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# Overutilization of post-polypectomy surveillance colonoscopy in clinical practice: A prospective, multicentre study☆

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ABSTRACT

*Background:* Although the adherence to post-polipectomy recommendations is advocated as a quality indicator of colonoscopy programmes, prospective data on actual use of surveillance are lacking.
*Aim:* To evaluate the appropriateness of post-polypectomy surveillance colonoscopy on a community-wide basis and to identify factors associated with it.
*Methods:* Data on consecutive post-polypectomy surveillance examinations performed over a 4-week period in 29 Italian endoscopy units were collected. The time interval between index and surveillance colonoscopy was calculated and compared to guidelines recommendations. Determinants of surveillance timing appropriateness were assessed by logistic step-wise regression.
*Results:* Of 7081 consecutive outpatients, 1218 (17.2%) were referred for post-polypectomy surveillance and 902 were included into the analysis. Surveillance colonoscopy was prescribed correctly in 330 subjects (36.6%) and earlier than recommended by guidelines in 490 (54.3%). Low-risk subjects had an anticipated surveillance colonoscopy more frequently than global cohort (67.4% vs. 54.3%, $p < 0.001$). At multivariate analysis, determinants of correct surveillance timing were high-volume workload centres (OR 1.92; 1.41–2.63 95%CI), centres providing written recommendation on surveillance interval (OR 1.70; 1.18–2.58 95%CI) and surveillance examinations performed within the national screening programme (OR 2.62; 1.92–3.59 95%CI).
*Conclusions:* In community practice, post-polipectomy surveillance colonoscopy is often performed earlier than recommended, especially in low-risk subjects. Interventions to improve adherence to guidelines and to reduce unnecessary examinations are needed.


## 1. Introduction

Colonoscopy has been proven to reduce the incidence and mortality of colorectal cancer (CRC) by adenoma resection [1–4]. Among individuals who have one or more adenomas removed at colonoscopy, 20–50% will be found to have a missed synchronous or new metachronous lesion when undergoing follow-up colonoscopy within 3–5 years [1] and are also considered to be at increased risk for CRC development. As a consequence, a surveillance programme of periodic examinations is usually indicated after a clearing colonoscopy, with the goal of minimizing the risk of further CRC. Timing of surveillance is mainly determined by an accurate assessment of the patient's individual risk for future advanced adenomas, which have a higher malignant potential. On the basis of adenoma characteristics at baseline, practice guidelines stratify patients at high or low risk for subsequent development of advanced neoplasia, and recommend colonoscopy at 3 years after removal of an advanced adenoma (defined as having a size ≥1 cm or villous histology or high-grade dysplasia) or 3 or more adenomas of any size and at 5–10 years after removal of 1 or 2 non-advanced (small tubular) adenomas [5].

In the last few years, due to the widespread diffusion of CRC screening programmes, a huge burden of medical resources has been applied to surveillance. Risk stratification, emphasized by practice guidelines, should markedly reduce the intensity of follow up in a considerable proportion of patients at low risk, thus avoiding the overutilization of resources for unnecessary examinations and allowing to shift them from intensive surveillance to screening and diagnosis [6–8]. Furthermore, it could also reduce the small, but finite, risk of colonoscopy complications [9].

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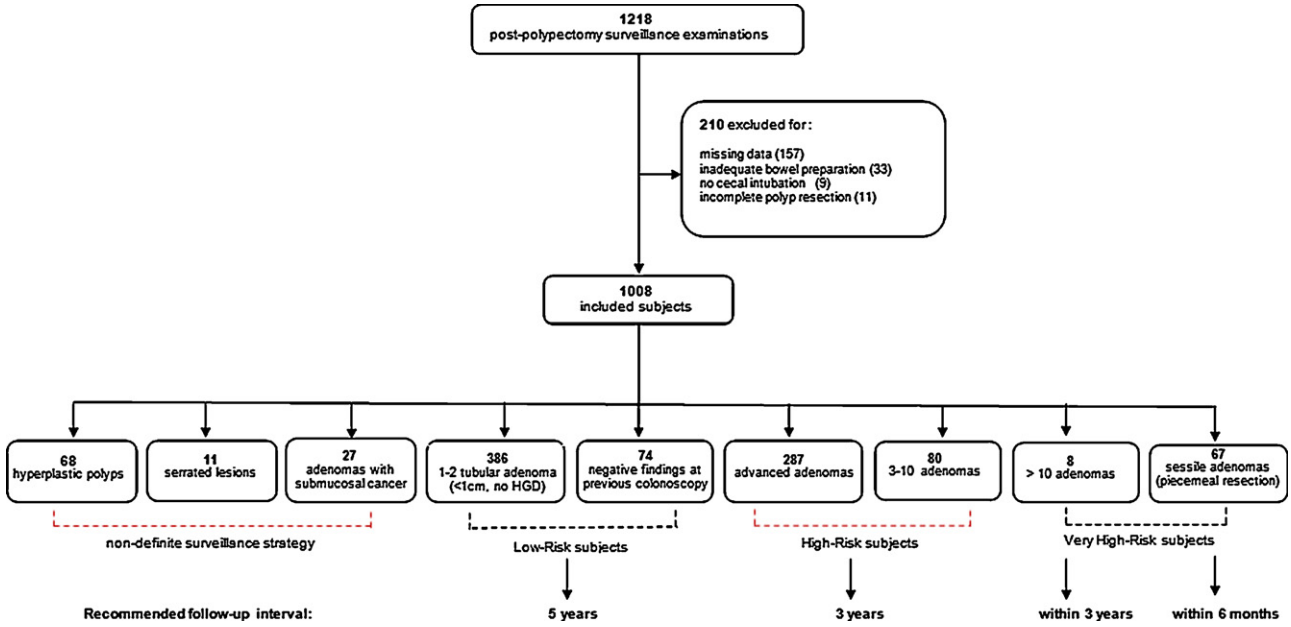


**Fig. 1.** Subject flow. The first line under the boxes represents risk categories according to reference guidelines [5,6]; the second line represents the recommended follow-up interval for each risk category.

However, surveys carried out among gastrointestinal (GI) specialists [10] and primary care physicians (11) have consistently shown a lack of adherence to surveillance guidelines, with repeated examinations being recommended in the majority of cases at intervals shorter than indicated. This suggests an overutilization of post-polypectomy surveillance (PPS) colonoscopy, which already accounts for about one out of four colonoscopies performed yearly [12,13]. Prospective data on the actual use of surveillance in community practice are lacking, despite the adherence to correct intervals of PPS is advocated as being an important quality indicator of colonoscopy programmes [14,15]

The aim of this study is to prospectively assess the appropriateness of surveillance colonoscopy in clinical practice on a nation-wide basis and the factors associated with adherence to published guidelines.

## 2. Methods

During a preliminary study-phase, an invitation, including a description of the project, was sent to 90 GI units: 30 in northern Italy, 30 in central and 30 in southern Italy, to be representative of the entire nation. During the National GI Meeting, held in Verona in March 2010, a dedicated session was organized for study planning; participants were AIGO members (Italian Association of Hospital Gastroenterologists) representative of 29 endoscopy units. From July 2010 to January 2011, data from consecutive colonoscopies performed in a 4-week period were prospectively recorded on a website database.

For each centre, the following indicators were collected: setting (academic vs. community hospital), colonoscopy workload (number of colonoscopies in the previous year: >3000 vs. 1000–3000 vs. 500–1000), participation of the centre to CRC national screening programme (yes *or* no) and endoscopist practice of routinely assigning recommendation on PPS interval according to pathology report (no vs. oral vs. written recommendations). Subjects undergoing colonoscopy for PPS (previous colonoscopy with complete removal of at least one polyp, no gastrointestinal symptoms, estimated life-expectancy > 10 years) were considered for the study.

For all the eligible subjects, the following data were recorded using a modified version of the *AGA Institute Polyp Surveillance Data Collection Form:* demographics (age, gender), family history for CRC (yes or no), date of previous follow-up or index colonoscopy, polyp findings (endoscopy and pathology results) and participation to the national CRC screening programme. Moreover, as in Italy the indication and timing for PPS colonoscopy may be provided by either the endoscopist or by other professional figures (e.g. general practitioners, oncologists, surgeons), the referring physician was also recorded. For the purpose of the analysis they were subsequently dichotomized as endoscopist vs. other physicians). All these data were obtained through the accurate evaluation of colonoscopy and pathology reports by the endoscopist who filled in the electronic form.

Subjects with missing data on polyp findings at previous colonoscopy (number, endoscopic or histological features) or with unsatisfactory quality standards of the examination (no coecal intubation, inadequate bowel preparation, incomplete polyp resection) were excluded. Patients with a medical history of inflammatory bowel disease, inherited or other polyposis syndrome and colorectal cancer were also excluded.

Included subjects were categorized on the basis of findings at index or previous follow-up colonoscopy in nine groups, as shown in Fig. 1. The observed surveillance interval was calculated as the time the between last index or follow-up endoscopy and actual colonoscopy and it was compared to the recommendations by the U.S. Multisociety Task Force (USMSTF) on Colorectal Cancer (see Table 1) [5,6]. The analysis on surveillance adequacy was restricted to those categories for whom definite recommendations on PPS intervals are specified by practice guidelines. For this purpose, we categorized these subjects in three groups: "*low-risk*" *(LR) subjects* (1 or 2 small tubular adenomas with low-grade dysplasia; history of polipectomy but negative findings at previous surveillance colonoscopy); "*high-risk*" *(HR) subjects* (3 or more adenomas; any adenoma >1 cm, or villous feature or high-grade dysplasia); "*very high-risk*" *(VHR) subjects* (more than ten adenomas; sessile adenomas removed piecemeal).

Qualitative data on timing of surveillance but no information on appropriateness were provided in those cases in which a non-definite surveillance strategy is recommended by the guidelines. In this group we included subjects with submucosal invasive cancer and those with serrated polyps. Subjects with hyperplastic polyps

**Table 1**
Surveillance recommendation according to US Multi-Society task Force on Colorectal cancer and the American Cancer Society [5,6].

| Risk groups based on colonoscopy findings | Surveillance recommendations |
|---|---|
| Patients with only one or two small (<1 cm) tubular adenomas with only low-grade dysplasia (low-risk subjects) | 5–10 years |
| Patients with 3 to 10 adenomas, or any adenoma >1 cm, or any adenoma with villous features, or high-grade dysplasia (high-risk subjects) | 3 years |
| High risk subjects with follow-up endoscopy showing normal findings or presence of only one or two small (<1 cm) tubular adenomas with only low-grade dysplasia | 5 years |
| Patients who have more than 10 adenomas at one examination | <3 years[a] |
| Patients with sessile adenomas that are removed piecemeal | 2–6 months |
| Patients with small rectal hyperplastic polyps | No follow-up indication |

[a] Clinician should consider the possibility of an underlying familial syndrome.

were also considered in this group, as electronic data collection form did not report information on their size and localization, thus preventing to discriminate subjects with small distal polyps from those with sessile serrated lesions of the right colon.

The study had no funding source. The study was approved by the Ethics Committee of the coordinating centre (Valduce Hospital); in accordance to the policy of local IRB, no informed consent for data recording was required, as demographic data were anonymous.

### 2.1. Statistical analysis

Primary outcome of the study was the adherence to USMSTF guidelines, evaluated by calculating the interval between the observed surveillance time and the theoretical one indicated by the guidelines according to findings at previous colonoscopy. In detail, for LR subjects PPS colonoscopy was considered anticipated (i.e. performed earlier than recommended by guidelines) or delayed (i.e. performed later than recommended by guidelines) if it was done within 5 years or after more than 10 years, respectively. For HR subjects surveillance interval was considered appropriate at 3 years and for VHR subjects it was considered within 3 years or within 6 months, according to endoscopic findings (Fig. 1). In order to obtain a conservative estimate of surveillance adequacy, a ±6-month time lag was judged as acceptable [16]. The proportions of patients in which the surveillance was anticipated, correct or delayed were calculated. The median anticipation time and corresponding interquartile ranges (IQR) were calculated.

A subgroup analysis was planned to evaluate the appropriateness of surveillance timing in LR and HR subjects. Chi-squared test was used for statistical analysis.

Collected data were stored in a database and entered into a statistical software programme (Intercooled Stata, Stata Corp., College Station, Tex.). For univariate analysis, comparisons between groups were made by means of chi-squared test and student's *t*-test, as appropriate. Multivariate analysis was performed by using a logistic step-wise regression model to disclose determinants of appropriateness of PPS colonoscopy. It was limited to those factors related to endoscopy setting and not to patient, in order to disclose items which can be targeted by corrective measures. All parameters showing a *p*-value lower than 0.2 at univariate analysis were included and those showing a *p*-value higher than 0.4 were removed, according to an automated backward-step-wise procedure. For all comparisons, odds ratio (OR) and 95% confidence interval (95%CI) were given for significant variables. A *p*-value of less than 0.05 was considered statistically significant.

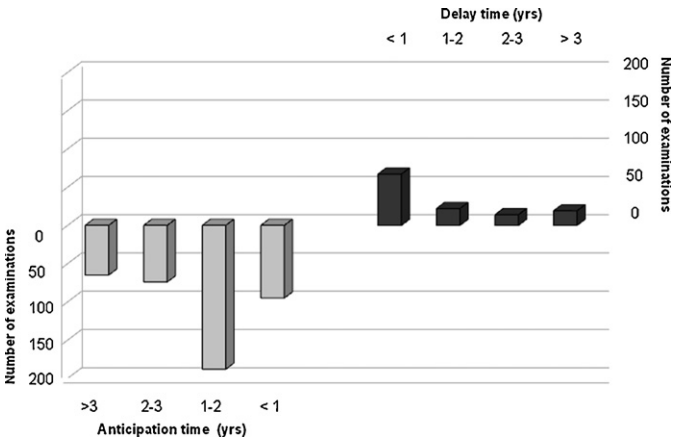


**Fig. 2.** Distribution of number of examinations according to surveillance interval time lag (yrs: years).

## 3. Results

### 3.1. Participating centres

The study was carried out in 29 Endoscopy Units, 18 of which were located in Northern Italy and the remaining 11 in Central and Southern Italy. Three centres were academic and 26 were community-based, 11 were high-volume workload (>3000 colonoscopies/year) and 24 were involved in the CRC national screening programme. All centres adopted USMSTF surveillance guidelines, but only 17 routinely provided written recommendation on timing of follow-up colonoscopy.

### 3.2. Study population

During the study period, 7081 consecutive colonoscopy outpatients were evaluated, 1218 (17.2%) of whom were referred for PPS. A total of 210 subjects were excluded because of missing data on polyp findings at previous colonoscopy (57 cases) or unsatisfactory quality standards of the examination (153 cases, 80 due to inadequate bowel preparation), so that 1008 subjects were entered into the analysis (Fig. 1). According to endoscopic findings at index or previous follow-up colonoscopy, 106 subjects were classified in the non-definite surveillance group (68 and 11 subjects with hyperplastic polyps and serrated lesions, 27 subjects with submucosal invasive cancer). The remaining 902 cases were categorized as low risk (LR, 460 subjects), high risk (HR, 367 subjects) and very high risk (VHR, 75 subjects) (Fig. 1).

### 3.3. Appropriateness of surveillance timing

Overall, surveillance colonoscopy interval resulted correct in 330 out of 902 subjects (36.6%), anticipated in 490 (54.3%) and delayed in the remaining 82 (9.1%). The median anticipation time resulted of 2.1 years (IQR 1.6–2.9).

A graphic distribution of surveillance interval time lags is represented in Fig. 2. For the 490 subjects with anticipated surveillance, the anticipation time resulted less than 1 year in 22.6% of them, from 1 to 2 years in 44.5%, from 2 to 3 years in 17.6% and more than 3 years in 15.3%, respectively. For the 122 subjects with delayed surveillance, the delay was less than 1 year in 55.3% of them, from 1 to 2 years in 18.2%, from 2 to 3 years in 11.4% and more than 3 years in 15.1%, respectively.

**Table 2**
Appropriateness of timing of surveillance according to the risk group (LR: low risk, HR: high risk).

| | Global cohort ($n$ = 902) | LR subjects ($n$ = 460) | HR subjects ($n$ = 367) |
|---|---|---|---|
| Correct (%) | 330 (36.6) | 146 (31.7) | 131 (35.7) |
| Anticipated (%) | 490 (54.3) | 310 (67.4) | 180 (49.0) |
| Delayed (%) | 82 (9.1) | 4 (0.9) | 56 (15.3) |

### 3.4. Non-definite surveillance group

Median surveillance interval for patients with hyperplastic/serrated lesions was 3.5 years (IQR 2.6–4.7); corresponding figures for subjects with submucosal invasive cancer were 0.5 years (0.4–1.4).

### 3.5. Subgroup analysis

Data on surveillance colonoscopy appropriateness stratified according to subjects' risk group are shown in Table 2. The proportions of correct surveillance intervals in LR and HR subjects were not significantly different as compared to the global cohort. However, a significantly higher proportion of LR subjects had an anticipated surveillance colonoscopy vs. the global cohort (67.4% vs. 54.3%, $p < 0.001$) and a significantly lower proportion of them had a delayed surveillance (0.9% vs. 9.1%, $p < 0.001$), as compared to the global cohort. In the HR group a significant difference was observed for delayed surveillance only (15.3% vs. 9.1%, $p = 0.001$). Among the 75 VHR subjects, 53 (70.7%) had a correct and 22 (29.3%) had a delayed surveillance examination.

### 3.6. Determinants of surveillance adequacy

At univariate analysis, several structure indicators were associated with a correct surveillance interval (Table 3). At multivariate analysis, determinants of surveillance timing appropriateness were centres with high-volume workload (OR 1.92; 1.41–2.63 95%CI), centres providing written recommendation on surveillance interval (OR 1.70; 1.18–2.58 95%CI) and for surveillance examinations prescribed within a programmatic colorectal cancer national screening programme (OR 2.62; 1.92–3.59 95%CI). No association was disclosed for referring physician, setting and participation of the centre to CRC national screening programme.

**Table 3**
Predictors of appropriateness of surveillance colonoscopy: univariate analysis.

| | Colonoscopies, total number | Correct surveillance, $n$ (%) | $p$-value* |
|---|---|---|---|
| Referring physician[a] | | | |
| Endoscopist | 588 | 227 (38.6) | 0.015 |
| Others | 288 | 87 (30.2) | |
| Endoscopy workload | | | |
| High-volume (>3000/yr) | 525 | 229 (43.6) | <0.001 |
| Others | 377 | 101 (26.8) | |
| Type of centre | | | |
| Non-academic | 815 | 312 (38.3) | <0.001 |
| Academic | 87 | 18 (20.7) | |
| Written recommendations on surveillance timing | | | |
| Yes | 702 | 287 (40.9) | <0.001 |
| No | 200 | 43 (21.5) | |
| Centre participation to the CRC national screening programme | | | |
| Yes | 805 | 305 (37.9) | 0.019 |
| No | 97 | 25 (25.8) | |
| Colonoscopy prescribed within CRC national screening programme | | | |
| Yes | 253 | 137 (54.1) | <0.001 |
| No | 649 | 193 (29.7) | |

[a] 26 data missing (referring physician not specified in the electronic data sheet).
* Comparisons by Chi-squared test.

## 4. Discussion

The present study shows a considerable overutilization of post-polypectomy surveillance colonoscopy. About two out of three surveillance colonoscopies were performed at inappropriate intervals and the vast majority of them were performed earlier than guidelines. The subgroup analysis disclosed that this proportion was significantly higher for LR subjects, for whom almost all inappropriate examinations were performed earlier than recommended. If we consider that about one out of five subjects is referred to colonoscopy for PPS, the absolute number of anticipated examinations becomes disturbing and might lead to a relevant overutilization of colonoscopy through the years. In the Italian setting, where medical procedures are refunded by the Government (Public National Health System), the problem of overutilization of prescriptions might be even greater than that of underuse. In particular, as concerns colonoscopy, the shift of the limited economic resources from screening and diagnostic procedures to surveillance might negatively affects the cost-effectiveness of the procedure and ultimately impair the overall quality of health assistance. Our estimates on surveillance overutilization might also be optimistic, as we excluded from the analysis all subjects referred to surveillance for hyperplastic polyps. Indeed, data collected in the study, prevented to discriminate subjects with small distal polyps, which are likely to be the majority and do not deserve surveillance, from those with sessile serrated lesions of the right colon, for whom follow-up colonoscopy is recommended [17,18].

These data are consistent with those retrospectively reported in two surveys, performed among GI specialists [10] and primary care physicians [11] by using theoretical clinical scenarios. These studies have shown that about 55–80% of LR subjects would have undergone surveillance colonoscopy earlier than indicated by the guidelines. A third retrospective survey [19] carried out among participants in the Prostate, Lung, Colorectal and Ovarian Cancer screening trial documented that about a half of LR subjects had received an anticipated surveillance colonoscopy. A further confirmation of this trend was obtained by a very recent retrospective study [20], which assessed the appropriateness of surveillance prescriptions by reviewing medical records from 152 participating physicians in 55 practices. The study confirmed that about one third of LR subjects evaluated were recommended to undergo colonoscopy within 1–3 years, especially in case of unsatisfactory bowel preparation.

As compared to previous reports, the present study has several strengths. First of all, data were prospectively collected, thus allowing to draw firm conclusions about anticipated examinations. Indeed, the study protocol excluded from the analysis all the subjects with incomplete procedures, poor bowel cleansing and incomplete polyp resection, in order to avoid potential confounding factors, which are known predictors of anticipated surveillance [21,22]. Actually, these colonoscopies should not be considered as surveillance procedures at all, as in the definition of PPS colonoscopy, the index examination should satisfy quality requirements for preparation and completeness of the procedure [5]. Moreover, the prospective design of the study allowed to include only asymptomatic subjects, referred to colonoscopy for surveillance, and to exclude patients referred to colonoscopy because of the onset of GI symptoms, despite the history of polypectomy. Another advantage given by the prospective design of the study was represented by the possibility to precisely calculate the extent of anticipation time, which, according to our data, had a median of about 2 years. This finding is even more relevant if we consider that a 6-month time lag was accepted. This allows to speculate that the main reason for anticipation may be represented by a grossly wrong indication of surveillance interval more than by logistic or structural issues (e.g. schedule problems related to the waiting list).

Last but not least, all participating centres adopted the USMSTFS guidelines, thus limiting the potential discrepancy in surveillance interval recommendations coming from different references. However, the large overutilization of surveillance colonoscopy among LR subjects could even be more disquieting when considering the recently published European guidelines on CRC [23]. Indeed, according to these guidelines, a surveillance colonoscopy would not be mandatory for subjects with one or two small tubular adenomas, which should conversely be returned to the screening programme.

The main strength of the study, i.e. the prospective design, can someway represent also its main limitation, as it does not allow to draw any conclusion about surveillance colonoscopy underuse. Indeed, no information can be driven on subjects which were given, but did not undergo a surveillance prescription. Our results can then be considered as complementary to those obtained by retrospective surveys [19], which better address the problem of low compliance with prescribed surveillance colonoscopy.

Another potential bias can be represented by the narrow data collection window (4 weeks), which could have provided results poorly representative of day-by-day clinical practice. However, the study period was restricted to maximize both the compliance and the accuracy of endoscopists in data reporting. Furthermore, about one out of three invited centres took part into the study. It is possible that participating centres could be those most interested in quality issues, so that they cannot be considered as completely representative of Italian real-life clinical practice. Last but not least, another limitation of present study is intrinsically related to its design, as any survey is based on self-reported data entry and no quality control of reports can be performed.

Several potential explanations may be advocated to clarify the reasons why doctors prescribe anticipated surveillance. First of all, the barriers in physicians' adherence to published recommendations may depend on a scarce awareness of guidelines, as already reported [24,25]. This hypothesis seems to be supported by the consistency of our results, which reflect what really happens in clinical practice, with those from the surveys based on clinical scenarios [10,11], which rely on the theoretical knowledge of current recommendations. Another factor to be considered may be the variability in guidelines among professional societies and their change across the years [5]. Furthermore, concerns about the potential risk of missing lesions, which could precipitate legal actions, have to be taken into account [26].

In light of these results, how can the appropriateness of the prescriptions be improved? The monitoring of quality indicators and auditable outcomes is the cornerstone of every programme of quality improvement, as it raises the awareness of critical areas deserving interventions. Thus, much improvement could be expected by just implementing the monitoring of surveillance intervals in clinical practice. Other answers can be drawn from the multivariate analysis, which provides suggestions for practical interventions. As shown for other colonoscopy quality indicators (i.e. coecal intubation and polyp detection rates), centres with high-volume workload reported better performances. This finding might partially be explained by a greater attitude towards systematic indicator recording for quality improvement programmes in structures with a more complex organization [27]. As a consequence, it is possible that they might have already adopted corrective measures for improving procedure outcomes, so that their procedural pathways and organizational frameworks could be taken as a model by smaller centres. Besides, the adherence to guidelines was higher for centres providing written recommendations on surveillance interval at the light of pathology report and for surveillance examinations prescribed within a programmatic colorectal cancer screening programme. It might be hypothesized that a wide availability of "guidelines reminders", such as web-based systems for quickly determining surveillance intervals, as adopted in CRC screening programmes, or the use of charts in the endoscopy suites or pocket-size cards, might be useful to improve the adequacy of prescriptions [28]. This tool could be of paramount importance mainly for endoscopists, whose adherence to post-polypectomy guidelines was not significantly different from that of other referring physicians prescribing surveillance.

In conclusion, in community practice we found a substantial overutilization of surveillance colonoscopy, mainly among low risk subjects, who are less likely to benefit. From a general point of view, this overutilization may prevent the endoscopy services from sustaining reasonable waiting lists for symptomatic patients and implementing screening programmes. The monitoring of post-polypectomy surveillance interval appropriateness should be a mainstay in continuous quality improvement colonoscopy programmes, and efforts to encourage adherence to guidelines should be pursued, as corrective measures seem to be effective and easy to apply.

## Conflict of interest statement

None declared.

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