

# CodiReal-PT: National Survey on Current Practices in Right Colon Oncological Surgery\*

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J Coloproctol 2024;44(3):e171–e179.

## Abstract

**Introduction** Colorectal cancer (CRC) is the third most prevalent tumor. Right colon cancer (RCC) comprises one-third of CRC cases and is associated with poorer outcomes, emphasizing the need for optimized treatment strategies. The present study aims to explore the nuances in the management of RCC across Portugal, focusing on surgical approaches and multidisciplinary treatment.

**Materials and Methods** The CodiReal-PT was a cross-sectional survey-based study adhering to the guidelines of the Checklist for Reporting Results of Internet E-Surveys (CHERRIES), focusing on current practices in RCC oncological surgery. The survey comprised 31 questions divided into 4 sections (demographics, multidisciplinary approach, surgery practices regarding RCC, and postoperative management). It was made available via e-mail to all active members of the Portuguese Society of Surgery (Sociedade Portuguesa de Cirurgia, SPCIR, in Portuguese), and data collection lasted from November to December 2022.

**Results** Data from 69% of Portuguese public hospitals was obtained. All the participant hospitals had multidisciplinary team meetings to manage CRC cases. However, 17% ( $n = 6$ ) did not discuss all elective-setting cases during their meetings. Dedicated colorectal surgical teams were present in 86% ( $n = 31$ ) of hospitals. Furthermore, the presence of these dedicated teams was associated with better practices, namely a

## Keywords

- Right Colon Cancer
- oncologic Surgery
- surgery
- Portugal

\* Representing the CodiReal Collaborative, all authors had a hand in conceptualizing and designing the study. José Gonçalves Moreira de Azevedo, Maria João Morais do Carmo Couto de Sousa, and Miguel Fernandes da Conceição Cunha received first authorship recognition for their work in preparing materials, gathering, and analyzing data. José Gonçalves Moreira de Azevedo penned the initial manuscript draft, with all authors contributing revisions to prior versions.

higher volume of right colectomies (mean:  $51.8 \pm 32.6$  versus  $23.8 \pm 4.8$ ;  $p = 0.001$ ), a preference for the laparoscopic approach (93.5 versus 60.0%;  $p = 0.021$ ), and standardization of anastomotic techniques (83.9 versus 40.0%;  $p = 0.029$ ).

**Conclusion** The present nationwide survey-based study provides a comprehensive landscape of RCC management practices across Portugal, underscoring the significant role of dedicated colorectal surgical teams and the need for further practice standardization. Nevertheless, multidisciplinary team meetings in all surveyed hospitals are an important indicator of improved RCC care. Future research should focus on the impact of specific surgical techniques on oncological outcomes and the potential benefits of centralizing care to high-volume centers.

## Introduction

Colorectal cancer (CRC) is the third most prevalent tumor type and the second leading cause of cancer-related mortality.<sup>1</sup> In Portugal, this was the leading cancer diagnosis in 2020 for both genders and accounted for 14.2% of all cancer deaths, making it the second deadliest cancer. Despite the global decrease in CRC mortality, Portugal recorded 4,275 deaths in 2020.<sup>2</sup> Right colon cancer (RCC) comprises approximately  $\frac{1}{3}$  of CRC cases and is typically associated with a poorer prognosis regardless of histological or molecular features.<sup>3–5</sup>

To optimize treatment strategies and improve clinical outcomes for RCC, multidisciplinary teams (MDTs) are recommended. These teams are instrumental in determining each patient's most effective treatment approach.<sup>6–8</sup> The constitution of referral centers can enhance this strategy by leveraging the volume–outcome relationship, which has been associated with reduced mortality.<sup>9,10</sup> Indeed, evidence suggests that high-volume centers and surgeons achieve superior outcomes. Referral also provides additional benefits, such as better access to advanced technology, facilitation of MDT meetings, and promotion of research.<sup>11,12</sup>

Still, the benefits of centralization in CRC are not fully established. Surgery remains the definitive treatment for localized colon cancer and is an option for selected patients with resectable metastatic disease. Minimally invasive techniques, such as laparoscopic and robot-assisted surgery, have been shown to be oncologically equivalent to open surgery, with the added benefit of improved short-term clinical outcomes. Consequently, laparoscopy is considered the standard for treating uncomplicated localized colon cancer when performed by skilled surgeons.<sup>13,14</sup> Regardless of the surgical approach, the aims should be consistent: achieving a R0 resection with appropriate mesocolic excision and central vascular ligation.

Despite the significant role that RCC surgical management plays in Portugal, detailed insights into the practices across the country still need to be provided. Hence, this study aimed to explore RCC management across Portuguese hospitals, including surgical approaches and multidisciplinary treatment of this tumor, to compile data and better inform future national guidelines.

## Materials and Methods

### Study Design and Participants

The CodiReal-PT study, focusing on current practices in right colon oncological surgery, was designed, executed, and described adhering to the guidelines of the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).<sup>15</sup> The authors constructed an anonymous and confidential online survey using the Google Forms (Google LLC., Mountain View, CA, USA) platform. Its content was based on a precedent survey by the Japanese Society for Cancer of the Colon and Rectum, adapted to reflect the Portuguese context.<sup>16</sup>

A preliminary version of the survey underwent refinement by a panel of five experts from the Portuguese Group for Research in Colorectal Cancer (Grupo Português de Investigação em Cancro Colorrectal, PICCO, in Portuguese), a collective striving to unify treatment protocols for colorectal cancer in Portugal and propel innovation through research. These members pretested the survey for usability and technical integrity before dissemination.

An email with the survey link was distributed to all members of the Portuguese Society of Surgery (Sociedade Portuguesa de Cirurgia, SPCIR, in Portuguese),<sup>17</sup> targeting practitioners specialized in colorectal cancer surgery. Participants were required to consent to the retention of their email addresses for a period of 6 months postpublication of the study, with the assurance of confidentiality and the exclusive use of their data for research objectives. Duplicate responses were eliminated through an email verification process. Only one entry from each hospital was considered, with the most experienced surgeon being chosen in case of multiple entries. Survey participation was voluntary, and participants were offered the possibility of being acknowledged as coauthors in subsequent publications stemming from this study. The survey allowed participants to respond at their convenience and included a 'no response' option for each question.

### Survey

The survey comprised 31 questions, organized into four sections. Each section contained no more than ten questions (questionnaire and responses – **Supplementary Table S1**; online only). The initial section included demographic

information, affiliations, and data on participant's professional level. The subsequent sections explored general practices, specific approaches to right colon cancer surgery, and postoperative management protocols.

Data collection spanned from November 13 to December 14, 2022.

### Statistical Analysis

We performed statistical evaluations using the IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, USA), version 26.0, with a significance threshold set at 5%. Numerical variables' adherence to a normal distribution was informally appraised using histogram analyses.

Descriptive statistics were presented as means and standard deviations, while categorical data were expressed in proportions. Association between variables was studied using the independent-sample Mann-Whitney U-test for continuous variables and Chi-squared tests for categorical data.

Further examinations considered factors such as per hospital and surgeon procedure volumes, delineated by thresholds for oncological colorectal surgeries and the presence and size of dedicated units. A cut-off of 100 surgeries per hospital and 10 per surgeon per year was used to define the volumes.<sup>11,12</sup>

### Ethical Considerations

The study did not require Institutional Review Board approval as it did not involve collecting patients' clinical data. Informed consent was obtained from all participants before survey completion, per the CHERRIES guidelines.<sup>15</sup>

## Results

### Survey Participation

A total of 65 surgeons from 36 Portuguese hospitals participated in the survey. From those hospitals, 33 were public, representing a 69% (18) coverage of Portuguese public hospitals. ►**Fig. 1** illustrates the geographic distribution of the participating hospitals, and a detailed list can be found in the ►**Supplementary Table S2** (online only). The Lisbon region boasted the highest number of participating hospitals.

### Colorectal Cancer Management Practices

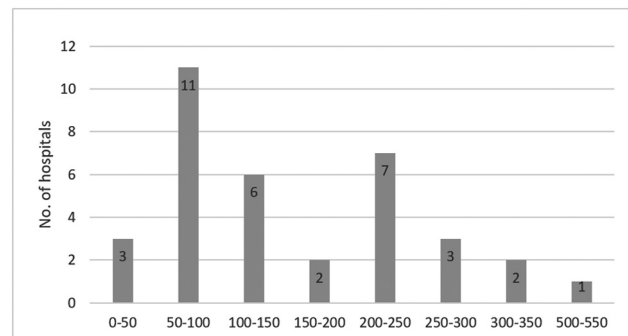
Over half of the survey respondents (55%) were consultants with more than a decade of professional experience, as depicted in the ►**Supplementary Table S2**. Every surveyed hospital reported having a multidisciplinary team (MDT) to manage colorectal cancer cases, and most hospitals (92%; 33) had team meetings on a weekly basis. However, 17% of the hospitals who reported having MDT meetings do not discuss all elective setting cases of colorectal cancer during them.

The number of colorectal oncologic surgeries performed annually varied across hospitals. About 45% of the hospitals conducted between 50 and 150 surgeries per year, as shown in ►**Fig. 2**. Higher volumes were typically noted in larger urban centers.

Concerning the surgical approach, most hospitals (28; 78%) performed the majority (> 60%) of their procedures in



**Fig. 1** Locations of the participating hospitals.



**Fig. 2** Number of colorectal oncologic surgeries performed by each hospital annually.

elective settings. Although open surgery is considered an option for selected patients in 60% of hospitals, 92% of them perform more than 50% of procedures using laparoscopy. Only two private hospitals reported using robotic surgery in the elective setting, for less than 40% of their procedures.

Notably, 86% of hospitals have dedicated colorectal surgical teams, most often comprising 4 to 6 surgeons. However, it was observed that several surgeries were still not performed by specialized colorectal teams.

### Subanalysis per Surgical Volume

►**Table 1** details the subanalysis per hospital and surgeon surgical volume. When categorizing hospitals based on a threshold of 100 colorectal oncologic surgeries performed annually, 46% fell below this volume. A noteworthy disparity was found: 31.3% of lower-volume hospitals lacked a dedicated colorectal group, while all higher-volume hospitals had such specialized teams ( $p=0.008$ ). On an individual level,

**Table 1** Comparison between colorectal surgery volume (Hospital and Surgeon)

	<i>Hospital volume</i>			<i>Colorectal surgeon volume (surgeries)</i>		
	< 100 colorectal surgeries per year (n = 16)	> 100 colorectal surgeries per year (n = 19)	*p-value	< 10 (n = 10)	≥ 10 (n = 19)	*p-value
<b>Number of colorectal surgeries (mean)</b>	62.19 ± 23.8	216.32 ± 88.4	<b>0.001</b>	**NA	**NA	
<b>Open approach: n (%)</b>			0.367			0.206
0–20%	5 (31.3)	8 (42.1)		1 (10.0)	8 (42.1)	
21–40%	4 (25.0)	8 (42.1)		5 (50.0)	6 (31.6)	
41–60%	5 (31.3)	3 (15.8)		4 (40.0)	5 (26.3)	
61–80%	1 (6.3)	–		–	–	
81–100%	1(6.3)	–		–	–	
Do not know	–	–		–	–	
<b>Laparoscopic approach: n (%)</b>			0.380			0.860
0–20%	2 (12.5)			–	–	
21–40%	1 (6.3)			–	1 (5.3)	
41–60%	5 (31.3)	7 (36.8)		5 (50.0)	8 (42.1)	
61–80%	3 (18.8)	6 (31.6)		3 (30.0)	5 (26.3)	
81–100%	5 (31.3)	6 (31.6)		2 (20.0)	5 (26.3)	
Do not know	–	–		–	–	
<b>Robotic approach: n (%)</b>			0.409			
0–20%	14(87.5)	15 (79.0)		10 (100)	14(73.7)	
21–40%	–	2 (10.5)		–	2 (10.6)	
41–60%	–	–		–	–	
61–80%	–	–		–	–	
81–100%	–	–		–	–	
Do not know	2 (12.5)	2 (10.5)		–	2 (10.6)	
<b>Hospital with colorectal surgery dedicated group: n (%)</b>			<b>0.008</b>	**NA	**NA	
Yes	11(68.8)	19 (100)		–	–	
No	5 (31.3)	–		–	–	
Do not know	–	–		–	–	
<b>Right colon cancer surgery</b>						
<b>Number</b>	23.67 ± 2.1	68.17 ± 30.4	<b>0.001</b>	**NA	**NA	
<b>Preferable approach: n (%)</b>			0.068			0.295
Open	3 (18.8)	–		1 (10.0)	–	
Laparoscopic	12 (75.0)	19 (100)		9 (90.0)	18 (94.7)	
Robotic	–	–		–	–	
Do not know / Prefer not to answer	1 (6.3)	–		–	1 (5.3)	
<b>Do you routinely resect the Gillot surgical stump? (duodenal window): n (%)</b>			0.664			<b>0.003</b>
Yes	10 (62.5)	9 (47.4)		2 (20.0)	12 (63.2)	
No	4 (25.0)	7 (36.8)		3 (30.0)	7 (36.8)	
Did not answer / Prefer not to answer	2 (12.5)	3 (15.8)		5 (50.0)	–	

**Table 1** (Continued)

	Hospital volume		*p-value	Colorectal surgeon volume (surgeries)		
	< 100 colorectal surgeries per year (n = 16)	> 100 colorectal surgeries per year (n = 19)		< 10 (n = 10)	≥ 10 (n = 19)	*p-value
Does your institution have a standard anastomosis type? – n (%)			0.782			0.197
Yes	12 (75.0)	15 (79.0)		9 (90.0)	13 (68.4)	
No	4 (25.0)	4 (21.1)		1 (10.0)	6 (31.6)	
Anastomosis usually performed: n (%)			0.554			0.765
Side-to-side (manual)	–	1 (5.3)		–	1 (5.3)	
Side-to-side (mechanical)	15 (93.8)	15 (79.0)		9 (90.0)	15 (79.0)	
End-to-side (mechanical)	1 (6.3)	2 (10.6)		1 (10.0)	2 (10.6)	
Other	–	1 (5.3)		–	1 (5.3)	
Laparoscopic right hemicolectomy anastomosis: n (%)			0.553			0.009
Intracorporeal	6 (37.5)	8 (42.1)		8 (80.0)	4 (21.1)	
Extracorporeal	9 (56.3)	10 (52.6)		2 (20.0)	14 (73.7)	
Both	–	1 (5.3)		–	1 (5.3)	
Did not answer / Prefer not to answer	1 (6.3)	–		–	–	

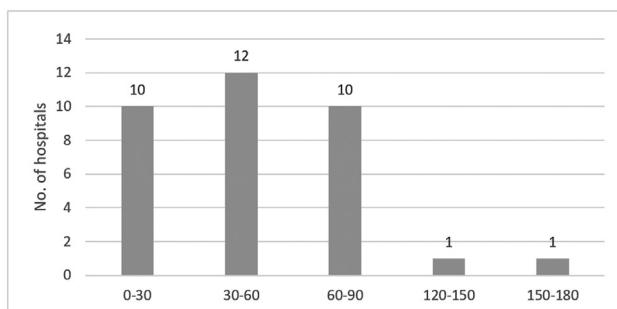
**Notes:** \*Descriptive statistics were expressed as mean and standard deviation values, while categorical data were expressed as proportions. The associations among the variables were studied using the independent-sample Mann-Whitney U-test for continuous variables and Chi-squared tests for categorical data. \*\*Not applicable.

35% of surgeons performed less than 10 colorectal oncologic resections per year.

### Right Colon Cancer Surgical Approaches

In total, 28% (10) of the hospitals conducted less than 30 right colectomies annually. On the other hand, the same number of hospitals (10; 28%) reported the performance of up to 90 procedures annually (►Fig. 3). Most right colectomies were performed laparoscopically, as reported in ►Fig. 4.

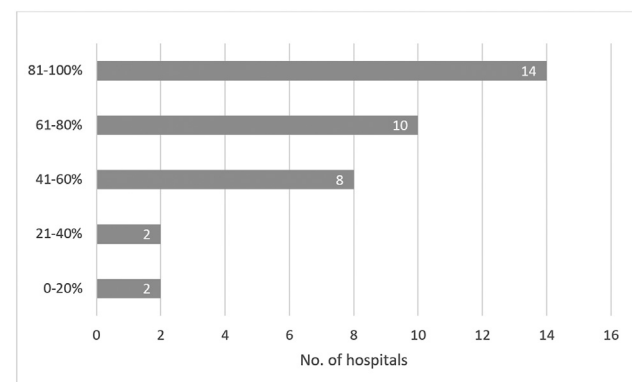
Only 31% routinely included the resection of the Gillot surgical trunk (duodenal window). Surgeons performing more than 10 oncologic surgeries annually were more likely to include this technique compared with those performing fewer procedures (63.2 versus 20.0%;  $p = 0.003$ ), as shown in ►Table 2.



**Fig. 3** Number of right hemicolectomies performed per hospital annually.

Regarding anastomosis techniques, 78% (28) of the hospitals employed a standard type, with 86% favoring a mechanical side-to-side technique. For laparoscopic procedures, 53% (19) of the hospitals managed the anastomosis extracorporeally.

Further comparison revealed that hospitals with dedicated colorectal surgery teams reported a higher volume of right colectomies ( $51.8 \pm 32.6$  versus  $23.8 \pm 4.8$ ;  $p = 0.001$ ) and a preference (93.5 versus 60.0%;  $p = 0.021$ ) for using a laparoscopic approach for right colon cancer (►Table 2). Standardization of anastomotic techniques was more common in hospitals with dedicated teams compared with those without (83.9 versus 40.0%;  $p = 0.029$ ).



**Fig. 4** Percentage of right colectomies performed by laparoscopy.

**Table 2** Comparison between colorectal surgery dedicated group

	<i>Dedicated group</i>		<i>*p-value</i>
	Yes ( <i>n</i> = 31)	No ( <i>n</i> = 5)	
<b>Number of colorectal surgeries: mean <math>\pm</math> standard deviation</b>	<b>162 <math>\pm</math> 102</b>	<b>49 <math>\pm</math> 19.5</b>	<b>0.001</b>
Open approach: <i>n</i> (%)			0.107
0–20%	12 (38.7)	1 (20.0)	
21–40%	11 (35.5)	1 (20.0)	
41–60%	7 (22.6)	2 (40.0)	
61–80%	–	1 (20.0)	
81–100%	1 (3.2)	–	
Do not know	–	–	
Laparoscopic approach: <i>n</i> (%)			0.620
0–20%	1 (3.2)	1 (20.0)	
21–40%	1 (3.2)	–	
41–60%	11 (35.5)	2 (40.0)	
61–80%	8 (25.8)	1 (20.0)	
81–100%	10 (32.3)	1 (20.0)	
Do not know	–	–	
Robotic approach: <i>n</i> (%)			0.409
0–20%	27 (87.1)	3 (60.0)	
21–40%	2 (6.5)	–	
41–60%	–	–	
61–80%	–	–	
81–100%	–	–	
Do not know	2 (6.5)	2 (40.0)	
<b>Right colon cancer surgery</b>			
<b>Number: mean <math>\pm</math> standard deviation</b>	<b>51.8 <math>\pm</math> 32.6</b>	<b>23.8 <math>\pm</math> 4.8</b>	<b>0.001</b>
<b>Preferable approach: <i>n</i> (%)</b>			<b>0.021</b>
Open	2 (6.5)	2 (40.0)	
Laparoscopic	29 (93.5)	3 (60.0)	
Robotic	–	–	
Do not know/Prefer not to answer	–	–	
<b>Vessel routinely ligated in right colon cancer surgery: <i>n</i> (%)</b>			<b>0.698</b>
Ileocolic vessels	2 (6.5)		
Right colic vessels (if present)	–	–	
Right branch of middle colic vessels	–	–	
Middle colic vessels	–	–	
All of the above	29 (93.5)	5 (100.0)	
Do not answer/Prefer not to answer			
<b>Do you routinely resect the Gillot surgical stump? (duodenal window) : <i>n</i> (%)</b>			<b>0.369</b>
Yes	10 (32.3)	1 (20.0)	
No	15 (48.4)	4 (80.0)	
Do not answer/Prefer not to answer	6 (19.4)	–	



**Table 2** (Continued)

	<i>Dedicated group</i>		<i>*p-value</i>
	Yes ( <i>n</i> = 31)	No ( <i>n</i> = 5)	
Number of colorectal surgeries: mean $\pm$ standard deviation	162 $\pm$ 102	49 $\pm$ 19.5	0.001
Does your institution have a standard anastomosis type? – <i>n</i> (%)			0.029
Yes	26 (83.9)	2 (40.0)	
No	5 (16.1)	3 (60.0)	
Anastomosis usually performed: <i>n</i> (%)			0.817
Side-to-side (Manual)	1 (3.2)	–	
Side-to-side (mechanical)	26 (83.9)	5 (100.0)	
End-to-side (mechanical)	3 (9.7)	–	
Other	1 (3.2)	–	
Laparoscopic right hemicolectomy anastomosis: <i>n</i> (%)			0.617
Intracorporeal	14 (45.2)	1 (20.0)	
Extracorporeal	15 (48.4)	4 (80.0)	
Both	1 (3.2)	–	
Do not answer/Prefer not to answer	1 (3.2)	–	

**Notes:** \*Descriptive statistics were expressed as mean and standard deviation values, while categorical data were expressed as proportions. The associations among the variables were studied using the independent-sample Mann-Whitney U-test for continuous variables and Chi-squared tests for categorical data.

### Follow-Up Protocols

Between 75 and 92% of the hospitals followed a standardized anatomopathological reporting protocol and conducted postoperative multidisciplinary meetings, respectively. In situations where adjuvant treatment was not indicated, follow-up was managed surgically for 66% of patients, spanning a 5-year period for 78%. A uniform follow-up protocol involving tumor markers, such as carcinoembryonic antigen (CEA), computed tomography (CT), and colonoscopy was adopted by 72% of the hospitals.

### Discussion

The significance of this nationwide survey-based study lies in its broad representation of RCC management practices across Portuguese hospitals, a crucial endeavor given this tumor's considerable contribution to colorectal cancer morbidity and mortality in Portugal. The proposed emphasis is pertinent, considering its poorer prognosis and the potential to enhance patient outcomes through optimized strategies, such as the inclusion of multidisciplinary teams and surgical centralization.

The main results of this survey-based study reveal that, while most hospitals have multidisciplinary team meetings and adhere to standard follow-ups. All higher-volume hospitals had such specialized teams. Indeed, the presence of dedicated colorectal surgical teams was associated with the preference for minimally invasive surgical approaches, and the adoption of a standard anastomosis type. Still, the surgeon's annual volume of oncologic surgeries also played

an important role, as it was associated with the Gillot trunk resection.

A detailed examination of these results indicates several noteworthy observations. First, the universal establishment of MDTs across surveyed hospitals is a positive step towards comprehensive RCC care. However, the variation present in elective cases suggests there's room for standardizing MDT functionalities to ensure all patients benefit from this multidisciplinary insight. This observation dovetails with studies underscoring the importance of consistent evaluations for improving CRC management outcomes.<sup>18</sup> Also, the consistent adoption of standard follow-up protocols points toward a well-structured postoperative care framework. Recent studies emphasize the importance of a structured follow-up in detecting recurrences early and improving long-term survival, suggesting that a unified protocol could improve patient outcomes.<sup>18</sup>

Second, the findings of this study align with previous research advocating for the centralization of surgical care and the utilization of high-volume centers to leverage the volume-outcome relationship.<sup>11,12</sup>

Undoubtedly, high-volume of surgeries both per hospital and per surgeon were associated with the best practices. This was evidenced by the superior performance of high-volume hospitals in terms of dedicated teams, right colectomy volumes, and the preference for laparoscopic approaches. Moreover, the Gillot trunk resection showed a significant variance based on surgeons' annual volume of oncologic procedures.

Concerning the surgical approach to RCC, laparoscopy is a practice supported by the literature that offers oncological

equivalency to open surgery with the added benefits of improved short-term outcomes.<sup>14,19</sup>

The widespread adoption of laparoscopy, particularly in high-volume centers with dedicated teams, exemplifies the ongoing shift toward minimally invasive surgeries in RCC treatment. This shift is crucial not only for patient recovery but also for aligning with global best practices in colorectal surgery.

One of the primary limitations of our study stems from its reliance on self-reported survey data. While these surveys offer a valuable snapshot of practices across a wide geographic and institutional spectrum, they may also introduce bias, such as recall or social desirability bias. Additionally, the exclusion of duplicate responses from the same hospital, while done with the intention of avoiding overrepresentation, may inadvertently limit the diversity of surgical opinions and experiences in our findings. Another limitation is the cross-sectional design, which captures practices at a single point in time and inherently limits our ability to draw causal inferences. Our study also did not fully explore the reasons behind the preference for or against certain surgical techniques, such as the Gillot trunk resection, which could provide deeper insights into optimizing surgical care.

Despite these limitations, the present study boasts significant strengths that contribute valuable insights to the field of colorectal cancer management. One of the foremost strengths is its national coverage of the survey, with a high response rate across Portugal, encompassing a broad spectrum of public and private hospitals. This wide representation offers a comprehensive overview of current practices and highlights, as well as variations in care that are crucial for guiding future improvements and standardizations in RCC management. Moreover, the study's emphasis on detailed surgical techniques, such as laparoscopic approaches and the Gillot trunk resection, against the backdrop of hospital volume and the presence of dedicated colorectal surgical teams, provides specific, actionable data. These insights are instrumental in advocating for the adoption of best practices and the centralization of care to improve patient outcomes.

## Conclusion

In conclusion, this study provides valuable insights into the current landscape of RCC management in Portugal, highlighting the critical role of dedicated colorectal surgical teams and the benefits of centralizing care. While progress is evident, areas for improvement remain, particularly in standardizing MDT discussions and surgical practices.

### Authors' Contributions

All authors contributed to the study's conception and design. J.G.M.A., M.J.M.C.C.S., and M.F.C.C. are joint first authors, having prepared the materials, collected data, and analyzed them. J.G.M.A. wrote the first draft of the manuscript, and all authors commented on previous versions. All authors read and approved the final manuscript. The Supplementary Material cites all the CodiReal collaborators and responders.

### Data Availability

The authors confirm that the data supporting this study's findings are available in the article and its supplementary materials. Additional data supporting the findings are available from the corresponding author upon reasonable request.

### Ethical Approval

This study was performed in line with the principles of the Declaration of Helsinki. The study did not require Institutional Review Board approval as it did not involve collecting patient clinical data.

### Informed Consent

Informed consent was obtained from all participants before survey completion, per the CHERRIES guidelines adherence requirement.

### Funding

The authors declare that they have not received funding from agencies in the public, private or non-profit sectors to conduct the present study.

### Conflict of Interests

The authors have no conflict of interests to declare.

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