

# Uptake and barriers for implementation of the resect and discard strategy: an international survey



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## Supplementary material

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## ABSTRACT

**Background and study aims** Optical real-time diagnosis (= resect-and-discard strategy) is an alternative to histopathology for diminutive colorectal polyps. However, clinical adoption of this approach seems sparse. We were interested in evaluating potential clinical uptake and barriers for implementation of this approach.

**Methods** We conducted an international survey using the “Google forms” platform. Nine endoscopy societies distributed the survey. Survey questions measured current clinical uptake and barriers for implementing the resect-and-discard strategy, perceived cancer risk associated with diminutive polyps and potential concerns with using CT-colonography as follow-up, as well as non-resection of diminutive polyps.

**Results** Eight hundred and eight endoscopists participated in the survey. 84.2% (95% CI 81.6%–86.7%) of endoscopists are currently not using the resect-and-discard strategy and 59.9% (95% CI 56.5%–63.2%) do not believe that the resect-and-discard strategy is feasible for implementation in its current form. European (38.5%) and Asian (45%) endoscopists had the highest rates of resect-and-discard practice, while Canadian (13.8%) and American (5.1%) endoscopists had some of the lowest implementation rates. 80.3% (95% CI 77.5%–83.0%) of endoscopists believe that using the resect-and-discard strategy for diminutive polyps will not increase cancer risk. 48.4% (95% CI 45.0%–51.9%) of endoscopists believe that leaving diminutive polyps in place is associated with increased cancer risk. This proportion was slightly higher (54.7%; 95% CI 53.6%–60.4%) when asked if current CT-colonography screening practice might increase cancer risks.

**Conclusion** Clinical uptake of resect-and-discard is very low. Most endoscopists believe that resect-and-discard is not feasible for clinical implementation in its current form. The most important barriers for implementation are fear of making an incorrect diagnosis, assigning incorrect surveillance intervals and medico-legal consequences.

\* These authors contributed equally.

## Introduction

Diminutive polyps ( $\leq 5$  mm) are the most common types found during colonoscopies [1]. Their histopathologic examination is costly while their potential for malignancy is low [1–3]. Because diminutive polyps have such a low risk for harboring or progressing to cancer it might be reasonable to forgo histopathology in favor of less costly strategies. Image enhanced endoscopy can be used for real-time optical diagnosis of colorectal polyps. Validated classification systems based on color, vascular pattern and other criteria have been developed to determine if a polyp is neoplastic or not. The approach of replacing histopathology with optical diagnosis has been named the resect-and-discard strategy [4–7]. Studies have shown that in the hands of adequately trained endoscopists, real-time optical diagnosis provides a good alternative to pathology while being more cost-effective [8,9]. Consequently, multiple gastroenterology societies have recommended adopting resect-and-discard as part of screening programs if certain quality standards can be met [10–12]. Clinical implementation of this approach, however, seems sparse.

We were therefore interested in evaluating the current clinical uptake and barriers for implementation of the resect-and-discard strategy, understanding the perceived cancer risk for diminutive polyps among endoscopists and potential concerns with leaving diminutive polyps unresected or with using computed tomography-colonography in screening and surveillance.

## Methods

The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) criteria was used to present the results of our survey [13].

### Study design

A cross-sectional international survey study was conducted. Target population were endoscopists with active colonoscopy practice regardless of profession, case-load, or experience. The survey was developed through discussion and consensus between 3 gastroenterologists (H.P., A.B., D.vR.). The study protocol and survey were approved by the CRCHUM Institutional Review Board (CER-number: 17.063). No personal information was collected or stored during the survey.

### Recruitment process

Twenty-nine Gastroenterology, Endoscopy and Surgical associations were contacted between July 2017 and May 2018 (**Table S1**). These associations were asked to send our online survey to their members using their mailing list, newsletter or social media (Twitter and Facebook). Survey participation was on a voluntary basis. The survey was advertised as taking a total of 3 minutes to complete. No monetary or non-monetary incentives were provided for the completion of our survey. Double clicking was allowed, results were only transmitted to the database if the participant clicked on survey completed at the end of the questionnaire. The survey advertisement text is available in **Appendix 1**.

## Survey content

We used “Google Forms” to administer an online questionnaire comprising 26 questions distributed on five pages (**Appendix 2**). The questions were listed in the same order for all participants. Participants were able to return to previous pages to modify their answers. The survey was only accessible through the link provided to the contacted associations.

The primary outcome was endoscopist uptake of the resect-and-discard strategy in current clinical practice. Secondary outcomes included perceived feasibility and barriers to implementation for a resect-and-discard strategy; perceived cancer risk for resect-and-discard implementation; perceived cancer risk for diminutive polyps; concerns with leaving diminutive polyps unresected; and the perceived cancer risk of adopting computed tomography (CT) colonography as primary screening and surveillance strategy.

The survey collected information on participant demographics and practice setting data including the country of practice; private, academic or mixed practice setting; training specialty; years in practice; number of yearly colonoscopies performed and practice reimbursement. The survey further assessed participants’ knowledge of the existence of the resect-and-discard strategy; current practice implementation and barriers for implementation of a resect-and-discard approach; opinion on cancer risk associated with diminutive polyps and the resect-and-discard strategy; as well as usage of forceps/snare for different polyp types. The survey questions with possible answer options can be found in **Appendix 2**.

### Statistical analysis

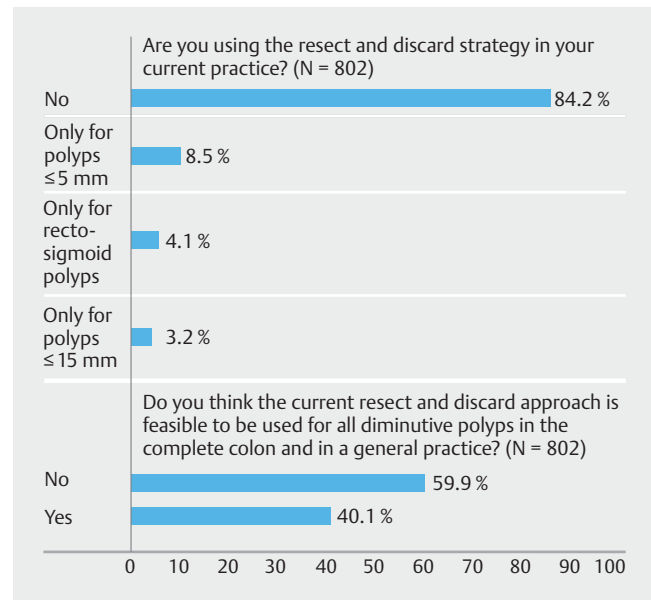
We used descriptive analysis with frequency and percentages to describe the participant’s characteristic and their answers. To examine the association between participant characteristics and survey responses, we used univariate using chi square test and multivariate analysis using multilevel logistic regression model. A two-tailed  $P < 0.05$  was considered significant. For statistical analysis, SPSS 25 (Chicago, Illinois, United States) was used.

## Results

The survey was distributed by nine associations (**Table S2**). We estimated that a total of 13,818 individuals were reached through emails based on the feedback we received regarding societies’ mailing lists. An additional 8,991 individuals were reached through social media. This number was estimated by the number of unique views from our posts on social media pages or the number of people following the page at the time of the post if the number of unique views was not accessible. This resulted in a distribution to 21,807 individuals, not considering individuals that could be members of more than one association. Overall, 808 responders participated in the survey. The response rate was 3.7%. Most of the responses received were from the ACG mailing list (459/808 responders). Response rate from ACG members was 3.8%, which was similar to the overall

► **Table 1** Characteristic of survey participants.

Characteristics	Responses (n = 808)
<b>Country of practice</b>	<b>N (%)</b>
▪ United States of America	454 (56.2)
▪ Europe	92 (11.4)
▪ Canada	80 (9.9)
▪ Asia	61 (7.5)
▪ South/Central America	55 (6.8)
▪ Australia/New Zealand	29 (3.6)
▪ Other	25 (3.1)
▪ Missing	12 (1.5)
<b>Practice setting</b>	
▪ Private	308 (38.1)
▪ Academic	233 (28.8)
▪ Community Hospital	133 (16.5)
▪ Mixed	126 (15.6)
▪ Missing	8 (1.0)
<b>Training and level</b>	
▪ Gastroenterologist	682 (84.4)
▪ Resident/Fellow in training	50 (6.2)
▪ General Surgeon	38 (4.7)
▪ Colorectal Surgeon	14 (1.7)
▪ Internal Medicine	10 (1.2)
▪ Nurse Endoscopist	6 (0.7)
▪ Missing	8 (1.0)
<b>Years in practice</b>	
▪ Less than 10 years	373 (46.2)
▪ Between 10–20 years	166 (20.5)
▪ More than 20 years	258 (31.9)
▪ Missing	11 (1.4)
<b>Colonoscopies performed each year</b>	
▪ Less than 100	33 (4.1)
▪ 100–300	151 (18.7)
▪ 301–500	163 (20.2)
▪ More than 500	454 (56.2)
▪ Missing	7 (0.9)
<b>Practice reimbursement</b>	
▪ Fee per colonoscopy procedure	368 (45.5)
▪ Salary	266 (32.9)
▪ Mixed	165 (20.4)
▪ Missing	9 (1.1)

► **Fig. 1** Endoscopist usage of resect-and-discard strategy and perceptions of feasibility.

response rate of 3.7% using newsletter, mailing list and social medias ( $P=0.96$ ).

### Endoscopist demographics

The majority of survey participants were from the United States (56.2%), Europe (11.4%) and Canada (9.9%). Most participants were Gastroenterologists (84.4%). Endoscopist practice setting was private (38.1%), academic (28.8%), and community-based (16.5%). 45.5% of endoscopists were reimbursed on a fee-for-service and 32.9% on a salary basis. More details provided in ► **Table 1**.

### Attitudes and practices with regards to a resect-and-discard strategy

84.2% (95% CI 81.6%–86.7%) of endoscopists were not using the resect-and-discard strategy at the time of the survey, while 59.9% (95% CI 56.5%–63.2%) did not believe such an approach was feasible for implementation (► **Fig. 1**). However, 80.3% (95% CI 77.5–83.0%) of endoscopists believed that using a resect-and-discard strategy for diminutive polyps would not lead to an increased cancer risk for patients. Practicing in Canada (OR=0.25; 95%CI 0.12–0.51) and in the United States (OR=0.09; 95%CI 0.05–0.14) were factors that were statistically significantly associated with not practicing a resect-and-discard strategy in the multivariate analysis (► **Table 2**).

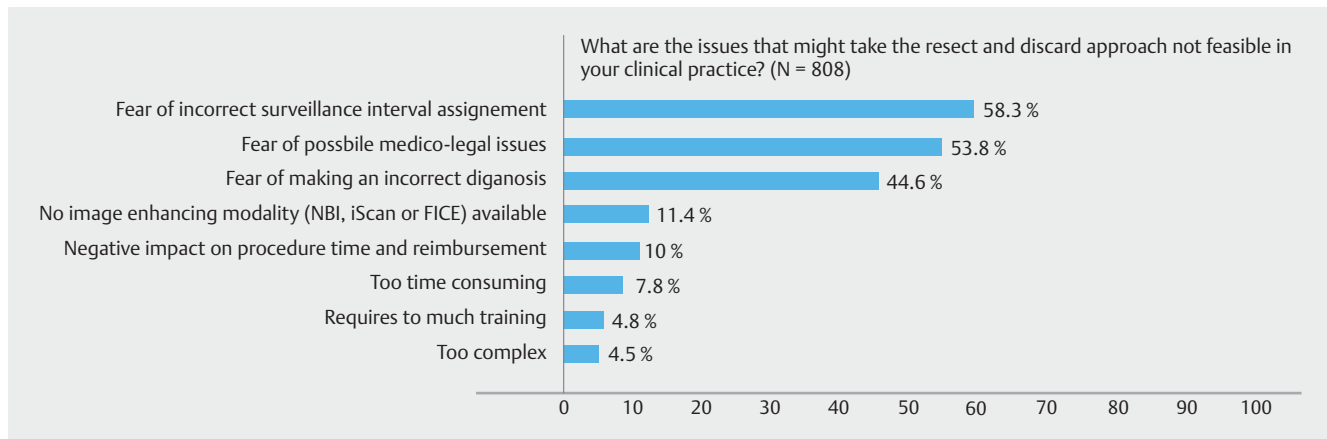
When stratified by region, the majority of endoscopists (range: 75.4–90.1%) replied that they had heard of the resect-and-discard strategy, however, most were not using it in their current practice (range: 55–94.9%). European (38.5%) and Asian (45%) endoscopists had the highest rates of resect-and-discard implementation, while Canadian (13.8%) and American (5.1%) endoscopists displayed lower rates. When asked if this strategy would be feasible in general practice most endos-

► **Table 2** Comparison of demographic characteristics between survey participants who use resect-and-discard in their current practice and those who don't.

Use of the resect-and-discard	Yes <sup>1</sup> n, (%)	No n, (%)	univariate analysis	multivariate analysis (OR)
Country of practice			0.01	
▪ Australia/New Zealand	5 (17.2%)	24 (82.7%)		n.s.
▪ Canada	11 (13.7%)	69 (86.3%)		0.25 (0.12; 0.51)
▪ United States	23 (5.1%)	431 (94.9%)		0.09 (0.05; 0.14)
▪ Asia	27 (45.0%)	33 (55.0%)		n.s.
▪ Europe	35 (38.5%)	56 (61.5%)		n.s.
▪ South/Central America	13 (23.6%)	42 (76.4%)		n.s.
▪ Other	9 (44.0%)	14 (56.0%)		n.s.
Practice setting			0.40	
▪ Academic	39 (16.7%)	194 (83.3%)		n.s.
▪ Community hospital	23 (17.4%)	109 (82.6%)		n.s.
▪ Private	41 (13.3%)	267 (86.7%)		n.s.
▪ Mixed	24 (18.4%)	102 (81.6%)		n.s.
Training and level			0.30	
▪ Gastroenterologist	104 (15.3%)	577 (84.7%)		n.s.
▪ Colorectal surgeon	4 (28.6%)	10 (71.4%)		n.s.
▪ General surgeon	8 (21.6%)	29 (78.4%)		n.s.
▪ Internal medicine	3 (30.0%)	7 (70.0%)		n.s.
▪ Nurse endoscopist	1 (16.7%)	5 (83.3%)		n.s.
▪ Resident/fellow	7 (14.0%)	43 (86.0%)		n.s.
Years in practice			0.01	
▪ <10	72 (19.4%)	300 (80.6%)		n.s.
▪ 10–20	23 (13.9%)	142 (86.1%)		n.s.
▪ >20	30 (11.6%)	228 (88.4%)		n.s.
Colonoscopies per year			<0.01	
▪ <100	12 (36.4%)	21 (63.6%)		n.s.
▪ 100–300	32 (21.2%)	119 (78.8%)		n.s.
▪ 301–500	26 (16.0%)	136 (84.0%)		n.s.
▪ >500	57 (12.6%)	396 (87.4%)		n.s.
Procedure reimbursement			0.01	
▪ Fee per procedure	45 (12.2%)	323 (87.8%)		n.s.
▪ Salary	47 (17.7%)	219 (82.3%)		n.s.
▪ Mixed	34 (20.9%)	129 (79.1%)		n.s.

n.s., not statistically significant

<sup>1</sup> Includes people who answered yes for polyps up to 5 mm, yes for polyps up to 10 mm and yes for rectosigmoid polyps only



► **Fig. 2** Endoscopist perception of reasons for resect-and-discard non-feasibility. Multiple answers were allowed.

copists replied “no” with the exception of European endoscopists, 54.3% of whom replied “yes”. There was geographic agreement that resect-and-discard did not increase patient cancer risk (**Table S3**).

When asked about barriers for implementation of a resect-and-discard strategy 44.6% of participants (95% CI 41.1–48.0%) were afraid of making a wrong diagnosis, 53.8% (95% CI 50.4–57.3%) were concerned of potential medico-legal issues and 58.3% (95% CI 54.9–61.7%) were afraid of assigning incorrect surveillance intervals to patients (► **Fig. 2**). For American endoscopists, the most important issue preventing implementation of a resect-and-discard strategy was fear of medico-legal issues (67.2%), which was significantly more than the rest of the world (37.7%;  $P < 0.001$ ). Fear of making a wrong diagnosis was the main barrier for the majority of endoscopists from Australia/New Zealand (60%) and Asia (37.7%). For the rest of the world, fear of incorrect surveillance interval assignment was the most important issue (**Table S4**).

### Perception of cancer risk associated with diminutive polyps

Overall, 63.0% of survey participants partly or completely agreed that diminutive polyps can be left unresected until the next screening colonoscopy because of a low associated cancer risk. Endoscopists were however evenly split on the effects of leaving such polyps unresected with regards to patient cancer risk, with 48.4% (95% CI 45.0%–51.9%) thinking that leaving diminutive polyps in place would increase the cancer risk of patients (► **Table 3**).

When stratified by region, only 20% of participants from Australia/New Zealand partly or completely agreed that diminutive polyps can be left unresected until the next screening colonoscopy, in contrast to participants from all other regions where between 58.2 and 68% partly or completely agreed that this approach was safe. The majority of endoscopists from the United States (51.3%), Asia (59.0%) and South/central America (54.5%) thought that leaving diminutive polyps in place could increase cancer risk. In contrast, most European (58.2%) and

Canadian (63.3%) endoscopists thought that this was not so (**Table S5**).

There was no consensus on appropriate follow-up after leaving diminutive polyps in place. 61.1% of North American endoscopists chose a maximum of 5-year follow-up after unresected diminutive polyps compared to other regions where 74.4% chose a 3-year or less maximum follow-up ( $P < 0.001$ ). Endoscopists from the United States (12.5%) and Canada (10.1%) had much higher rates of recommending the maximum option of 10-year follow-up after unresected diminutive polyps. When stratified by profession (Gastroenterologist, surgeon, internist, nurse endoscopist), 50.3% of gastroenterologists chose a maximum of 5-year follow-up and 73.5% of other specialties chose a maximum of 3-years or less follow-up when leaving diminutive polyps unresected ( $P = 0.003$ ).

### Perceptions of non-resection of diminutive polyps and use of CT-Colonography

Overall, 52% of endoscopists were leaving non-adenomatous appearing diminutive polyps in place in their current practice. Geographical distribution was very variable: between 37.7% (Asia) and 80.0% (Australia/ New Zealand) of endoscopists responded that they were leaving non-adenomatous appearing diminutive polyps in place in their current practice (**Table S5**).

Of the surveyed endoscopists, 54.7% (95% CI 53.6–60.4%) thought that current CT-colonography guidelines were “probably” or “definitely” putting patients at higher cancer risk (► **Table 4**). When stratified by region, the majority of American, European, Asian and South/Central American endoscopists agreed with that statement versus a minority of Canadian (32.5%) and Australian/New Zealand (20%) endoscopists.

### Discussion

To our knowledge, our study represents the largest international survey available to date studying endoscopist opinion on resect-and-discard and diminutive polyps. It is also the first providing data on geographic differences in endoscopist attitudes

► **Table 3** Endoscopist perceptions on the cancer risk of diminutive polyps.

Questions <sup>1</sup>	Responses; N (%)	
Do you think that leaving diminutive polyps increases the risk of cancer of patients?	N = 797	
No	411	(51.6)
Yes	386	(48.4)
Cancer risk in a diminutive polyp is so low that such polyp can be left unresected until the next follow-up colonoscopy	N = 803	
I agree	101	(12.6)
I partly agree	405	(50.4)
I partly disagree	129	(16.1)
I completely disagree	168	(20.9)
If you leave a diminutive polyp unresected, the next colonoscopy should be within a maximum of	N = 790	
1 year	92	(11.6)
3 years	245	(31.0)
5 years	383	(48.5)
10 years	70	(8.9)
Do you leave diminutive polyps (up to 5 mm) in place in your current practice?	N = 808	
Sometimes	370	(45.8)
In the majority of cases	51	(6.3)
Always	4	(0.5)
If appearance of the polyp suggests it is non-adenomatous	420	(52.0)
If patient is on anticoagulation medication	170	(21.0)
If patient has severe comorbidities	161	(19.9)
If follow-up colonoscopy already scheduled	98	(12.1)
<sup>1</sup> Multiple answers were allowed		

► **Table 4** Endoscopist perceptions of CT-colonography, resect-and-discard and cancer risk.

Questions	Responses; N (%)	
Do you think that current CT-colonography practice, which leaves polyps <6 mm in place until the next surveillance exam, leads to an increased risk of colon cancer for the patient?	N = 804	
No	59	(7.3)
Probably Not	305	(37.9)
Probably Yes	324	(40.3)
Yes	116	(14.4)
Do you think that using the resect-and-discard strategy for diminutive polyps increase the risk of cancer of patients?	N = 808	
No	639	(80.3)
Yes	157	(19.7)
CT, computed tomography		

towards resect-and-discard. Endoscopist characteristics were also well distributed according to practice setting, practice reimbursement and years in practice which lends external validity to our data. Geographic distribution was skewed towards North

America with endoscopists from the United States, Europe and Canada providing the majority of responses.

Our survey found that only 15.8% of endoscopists use the resect-and-discard strategy in their current practice and 59.9%

thought that implementation was not feasible of the resect-and-discard strategy in its current form. The most important reasons why the resect-and-discard strategy was not feasible included fear of making an incorrect diagnosis leading to incorrect surveillance interval assignment and medicolegal issues. Our results were similar to those found by Soudagar et al. 2016, where medicolegal concerns were the main barrier for implementation of the resect-and-discard strategy for the 105 Gastroenterologists surveyed during a national conference in the United States [14]. These reasons seem to point towards a concern of potential interval CRCs when using a resect-and-discard strategy, however, 80.3% of endoscopists voiced the opinion that a resect-and-discard strategy would not increase CRC risk. This could be caused by endoscopists feeling that interval cancer, while not more frequent with the resect-and-discard strategy, would be more difficult to explain in a possible future medicolegal pursuit. Very few endoscopists cited complexity of resect-and-discard and training requirements as barriers for implementation. While the consensus for most regions is that resect-and-discard was not feasible, European endoscopists showed an increased adoption of the strategy (54.3%). Endoscopist practice can be dependent upon current health-care culture, such as fear of medico-legal issues, acquiring new technology, and early adoption of new trends, which potentially explains the varying dispositions observed between geographic regions.

While the survey found that endoscopists did not completely trust their capacity to make accurate diagnoses, recent meta-analyses have shown that adequately trained endoscopists can achieve >90% concordance with histology-based diagnosis and >90% negative predictive value during optical diagnosis [8, 9]. The American Society for Gastrointestinal Endoscopy (ASGE) and the European Society of Gastrointestinal Endoscopy (ESGE) currently recommend the use of resect-and-discard if these thresholds can be met. However other studies have shown that endoscopists can be unable to reach these benchmarks even after optical diagnosis training [10, 15, 16]. Most gastroenterology and endoscopy societies across the world have not yet officially made statements on resect-and-discard in their guidelines because of this contradictory data, contributing to the low implementation rate we found in this study. Further, recent research in imaging technologies and optical diagnosis have led to the emergence of many optical diagnosis-based classification systems, each with their own criteria, which can be confusing and overwhelming for endoscopists [17]. Our survey shows a definite concern from endoscopists about the feasibility of making optical diagnoses and highlights the need for simplifying decision-making or removing the need for optical diagnosis altogether [18]. A recent study has proposed a simplified and/or location-based strategy to reduce the need for optical diagnosis [19]. These simplified strategies achieved >90% surveillance interval agreement compared to pathology and allowed for providing more patients with surveillance interval planning on the same day as the colonoscopy [19]. Other recent studies have proposed using only number and size of polyps as criteria for surveillance interval assignment [20, 21]. This approach was able to achieve a 90% surveillance interval

agreement with pathology in one instance and an 89.3% agreement in another [20, 21]. More than 80% of patients could be provided with a surveillance interval on the same day using such an approach [20, 21]. These alternative approaches thus appear promising even though endoscopists tended to prefer shorter intervals [20]. Limitations of simplified polyp (number and size only) or location-based strategies include the problem of not being able to distinguish between early signs of cancer (i. e. NICE-3 morphology) in optical diagnosis.

There was no consensus between endoscopists on cancer risk of diminutive polyps, with about 50% believing that leaving them unresected increased cancer risk. This result differs from a survey by Gellad et al. 2013, which reported that the majority of respondents would be somewhat agreeable to leave diminutive polyps in place if guidelines would support this practice [22]. Half of endoscopists in our study believed that CT-colonography increased patient risk. Studies on CT-colonography performance show a sensitivity of >90% for the detection of polyps >10 mm and >95% for the detection of colorectal cancer [23–25]. CT-colonography was, however, shown to have lower detection of high-risk SSAs when compared to colonoscopy [26] and exhibits poor sensitivity in diminutive polyp detection [27]. However, risk of malignancy of diminutive colon polyps was shown to be extremely low: 2% having advanced histology, and approximately 0.05% containing high grade dysplasia or neoplasia [1, 2]. Studies with large numbers of small and diminutive polyps found no CRC present in any of these polyps [2, 28]. Recent studies on the natural history of diminutive polyps showed a very indolent course for these polyps on follow-ups [29, 30]. Current literature therefore suggests that risk of CRC arising from diminutive polyps is extremely low.

It is interesting to note that most endoscopists in our survey reported leaving polyps unresected in their patients and assigning 3- to 5-year maximum surveillance intervals when doing so. A recent meta-analysis has shown poor worldwide adherence for post-colonoscopy surveillance intervals [31]. Because resect-and-discard allows for providing more patients on the same day as the colonoscopy with a decision on when the next surveillance interval can be scheduled, clinical introduction of resect-and-discard might not only reduce immediate pathology costs but also upstream costs through avoiding unnecessary short follow-up surveillance intervals.

One important study limitation is the low response rate causing a potential for selection bias. However, since endoscopists can be members of multiple societies our response rate might be underestimated and represented a worst-case scenario. The advertising of our survey through Facebook/Twitter could also have skewed our sample towards younger endoscopists with more of an online presence or encourage double clicking from some of the participants. Furthermore, survey study always raise the issue of possible participation bias where survey participants are more incline to be up to date with recent guidelines and recommendations. Even in this selected population, resect-and-discard uptake was very low; suggesting the true uptake in the general population is probably even lower. The majority of responses were from the United States, Canada and Europe, which potentially limits our interpretation

and generalizability to other regions. The survey was only available in English, which could have led to selection bias for certain regions of the world and for anglophone participants. However, we present the largest survey available to date on the topic.

## Conclusion

In conclusion, current uptake of resect-and-discard is very low (15.8%) with most endoscopists agreeing that such strategies are not feasible. Fear of making the wrong diagnosis and potential medicolegal repercussions are cited amongst the main reasons for difficulty of implementation. The development of simplified resect-and-discard models will likely provide a solution to these barriers for implementing resect-and-discard in clinical practise.

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## Competing interests

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