

Individual invitation letters lead to significant increase in attendance for screening colonoscopies: Results of a pilot study in Northern Hesse, Germany

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Abstract

Background: Colorectal cancer (CRC) is the second most common cancer in Germany. Screening colonoscopies are considered an effective tool for early detection and prevention of CRC and are recommended in Germany for citizens over the age of 55. To increase the participation rate for screening colonoscopies, an invitation procedure was initiated in parts of Germany for patients between the ages of 55 and 75 who had never undergone a screening colonoscopy before.

Methods: We examined the number of participating patients before, during, and after the invitation procedure and compared the number of the participating patients who received a cover letter with the participating patients from the control group. Additionally, we classified the findings of the colonoscopies including CRC, advanced adenomas, and polyps.

Results: During the invitation period, the participation rate of the invitation group increased from 220 patients to 531 patients compared to 1256 to 1693 in the control group. The increase was significantly greater in patients with cover letters (+141% vs. +35%, $p < 0.0001$). Also, significantly more polyps and adenomas were found in patients from the invitation letter group (254 (+102%) vs. 679 (-9%), $p < 0.0001$).

Conclusions: Our study clearly indicates that personal invitation letters are an effective measure to increase overall participation rates in screening colonoscopies.

Keywords

Screening colonoscopy, invitation procedure, participation rate, colorectal cancer, advanced adenomas

Received: 31 December 2017; accepted: 18 March 2018

Key summary

1. Summarize the established knowledge on this subject:
 - Colorectal cancer is the second most common cancer in Germany.
 - Screening colonoscopies are an effective tool for early detection and prevention of a colorectal carcinoma.
 - Screening colonoscopies are recommended in European and German guidelines.
 - There are low participation rates for screening colonoscopies.
2. What are the significant and/or new findings of this study?

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- Invitation letters lead to a significant increase in the participation rates for screening colonoscopies.
- The participation rate decreased after the invitation period ended.
- Advanced adenomas were found more often after the invitation letters had been sent out.
- Advanced adenomas were found significantly more often in men than in women.

Introduction and background

Colonoscopy screening of asymptomatic individuals is considered to be an effective tool for early detection of colorectal cancer (CRC) and its precursor lesions.^{1–5} There is a correlation between early detection and better chances of survival.^{1,6} Furthermore, CRC can be prevented by removal of its precursor lesions.^{1,7–10} In 2002, Germany was the first country worldwide to offer screening colonoscopies for citizens over the age of 55. The screening results are collected in a national registry.^{11–13}

However, the participation rate in screening colonoscopy remains rather low—overall about 23.8% of eligible women and 21.3% of eligible men underwent a screening colonoscopy between 2003 and 2014.¹⁴ With the objective to increase the number of participating individuals undergoing a screening colonoscopy, the “Gastroenterology Hesse eG”—an association of established gastroenterologists in Hesse—started with the health insurance company AOK Hesse—an invitation procedure for screening colonoscopies for citizens over the age of 55 who had never had a screening colonoscopy before.

The aim of our study was to evaluate if invitations for screening colonoscopies increase the number of participants in a known effective screening measure for detection of CRC and its precursor lesions.

Methods

Patient cohort

In June 2014 the invitation procedure of the “Gastroenterology Hesse eG” and the health insurance company AOK Hesse was inaugurated in the north of Hesse, one of the 16 federal states in Germany, with more than 6 million inhabitants. The regions in Hesse taking part were the counties of Kassel, Werra-Meißner-Kreis, Waldeck-Frankenberg, Schwalm-Eder-Kreis, Hersfeld-Rotenburg, Marburg-Biedenkopf, Vogelsberg and Fulda. The potential participants—individuals ages 55 to 75 who had never undergone a colonoscopy (and therefore also no screening colonoscopy) before obtained a cover letter from AOK Hesse as well as an information sheet explaining the reasons for the pilot project. Established gastroenterologists performed the screening colonoscopies. The invitation period was carried out for 28 weeks—from June 16, 2014 until December 15, 2014—in

which around 3000 letters were sent out on a weekly basis. In total, about 84,000 were sent out during the study period.

Our control population comprised individuals ages 55–75 in the Hessian population from health insurance companies other than AOK Hesse who were also undergoing a colonoscopy for the first time. These screening colonoscopies were performed by the same gastroenterologists. The results of the colonoscopies during the invitation period were compared to those of the colonoscopies nine months before and three months after, respectively, the invitation procedure.

In total, data from 859 screening colonoscopies from policyholders of AOK Hesse and 3470 from non-AOK policyholders were compared.

Study procedures

After the data had been collected, we examined retrospectively the number of participants before, during, and after the invitation period and compared the number of invited participants from AOK Hesse with the control group. We classified the time period before the invitation procedure as period 1 (P1, July 2013–March 2014), the time period during the invitation procedure including the following quarter as period 2 (P2, July 2014–March 2015) and the subsequent quarter as period 3 (P3, April–July 2015). We decided to add the first quarter of 2015 (the first quarter after the invitation procedure had stopped) to P2 because we assume that some screening colonoscopies took place after the invitation process had already been stopped.

Additionally, we classified the findings of the colonoscopies into the following groups: polyps (hyperplastic, other benign and adenomas), advanced adenomas (AA; >1 cm, villous components in histology—as villous or tubulovillous features, and high-grade intraepithelial neoplasia (IEN)²), and CRC.

Polyps were removed by snare or forceps polypectomy during colonoscopy and investigated by local pathologists.

The results of the participants undergoing screening colonoscopies in the north of Hesse before, during, and after the invitation period were transmitted to IOMTECH, Berlin, Germany, a company providing quality assurance and storage. IOMTECH collected the data from established gastroenterologists who were members of the association “Gastroenterology Hesse,” in which 70% of established gastroenterologists are registered. IOMTECH Berlin collected the

data from the screening colonoscopies prospectively. We were able to investigate the data retrospectively after receiving the ethical approval.

Data analysis

Categorical variables were compared with the χ^2 test or Fisher's exact test, and quantitative variables with the nonparametric Kruskal–Wallis test, whereby post-hoc comparisons p values were adjusted applying the Bonferroni–Holm procedure.

All tests were two tailed and the level of significance was 5%. Statistical analysis was performed with R (version 3.2.4, R Foundation of Statistical Computing, Vienna, Austria).

Ethical considerations

The principle of a pseudonymized (each patient was encoded by sex, age and the first three digits of the postal code) documentation was approved by the

local ethics committee of the medical department of Goethe University in Frankfurt on October 30, 2017 (Ethik-Kommission des Fachbereichs Medizin der Goethe Universität Frankfurt, 30.10.2017, 332/17).

The study has been registered under DRKS00012708 (<http://www.drks.de>).

All the principles outlined in the Declaration of Helsinki of 1975 have been followed in this retrospective study.

Informed consent

Since this was a retrospective study, no informed consent was obtained from the patients included.

Results

Before the invitation period, in P1, 220 participants from AOK Hesse from the north of Hesse underwent a screening colonoscopy compared to 1256 participants with other health insurance. In P2 the number rose to

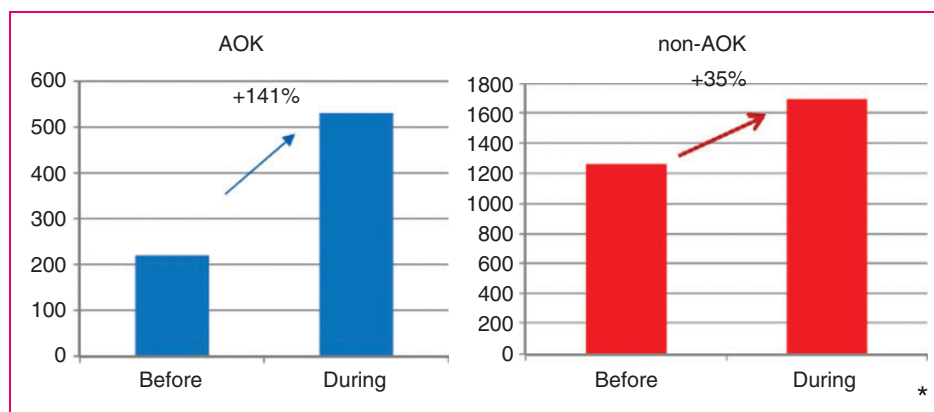


Figure 1. Number of colonoscopies before and during the invitation procedure, comparison AOK/non-AOK.

* $p < 0.0001$.

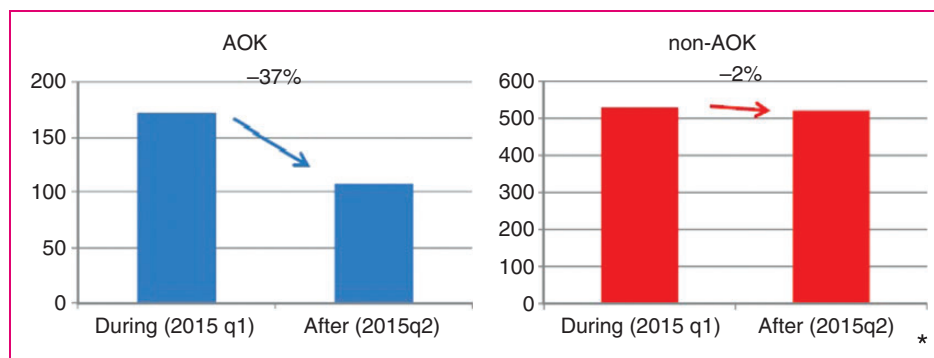


Figure 2. Number of colonoscopies during (2015q1) and after (2015q2) the invitation procedure, comparison AOK/non-AOK.

* $p = 0.0013$.

531 individuals from AOK Hesse and to 1693 participants with other health insurance. The increase was significantly greater in AOK participants (+141% vs. +35%, $p < 0.0001^*$, fig. 1).

In comparison to the last quarter of P2, the number of participants decreased in P3 from 172 (2015q1) to 108 (2015q2) (AOK Hesse) and from 529 (2015q1) to 521 (2015q2) (other health insurance) (−37% vs. −2%; $p = 0.0013^*$, fig. 2).

Interestingly, significantly more findings (polyps, adenomas, AA, CRC and other benign findings) were detected in AOK Hesse participants compared to the control cohort during the invitation period

(254 (+102%) AOK Hesse vs. 679 (−9%) others, $p < 0.0001$) (Table 1).

After the invitation period, significantly fewer findings were detected and removed in the AOK Hesse cohort. Fewer findings were also reported in the control group (Table 2).

Findings of CRC, AA and polyps (Table 3)

AA are characterized as adenomas ≥ 1 cm, or with villous features (villous or tubulovillous), or with high-grade severe dysplasia, respectively (Table 4).¹⁵

Before the invitation letters were sent, AA could be found in 6.84% in total (7.72% of AOK participants and 6.69% of non-AOK participants); during the invitation process AA were detected in 7.33% in total (9.79% in AOK and 6.5% in non-AOK participants); and after AA were found in 7.31% in total (12.03% of AOK participants and 6.33% of non-AOK participants). Altogether, more AA were detected after invitation letters had been sent (Table 5).

AA were found significantly more often in men than in women ($p < 0.0001$).

Table 1. Number of findings before and during the invitation procedure, comparison AOK/non-AOK.

	Before (P1)	During (P2)	Changes (%)
AOK	126	254	101.59
non-AOK	743	679	−8.61

$p < 0.0001$.

Table 2. Number of findings during and after the invitation procedure, comparison AOK/non-AOK.

	During invitation (2015q1)	After invitation (2015q2)	Changes (%)
AOK	76	43	−43.42
non-AOK	224	212	−5.35

$p = 0.0204$.

Localization

As AA have a different risk of degradation in different colonic areas,¹⁵ we also examined the localization of AA.

In total, 350 AA were detected. A total of 51.71% were located in the colon (no differentiation between single sections), and 48.29% were located in the proximal sigmoid and sigmoid/rectum.

No significant differences in localization were observed between individuals from AOK Hesse and participants from other health insurance ($p > 0.2$).

Table 3. Findings (colorectal cancer (CRC), advanced adenoma and polyps) before, during and after the invitation process in AOK and non-AOK participants, in total.

	Before (n) AOK/non-AOK	During (n) AOK/non-AOK	After (n) AOK/non-AOK
CRC	2/10	1/6	0/3
High-grade dysplasia	0/4	2/4	1/0
Villous adenomas	0/2	1/0	0/1
Tubulovillous adenomas	12/48	36/56	9/18
Mixed polyps	0/0	0/1	0/0
Tubular adenoma	59/404	118/358	23/113
Traditional serrated adenoma	0/1	0/0	0/0
Sessile-serrated adenoma	0/0	1/4	0/0
Hyperplastic polyp	59/330	105/269	12/87
Other benign	3/25	9/26	0/6

Table 4. Numbers of advanced adenomas (AA) before, during and after the invitation procedure in AOK and non-AOK participants, in total.

	Before (n) AOK/non-AOK	During (n) AOK/non-AOK	After (n) AOK/non-AOK
AA, total	17/84	52/111	13/33
- Adenoma \geq 1 cm	5/30	13/51	3/14
- Villous features	12/50	37/56	9/19
- High-grade dysplasia	0/4	2/4	1/0

Table 5. Comparing histological findings (especially advanced adenomas (AA)) in women and men in all health insurance programs (AOK and non-AOK).

	Male	Female
Histological findings	1597	1799
AA	191	109

$p < 0.0001$.

Discussion

This study shows for the first time that a personal invitation to a screening colonoscopy leads to (1) significantly higher participation rates in male as well as female healthy individuals and (2) an improved endoscopic performance as indicated by higher detection rates of CRC and its precursor lesions in invited participants in comparison to their noninvited counterparts.

It has been hypothesized before that remarkable effects in screening colonoscopies may be achieved by high attendance and participation rates, which may be increased by an invitation procedure.¹⁶ The adoption rate among the general public for screening programs—in our case CRC screening programs—is certainly a coefficient for its efficacy and effectiveness.¹⁷ A national polyp study in the United States (US) showed a reduction of CRC mortality of about 53% after a median follow-up of 15 years after adenomatous polyps had been removed colonoscopically.¹⁰ This study indicates, in accordance with other studies, that patients without polyps or with nonadenomatous polyps have low rates of development of colorectal neoplasia after undergoing a colonoscopy.^{10,18–20}

In our study, we show a significant rise in the number of performed colonoscopies after an invitation procedure. Accordingly, there was a significant reduction in the participation rate after the invitation procedure had stopped. We conclude that the supporting and the “awareness-raising” effect of the invitation letter are transient. Another study from 2017 showed similar results regarding an increased participation rate in undergoing screening colonoscopy after a written invitation.²¹

A study by Brenner et al. from 2017—in which a personal invitation for 50- to 54-year-old citizens had taken place—indicates that screening colonoscopies should already be offered, at least for men, from age 50 onward, as the prevalence of advanced neoplasia for men is twice as much as in women.²² In our study, we investigated patients only over the age of 55. However, we also showed that AA were found significantly more often in men than in women ($p < 0.0001$), which may support the idea that screening colonoscopies should be offered at the age of 50, at least for men.

The adoption rate among the general public of screening colonoscopies is important for their efficacy.¹⁷ Sending invitation letters may be one tool to increase the attendance rate. This has been shown in screening programs for several forms of cancer,²³ including CRC.²⁴

Adenomatous polyps can degenerate. The risk of degeneration and malignancy correlates with size, histologic type, and degree of dysplasia.¹⁵ AA are characterized as adenomas \geq 1 cm, or with villous features (villous or tubulovillous), or with high-grade or severe dysplasia.¹⁵ Given the higher risk of degradation in AA, detection and removal of adenomas, and especially AA, seems to be essential for the prevention of CRC.^{9,10,25}

In this study, we investigated the detection rate of AA. In the AOK patient cohort, AA could be found in 7.72% of patients before (P1) and in 9.79% of patients during (P2) the invitation period. We theorize that the knowledge of an invitation process led to greater attention and alertness in the gastroenterologists performing the colonoscopies. Another possible factor might be that people who had a higher risk for CRC (maybe because of a positive family history) or who already experienced unspecific symptoms (e.g. blood in the stool) felt more motivated to undergo a colonoscopy after receiving the invitation letter. Nevertheless, there was a high prevalence of AA found during the invitation process, which supports the idea of raising the attendance for screening colonoscopies by sending invitation letters.

We found that more than 50% of AA were detected in the right colon, compared to the other half, which

was located in the proximal sigmoid and sigmoid/rectum. Considering complete colonoscopies seem to be essential to reducing the rate of AA. Additionally, a prospective nationwide study in Germany (including 2,821,392 asymptomatic patients) showed that about one-third of the detected cancers were located proximal to the sigmoid colon and would not have been diagnosed by a sigmoidoscopy.¹³ However, there is an absence of data demonstrating the effectiveness of the use of screening colonoscopies for prevention of CRC, whereas for sigmoidoscopy there are randomized, controlled studies showing a significant reduction in the incidence of and mortality from CRC.^{26,27} It has also been indicated that sigmoidoscopy may be an equivalent and even more cost-effective tool for screening.^{1,26–28} By contrast, a retrospective, population-based case-control study by Brenner et al.²⁹ hypothesizes that the risks and costs of a colonoscopy—in comparison to a sigmoidoscopy—are justified by a significant advantage in the distal and proximal colon. In addition, in the US,^{30,31} and internationally,^{32,33} a shift is described toward right-sided or proximal colon cancers, with the highest relative increase in incidence located in the cecum.^{34,35} This may be caused by improvements in diagnosis and by increased screening by sigmoidoscopy with removing suspect polyps; however, there does seem to be a real increase in right-sided cancers.³³

Interpretation of our data might be limited by the fact that there is no distinction between symptomatic and asymptomatic participants or between high-risk (e.g. positive family history of CRC or inflammatory bowel disease) and no-high-risk individuals. Furthermore, we did not investigate aspects such as levels of education or lifestyle habits that may influence colonoscopy utilization. To reduce the effect of these limitations, only patients who had never undergone a colonoscopy before received an invitation letter for the screening colonoscopy. But, effects from the pooling of symptomatic and asymptomatic or of high-risk or no-high-risk patients cannot be ruled out.

Another aspect that may limit the interpretation of our data is that we included only the data from gastroenterologists who are members of the association “Gastroenterology Hesse.” There may be other internal specialists who may also have performed screening colonoscopies that could not be considered in our investigation. As the majority of gastroenterologists are in “Gastroenterology Hesse,” we assume that most of the performed screening colonoscopies were collected in our data.

In summary, our study clearly indicates that personal invitation letters are an effective measure to increase overall participation rates in screening colonoscopies. However, further studies are needed to confirm our results in a larger, nationwide screening cohort.

Acknowledgments

The authors would like to thank all the gastroenterologists and patients who participated in the study. The authors would also like to thank the Gastroenterologie Hessen eG as well as the AOK Hessen for initiating the study.

Declaration of conflicting interests

None declared.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Informed consent

Since this was a retrospective study, no informed consent was obtained from the patients included.

Ethics approval

The principle of a pseudonymized (each patient was encoded by sex, age and the first three digits of the postal code) documentation was approved by the local ethics committee of the medical department of Goethe University in Frankfurt on October 30, 2017 (Ethik-Kommission des Fachbereichs Medizin der Goethe Universität Frankfurt, 30.10.2017, 332/17). All the principles outlined in the Declaration of Helsinki of 1975 have been followed in this retrospective study.

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