margarida, Portugal; Cione Gianpiero, Italy; Cipe Gokhan, Turkey; Ciprian Duta, Romania; Cirocco William, USA; Citgez Bulent, Turkey; Clark Jill E, USA; Clementi Ilaria IC, Italy; Clerc Daniel, Switzerland; Clermonts

Stefan HEM, Netherlands; Cobellis Luigi, Italy; Colak Tahsin, Turkey; Colao Garcia Laura, Spain; Colombo Francesco, Italy; Comba Andrea, Italy; Coret Franco Alba CFA, Spain; Correa Bonito Alba, Spain; Cosman Bard, USA; Costa Susana GS, Portugal; Costa Marta RP, Portugal; Costa Pereira Joaquim, Portugal; Cózar Lozano Coral, Spain; Cravero Francesca, Italy; Creavin Ben, Ireland; Cross Katie LR, UK; Cruz Arturo, Spain; Cui Junhui, China; Cunha Miguel F, Portugal; Curado Antonio, Portugal; D'Ugo Stefano, Italy; Dajti Irida, Albania; Dalessandro Antonio, France; Dal Monte Giorgio, Italy; Danelli Piergiorgio, Italy; Daniels Ian R, UK; Dar Asif M, India; Davies Richard J, UK; De Andrés Beatriz, Spain; De Angelis Marsilio, Italy; De Falco Nadia, Italy; De Luca Maurizio, Italy; De Luca Raffaele, Italy; De Nardi Paola, Italy; De Rosa Michele, Italy; De Silva Kaluthanthiri Patabanadi VR, Sri Lanka; De Simone Veronica, Italy; De Wilt Johannes HW, Netherlands; De-León-Rendón Jorge Luis, Mexico; Dean Phillip, USA; Deangelis Nicola, France; Dedemadi Georgia, Greece; Delgadillo Xavier, Switzerland; Delgadillo Edgar, Switzerland; D'Elia Antonio, Italy; Delibegovic Samir, Bosnia and Herzegovina; Delis S, Greece; Della Porta Massimiliano, Italy; Del Rio Paolo, Italy; De Marano Gaetano, Italy; Demey Karel, Belgium; Demirli Atıcı Semra, Turkey; Denoya Paula I, USA; Derebey Murat, Turkey; De Santis Mariangela, France; Devezas Vítor BS, Portugal; Dhaif Ali, Bahrain; Diaconescu Bogdan, Romania; Di Candido Francesca, Italy; Die Javier, Spain; Dieguez Beatriz, Spain; Dieter Hahnloser, Switzerland; Diez Alonso Manuel, Spain; Dimaren Ishmael, Philippines; Disimone Massimo, Italy; Doerner Johannes, Germany; Domingos Hugo VG, Portugal; Dominguez Rubén RD, Paraguay; Dorenbusch Michael, USA; Doulias Triantafyllos A, UK; Duff Sarah, UK; Dulskas Audrius, Lithuania; Dunn Gary, USA; Duque-Mallén Victoria, Spain; Dusek Tomas, Czech Republic; Dusitanond Navara, Thailand; Dzulkarnaen Zakaria Andee, Malaysia; Dworkin Michael, United Kingdom; Dybau Aleh, Belarus; Dziakova Jana, Spain; Dziki Lukasz, Poland; Dziki Adam, Poland; Efetov Sergey K, Russia; Eisa Mohamed, Egypt; Eisenstat Ted, USA; El Sorogy Mohamed, Egypt; El-Hussuna Alaa, Denmark; Elfeki Hossam, Egypt; Elhussuna Alaa, Denmark; Eliasrabelo Fernanda, Brazil; Ellis Tyler, USA; Elzalabany Tamer, Egypt; Emile Sameh H, Egypt; Emiroglu Mustafa, Turkey; Emmanuel Odet, France; Enomoto Masanobu, Japan; Epifani Angelo Gabriele, Italy; Erenler Ilknur, Turkey; Erkan Arman, USA; Erol Timuçin, Turkey; Erturk Suphan, Turkey; Escalante Ricardo, Venezuela; Escartin Jorg, Spain; Escrevente Ricardo, Portugal; Espin-Basany Eloy, Spain; Estaire-Gomez Mercedes, Spain; Falaschi Federica, Italy; Falken Ylva, Sweden; Fantini Corrado, Italy; Fantozzi Mauricio, Argentina; Farid Asim, USA; Farina Pablo, Argentina; Farmer Russ, USA; Farmer Martin, UK; Faul Eleanor M, Ireland; Favara Andrea, Italy; Febra Pedro, Portugal; Fenner Lyra Junior Humberto, Brazil; Fermani Claudio, Argentina; Fernandes Fábio FN, Portugal; Fernandes Miguel, Portugal; Ferracci Federica, Italy; Ferrara Francesco, Italy; Ferrari Giovanni, Italy; Ferrario Luca, Italy; Ferreira Rita, Portugal; Ferreira Carlos, Portugal; Ferris Jeff, USA; Ferronetti Antonio, Italy; Fialho Guilherme L, Portugal; Fichera Alessandro, USA; Figueiredo Odete, Portugal; Filipe Vieira Pedro JG, Portugal; Fiore Felicia, Italy; Folliero Cristina, Italy; Folstad Torbjorn, Norway; Forerotorres Alexander, Spain; Forgan Timothy R, South Africa; Franceschilli Marzia, Italy; Frizelle Frank, New Zealand; Froehner Junior Ilario, Brazil; Frois Miguel, Portugal; Frontali Alice, France; Fu Chuangang, China; Fulginiti Serena, Italy; Galiffa Giampaolo, Italy; Gallagher Hugh J, UK; Gallardo Cristian, Chile; Galleano Raffaele, Italy; Gama Barbara, Portugal; Garcia Conde Maria, Spain; Garcia Granero Alvaro, Spain; Garcia Esther, Spain; García Sánchez Felipe, Spain; Garcia Septiem Javier, Spain; Garcia Walter, Argentina; Garcia-Urena Miguel Angel, Spain; Garmanova Tatiana N, Russia; Garofalo Thomas, USA; Garoufalia Zoe, Greece; Garulli Gianluca, Italy; Gatti Matteo, Italy; Gecim Ethem, Turkey; Gellona Jose, Chile; Gercek Yuksel, UK; Ghignone Federico, Italy; Gianchandani Moorjani Rajesh, Spain; Gianfrancisco James A, USA; Giani Iacopo, Italy; Gibert Juan, Spain; Gilles Manceau, France; Gilmore Andrew, Australia; Gilsanz Carlos, Spain; Gilshtein Hayim, USA; Girgin Behic, Turkey; Giria Joao, Portugal; Giuffrida Maria Carmela, Italy; Giuliani Antonio, Italy; Goi Gloria, Italy; Golovina Anastasiya, Russia; Gomez Rosado Juan Carlos, Spain; González Enrique, Spain; Granada Nemesio, Philippines; Grimme Frederike, Netherlands; Grobler Stephen, South Africa; Guaitoli Eleonora, Italy; Guerci Claudio, Italy; Guerra Daniel, Mexico; Guerreiro José MM, Portugal; Guido Jutten, Belgium; Gulcu Baris, Turkey; Gunay Emre, Turkey; Gundes Ebubekir, Turkey; Gurbuz Bulent,Turkey; Gurjar Shashank, UK; Hainsworth Alison J, UK; Hall Nigel, UK; Hamed Hosam H, Egypt; Hammer Clare, UK; Hannon Rob, Ireland; Harmston Christopher, New Zealand; Harran Nadine, South Africa; Hartendorp Paul, USA; Hassan Iyad, UAE; Hassan Imran, USA; Hawkins Alexander T, USA; Hayssen Theresa, USA; Hendren Samantha, USA; Hernandez Garcia Miguel, Spain; Hershman Michael,

UK; Hild Stefanie, Germany; Hilton Joanna, UK; Hiranyakas Art, Thailand; Ho Ming, Australia; Hollington Paul, Australia; Holubar Stefan, USA; Hompes Roel, Netherlands; Houcine Maghrebi, Tunisia; Hovsepyan Vardges, Armenia; Hul Rene, Netherlands; Hunt Louise E, UK; Hyder Zargham, UK; Ibrahim Aini F, Malaysia; Iglesias Gustavo, Brazil; Iesalnieks Igors, Germany; Ilkanich Andrei, Russia; Imanova Nargiz, Azerbaijan; Isik Arda, Turkey; Jayathilaka Buddika, UK; Jimenez Virginia, Spain; Jimenez-Gomez Luis Miguel, Spain; Jitmungngan Romyen, Thailand; Joelsson Magnus, Sweden; Joshi Heman, UK; Juloski Jovan T, Serbia; Juwid Abdallah E, Libya; Kanjanasilp Prapon, Thailand; Kannappa Lava, UK; Kanno Danilo, Brazil; Kaplan Esin, Turkey; Kara Yasin, Turkey; Kartal Abdulcabbar, Turkey; Kawamura Junichiro, Japan; Kaya Tayfun, Turkey; Kazemi Nava Andrea, Italy; Kazachenko Ekaterina A, Russia; Kelkar Ashish, UK; Kelly Michael E, Ireland; Keramati Mohammad Reza, Iran; Kerawala Asad, Pakistan; Khalil Mohammad I, Bangladesh; Khan Jim S, UK; Khan Rbn, UK; Khitaryan Alexander, Russia; Kinjo Tatsuya, Japan; Kirilova Tanya N, Bulgaria; Kirmizi Yasemin, Turkey; Klaristenfeld Daniel, USA; Knapp Jens, Norway; Koc Mehmet A, Turkey; Kocián Petr, Czechia; Konishi Tsuyoshi, Japan; Konstantoudakis Georgios, Cyprus; Konsten Joop, Netherlands; Kontovounisios Christos, UK; Korkmaztoker Melike, Turkey; Kørner Hartwig, Norway, Krdzic Igor D, Serbia; Krivokapic Zoran, Serbia; Kumar Sanjeev, India; Kumar Sandip, Malaysia; Kushtrim Shala, Germany; Kynaston James, UK; Langmayr Johannes, Austria; La Torre Marco, Italy; La Torre Filippo, Italy; Labalde Maria, Spain; Lagopoulos Vasileios, Greece; Lal Roshan, UK; Landaluce- Olavarria Aitor, Spain; Langone Antonio, Italy ; Lapolla Pierfrancesco, Italy; Larach Sergio, USA; Larach Andres, Chile, Larsson Peranders, Sweden; Lasala Alfred, Philippines; Lauretta Andrea, Italy; Leao Pedro, Portugal; Lee Pamela C, USA; Lee Suk-Hwan, South Korea; Lee Wooyong, South Korea; Lefevre Jeremie H, France; Leite Julio, Portugal; Lemaire Julien, Belgium; Lemma Maria, Italy; Lemme Gustavo Nestor, Argentina; Lenna Giovanni, Italy; Leo Cosimo Alex, UK; Leventoglu Sezai, Turkey; Licardie Eugenio, Spain; Lienert Mark, Germany; Lima Sergio, Brazil; Limbert Manuel CSB, Portugal; Lisi Giorgio, Italy; Litta Francesco, Italy; Littaua Dennis, Philippines; Liu Fanlong, China; Liyanage Chris, New Zealand; Llovera Antony, Cuba; Lo Oswens, China; Lo Dico Rea, France; Lobascio Pierluigi, Italy; Lohsiriwat Varut, Thailand; Lombana Luis, Colombia; Lopez Marc, Philippines; Lopez Jose, Mexico; Lopez Francisco, Chile; Lorber Julie, USA; Losada Manuel, Spain; Lowenfeld Lea, USA; Lucci Enrico, Italy; Luglio Gaetano, Italy; Lynch Craig, Australia; Luqman, Pakistan; Machairas Nikolaos, UK; Maciel João MRP, Portugal; Madbouly Khaled, Egypt; Madhoun, Nisreen; USA, Maffioli Anna, Italy; Magbojos Christian Raymond S, Philippines; Magistro Carmelo CM, Italy; Magrino Thomas, USA; Makhoul Rami, USA; Mallmann Karen DP, Brazil; Manatakis Dimitrios K, Greece; Mancini Stefano, Italy; Manfredelli Simone, France; Mangione John, USA; Manso Antonio, Portugal; Marakutsa Eugen V, Moldova; Marano Alessandra, Italy; Marchesi Federico, Italy; Marchiori Mauro, Brazil; Marfan Michael, Australia; Marianelli Raphael, Brazil; Mariani Nicolò M, Italy; Marimuthu Kalimuthu, UK; Marinello Franco, Spain; Marinis Athanasios, Greece; Marino Marco V, Italy; Markides Georgios, Cyprus; Marquez Lucila, Spain; Marra Angelo A, Italy; Martín Navarro Fabian, Mexico; Martin-Martin Gonzalo P, Spain; Martinez Javier, Spain; Martinez-Iglesias Marta A, UK; Martins Ruben AFP, Portugal; Martins Ana RG, Portugal; Mascali Davide DM, Italy; Massucco Paolo, Italy; Matas Fernando, Spain; Mathew Alexander, USA; Matzel Klaus E, Germany; Maun Dipen, USA; Maurus Christine F, Switzerland; McCormick Jim, USA; McIntyre Robert, UK; McKinley Aileen, UK; McLemore Lisa, USA; McNeil Jennifer, USA; McNevin Shane, USA; Medich David, USA; Medina Cesar, Mexico; Medina Quintana Rita E, Spain; Melo Ingrid, Paraguay; Melstrom Kurt A, USA; Mendoza-Moreno Fernando, Spain; Menna Maria Paola, Italy; Mentz Ricardo, Argentina; Merlini David A, Italy; Mihmanli Mehmet, Turkey; Mike Spencer, USA; Millan Monica, Spain; Miller Jerad, USA; Milone Marco, Italy; Minahi Ilyas,UK; Minaya-Bravo Ana María, Spain; Mingoli Andrea, Italy; Minicozzi Annamaria, UK; Miranda Pedro, Portugal; Miro Antonio, Italy; Miskovic Danilo, UK; Mistrangelo Massimiliano, Italy; Mitra Rajarshi, UAE; Mittal Rohin, India; Mladenovikj Dragoslav P, North Macedonia; Moctezuma Velázquez Paulina, Mexico; Mohamed Kamil Nil Amri, Malaysia; Mohammed Mohammed MH, Egypt; Mohsen Yasser MA, UK; Monami Benoit N, Belgium; Monroe Justin, USA; Monroy Hermogenes DJ, Philippines; Montori Giulia, Italy; Montuori Mauro, Italy; Mora-Guzmán Ismael, Spain; Moraes Ana, Brazil; Morales Carlos, USA; Morelli Luca, Italy; Moreno Almudena, Spain; Moretto Gianluigi, Italy; Morici Riccardo, Italy; Morici Riccardo, Italy; Morini Andrea, Italy; Moro-Valdezate David, Spain; Moroni Eliana, Italy; Morton Dion, UK; Moura Catarina, Portugal; Moysidis Moysis M, Greece; Mozo Ana S, Spain; Nacion Aeris Jane D, Philippines; Nada Mohamed,

Egypt; Nagasaki Toshiya, Japan; Nakamoto Yoshihiko, Japan; Neary Peter, Ireland; Negoi Ionut, Romania; Neijenhuis Peter A, Niger; Ng Simon SM, China; Niazi Samiullah, Pakistan; Nikoupour Hamed, Iran; Nogueiro Jorge PM, Portugal; Noguera Jose, Spain; Nova Carlos, Portugal; Nunes Amadeu, Portugal; O'Riordain Micheal G, Ireland; Oke Olatunbosun A, Nigeria; Okkabaz Nuri, Turkey; Oliva Cristiano, Italy; Oliveira Olga, Portugal; Oliveira Manuel, Portugal; Oliveira Antonio, Portugal; Oliveira Lucia CC, Brazil; Olivier James B, UK; Olivier Pittet, Switzerland; Omejc Mirko, Slovenia; Ong Loreto B, Philippines; Ong David, Malaysia; Onglao Mark, Philippines; Onody Peter, Hungary; Orefice Raffaele, Italy; Ortega David, Peru; Ozben Volkan, Turkey; Ozcan Onder, Turkey; Ozturk Ersin, Turkey; Pacheco Andre, Portugal; Paci Marco, France; Paczosa Marcin, Poland; Padmanabhan Anantha, USA; Pai Ajit, India; Palmer Gabriella, Sweden; Pandey Diwakar, India; Panis Yves, France; Pantel, Haddon, USA; Paonariang Krisada, Thailand; Papa Mario V, Italy; Papadopoulos Aristeidis, Greece; Papagni Vincenzo, Italy; Papp Andras, Sweden; Parello Angelo, Italy; Parente Alessandro, UK; Parra Pedro, Spain; Pascual-Migueláñez Isabel, Spain; Pata Francesco, Italy; Patel Nikhil, USA; Patel Reeya, UK; Pattyn Paul RL, Belgium; Paul Bikram, USA; Pavanello Maurizio, Italy; Pedro Luis E, Argentina; Pellino Gianluca, Spain; Peltrini Roberto, Italy; Peña Ros Emilio, Spain; Pennacchi Luca UC, Italy; Pereira André A Portugal; Pereira Bela, Portugal; Perez Guillermo, Ecuador; Perez Horacio, Portugal; Perez Natalia, Spain; Perez Flecha Marina, Spain; Perinotti Roberto, Italy; Pernazza Graziano, Italy; Perra Teresa, Italy; Pertile Davide, Italy; Pessia Beatrice, Italy; Pessoa Joana, Brazil; Petagna Lorenzo, Italy; Peters Walter, USA; Petit Mindy, USA; Petracca Gabriele Luciano, Italy; Pezzolla Francesco, Italy; Philp Matthew, USA; Pianim Nana, USA; Picciariello Arcangelo, Italy; Piccinini Pablo E, Argentina; Piccinni Giuseppe, Italy; Piccolo Davide, Italy; Pigalarga, Rodolfo; USA; Pikarsky Alon J, Israel; Pimentel Alice, Portugal; Pinchot Scott, USA; Pinotti Enrico, Italy; Pinto Diogo, Portugal; Pirozzi Felice, Italy; Plastiras Aris, Greece; Platto Marco, Italy; Plerhoples Tim, USA; Podda Mauro, Italy; Poggi Luis, Peru; Polastri Roberto, Italy; Porcu Alberto, Italy; Porter Michael, USA; Poskus Eligijus, Lithuania; Potolicchio Analia I, Argentina; Poylin Vitaliy, USA; Pozzo Mauro, Italy; Pramateftakis Manos, Greece; Pravosudov Igor V, Russia; Praxedes Vanessa P, Portugal; Primoromaguera Vicent, Spain; Progno Valerio C, Italy; Proud David M, Australia; Pucciarelli Salvatore, Italy; Qadir Abdul, UK; Qayoom Hina, Pakistan; Quindos Patricia, Spain; Quintanilha Rui, Portugal; Quinteros Francisco A, USA; Qureshi Nafees, UK; Rachadell Juan J, Portugal; Ralf Schmidt, Germany; Raman Shankar, USA; Ramos Diego, Spain; Ramos Jose, Portugal; Ramwell Andrew, UK, Randazzo Valentina, Italy; Rattanarpichart Patsaporn, Thailand; Ratto Carlo, Italy; Rautio Tero, Finland; Raviolo Carla, Italy; Read Thomas, USA; Real Joao, Portugal; Rega Daniela, Italy; Regadas Francisco, Brazil; Regenbogen Scott, USA; Reia Marta, Portugal; Reina Angel, Spain; Rems Miran, Slovenia; Rencuzogullari Ahmet, Turkey; Renwick Andrew A, UK; Reyes Juan C, Colombia; Reyes Jeryl Anne Silvia R, Philippines; Ribeiro Jr Ulysses, Brazil; Ridzuan Farouk, Singapore; Ripetti Valter, Italy; Ripoll Cristina, Mexico; Ripollés-Melchor Javier, Spain; Rizal Rizal, Indonesia; Rizk Mariam, UK; Rizvi Irfan, USA; Robinson Jonathan, UK; Rodimov Sergei, Russia; Rodrigues João VL, Brazil; Rodriguez Javier, Mexico; Rodriguez Cristian, Argentina; Rodriguez Homero, Panama; Rodriguez Garcia Jaime, Mexico; Roig Jose, Spain; Rojanasakul Arun, Thailand; Rojas Julio, Chile; Romanelli Elena, France; Rosa Fausto, Italy; Rosato Guillermo, Argentina; Rosenberg Robert, Switzerland; Rosete Manuel, Portugal; Roslani April C, Malaysia; Rottoli Matteo, Italy; Roxas Manuel Francisco Roxas T, Philippines; Roxburgh Campbell S, UK; Ruan Joseph, USA; Rubbini Michele M, Italy; Rubio Eduardo, Spain; Ruddy Theresa, USA; Rueda Camilo, Spain; Ruiztovar Jaime, Spain; Rusconi Andrea, Italy; Rutegård Martin, Sweden; Sá Milene RRM, Portugal; Saad Luiz Henrique Cury, Brazil; Sadien Iannish D, UK; Sadowski Brian M, USA; Saeed Mirza Faraz, Bahrain; Safiyeva Aynur K, Azerbaijan; Sagap Ismail, Malaysia; Sahnan Kapil, UK; Sairafi Rami, Saudi Arabia; Saklami Avanish P, India; Salgado-Nesme Noel NSN, Mexico; Salman Nevriye, Turkey; Samalavicius Narimantas E, Lithuania; Sambucci Daniele, Italy; Sanchez Noel, USA; Sanchez Robles Juan Carlos, Mexico; Sanmiguel Carlos, Spain; Santacruz Eduardo, Paraguay; Santoni Simone, Italy; Santos Pedro MD, Portugal; Santos Brian U, Argentina; Santos Carlos, Portugal; Sapienza Paolo, Italy; Saracoglu Ayten, Turkey; Saracoglu Kemal T, Turkey; Sardinas Carlos, Venezuela; Sari Ramazan, Turkey; Sarma Diwakar, UK; Sartori Alberto A, Italy; Sasia Diego, Italy; Sbaih Mohammed H, Saudi Arabia; Scabini Stefano, Italy; Scaringi Stefano, Italy; Scheinin Tom M, Finland; Schiavo Marcello, Italy; Schizas Alexis, UK; Sciaudone Guido, Italy; Scognamillo Fabrizio, Italy; Scott Kelley, USA; Scow Jeffrey S, USA; Sechi Raffaele, Italy; Seehra Harkiran, UK; Segering Joerg, Germany; Selcuk Mehtap, Turkey;

Selemane Carlos, Mozambique; Seltman Ann, USA; Selvaggi Francesco, Italy; Sensi Bruno, Italy; Seow-Choen Francis, Singapore; Sernagiotto Carlo, Italy; Serralta De Colsa Daniel, Spain; Serrano González Javier, Spain; Sert Ismail, Turkey; Serventi Alberto, Italy; Sforza Sergio, Italy; Shabbir Jamshed, UK; Shabeeb Fadel, UAE; Shafik Ali, Egypt; Shalaby Mostafa, Egypt; Shanker Bethann, USA; Shanmugam Venkatesh, UK; Shariff Umar, UK; Shehta Ahmed, Egypt; Shelton Andrew, USA; Shintaro Akamoto, Japan; Shlyk Daria, Russia; Shukla Amit, UK; Sibio Simone, Italy; Sietze Koopal, Netherlands; Sigurdardottir Johanna, Sweden; Silva Jorge, Mexico; Silva Anaisa, Portugal; Simianu Val, USA; Singh Baljit, UK; Siragusa Leandro, Italy; Sirikurnpiboon Siripong, Thailand; Sivrikoz Emre, Turkey; Sizonenko Nikolay, Russia; Slavchev Mihail T, Bulgaria; Sniuolis Pranas, Lithuania; Soares Duarte, Qatar; Sojar Valentin, Slovenia; Sokmen Selman, Turkey; Sokol Thomas, USA; Soldatov Denis, Russia; Soncini Stefania, Italy; Sordo Ricardo, Mexico; Sosa María V, Spain; Sousa Xavier, Portugal; Sozutek Alper, Turkey; Spiezio Giovanni, Italy; Spinelli Antonino, Italy; Stahl Etienne, Mexico; Stanojevic Goran Z, Serbia; Steckel Brian, USA; Stefan Neagu, Romania; Stefanescu Victor, Romania; Steinhagen Randolph, USA; Stella Marco, Italy; Stephensen Bree D, Australia; Stevenson Andrew RL, Australia; Stitzenberg Karyn, USA; Strombom Paul, USA; Sturiale Alessandro, Italy; Suhail Anjum, Pakistan; Sungurtekin Ugur, Turkey; Sutton Jeffrey M, USA; Suwannakij Chanchai, Thailand; Szczepkowski Marek, Poland; Sztipits Tamas, Hungary; Takashi Akiyoshi, Japan; Takkenberg Marijn, Netherlands; Tallon-Aguilar Luis, Spain; Tam Michael, USA; Tamburini Andrea M, Italy; Tamini Nicolò, Italy; Tammaro Pasquale, Italy; Tan Kerkan, Singapore; Tan Teerasan, Thailand; Tanal Mert, Turkey; Tanda Cinzia, Italy; Tang Jinghua, China; Tapiolas Ingrid, UK; Täreby Magnus, Sweden; Tariverdiev Andrey, Russia; Tayar Serkan, Turkey; Tejedor Patricia, Spain; Terrosu Giovanni, Italy; Testa Alessandro, Italy; Tewari Shirish, UK; Thabet Waleed, Egypt; Thakur Sukesh, India; Thomas Ehmann, Germany; Thomas Kuruc, Germany; Tiesi Vincenzo, Italy; Tin Moemoetin, Myanmar; Tita Agustin C, Argentina; Titu Liviu V, UK; Tkachenko Fedot, Ukraine; Tonello Paolo, Italy; Tooley Richard, USA; Torres Juan, Spain; Troci Albert, Italy; Trompetto Mario, Italy; Troncoso Pereira Paula, Spain; Tropeano Francesca Paola FP, Italy; Trostchansky Ivan, Uruguay; Tsujinaka Shingo, Japan; Tufo Andrea, Italy; Tulina Inna, Russia; Turati Luca, Italy; Turchina Catalin, Sweden; Turina Matthias, Switzerland; Tutino Roberta, Italy; Tyler Km, USA; Uemura Mamoru, Japan; Unal Ayse G, Turkey; Uraiqat Ahmad, Jordan; Uribe Sebastián, Chile; V Duke, USA; Vailati Bruna, Brazil; Vaingurt Mariano, Argentina; Valente Michael, USA; Van Dellen Jonathan, UK; Van Ramshorst Gabrielle H, Belgium; Vannelli Alberto, Italy; Vanriel W, Belgium; Varabei Aliaksandr, Belarus; Varcada Massimo, UK; Varela Cristopher L, Venezuela; Varma Madhulika G, USA; Vasapollo Leoluca F, Italy; Venn Mary L, UK; Vercillo Kristin, USA; Vergara-Fernandez Omar, Mexico; Veronesi Paolo, Italy; Vicente Aline, Brazil; Victor Tomulescu, Romania; Vieiradesousa Paulo, Portugal; Vignali Andrea, Italy; Vigorita Vincenzo, Spain; Vilchis Jose, Mexico; Villaverde Kathia, Peru; Vindevoghel Koen, Belgium; Violante Tommaso, Italy; Vitoopinyoparb Kasidin, Thailand; Voutsarakis Athanasios, UK; Voutsarakis Athanasios, UK; Wainstein Ricardo, Argentina; Wakefield Simon, UK; Wallon Conny, Sweden; Wang Yongbing, China; Wang Xiaodong, China; Wang Xiaofeng, China; Warden Claire, South Africa; Wei Rockson, China; Wheeler Matthew, USA; Willem Bemelman, Netherlands; Wilson Matthew, USA; Winter Des C, Ireland; Wongwiwatseree Yongsun, Thailand; Woon Kyung Jeong, South Korea; Wright Danette B, Australia; Wu Jiong, China; Wuraola Funmilola O, Nigeria; Xenaki Sofia A, Greece; Xiaohua Jiang, China; Xiaoqiang Jia, China; Xue Yahong, China; Xynos Evangelos, Greece; Yamada Kazunosuke, Japan; Yanar Hakan, Turkey; Yang Bolin, China; Yanishev Alexey, Russia; Yildirim Ali C, Turkey; Yildiz Ufukmete, Turkey; Yildiz Alp, Turkey; Yilmaz Mehmet, Turkey; Younis Muhammad Umar MUY, UAE; Yousef Zeyad, Saudi Arabia; Yu Dongsheng, China; Zalucki James, USA; Zaman Ahamaduz, Bangladesh; Zamora Aída T, Spain; Zampitis Nikolaos, Cyprus; Zanus Giacomo, Italy; Zapata Gonzalo H, Argentina; Zelic Marko, Croatia; Zenger Serkan, Turkey; Zheng Jianyong, China; Zigiotto Daniele, Italy; Zmora Oded, Israel; Zoikas Athanasios, Greece; Zorcolo Luigi, Italy; Zucchella Martino, Italy; Zuhdy Mohammad, Egypt.

APPENDIX 2: DECOR-19 Survey

Q1	The information provided in this questionnaire will be exclusively used for research purposes. It will not be used in a manner which would allow identification of your individual responses.
1	Accept
Q2	Email
Q3	Gender
Q4	Country
Q5	Hospital name
Q6	Type of hospital
1	Academic
2	Non-academic teaching
3	Non-teaching
Q7	Number of hospital beds
1	<250%
2	251-750%
3	751-1250%
4	>1250%
Q8	Unit type
1	Colorectal
2	General surgery
Q9	Number of surgery for colon cancer per year
1	<50
2	51-150
3	>150
Q10	Laparoscopic or robotics for colon cancer (last year's estimate)
1	<25%
2	26-50%
3	51-75%
4	>75%
Q11	Number of surgery for rectal cancer per year
1	<50
2	51-150
3	>150
Q12	Laparoscopic or robotics for rectal cancer (last year's estimate)
1	<25%
2	26-50%
3	51-75%
4	>75%
Q13	Average interval between completion of long course chemoradiation and surgery for locally advanced rectal cancer
1	<8 weeks
2	8-12 weeks
3	>12 weeks

Q14	Has your unit experienced any flaw/delay in colorectal cancer care (e.g. in undertaking surgery, oncology, radiotherapy, endoscopy, or noting a reduced number of referrals from other centers)?
1	Yes
2	No (skip to Q35)
Q15	How has your hospital been preparing for the COVID-19 emergency?
1	Fully dedicated to COVID-19 patients
2	By creating dedicated pathways and wards to COVID-19 patients
3	Not involved at all in COVID-19 patients' care
Q16	Did your hospital establish external connections to COVID-free facilities in order to perform oncologic surgery?
1	Yes
2	No
Q17	Is a hospital-based cancer care coordinator currently available?
1	Yes
2	No
Q18	Are personal protective equipment readily available (adequate for quantity and quality) at your workplace?
1	Yes
2	No
Q19	Status of elective surgical practice
1	Temporarily put on hold
2	Temporarily reduced (skip to Q19_b)
3	Unaffected (skip to Q20)
Q19_a	For how many weeks?
1	<=4
2	5-8
3	>8
Q19_b	To what extent
1	<=50%
2	>50%
Q20	Have you ever had a patient refusing elective surgery for colorectal cancer?
1	Yes
2	No (skip to Q21)
Q20_a	For what reason(s)?
1	Fear of being infected
2	Other
Q20_a_i	If you selected Other, please specify:
Q21	Has any member of staff in your unit been quarantined after testing COVID-19 positive?
1	Yes
2	No
Q21_a	If you selected Yes, please specify (%)
Q22	Has any member of staff in your unit been relocated to ICUs and/or COVID-19 units?
1	Yes
2	No
Q22_a	If you selected Yes, please specify (%)
Q23	Have you ever experienced prolonged deferral of elective endoscopy for colorectal cancer patients?
1	Yes
2	No (skip to Q24)

Q23_a	How many weeks delay on average?
1	<=4
2	5-8
3	>8
Q24	Have you ever experienced prolonged deferral of elective imaging (EAUS/CT/MRI/PET) for colorectal cancer patients?
1	Yes
2	No (skip to Q25)
Q24_a	How many weeks delay on average?
1	<=4
2	5-8
3	>8
Q25	Have you ever experienced delayed turnaround time of histopathology reports for colorectal cancer patients (e.g. pre-op. biopsies)?
1	Yes
2	No (skip to Q26)
Q25_a	How many weeks delay on average?
1	<=4
2	5-8
3	>8
Q26	Have multidisciplinary team meetings ever been put on hold?
1	Yes
2	No
Q27	Have you ever experienced prolonged deferral of neoadjuvant chemoradiation for rectal cancer patients?
1	Yes
2	No (skip to Q28)
Q27_a	How many weeks delay on average?
1	<=4
2	5-8
3	>8
Q28	Prolonged interval between the end of chemoradiation and surgery
1	Yes
2	No
Q29	Have you ever experienced prolonged deferral of surgery for colorectal cancer patients?
1	Yes
2	No (skip to Q30)
Q29_a	How many weeks delay on average?
1	<=4
2	5-8
3	>8
Q29_b	For what reasons (multiple choice question)?
1	Increasing need for restaging deferred patients
2	Reduced number of referrals
3	Reduced number of theatre slots
4	Suspension of multidisciplinary team meetings
5	Shortage of nurses
6	Shortage of anesthetists

7	Shortage of surgeons
8	Hospital directions
9	Reduced number of intensive care unit (ICU) beds
10	Reduced number of hospital beds
11	Reduced number of referrals from other centers
12	Lack of cancer care coordinator
13	Lack of personal protective equipment
14	Other
Q29_b_i	If you selected Other, please specify:
Q30	Have you ever changed your initial elective treatment plan?
1	Yes
2	No (skip t Q31)
Q30_a	In which way?
1	Neoadjuvant CRT converted to resection
2	Laparoscopy converted to open
3	Robotic converted to laparoscopy
4	Robotic converted to open
5	TAMIS/TEM converted to abdominal (or abdominoperineal) approach
6	TAMIS/TEM converted to neoadjuvant CRT
7	Resection converted to chemo- or chemoradiotherapy
8	Resection converted to endoscopic stenting
9	Other
Q30_a_i	If you selected Other, please specify:
Q30_b	For what reason(s)?
1	Disease progression
2	Reduced number of theatre slots
3	Shortage of personnel
4	Other
Q30_b_i	If you selected Other, please specify:
Q31	Did any patient on the waiting list undergo urgent operation for colorectal cancer?
1	Yes
2	No (skip to Q32)
Q31_a	How many on average?
1	<=10
2	>10
Q31_b	Do you find this number higher than that observed in a same time period before the outbreak?
1	Yes
2	No
Q31_c	For what reason(s)?
1	Delayed diagnostics
2	Delayed chemotherapy
3	Delayed radiotherapy
4	Onset of complication
Q31_c_i	Type of complication (if any)
1	Bowel obstruction
2	Bleeding
3	Bowel perforation
Q32	How many colorectal cancer patients were COVID-19 positive at the time of the operation?

Q33	How many colorectal cancer patients tested COVID-19 positive in the post-operative period?
Q34	Current colorectal cancer care at your unit
1	Fully recovered
2	Improved but not yet fully recovered
3	Still limited
Q34_a	Since when?
1	COVID-19 did not significantly affect my geographical area
2	Working at a COVID-19-free hospital
3	Surgical bed capacity not reduced for COVID-19 care
4	Operating slots not reduced for colorectal cancer
5	Intensive care unit bed capacity not reduced for colorectal cancer surgery
6	Surgical staff not redeployed to dedicated COVID-19 units
7	No delay in diagnostic assessment of colorectal cancer
8	No delay in oncologic treatment of colorectal cancer
9	Other
Q35_a	If you selected Other, please specify:

Appendix 3. Checklist for Reporting Results of Internet E-Surveys (CHERRIES)[11]

Item category	Checklist item	Page no.	Description
Design	Study design	Page 2	The target population were members of renowned Societies with interest in coloproctology.
Ethics	Ethics approval	Page 2	This study was exempt from review board approval at Authors' Institutions.
	Informed consent	Page 2	All participants had already provided informed consent to participate in online surveys. Informed consent for the present survey was obtained from all those agreeing to complete a survey, with participants informed on the welcome page that the survey aimed to assess the delay in colorectal cancer care, that it would take approximately 10-15 minutes to complete, that all responses were confidential and that reporting would be on an aggregate level only. Consent was indicated when respondents clicking the 'Accept' button from this page.
	Data protection	Page 3	Proprietary survey software and local servers were used to ensure data protection. No personal information was linked to survey results in any way. The fully de-identified dataset is kept on password protected computers.
Development and pre-testing		Page 3	Co-Authors (GAS, UG, GG) piloted the survey, assessed the design and checked the feasibility and validity of the questions. Estimated mean time to complete the survey was 10-15 minutes.
Recruitment process	Open *vs.* closed survey	Page 2	This was an open survey. Participants were recruited through dedicated scientific societies advertisement.
	Contact mode	Page 2	The initial contact with the potential participants was made on the Internet.
	Advertising the survey	Page 2	The survey was advertised among members of Scientific Societies in the field of coloproctology.
Survey administration	Web/email	Pages 2-3	This was a web-based survey, with respondents channeled to 'Online surveys' (formerly BOS – Bristol Online Survey) site, developed by the University of Bristol. Responses were collected through the online survey platform and stored on secure local servers. Responses were single or multiple choice, numeric, and open text.
	Context	Pages 2-3	The online survey platform is licensed by the Queen Mary University of London for research projects.
	Mandatory/ voluntary	Page 2	Voluntary.
	Incentives	Page 2	No compensation offered.
	Time/date	Page 3	Responses were collected between May 20th to June 10th 2020.
	Item randomisation	Page 3	No randomisation of items was used.

Response rates	Adaptive questioning	Page 3	Adaptive questioning (branched) was used. Relevant survey items were displayed based on previous responses.
	Number of screens	Page 2	The full survey was distributed over 9 pages
	Number of items	Page 2	A maximum of 5 items were displayed on any one survey page. The full survey comprised a total of 35 items, although because of the adaptive nature of the questionnaire, not all respondents answered all items.
	Completeness check	Page 3	All survey items were deemed to be mandatory, and respondents prompted to complete outstanding items before leaving the survey page on which the item was contained.
	Review step	Page 3	Respondents were unable to change their responses once submitted.
	Unique site visitor	Page 2	Determination of unique visitors was only possible for the closed group of participants who received an email invitation based on IP addresses.
	View rate	Page 2	Not applicable.
	Participation rate	Page 2	Not applicable.
	Completion rate	Page 3	100%.
Preventing multiple entries from same individual	Cookies used	Page 3	No
	IP check	Page 3	No
	Log file analysis	Page 3	Not used
	Registration	Page 3	Not applicable
Analysis	Handling of incomplete questionnaires	Page 3	Not applicable
	Questionnaires with atypical timestamp	Page 3	No respondents were removed from the survey for completing the items too quickly. The minimum completed survey was timed at approximately 10 minutes.
	Statistical correction	Page 3	Not applicable

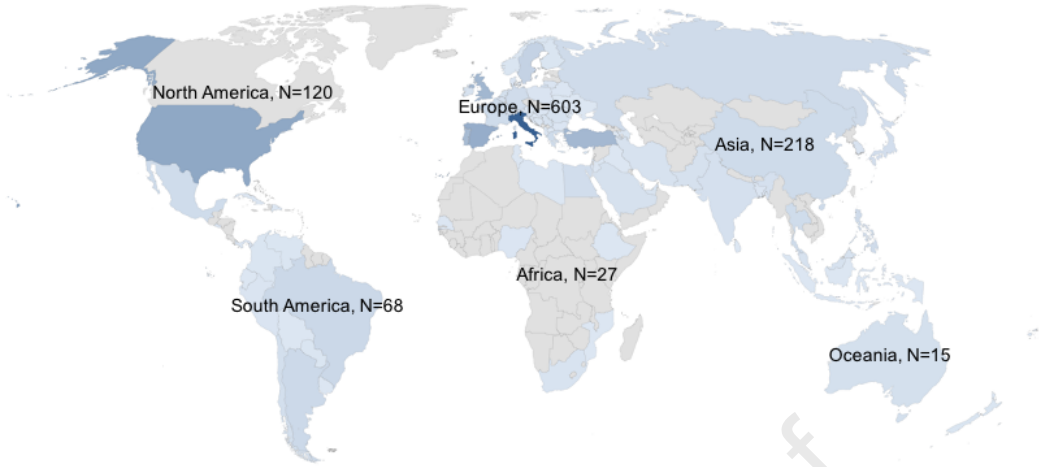
Appendix 3. Colorectal cancer care at the date of survey completion across six geographical regions (N=745 reporting delayed care)

	N=745 (100%)	**Asia** 158 (21.2)	**Europe** 422 (56.6)	**N.America** 82 (11.0)	**S.America** 57 (7.7)	**Africa** 16 (2.1)	**Oceania** 10 (1.3)
Fully recovered to pre-COVID status	131 (17.6)	40 (25.3)	73 (17.3)	13 (15.9)	1 (1.8)	1 (6.2)	3 (30.0)
Improved but not fully recovered to pre-COVID status	420 (56.4)	70 (44.3)	278 (65.9)	48 (58.5)	15 (26.3)	3 (18.8)	6 (60.0)
Persistently limited as during the outbreak	194 (26.0)	48 (30.4)	71 (16.8)	21 (25.6)	41 (71.9)	12 (75.0)	1 (10.0)

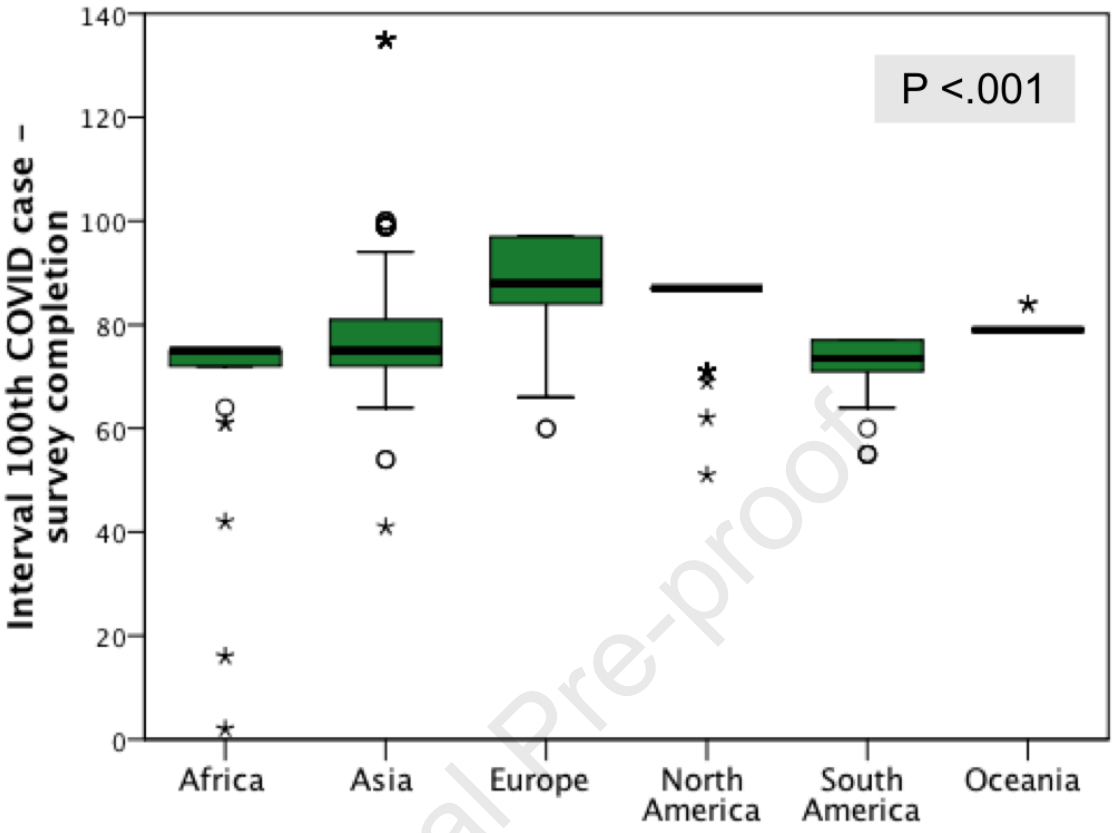
Appendix 4. **Zero-inflated negative binomial regression exploring the interval (days) between the date of achievement of the 100th COVID-19 case and the date of recovery (fully/improved) or the date of persistently limited colorectal cancer (CRC) practice (N=745 reporting delayed care)**

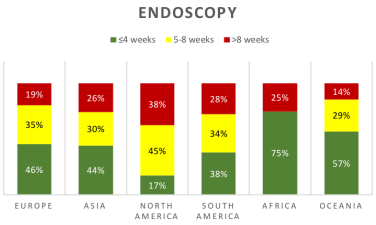
	MIR	95%CI		*P*
		Lower	Upper	
Status of CRC care				
Fully recovered (*reference*)				
Improved	0.99	0.88	1.11	*0.087*
Persistently limited	0.41	0.35	0.47	*<.001*
Gender				
Female (*reference*)				
Males	0.99	0.89	1.11	*0.938*
Type of hospital				
Academic (*reference*)				
Non-academic teaching	1.01	0.90	1.13	*0.853*
Non-teaching	0.97	0.81	1.17	*0.778*
Number of beds				
<250 (*reference*)				
251-750	1.01	0.85	1.21	*0.904*
751-1250	1.07	0.87	1.30	*0.527*
>1250	1.01	0.81	1.26	*0.921*
Type of division				
Fully dedicated to CRC care (*reference*)				
General surgery	1.07	0.96	1.20	*0.241*
Colon cancer surgeries per year				
≤50 (*reference*)				
51-150	1.02	0.89	1.16	*0.774*
>150	1.03	0.88	1.20	*0.728*
Rectal cancer surgeries per year				
≤50 (*reference*)				
51-150	1.06	0.93	1.20	*0.398*
>150	1.17	0.95	1.44	*0.150*

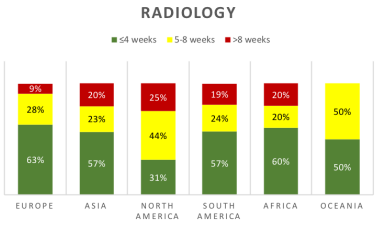
CI: confidence interval; MIR: mean interval ratio

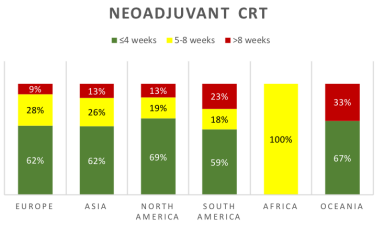


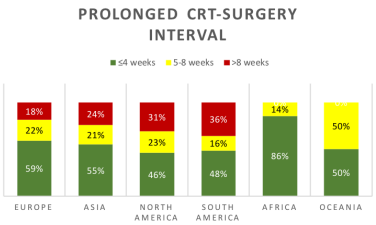
Region (No. countries)	84 countries (No. participants)	Surgical societies
Europe (32)	Albania (1), Austria (1), Belarus (2), Belgium (10), Bosnia Herzegovina (1), Bulgaria (2), Croatia (1), Cyprus (3), Czechia (2), Denmark (3), Finland (3), France (15), Germany (16), Greece (16), Hungary (2), Ireland (7), Italy (204), Lithuania (4), Moldova (1), Netherlands (11), North Macedonia (1), Norway (3), Poland (4), Portugal (69), Romania (8), Serbia (6), Slovenia (3), Spain (88), Sweden (32), Switzerland (11), Ukraine (1), United Kingdom (72)	European Society of Coloproctology (ESCP), German Society for Coloproctology (DGK), International Society of University Colon and Rectal Surgeons (ISUCRS), Italian Society of Colorectal Surgery (SICCR), Portuguese Society of Coloproctology, Portuguese Society of Surgery (SPCIR), Russian Association of Coloproctology, Swedish Society of Colorectal Surgery, Turkish Society of Colon and Rectal Surgery (TKRCD)
Asia (26)	Armenia (1), Azerbaijan (2), Bahrain (2), Bangladesh (2), China (19), India (8), Indonesia (1), Iran (7), Iraq (1), Israel (2), Japan (12), Jordan (1), Malaysia (7), Myanmar (1), Pakistan (8), Philippines (17), Qatar (1), Russia (18), Saudi Arabia (9), Singapore (4), South Korea (4), Sri Lanka (1), Thailand (17), Tunisia (1), Turkey (67) United Arab Emirates (5)	Asia-Pacific Federation of Coloproctology (APFCP), Chinese Society of Coloproctology, International Society of University Colon and Rectal Surgeons (ISUCRS), Korean Society of Coloproctology, Malaysian Society of Colorectal Surgeons (MSCRS), Philippine Society of Colon and Rectal Surgeons (PSCRS), Philippine Society of General Surgeons (PSGS)
North America (6)	Cuba (1), Dominican Republic (1), El Salvador (1), Mexico (17), Panama (2), United States (98)	American Society of Colon and Rectal Surgeons (ASCRS), International Society of University Colon and Rectal Surgeons (ISUCRS)
South America (10)	Argentina (19), Bolivia (1), Brazil (22), Chile (12), Colombia (2), Ecuador (1), Paraguay (3), Peru (4), Uruguay (1), Venezuela (3)	International Society of University Colon and Rectal Surgeons (ISUCRS), LatinAmerican Association of Coloproctology (ALACP), Venezuelan Coloproctology Society
Africa (7)	Egypt (15), Ethiopia (1), Libya (1), Mozambique (1), Nigeria (2), Senegal (1), South Africa (6)	Egyptian Society of Colon and Rectal Surgeons (ESCRS), International Society of University Colon and Rectal Surgeons (ISUCRS), South African Colorectal Society (SACRS)
Oceania (3)	Australia (11), Fiji (1), New Zealand (3)	Asia-Pacific Federation of Coloproctology (APFCP), International Society of University Colon and Rectal Surgeons (ISUCRS)

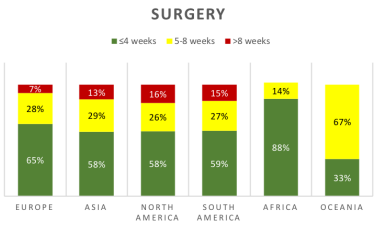


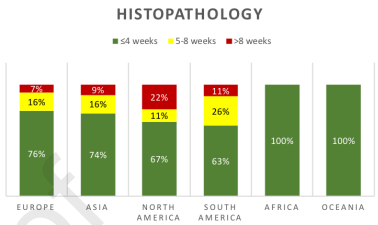


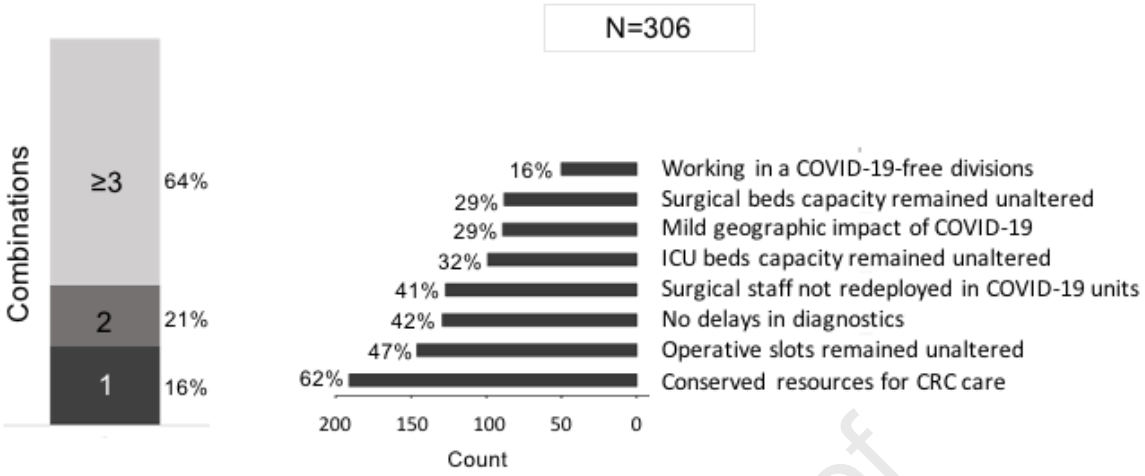












Article Summary

Global changes in both diagnostic and therapeutic practices in colorectal cancer care were evident in this survey conducted to analyze the impact of COVID-19 outbreak. The importance of this finding is that changes were associated with differences in health care delivery systems, hospital's preparedness, resources availability, and local COVID-19 prevalence rather than geographical variations. ~~These findings may help adopting preventing measures during future virus surges.~~