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Colorectal cancer and screening awareness, beliefs and attitudes

Doctoral (Ph.D.) thesis

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INTRODUCTION

The World Health Organization predicts that colorectal carcinoma (CRC) will be the second most common cause of tumor-related mortality in 2018. The standardized mortality rate was the highest in Hungary (followed by Croatia) within the member states of the European Union in 2015. In Hungary, the second most common cause of death is CRC, a great challenge for public health. In countries running an effective campaign against smoking, CRC has become the most common malignant tumor, overtaking lung carcinoma. According to recent Hungarian data, 5 841 and 4 776 newly diagnosed CRC cases were recorded in 2015 among males and females, respectively; and CRC was responsible for 5 841 fatalities in 2017. In CRC, 70% of the cases are sporadic, 10-30% run in the family, and 7% is accompanied by diseases where the development of CRC is almost inevitable. In Hungary, most of the diagnosed cases are advanced (stages 3 or 4) where the yield of a curative therapy is humble. An approach to fixing this issue might be the introduction of CRC screening for people above 50 years of age as a proxy for the operating sporadic screening model. Although the preparations of the regular screening have been progressing for many years, the program has not been launched until the submission of this thesis. The initial step of the screening program would be the invitation of 1.8 million potential attendees between 50 and 75 years by volunteer family doctors or screening centers. Adenomatous polyps are present in 5-10% of the general population, which spikes up to 20-25% among those above 50 years and of average risk of CRC. The length of the preclinical period of CRC supports the idea of screening because the multistep adenoma-CRC sequence embraces a 10-15-year period. The incidence of adenomas is the highest between 55 and 65 years, whereas that of CRC is the highest between 65 and 75 years. The primary objective of CRC screening is the detection and removal of adenomas in average-risk persons and the early recognition of asymptomatic lesions, thereby providing better opportunities for curative therapy. The application of standard screening optimizes costs of care compared to the burden imposed by the management of advanced CRC. Data from the opportunistic CRC screening revealed a very low attendance rate (32%), for which several restraining factors are responsible. Besides, the rationale for carrying out this study is supported by the fact that knowledge of and attitude towards CRC have not been surveyed and published in Hungary.

Objectives

To explore the knowledge of CRC and CRC screening in a population between 40 and 70 years in Baranya county and to identify factors having a great impact on screening attendance rate.

Hypotheses

Respondents' knowledge of screening (timing, frequency, and protocol) is insufficient and influenced by sex, the level of education, and how often they see a doctor.

Respondents' knowledge of signs and symptoms, and risk factors is short, those who are well-informed about them choose healthcare employers as the major source of information.

Screening acceptance is influenced by previous experience and knowledge of screening as well as by the recommendation for screening.

Screening attendance is influenced by previous experience and knowledge of screening as well as by the recommendation for and acceptance of screening.

MATERIALS AND METHODS

Design of the study: qualitative cross-sectional study.

Sample

Region of sampling: Baranya county.

Recruitment period: April 2015 - April 2016.

Planned sample size: 1100 participants.

Inclusion criteria: Between 40 and 70 years of age. Participants between 40 and 50 years were included because knowledge and attitude developed during this period substantially influence future screening attendance.

Exclusion criteria: diagnosed malignant diseases.

Type of sampling: non-random, quota sampling.

Sites of sampling: 23 volunteered general practitioner districts.

Data collection

Data were collected with an anonymous self-developed self-completion questionnaire. Domains of the questionnaire covered socio-demographic features, health and healthcare, knowledge of CRC and sources of information, knowledge of and attitude towards CRC screening, and potential influencing factors.

Analysis

We used descriptive statistics (mean, median, relative frequencies), parametric, and non-parametric tests with 95% confidence intervals. Analysis was carried out with SAS version 9.2. Regarding signs and symptoms, respondents indicating six correct answers with a maximum of one incorrect answer were considered as being well-informed, everybody else was considered not well-informed. Regarding risk factors, respondents indicating eight correct answers with a maximum one incorrect answer or those indicating seven correct answers without incorrect answers were considered as being well-informed, everybody else was considered not well-informed. Some questions were Likert-scale-based (7-grade) with the two endpoints of totally unacceptable and fully acceptable. We aggregated the number of existing chronic diseases and the number of events of participation in prior screenings for any disease, which resulted in a continuous variable.

Missing data

We used available case analysis to handle missing data.

Representativeness

The comparison of our study population to a general target population (data were recorded by the Hungarian Central Statistical Office from inhabitants of Baranya county between 40 and 70 years of age in the census in 2011) detected no significant difference in age ($p=0.4616$), sex ($p=0.7466$), and place of residence ($p=0.8458$).

RESULTS

Socio-demographic characteristics

Table I/a

Socio-demographic characteristics		N	%
Age	40-50	369	36.5
	51-60	339	33.5
	61-70	304	30.0
	All	1012	100.0
Sex	Male	470	46.4
	Female	542	53.6
	All	1012	100.0
Place of residence	County town	395	39.0
	Other town	266	26.3
	Village	351	34.7
	All	1012	100.0
Marital status	Unmarried	72	7.1
	Married/Common-law marriage	624	61.7
	Divorced/Separated	193	19.1
	Widowed	123	12.1
	All	1012	100.0

Table I/b

Socio-demographic characteristics		N	%
Education level	Less than primary school	9	0.9
	Primary school	119	11.8
	Vocational school / Industrial school	314	31.0
	Secondary school	286	28.2
	Higher education	110	10.9
	College/University	174	17.2
	All	1012	100.0
Health education	Yes	113	11.2
	No	895	88.8
	All	1008	100.0
Employment status	Employed	550	54.3
	Unemployed	75	7.4
	Parental leave	5	0.5
	Pension	292	28.9
	Disability pension	81	8.0
	Dependent	4	0.4
	Housewife	5	0.5
	All	1012	100.0

Knowledge of CRC and CRC screening

Only 32.7% of respondents indicated correctly the recommended age at first CRC screening, these respondents saw the doctor significantly more often than those answering incorrectly. ($p=0.0079$). In the study of Tseng et al., Papanikolaou et al., and R. Ramirez-Amill, 47.9%, 83.0%, and 68.0% of respondents answered correctly to this question, respectively. 22.4% of respondents knew the recommended frequency of screening, these respondents had a higher level of education than those who answered incorrectly ($p=0.0005$). 59.2% of respondents knew the screening protocol (i.e., two-step screening), these respondents had a higher level of education ($p<0.0001$) and were more likely to be females (OR=1.3392; 95% CI: 1.0416-1.7219) than those answering incorrectly.

These results support our **first hypothesis** claiming that respondents' knowledge of screening recommendations is not sufficient. Results were better regarding screening protocol. The level of knowledge was positively influenced by female sex, the higher level of education, and by that if someone sees the doctor more often.

41.5% of respondents knew that the removal of polyps helps to avoid the development of CRC. In the work of Christou et al., a prominently lower fraction (20.4%) knew the role of polyps in the pathogenesis of CRC.

69.6% of respondents knew that CRC is curable if detected in an early stage, these respondents had a higher level of education than those answering incorrectly ($p=0.0085$). *In the study of Sessa et al., 78.5% of respondents agreed with this statement. When we compared our results to that published by Sessa et al., we observed no significant difference.*

56.2% of respondents knew that the early period during the disease course of CRC can be asymptomatic, these respondents had a higher level of education than those answering incorrectly ($p<0.0001$). Those indicating this statement to be correct attended a higher number of screening tests in the past 1 year than those indicating this statement to be false ($p=0.0005$) or than those not knowing the answer to this question ($p<0.0001$).

60.0% of respondents agreed with the statement that CRC is a common cause of death in Hungary. These respondents had a higher level of education and attended a higher number screening tests than those who deemed this statement to be false ($p=0.0032$ and $p=0.0011$, respectively) or answered incorrectly ($p=0.0005$ and $p=0.0002$, respectively).

14.1% of respondents knew that CRC can run in the family and 41.3% had an acquaintance or a friend who was diagnosed with CRC.

26.0% of respondents rated their own knowledge of CRC as sufficient, these respondents were less likely to be males (OR=0.6584; 95% CI: 0.4942-0.8772) and had a higher level of education ($p<0.0001$).

Respondents were asked to indicate the screening modalities about which they have already heard (answers are given in descending order): 1. colonoscopy (57.6%), 2. FOBT (38.3%), 3. sigmoidoscopy (29.4%), and 4. enzyme-based screening (26.9%). *In the study of S. Al-Sharbatti et al., a lower proportion of respondents have heard about colonoscopy and sigmoidoscopy (38.4% and 16.1%, respectively) than in our study.* Surprisingly, 27% of respondents have not heard about any screening modalities at all. *In the study of Berkowitz et al. and Horváthné, this proportion was 42% and 33.3%, respectively.* Our study participants had more information about screening modalities than those in the study of *Berkowitz et al.* Males were less likely to hear about enzyme-based screening (OR=0.6098; 95% CI: 0.4587-0.8107) and colonoscopy (OR=0.5716; 95% CI: 0.4442-0.7356). However, those who have heard about it were significantly older ($p=0.0104$). Respondents who have not heard about any modality were more likely to be males (OR=1.7081; 95% CI: 1.2909-2.2601), younger ($p=0.0016$), had a lower level of education ($p<0.0001$), and tended to see the doctor less often ($p<0.0001$).

Our study assessed the respondents' knowledge of risk factors, and signs and symptoms. This domain of the questionnaire offered multiple answers to be judged as correct or incorrect. Answers indicated are given in descending order:

Risk factors: 1. superficial colonic polyps (65.5%), 2. inflammatory bowel disease (53.1%), 3. positive family history for CRC (45.4%), 4. excessive alcohol intake (39.2%), 5. age above 50 years (35.8%), 6. low intake of fruits and vegetables (34.2%), 7. excessive intake of red, grilled meat (33.3%), 8. overweightedness or obesity (33.1%), 9. bowel infection (32.0%), 10. sedentary lifestyle (29.9%), 11. high calorie intake, mainly from fat (28.6%), 12. smoking (25.5%), 13. use of painkillers (5.1%), 14. high blood pressure (5.0%), 15. excessive intake of poultries (1.9%), 16. high fluid intake (1.1%), and 17. oral contraceptives (1.1%). *Results of Koo et al. were substantially different. Respondents indicated dietary habits and family history as the two most common risk factor of CRC (47% and 30%, respectively).* In accordance with the classification described in the Materials and Methods section, 18.8% of respondents were well-informed, while 81.2% were not well-informed about risk factors. *In the study of Bidouei et al., 90% of respondents did not have enough information about risk factors.* A higher proportion of respondents from the county town were well-informed than that from other villages ($p<0.0001$). Those being well-informed had a higher level of education ($p<0.0001$).

Signs and symptoms: 1. blood and mucus in stool (67.0%), 2. altered bowel habits (diarrhea, obstipation; 59.4%), 3. rectal bleeding (58.2%), 4. sudden, involuntary weight loss (54.3%), 5. strong, persistent abdominal pain (34.1%), 6. persistent bloating (30.2%), 7. pain, sensitive area, itching, or lumps around the anus (27.4%), 8. loss of appetite (21.6%), 9. frequent nausea, vomiting (14.9%), 10. temperature (8.7%), 11. hypertension (2.7%), 12. hyperglycemia (2.7%), 13. limb weakness (2.6%), and 14. dizziness (2.4%). *In the study of Koo et al., respondents indicated signs and symptoms in a similar order: bloody stool in 55% and altered bowel habits in 48%.* In accordance with the classification described in the Materials and Methods section, 21.0% of respondents were well-informed and 79.0% were not well-informed. *In the study of Bidouei et al., 90% of respondents did not have enough information about signs and symptoms.* A higher proportion of respondents from the county town were well-informed than that from other villages ($p<0.0001$). Those being well-informed had a higher level of education ($p<0.0001$).

As the source of information, respondents indicated a family doctor or a specialist in 36.2%, television in 35.0%, newspapers and other printed material in 24.6%, the internet in 24.2%, friends, acquaintances, and co-workers in 24.0%, healthcare workers in 21.2%, and the family in 17.8%. 13.3% of respondents have not heard about CRC. *In the study of Christou et al., a higher proportion of respondents (22%) have not heard about CRC. In the study of Domati et al., the list of sources of information was, as follows: 1. friends, 2. television, 3. newspapers,*

4. family doctor, and 5. specialist. The summary of sources of information and their associates is provided in Table II.

Table II. Summary of sources of information and their associates

General practitioners, specialists	Users are older	p<0.0001
	Users were likely to have heard about FOBT	OR=3.6122; 95% CI: 2.7556-4.7349
	Users were likely to have heard about the M2-PK isoenzyme test	OR=2.3174; 95% CI: 1.7428-3.0816
	Users were likely to have heard about colonoscopy	OR=2.7722; 95% CI: 2.0994-3.6604
Assistants	Users were likely to have heard about FOBT	OR=3.6027; 95% CI: 2.6307-4.9337
	Users were likely to have heard about the M2-PK isoenzyme test	OR=2.4870; 95% CI: 1.8104-3.4165
	Users were likely to have heard about colonoscopy	OR=2.4050; 95% CI: 1.7229-3.3571
Internet	Users are younger	p<0.0001
	Users have better financial situation	p=0.0014
	Users were likely to be well-informed about risk factors	OR=3.3190; 95% CI: 2.3763-4.6358
	Users were likely to be well-informed about symptoms	OR=2.6272; 95% CI: 1.8992-3.6342
Newspapers, brochures	Users were likely to have heard about sigmoidoscopy	OR=2.0221; 95% CI: 1.4950-2.7350
	Users are older	p=0.0455
I have never heard about CRC	Users are younger	p=0.0104
	Users see the doctor less often	p<0.0001

Regarding the **second hypothesis** of our study, respondents' knowledge of risk factors and signs and symptoms seemed insufficient. Instead of the healthcare workers, the major source of information proved to be the internet.

Nobody recommended the screening for 62.5% of respondents. A family doctor recommended the screening for 23.5%, a specialist for 9.6%, a family member, a friend, or an acquaintance for 8.4%, and a nurse for 7.0% of respondents. *In the study of Hudson et al., a higher proportion of patients was offered a recommendation for screening (82%).* Respondents whom the screening was not recommended were significantly younger (p<0.0001), tended to see the doctor less often (p<0.0001), were less likely to know when to attend the first screening (OR=1.6420; 95% CI: 1.1042-2.4415), and less more likely to know the recommended frequency of screening (OR=1.7720; 95% CI: 1.3127-2.3921).

Attitudes towards CRC screening and other screenings

10.9% of respondents had a colonoscopy within 10 years, 8.2% an FOBT within 1 year, 2.6% a sigmoidoscopy within 10 years, and 2.0% an enzyme-based screening within 1 year. *In the study of Christou et al., results on colonoscopy and FOBT were similar (15% and 5.6%, respectively).* The majority of respondents (80.8%) did not attend CRC screening. *The proportion of those attending any type of CRC screening was higher in the study of Ye et al. (53.9%) but similar in the study of Deng et al. (22.5%).* Those attending any type of CRC screening were more likely to have a positive family history for CRC (OR=2.3277; 95% CI: 1.6892-3.2075), to have a friend or acquaintance who had CRC (OR=2.0891; 95% CI: 1.4882-2.9325), and to attend other screenings than CRC screening within 1 year (OR=2.3474; 95%

CI: 1.2340-4.4652). In the study of Tran et al., respondents with a positive family history for CRC, with health insurance, and those seeing the doctor on a regular basis were more likely to attend CRC screening, as well.

Respondents were asked to indicate on a Likert scale between 1 to 7 how acceptable they consider CRC screening modalities. The median scores of acceptance of FOBT and enzyme-based screening were both 7, that of sigmoidoscopy and colonoscopy were both 5. Factors decreasing acceptance are summarized in Table III.

Table III. Summary of factors decreasing the acceptance of CRC screening

FOBT ¹ ; M2-PK isoenzyme test ²	Respondents were not religious	p<0.0001 ^{1,2}
	Respondents did not have healthcare education	p=0.0007 ¹ ; p<0.0001 ²
	Respondents had yet not taken part in CRC screening	p=0.0019 ¹ ; p=0.0202 ²
	General practitioner did not recommend CRC screening	p=0.0157 ¹
	Family members/friends did not recommend CRC screening	p=0.0048 ¹ ; p=0.0101 ²
	Respondents felt they lacked enough information on CRC	p=0.0022 ¹ ; p=0.0039 ²
	Respondents had not heard of CRC screening methods before	p<0.0001 ²
	Respondents did not participate in prior screenings for any disease within 1 year	p=0.0195 ¹ ; p<0.0001 ²
	Participants lived other town, than county town	p<0.0001 ²
	Participants lived other town, than village	p=0.0001 ²
Sigmoidoscopy ³ ; Colonoscopy ⁴	Males dispreferred this screening method	p=0.0132 ⁴
	Younger people dispreferred this screening method	p=0.0273 ⁴
	Respondents were not religious	p=0.0152 ³ ; p=0.0072 ⁴
	Respondents did not have healthcare education	p=0.0041 ³ ; p<0.0018 ⁴
	Respondents had not yet taken part in CRC screening	p=0.0070 ³ ; p<0.0001 ⁴
	General practitioner did not recommend CRC screening	p<0.0001 ^{3,4}
	Specialist did not recommend CRC screening	p=0.0021 ⁴
	Assistants did not recommend CRC screening	p<0.0001 ^{3,4}
	Family members/friends did not recommend CRC screening	p=0.0026 ³ ; p=0.0054 ⁴
	Respondents felt they lacked enough information on CRC	p=0.0021 ³ ; p<0.0001 ⁴
	Respondents had not heard of CRC screening methods before	p<0.0001 ^{3,4}
	Participants had no chronic diseases	p=0.0020 ³ ; p=0.0002 ⁴
	Respondents did not participate in prior screenings for any disease within 1 year	p<0.0001 ^{3,4}

Results confirmed our **third hypothesis** claiming that the acceptance of CRC screening modalities is influenced positively by previous experience and knowledge of screening, and by getting a recommendation for screening from anyone.

33.7% of respondents felt that the preparations before colonoscopy are challenging, while another 17.6% did not do so (48.7% could not decide). Those feeling it challenging were more likely to be women compared to those not doing so (OR=1.5699 95% CI: 1.0878-2.2658) or to those who could not decide (OR=1.6405 95% CI: 1.2382-2.1735).

Respondents were asked to judge on a Likert-scale between 1 and 7 (where 1 is a totally unacceptable and 7 is fully acceptable) how acceptable the given statements they consider (the median scores are given for each statement): „I think that colonoscopy is painful” scored 6, both „I feel it embarrassing to get in touch with feces during the examination” and „I considered colonoscopy to be dangerous” scored 4, „I am afraid that the examination will detect a tumor

or a lesion” scored 5, both „I am afraid that I suffer an injury during the examination” and „I think the examination to be too intimate, I feel ashamed during it” scored 4, both „Attendance of screening makes me feel safe because I can keep my health under control” and „Healthy lifestyle, such as the healthy diet and regular exercise, reduces the risk of CRC” scored 6.

The statement „Attendance of screening makes me feel safe because I can keep my health under control” was considered to be less acceptable among those not attending any screening within one year ($p < 0.0001$).

The statement „Healthy lifestyles, such as the healthy diet and regular exercise, reduces the risk of CRC” was more acceptable for those not suffering from chronic conditions ($p = 0.0115$), those respondents who were well-informed about risk factors considered this statement significantly more acceptable ($p < 0.0001$).

Respondents who have already heard about FOBT were more likely to agree with the statement „I feel it embarrassing to get in touch with feces during the examination” ($p = 0.0266$).

Women were more likely to think that colonoscopy is painful ($p = 0.0003$), dangerous ($p = 0.0076$), that injuries can happen during the examination ($p = 0.0162$), and that CRC screening is intimate and embarrassing ($p = 0.0005$). *In the study of Wong et al., women were more likely to have fears of pain, danger, and getting disturbed during the examination.*

Respondents were given questions about their opinion on when to attend CRC screening. Answers were, as follows: 1. screening is recommended by a physician (41.2%), 2. before the development of symptoms on a regular basis (25.8%), 3. when symptoms develop (25.6%), 4. I do not know/I deny to answer (5.8%), and 5. I am healthy, I do not need screening (1.6%). The level of education significantly influenced the attendance of screening ($p < 0.0001$). Respondents who would attend screening when symptoms develop ($p < 0.0001$), who would attend screening if the physician recommended doing so ($p < 0.0001$), who feel that asymptomatic patients should not attend screening ($p = 0.0006$), or those not knowing when to attend screening ($p < 0.0001$) had a lower level of education than those who think that attendance is required on a regular basis before symptoms develop. *The study of Messina et al. supports our results: respondents finishing primary or secondary school had a higher chance to rely on the physicians’ decision about the need for screening.*

70.4% of participants would attend the screening if recommended by any physician. *In the study of Christou et al., a higher proportion of respondents would attend the screening if recommended by a physician (84%).*

71% of respondents would like to know if they have CRC. These respondents had a higher level of education ($p = 0.0111$), were more likely to be religious (OR=1.6370; 95% CI: 1.2455-

2.1516), placed a greater trust in the healthcare system and the physicians ($p < 0.0001$), had a higher number of events of participation in prior screenings for any disease within 1 year ($p < 0.0001$), thought FOBT to be more acceptable ($p < 0.0001$), and were more likely to know the screening protocol (OR=1.8930; 95% CI: 1.2533-2.8593).

73.1% of respondents thought that they have a similar chance to develop CRC compared to those who are at average risk of the disease. *In the studies of Sifri et al. and Christou et al., a higher proportion of respondents thought that they are of high risk of CRC (20% and 14%, respectively).* Respondents who has already been attended screening ($p < 0.0001$), attended any other screening than CRC within 1 year ($p = 0.0038$), had a first degree relative with CRC ($p < 0.0001$), and had a friend or an acquaintance with CRC ($p < 0.0001$) classified themselves to be at a higher risk. Single responders classified themselves to be at a lower risk than those who are married or had a spousal relationship ($p < 0.0001$) and those who are widows/widowers ($p = 0.0035$). Respondents who were well-informed about risk factors and signs and symptoms classified themselves to be at a higher risk ($p = 0.0006$ and $p = 0.0054$, respectively). Respondents knowing that CRC is a common cause of death in Hungary classified themselves to be at a higher risk ($p < 0.0001$) compared to those not knowing the correct answer.

We analyzed the promoting and restraining factors, which might play a role in the decision about screening attendance:

Promoting factors: 1. complex screening - multiple screenings (not only CRC) on the same day - (35.4%), 2. trouble-free screening (34.1%), 3. unpleasure or painful tests performed under general anesthesia (32.6%), 4. accurate and comprehensive information about screening methods, screening possibilities, course, and the degree of unpleasantness (31.9%), 5. consultation between physicians and attendees before screening under four eyes (27.2%), and 6. a supportive family (10.4%). Women (OR=1.8570; 95% CI: 1.4170-2.4337), those who had a colonoscopy (OR=2.0215; 95% CI: 1.3528-3.0206), and those who knew the screening protocol (OR=1.4530; 95% CI: 1.1052-1.9103) were more likely to indicate general anesthesia as a promoting factor. Those indicated a supportive family as a promoting factor were significantly older ($p = 0.0356$). Respondents indicating complex screening had significantly more chronic diseases ($p = 0.0496$) and were more likely to attend any other screenings than CRC within 1 year (OR= 2.2277; 95% CI: 1.3912-3.5670).

Restraining factors: 1. I do not have any problem or symptom; therefore, I do not need such an examination (20.9%), 2. I think that the examinations might be very painful and I have fears of pain (20.0%), 3. the examination is embarrassing for me (13.6%), 4. I consider the examinations frightening (10.7%), 5. I think the results can worry me (9.5%), 6. my physician did not mention

the need for screening (9.1%), 7. it embarrasses me to talk to other people about this (7.6%), 8. I have other health problems, it is enough to deal with that (6.4%), 9. I had an unpleasant experience with screening (5.1%), 10. I am very busy, I cannot take a day off (4.9%), 11. if something pops up on the screening, it is already too late to do anything (3.5%), 12. I am too old/young to be screened (3.3%), 13. I do not have a treating physician, I do not know whom I could ask about this (2.3%). *From the study of Tarasenko et al., the following results were published about restraining factors: 1. excellent health (96.7%), 2. others' experience (86.7%), 3. screening protocol (86.7%), 4. lack of knowledge (83.3%), and 5. lack of recommendations given by physicians (80%). In the study of Horváthné, a higher proportion of respondents (66.7%) indicated the lack of symptoms as a restraining factor. 32.4% of respondents thought that there are no restraining factors which can keep them from the screening away, these respondents had a significantly higher level of education ($p=0.0054$), attended multiple types of screenings within 1 year ($p<0.0001$), are more likely to know the screening protocol (OR=1.6834; 95% CI: 1.2761-2.2206), had FOBT (OR=2.1497; 95% CI: 1.3675- 3.3793), had enzyme-based screening (OR=3.1614; 95% CI: 1.2795-7.8113), had sigmoidoscopy (OR=4.8339; 95% CI: 2.0792-11.2380), or had colonoscopy (OR=2.7372; 95% CI: 1.8294-4.0956). 67.4% of respondents would prefer to receive more information about CRC and CRC screening. In the study of Papanikolaou et al., this proportion was lower (60%).*

In the first part of the questionnaire, we asked the participants whether they would like to know if they had CRC. 29.0% of the respondents did not want to know it. There were no previous questions about CRC. At the end of the questionnaire, we asked a question about future attendance intention. 22.1% definitely decided to attend the screening in the future, 61.1% was thinking about future attendance, while 16.8% denied further participation in screening. *The proportion of denial was similar in the study of Bynum et al. (15.1%) but higher in that of Domati et al. (21%).* Among respondents preferred to know whether they have CRC, 28.5% definitely decided to attend future screenings, 63.9% was thinking about it, while 7.6% denied future participation. Among respondents not preferred to know whether they have CRC, 6.2% definitely decided to attend future screenings, 54.3% was thinking about it, while 39.5% denied future participation. If we assume that those answering „no” for „Would you prefer to know whether you have CRC?” would deny attending the screening, future attendance intention expressed in the beginning and that expressed at the end of the questionnaire become comparable. Predictive factors of future attendance intention included previous experience and knowledge of CRC screening, physicians' recommendation of CRC screening, and the acceptance of colonoscopy. Respondents hesitating or denying attending screening were more

likely to have no information about CRC screening modalities ($\beta=0.686$; $p=0.025$; OR=1.985 95% CI: 1.090–3.615), more likely to have no previous experience of CRC screening ($\beta=1.271$; $p<0.001$; OR=3.565 95% CI: 2.262–5.619), less likely to receive a recommendation for screening ($\beta=0.745$; $p<0.001$; OR=2.106 95% CI: 1.389–3.194), and less likely to accept colonoscopy ($\beta=-0.210$; $p<0.001$; OR=0.811 95% CI: 0.762–0.863). In *the study of Gregory et al.*, predictive factors included restraining factors, knowledge of the yield of screening, and prior meeting with CRC patients.

Our results supported the **fourth hypothesis** claiming that predictive factors of screening attendance include previous experience and knowledge of screening, acceptance, and screening recommendation.

Discussion

To sum up, respondents' knowledge of CRC screening proved to be insufficient. Most respondents have not heard about the different screening modalities. Regarding CRC, respondents were underinformed about the recommended frequency of screening, the preclinical phase, curability, risk factors, and signs and symptoms of CRC, though it was advantageous that family doctors and specialists were indicated as the most common source of information. Those respondents who were well-informed about risk factors and signs and symptoms were likely to indicate the internet as the source of information. When thinking about how to improve the knowledge of the population, one should focus on the youngsters, males, the stratum with a level of education, those seeing the doctor rarely, and the inhabitants of smaller villages. The screening attendance rate was low within the study population. Screening acceptance was negatively influenced by several factors, such as male sex, younger age, atheism, residence in other cities, lack of healthcare education, lack of screening experience, lack of chronic diseases, no recommendation for screening by healthcare workers and family members/friends, and low level of knowledge of CRC and CRC screening judged by the respondents. Most respondents were open to CRC screening, in other words, they favored to acquire more information about it or to know whether they had CRC or not. This open-mindedness is lacking regarding future attendance intention: the majority of respondents hesitated or denied to attend. When resolving this contradiction, we must take the predictive factors of screening attendance into account, such as previous experience and knowledge of screening modalities, screening acceptance, and screening recommendation. The importance of screening recommendation should not be underestimated because most respondents favored attending the screening if recommended by physicians. This attitude towards screening attendance is of critical importance because it transfers the responsibility of screening attendees to physicians. When incorporating CRC screening into the healthcare programs, healthcare developers should set up a subprogram to increase compliance of the population by giving more information about screening and by increasing the screening acceptance. In this process, healthcare workers play a key role. Time spent on patients by physicians should be increased, which allows putting greater emphasis on prevention. Utilization of the electronic media could be improved, the inclusion of celebrities in screening campaigns via the television and the social media may boost screening activity. Information transmitted through these channels should be adjusted to the wants and needs of the target population. In addition to these public health initiatives, other more powerful initiatives could be taken, such as advantages given to those

companies providing an extra day off for those employees attending the complex screening. We must acknowledge that these initiatives require the investment of significant resources from both parties (employers and the national screening coordination), though the yield is promising.

SUMMARY OF NEW RESULTS

Knowledge of CRC and CRC screening:

- ❖ 26.0% of respondents judged their own knowledge of CRC to be sufficient, these respondents were less likely to be males and had a higher level of education.
- ❖ 22.4% of respondents knew the recommended frequency of screening, 59.2% knew the screening protocol, these respondents had a higher level of education and were more likely to be females.
- ❖ 56.2% of respondents knew that there is an asymptomatic period during the course of CRC, these respondents had a higher level of education and tended to attend other screenings than CRC screening within 1 year more frequently.
- ❖ Respondents who have not heard about any of the described screening modalities were significantly younger, had a lower level of education, tended to see the doctor less often, and were more likely to be males.
- ❖ The major source of information of respondents who were well-informed about risk factors and signs and symptoms was the internet.
- ❖ Respondents who had no chronic diseases and were well-informed about risk factors tended to accept the statement „Healthy lifestyle, such as the healthy diet and regular exercise, reduces the risk of CRC”.

Attitudes towards CRC screening:

- ❖ Screening acceptance was influenced by several factors. The acceptance was decreased in males, younger subjects, atheists, those living in other villages, those not received health education, those judged themselves to be not well-informed about CRC, those not attended screening, those who have not heard about screening, those whom screening was not recommended by friends, family members, or healthcare workers, those who had no chronic diseases, and those avoided screening in the past 1 year.
- ❖ 33.7% of respondents thought that the preparations for colonoscopy are stressful, these respondents were more likely to be women.
- ❖ The statement „Attendance of screening makes me feel safe because I can keep my health under control” was less acceptable for those avoided screening in the past 1 year.
- ❖ The statement „I feel it embarrassing to get in touch with feces during the examination” was less acceptable for those who have heard about FOBT already.

- ❖ 71.0% of respondents preferred to know if they suffer from CRC. These respondents had a higher level of education, were more likely to be religious, had greater trust in the physicians/healthcare system, knew the screening protocol better, accepted the screening modalities better, and attended for a higher number of screenings within 1 year.
- ❖ Respondents classified themselves to be at higher risk if they were singles, were well-informed about risk factors and signs and symptoms, had sufficient knowledge of the frequency of CRC, had previous experience of CRC screening or other screenings, had a positive family history for CRC and had friends or acquaintances who had CRC, furthermore respondents classified themselves to be at lower risk if they were singles.
- ❖ Promoting factors: Examination under general anesthesia was rather preferred by women, those who had previous experience in colonoscopy, and those who knew the screening protocol. Older respondents preferred the support of family in screening. Those suffering from many chronic diseases or attended other screenings within 1 year rather preferred complex screening.
- ❖ 32.4% of respondents reckoned that there is not a single factor which could keep them from the screening attendance away. This positive attitude was typical of those with a higher level of education, those attended CRC screening or other screenings within 1 year, and those who knew the screening protocol.

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