

# Surveillance colonoscopy in Austria: Are we following the guidelines?

## Authors

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## ABSTRACT

**Background and study aim** The European guidelines for quality assurance in colorectal cancer screening and diagnosis contain postpolypectomy surveillance recommendations. They recommend follow-up intervals depending on the findings at index colonoscopy, and divide patients into a low-, intermediate- or high-risk group. The aim of this study was to assess the adherence of Austrian endoscopists to the European guidelines and to determine whether sending a reminder letter resulted in better adherence.

**Methods** A single reminder letter containing the guidelines was sent to all endoscopists who participated in the Certificate of Quality for Screening Colonoscopy program in Austria. Adherence was assessed before and after the letter had been sent. Factors associated with adherence were investigated.

**Results** We found poor baseline adherence to the guidelines. After the reminder letter, the adherence slightly improved in the low-risk group, but did not change in the intermediate-risk or high-risk groups. An adenoma detection rate of at least 20% was associated with higher adherence rates. Generally, internists and hospitals showed better adherence compared with surgeons and private practices, respectively, both before and after the reminder letter.

**Conclusion** A single reminder letter was not enough to improve the poor adherence to the European postpolypectomy surveillance guidelines. Thus, future studies are required to identify and eliminate all factors responsible for non-adherence to postpolypectomy guidelines in order to reach the goal of a safe, effective, and cost-effective colorectal cancer prevention tool in the near future.

## Introduction

Colorectal cancer (CRC) is the second most common cancer in Europe and the second leading cause of carcinoma-related death [1]. Many studies have shown that CRC screening is effective in reducing CRC incidence and mortality [2–4]. If adenomas are found at the initial screening colonoscopy, the risk of developing further adenomas is high [5–8], and follow-up surveillance colonoscopy is recommended.

The “European guidelines for quality assurance in colorectal cancer screening and diagnosis” from the European Commission have been in existence since 2010, and contain recommended time intervals for follow-up and surveillance colonoscopy [9]. In the European Guidelines, findings at the index colonoscopy are divided into three groups:

- low-risk group, containing colonoscopies with 1–2 small (<1 cm), tubular adenomas with low-grade dysplasia;
- intermediate group, containing colonoscopies with 3–4 small (<1 cm) tubular adenomas or at least one adenoma

having at least one of the following criteria: 1–2 cm tubular adenoma or villous/tubulovillous histology or high grade dysplasia;

- high-risk group, containing colonoscopies where more than five adenomas were found or at least one adenoma larger than 2 cm.

The surveillance interval should be 7–10 years for the low-risk group, 3 years for the intermediate-risk group, and for people at high risk a repeat colonoscopy should be performed within 1 year.

Studies have shown that patients have a 3–4-times elevated risk of developing cancer when postpolypectomy aftercare is insufficient [10]. On the other hand, the systematic overuse of colonoscopies, which is currently seen in the United States, leads to cost-ineffectiveness and to the exposure of patients to excess risk. Thus, determining, documenting, and recommending the correct surveillance interval after the index colonoscopy is very important and forms part of a high-quality screening colonoscopy [11, 12]. Several studies have found poor adherence to postpolypectomy guidelines, with the tendency to shorten recommended intervals [13–18].

In 2007, the national project Certificate of Quality for Screening Colonoscopy (CQSC) was inaugurated in Austria to define quality standards, as well as to control and improve the quality of screening colonoscopies conducted by voluntarily participating endoscopists [19–21].

The aims of our study were to assess whether participants of the CQSC are following the European guidelines for quality assurance in CRC screening and diagnosis (2010) [9], and whether sending a reminder letter that highlighted the importance of the recommendation for the correct surveillance interval and which included the German translation of the European guidelines, resulted in better adherence. We further aimed to identify factors associated with poor adherence.

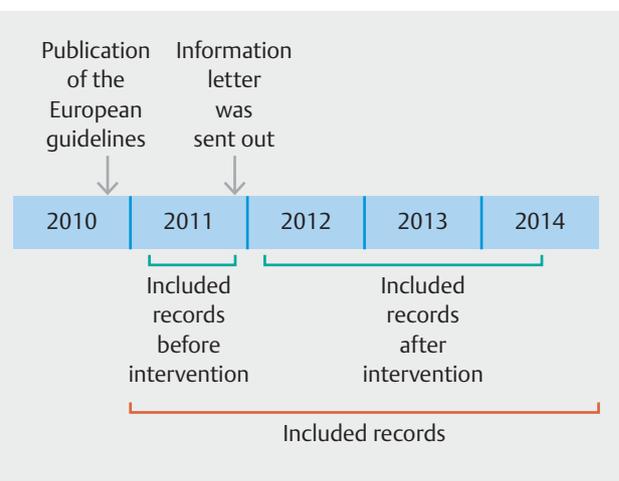
## Methods

### Study population

Database records of the CQSC were used for this study. Details about this project from the Austrian Society for Gastroenterology and Hepatology, the Austrian Federation of Statutory Insurance Institutions, and Austrian Cancer Aid have been described previously [19, 20, 22].

In brief, experienced endoscopists can apply for the certificate if certain quality standards are met. Participants commit to providing data about the screening colonoscopies, including histological findings, patient characteristics, and surveillance recommendations. In return, they annually receive a benchmarking report with feedback about various quality parameters, including their adenoma detection rate (ADR). Internists as well as surgeons participate in the program.

Patients who underwent a screening colonoscopy within the CQSC in Austria between February 2011 and May 2014 were included in the study. All asymptomatic patients with no familial colorectal carcinoma syndrome and no inflammatory bowel disease were eligible for screening colonoscopy. This study was



► Fig. 1 Time line of the study.

approved by the ethics committee of the Medical University of Vienna (EK 1696/2014).

Several records were excluded from statistical analyses. Colonoscopies were excluded if the European postpolypectomy guidelines could not be applied. Therefore, colonoscopies were excluded in the following cases: CRC; serrated adenomas; no polyps detected; the detected polyps were not, or not completely, removed; surveillance colonoscopies (following a screening colonoscopy that led to a shortening of the surveillance interval); insufficient bowel preparation; incomplete colonoscopy. Furthermore, several colonoscopies could not be included in the study because they could not be clearly classified to a risk group owing to limited information about the colonoscopy outcomes (e. g. number of detected adenomas).

For the comparison before vs. after the letter, colonoscopies performed by endoscopists who did not participate during the whole study period were excluded. Additionally, colonoscopies performed within 3 months after the information letter (between 30.11.2011 and 1.3.2012) were excluded to ensure that the participants had read the letter (► Fig. 1)

### Intervention

As recommending the correct surveillance interval is a crucial part of a high-quality screening colonoscopy, the CQSC sent a letter containing the German translation of the European postpolypectomy guidelines from 2010 to all participating endoscopists in December of 2011. The German version was published in 2012 [23]. The letter was sent by registered mail in order to ensure that every participant received it. The time line is presented in ► Fig. 1.

### Statistical analyses

Colonoscopies were rated as low risk, intermediate risk or high risk depending on the histological findings and according to the European guidelines [9]. The suggested surveillance interval recorded in the database was compared with the recommended surveillance interval for the risk groups, and evaluated as adhering or not adhering to the European guidelines. Proportions

## 93 680 (86 815) colonoscopies in the CQSC database 1/2/2011 – 22/05/2014

Colonoscopy performed within 3 months after the information letter n = 5620

Colonoscopies could not be clearly categorized into a risk group n = 11 519 (8939)

Colonoscopies from endoscopists who did not participate during the whole study period n = 3218

19 593 included colonoscopies

14 852 included colonoscopies for the comparison before vs. after the information letter

Guidelines not applicable because

- wrong diagnosis (CRC n = 719 [610], serrated adenomas n = 1331 [1139], no polyps n = 57 375 [49 683])
- detected polyps were not (completely) removed n = 1690 (1480)
- surveillance colonoscopies n = 250 (244)
- incomplete colonoscopies n = 593 (512)
- insufficient bowel preparation n = 610 (518)

► **Fig. 2** Flow chart of excluded colonoscopies. Records that were also excluded from the comparison of before vs. after the information letter are shown in blue. CQSC, Certificate of Quality for Screening Colonoscopy; CRC, colorectal cancer.

of adherence were calculated for each group and compared using the chi-squared test for the results before vs. after the letter. Differences in the mean surveillance intervals in months were analyzed using unpaired *t* test. Other differences are expressed as odds ratios (ORs) with 95% confidence intervals (CIs). No correction for multiple testing was applied.

All analyses were performed using R software 3.3.3, SAS package, version 9.4 (Cary, North Carolina, USA) and SPSS software, version 24 (IBM Corp., Armonk, New York, USA).

## Results

A total of 315 endoscopy units have been or currently are participating in the CQSC. They include 197 private practices, 114 endoscopy units in hospitals, and 4 outpatient clinics.

From February 2011 until May 2014, the database of the CQSC contained 93 680 screening colonoscopy records. Polyps were detected in 38.2% of all colonoscopies. In total, colonoscopies of 19 593 patients were assessed (► **Fig. 2**).

The mean age was  $61 \pm 8.8$  years and was similar between patients who underwent the colonoscopy in hospitals ( $60.5 \pm 9$  years) and private practices ( $61.2 \pm 8.7$  years), as well as between patients examined by surgeons ( $60.9 \pm 8.6$  years) and internists ( $61 \pm 8.9$  years). Overall, 44.5% of the patients were female. In private practices, slightly more women underwent a screening colonoscopy (private practices 45.1% vs. hospitals 43.0%;  $P < 0.01$ ); the distribution of patient sex did not differ for patients examined by surgeons (44% females) and internists (44.8% females).

### Baseline adherence

Not all included records contained surveillance recommendations. Before the letter, no surveillance interval was provided at all in 871 records (25.6%). In all, 70.8% records contained surveillance recommendations within the low-risk group, 85.4%

within the intermediate-risk group, and 67.6% within the high-risk group (► **Table 1**).

Generally, the study revealed poor adherence to the European postpolypectomy surveillance guidelines before the letter. The lowest adherence was found in the low-risk group (adherence rate before the letter 7.1%), with the tendency to shorten the interval. The best adherence was seen in the high-risk group (47.6% before the letter), where all incorrectly recommended intervals were too long.

### Adherence after the reminder letter

The adherence after the reminder letter was slightly better in the low-risk group (7.1% vs. 9.9%;  $P < 0.01$ ), but showed no difference in the intermediate-risk group (34.6% vs. 35.9%;  $P = 0.50$ ) or the high-risk group (47.6% vs. 37.6%;  $P = 0.06$ ) (► **Table 1**).

The rate of missing recommendations was higher before the letter initiative than after the initiative in the low-risk group (29.2% vs. 23.7%;  $P < 0.01$ ) (► **Table 1**).

### Endoscopist characteristics and adherence

A total of 238 of the 249 participants had at least 5 colonoscopies in the database and were included in the substudy. The mean ADR was  $22.4 \pm 9.9$  (range 0–61.5). A total of 98 participants had an ADR lower than 20%. Generally, endoscopists with an ADR  $\geq 20$  showed significantly higher adherence rates compared with endoscopists with an ADR  $< 20$  (24.2% vs. 13.9%; OR 0.5, 95%CI 0.5–0.6) (► **Table 2**).

Before the letter, physicians in private practices generally recommended shorter intervals than physicians in hospitals, and were less adherent to the guidelines, both in the low-risk group (5.8% vs. 11.5%; OR 0.5, 95%CI 0.3–0.7) and the intermediate-risk group (31.3% vs. 44.4%; OR 0.6, 95%CI 0.4–0.8). The adherence rate for the high-risk group did not significantly differ

► **Table 1** Adherence rates – general results. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	Before letter	After letter	P value
Low risk, n (%)			
▪ Recommended interval, mean ± SD, months	52.3 ± 23.7	53.6 ± 27.0	0.07
▪ Too short	1550 (63.7)	5817 (66.4)	
▪ Correct	172 (7.1)	870 (9.9)	<0.01
▪ Too long	1 (<0.1)	1 (<0.1)	
▪ No interval	711 (29.2)	2077 (23.7)	<0.01
Intermediate risk, n (%)			
▪ Recommended interval, mean ± SD, months	25.5 ± 14.5	29.2 ± 23 – 4	<0.01
▪ Too short	396 (45.9)	972 (41.2)	
▪ Correct	298 (34.6)	847 (35.9)	0.50
▪ Too long	42 (4.9)	239 (10.0)	
▪ No interval	126 (14.6)	304 (12.9)	0.20
High risk, n (%)			
▪ Recommended interval, mean ± SD, months	15.6 ± 11.9	21.0 ± 15.1	<0.01
▪ Correct	50 (47.6)	121 (37.6)	0.06
▪ Too long	21 (20.0)	105 (32.6)	
▪ No interval	34 (32.4)	96 (29.8)	0.62

► **Table 2** Adherence rates by adenoma detection rate. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	ADR ≥ 20	ADR < 20	OR (95%CI)*
General, n (%)			
▪ Correct	2445 (24.2)	661 (13.9)	0.5 (0.5 – 0.6)
Low risk, n (%)			
▪ Too short	6007 (60.3)	3374 (70.7)	
▪ Correct	1211 (12.2)	197 (4.1)	0.3 (0.3 – 0.4)
▪ Too long	5 (<0.1)	0 (0)	
▪ No interval	2737 (27.5)	1203 (25.2)	
Intermediate risk, n (%)			
▪ Too short	1286 (41.6)	545 (44.4)	
▪ Correct	1061 (34.4)	424 (34.5)	1.0 (0.9 – 1.1)
▪ Too long	275 (8.9)	96 (7.8)	
▪ No interval	473 (15.3)	163 (13.3)	
High risk, n (%)			
▪ Correct	173 (46.5)	40 (22.7)	0.3 (0.2 – 0.5)
▪ Too long	92 (24.7)	66 (37.5)	
▪ No interval	107 (28.8)	70 (39.8)	

ADR, adenoma detection rate; OR, odds ratio; CI, confidence interval.

\* The differences between the percentage of correctly recommended intervals by endoscopists with an ADR < 20 and intervals by endoscopists with an ADR ≥ 20 are described as ORs.

► **Table 3** Adherence rates by setting. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	Hospital			Private practice		
	Before letter	After letter	P value or OR (95%CI)*	Before letter	After letter	P value or OR (95%CI)*
Low risk, n (%)						
▪ Recommended interval, mean ± SD, months	58.7 ± 23.9	57.2 ± 25.1	0.27	50.4 ± 23.4	52.2 ± 27.4	0.02
▪ Too short	345 (64.0)	1200 (57.3)		1208 (63.7)	4561 (70.5)	
▪ Correct	62 (11.5)	278 (13.3)	1.2 (0.9–1.6)	110 (5.8)	558 (8.6)	1.5 (1.2–1.9)
▪ Too long	0 (0)	0 (0)		1 (<0.1)	1 (<0.1)	
▪ No interval	132 (24.5)	615 (29.4)		577 (30.4)	1349 (20.8)	
Intermediate risk, n (%)						
▪ Recommended interval, mean ± SD, months	29.2 ± 16.2	30.1 ± 17.3	0.49	24.2 ± 13.6	28.8 ± 24.9	<0.01
▪ Too short	82 (38.0)	174 (33.9)		314 (48.6)	793 (45.1)	
▪ Correct	96 (44.4)	193 (37.5)	0.8 (0.5–1.0)	202 (31.3)	647 (36.8)	1.3 (1.1–1.6)
▪ Too long	19 (8.8)	56 (10.9)		23 (3.6)	177 (10.1)	
▪ No interval	19 (8.8)	91 (17.7)		107 (16.6)	142 (8.1)	
High risk, n (%)						
▪ Recommended interval, mean ± SD, months	21.0 ± 14.8	20.0 ± 15.6	0.80	13.3 ± 9.7	21.5 ± 14.9	<0.01
▪ Correct	11 (42.3)	30 (44.1)	0.7 (0.4–1.2)	39 (49.4)	89 (38.0)	0.6 (0.4–1.1)
▪ Too long	11 (42.3)	25 (36.8)		10 (12.7)	82 (35.0)	
▪ No interval	4 (15.4)	13 (19.1)		30 (38.0)	63 (26.9)	
OR, odds ratio; CI, confidence interval. * The differences between the percentage of correctly recommended intervals before the letter and after the letter are described as ORs.						

(private practices 49.4% vs. hospitals 42.3%; OR 1.3, 95%CI 0.5–3.3) (► **Table 3**).

The reminder letter did not lead to better adherence in hospitals. In private practices however, the adherence rate in the low-risk group was significantly higher after the letter (5.8% vs. 8.6%; OR 1.5, 95%CI 1.2–1.9) (► **Table 3**).

In all risk groups, internists recommended longer intervals than surgeons. Internists had better adherence rates in the low-risk (9.7% vs. 0.9%; OR 0.1, 95%CI 0.04–0.2) and intermediate-risk groups (39.9% vs. 23.2%; OR 0.5, 95%CI 0.3–0.6), but not in the high-risk group (46.6% vs. 59.5%; OR 1.7, 95%CI 0.7–3.9). Surgeons, but not internists, showed significantly higher adherence rates after the reminder letter in the low-risk group (0.9% vs. 2.6%; OR 2.9, 95%CI 1.4–6.0) (► **Table 4**).

### Patient characteristics and adherence

A total of 1395 of the 19593 patients (7.1%) were 75 years or older (≥75). Across all risk groups, these colonoscopies showed a similar adherence rate compared with colonoscopies in younger patients (<75 years) (<75 15.9% vs. ≥75 15.6%; OR 1, 95%CI 0.9–1.2) (► **Table 5**).

Only in the low-risk group were the recommended surveillance intervals for females significantly more adherent to the guidelines than for male patients (female 10.6% vs. male 8.6%; OR 0.8, 95%CI 0.7–0.9), but this was not the case for the results overall (female 15.8% vs. male 15.9%; OR 1, 95%CI 0.9–1.1) (► **Table 6**).

## Discussion

In general, we found rather poor adherence to the postpolypectomy guidelines, which is in line with the literature [13–16,24]. In only 7.1%, 34.6%, and 47.6% examinations was the surveillance interval recommended correctly according to the guidelines for low-risk, intermediate-risk, and high-risk groups, respectively. Additionally, in more than a quarter of all colonoscopies, no follow-up colonoscopy was recommended at all.

Endoscopists tended to shorten surveillance intervals for low- and intermediate-risk patients, and to lengthen intervals for high-risk patients.

The high-risk group was by far the smallest group; thus, these results might not be reliable. Another reason for nonadherence in the high-risk group might be the fact that various

**► Table 4** Adherence rates by profession. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	Internists			Surgeons		
	Before letter	After letter	P value or OR (95%CI)*	Before letter	After letter	P value or OR (95%CI)*
Low risk, n (%)						
▪ Recommended interval, mean ± SD, months	59.5 ± 23.9	58.8 ± 29.2	0.44	41.7 ± 18.1	43.7 ± 19.3	<0.01
▪ Too short	795 (53.8)	3298 (59.7)		731 (82.1)	2376 (84.6)	
▪ Correct	144 (9.7)	717 (13.0)	1.4 (1.1–1.7)	8 (0.9)	72 (2.6)	2.9 (1.4–6.0)
▪ Too long	1 (0.1)	2 (<0.1)		0 (0)	0 (0)	
▪ No interval	539 (36.4)	1506 (27.3)		151 (17.0)	361 (12.9)	
Intermediate risk, n (%)						
▪ Recommended interval, mean ± SD, months	27.8 ± 14.4	32.3 ± 26.5	0.49	21. ± 13.7	22.2 ± 13.8	0.52
▪ Too short	223 (41.4)	527 (35.0)		169 (57.7)	421 (60.0)	
▪ Correct	215 (39.9)	632 (41.9)	1.1 (0.9–1.3)	68 (23.2)	184 (26.2)	1.2 (0.9–1.6)
▪ Too long	27 (5.0)	186 (12.3)		12 (4.1)	37 (5.3)	
▪ No interval	74 (13.7)	162 (10.7)		44 (15.0)	60 (8.5)	
High risk, n (%)						
▪ Recommended interval, mean ± SD, months	13.3 ± 11.3	21.4 ± 16.3	<0.01	12.8 ± 8.4	20.4 ± 13.2	<0.01
▪ Correct	27 (46.6)	58 (36.3)	0.7 (0.4–1.2)	22 (59.5)	56 (42.7)	0.5 (0.2–1.1)
▪ Too long	9 (15.5)	49 (30.6)		4 (10.8)	54 (41.2)	
▪ No interval	22 (37.9)	53 (33.1)		11 (29.7)	21 (16.0)	

OR, odds ratio; CI, confidence interval.

\* The differences between the percentage of correctly recommended intervals before the letter and after the letter are described as ORs.

societies have published different postpolypectomy surveillance guidelines, which constantly change and mainly differ in the treatment of high-risk adenomas [25–28].

In 2014, Rex et al. published “Quality Indicators for Colonoscopy” and declared adherence to postpolypectomy guidelines as one of the main quality indicators for screening colonoscopy [29]. The target is stated as >90% correctly recommended intervals. Thus, recommending the correct surveillance interval, as well as documentation and explanation to the patient, are critical elements of a high-quality screening colonoscopy [29].

Saini et al. [30] suggest lack of knowledge or disagreement to guidelines might lead to deviation from their recommendations. Thus, we wanted to assess whether a single reminder letter, highlighting the importance of correct polypectomy aftercare and containing the German translation of the European postpolypectomy guidelines from 2010, might increase awareness of and adherence to the guidelines. The letter was sent to endoscopists participating voluntarily in the CQSC program, so it can be assumed that they were interested in improving quality. The information letter slightly improved the adherence in the low-risk group (7.1% vs. 9.9%;  $P < 0.01$ ) but it did not change adherence in the intermediate-risk group (34.6% vs.

35.9%;  $P = 0.50$ ) or the high-risk group (47.6% vs. 37.6%;  $P = 0.06$ ).

Thus, one single reminder letter might not be enough to see an effect. Further information and education is necessary to improve postpolypectomy aftercare. Participants of the quality certificate could be invited to free seminars or lectures to be educated about the guidelines and the importance of adhering to their recommendations. Another possibility is giving feedback on adherence to the guidelines; this could be included in the annual benchmark. A further option would be an instant, automated categorization to a risk group with the recommended surveillance interval, which presents on completion of the colonoscopy form.

Very few studies have assessed potential factors associated with a poor adherence to guidelines. One possible aspect leading to reduced adherence is the concern of having missed adenomas. This might lead physicians to ignore the guidelines and recommend shorter intervals. As participants of the quality certificate are aware of their own ADR, we were interested in whether this might influence the recommended surveillance intervals. Interestingly, endoscopists with an ADR  $\geq 20$  showed higher adherence rates. Recommended intervals were longer in

► **Table 5** Adherence rates by patients' age. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	<75 years	≥75 years	OR (95%CI)*
General, n (%)			
▪ Correct	2889 (15.9)	217 (15.6)	1 (0.9–1.2)
Low risk, n (%)			
▪ Too short	8702 (63.5)	684 (65.6)	
▪ Correct	1306 (9.5)	102 (9.8)	1 (0.8–1.3)
▪ Too long	4 (<0.1)	1 (0.1)	
▪ No interval	3685 (26.9)	256 (24.5)	0.9 (0.8–1)
Intermediate risk, n (%)			
▪ Too short	1680 (42.1)	133 (42.1)	
▪ Correct	1385 (34.7)	100 (31.6)	1.1 (0.9–1.5)
▪ Too long	339 (8.5)	32 (10.1)	
▪ No interval	585 (14.7)	51 (16.1)	0.3 (0.2–0.5)
High risk, n (%)			
▪ Correct	198 (38.7)	15 (41.7)	0.9 (0.4–1.8)
▪ Too long	150 (29.3)	8 (22.2)	
▪ No interval	164 (32.0)	13 (36.1)	1.2 (0.6–2.4)

OR, odds ratio; CI, confidence interval.

\* The differences between the percentage of correctly recommended intervals for patients younger than 75 years (<75 years) and intervals for patients of 75 years or older (≥75 years) are described as ORs.

► **Table 6** Adherence rates by patients' sex. Recommended intervals were categorized as too long, too short or correct according to the risk group.

	Female	Male	OR (95%CI)*
General, n (%)			
▪ Correct	8724 (15.8)	1728 (15.9)	1 (0.9–1.1)
Low risk, n (%)			
▪ Too short	4317 (62.5)	5069 (64.7)	
▪ Correct	734 (10.6)	674 (8.6)	0.8 (0.7–0.9)
▪ Too long	2 (<0.1)	3 (<0.1)	
▪ No interval	1851 (26.8)	2090 (26.7)	
Intermediate risk, n (%)			
▪ Too short	621 (38.5)	1192 (44.3)	
▪ Correct	563 (34.9)	922 (34.3)	1 (0.9–1.1)
▪ Too long	164 (10.2)	207 (7.7)	
▪ No interval	266 (16.5)	370 (13.7)	
High risk, n (%)			
▪ Correct	81 (39.3)	132 (38.6)	1 (0.7–1.4)
▪ Too long	59 (28.6)	99 (28.9)	
▪ No interval	66 (32)	111 (32.5)	

OR, odds ratio; CI, confidence interval.

\* The differences between the percentage of correctly recommended intervals for female and male patients are described as ORs.

the low-risk group. This supports the hypotheses that endoscopists with a higher ADR feel more confident at not having missed adenomas. As the adherence was higher in the high-risk group as well, however, with shorter recommended intervals, another reason might be that these endoscopists with a higher ADR were generally better trained and more aware of the guidelines.

Interestingly, we observed a difference between hospitals and private practices regarding adherence to the guidelines. Generally, hospitals showed higher adherence rates, with longer recommended intervals in low- and intermediate-risk groups than private practices. Endoscopists in hospitals might be more confident to have found every polyp, maybe because they perform colonoscopy more frequently.

The follow-up intervals recommended by internists were by far more consistent with the guidelines than surgeons' recommendations, except in the high-risk group, which did not differ. In a former study, our group showed that the quality of screening colonoscopies, including ADR, did not differ between internists and surgeons [21]. Thus, other factors, such as better knowledge of postpolypectomy guidelines, are responsible for this discrepancy.

Menees et al. [31, 32] suggest that poor bowel preparation and patient factors (e.g. older age), which are associated with a higher risk for CRC, are also associated with poor adherence to

guidelines. In this study, we excluded colonoscopies with poor bowel preparation and incomplete colonoscopies in order to exclude this possible effect. We found reduced adherence rates in incomplete colonoscopies (15.9% vs. 6.4%; OR 0.4, 95%CI 0.3–0.6, data not shown), as well as in colonoscopies with poor bowel preparation (15.9% vs. 10.9%; OR 0.7, 95%CI 0.5–0.9, data not shown).

According to the European guidelines [9], average-risk screening colonoscopy should be discontinued after the age of 74 years. Therefore, we assessed the frequency of surveillance recommendations, as well as adherence to guidelines, in the risk groups. Interestingly, recommendations for patients 75 years or older did not significantly differ from those for younger patients. Only in the intermediate-risk group were surveillance recommendations given more often to younger patients (<75 14.7 vs. ≥75 36.1; 95%CI 0.2–0.5; ► **Table 5**).

Furthermore, we assessed the influence of patient sex on the recommended intervals and on the adherence rates. The overall results did not significantly differ.

Various guidelines have been published containing surveillance intervals depending on the number, size, and histological characteristics of the detected adenomas [25–28]. They contain similar but not identical recommendations. Differences mainly concern the high-risk group. The European guidelines from 2010 [9], the current guidelines from the British Society of Gastroenterology from 2010 [26], and the Austrian Society

of Gastroenterology and Hepatology [23] suggest a surveillance interval of a year or less after a colonoscopy with high-risk findings. The current US Multi-Society Task Force on Colorectal Cancer (2012) [25] and the updated European Society of Gastrointestinal Endoscopy (ESGE) guidelines [28] recommend a surveillance colonoscopy after 3 years in the high-risk group. For the low-risk group, the American guidelines recommend an interval of 5–10 years, depending for instance on the bowel preparation. The ESGE guidelines from 2010 and 2013 recommend an interval of 10 years, with a shortening of the interval after a colonoscopy with insufficient bowel preparation.

This coexistence of various, rapidly changing postpolypectomy guidelines might confuse endoscopists and make them insecure about their recommendations. Rex stated that postpolypectomy surveillance guidelines still need to be optimized [33].

This study has several limitations. The study was conducted using a database that was not primarily designed for this study. Thus, not all reports could be included. Additionally, several factors that might have influenced the recommended follow-up intervals could not be assessed, and therefore some examinations could not be excluded from the general study. This concerns colonoscopies with poor bowel preparation that were conducted before November 2012, as bowel preparation was not assessed before this date. Additionally, not all surveillance colonoscopies could be excluded.

All endoscopists who were included in this study participate voluntarily in the Austrian quality assurance program. It could be assumed that these endoscopists are more motivated and thus show better results compared with average physicians.

Further studies are required to identify and eliminate all factors responsible for nonadherence to postpolypectomy guidelines in order to reach the goal of a safe, effective, and cost-effective CRC prevention tool in the near future.

## Competing interests

None

## References

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