Uncovering Reasons for Colorectal Cancer Screening Avoidance*

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Abstract

Colorectal cancer is one of the most common cancer diseases in Slovakia. Preventive screening programs are of essential importance as early diagnosis significantly increases the chances of survival. Although the preventive care is well-accessible in Slovakia, take-up rate remains still low. To shed light on the reasons for colorectal screening avoidance, we run an online survey experiment with a sample of 808 Slovaks in the target age range between 50 and 65 years. We compare observable characteristics of respondents that are proactive and inactive with respect to the participation in the prevention screenings, focusing on potential barriers to participation. We also test a causal effect of three theory-driven information treatments and of an offer of a free FOBT home-kit on intentions to become proactive. In a follow-up survey three months later we also ask if respondents have really conducted any prevention screening. We find rather small differences in characteristics of the proactive and inactive respondents, and null effects of the information treatments.

Keywords: survey experiment, colorectal cancer, preventive screening, Slovakia

JEL: I12, D01, C99

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1. Introduction

Colorectal cancer is the most frequent cancer by incidences in Slovakia for men and the second most frequent for women. It was responsible for 2,396 deaths in Slovakia in 2018, which makes it the second most mortal cancer in this state (The Global Cancer Observatory, 2020). Slovakia is the third country in the world with the highest colorectal cancer rate (age-standardized), reaching 43,8 per 100 000 population, which makes it one of the countries that could benefit the most from the prevention such as colorectal cancer screening programs (Bray et al., 2018). The European Council set an acceptable rate of participation to 45% and desirable rate to 65%, but the actual rate in Slovakia is around 30% only (Altobelli et al., 2014; Health Government, 2018). Therefore, it is desirable to find ways to motivate people eligible for prevention to take part in the screening programs. One of the possible ways how to do so would be to identify barriers to screening participation and the possibilities of removing those barriers. To do that, we designed an online survey experiment targeting people from Slovakia who were more than 50 years old and thus had increased risk for colorectal cancer.

In this paper, we present the results from a large online survey experiment run in Slovakia in 2022. Our contribution lies in that we employ a unique sample of real respondents in the target group with an increased risk of colorectal cancer and are, therefore, eligible for screening programs in Slovakia. This is the first study to compare characteristics of the proactive and inactive groups to reveal the potential barriers to participation in screening. We test the differences in subjective perception of the risk of getting colorectal cancer; in their risk- and time-preferences in both incentivized as well in incentivized measures; in the trust toward healthcare and their GP; in the willingness to pay/ to be paid for a screening; and in their lifestyle.

We also test the causal effects of three theory-driven treatment interventions which have never been applied in the context of colorectal cancer on persuasion to undergo screening: reminding the importance of screening programs in general by questionnaire (T0), intergenerational reciprocity (T1), reappraisal of the uncertainty resolution in a positive framing (T2) and in a negative framing (T3). The orthogonal treatment of randomly offering FOBT (fecal occult blood test) is also new to the literature, even though insurance companies frequently conduct mailing campaigns where all clients in target age-range receive the FOBT kits, without evaluating its effectiveness. In the follow-up survey collected three months after the main questionnaire, we complement the standard approach of simply asking for intentions immediately after exposing respondents to the information treatment by asking for a second outcome variable – if they have undergone any screening in the past three months.

2. Background and Previous Literature

To motivate people to get screened for colorectal cancer, important factors influencing the decision of recipients should be identified. Standard information economics models suggest that any additional information obtained for free should be perceived as beneficial by the economic agents (Milkman et al., 2013). Therefore even the information that contains an unpleasant message should be valued as it can motivate the agent to take steps that eventually increase his or her quality of life or life expectancy. Unfortunately, it does not seem to be the case in real-life setting. According to Eibich & Goldzahl (2020), real health-related behavior is influenced by beliefs about the effectiveness of a preventive action and its unpleasant aspects such as pain and time constraints.

Pletscher (2017) suggests that decision-making factors whether to get screened include fees, known benefits of screening, and an easy access to a list of providers, but there are probably even more important factors. There is, for example, a possibility of concerns about judgment or verbal violence in connection with cancer screening (Malambo, 2021). One of the main barriers to the testing could also be a fear of bad news as implied by Koszegi (2003). The option of a partial self-diagnosis forgoing a

doctor's visit can make a difference in attitudes of a patient, because it changes the ease of obtaining information in the first step and may change expectations in the second step, which are both moderators of information avoidance (Sweeny et al., 2010)

Results from previous studies suggest also other reasons to evade screening such as lack of adequate information, lack of patient-friendly services, socio-cultural opinions on health and crucial factors such as education, lifestyle, insurance, and other aspects of life (both work-related and personal) (Girgis et al., 1991; Juon et al., 2009; Markovic et al., 2005; Maxwell et al., 2001). Additionally, according to Carman & Kooreman (2014), probability elicitation tools and different framing could be of use since accurate information about risks of diseases and risk reducing prevention could lead to more use of that prevention by the population. Specific example of useful change in wording mentions Bober et al. (2007), where "disease detection" is suggested to be replaced with "health-promoting".

One way to improve awareness and offer adequate information about screenings could be through invitation letters sent to the target group by insurance companies. Informative letters or messages are well-known tool to increase cooperation in fields like taxes, traffic regulations or license fees (Bott et al., 2019; Fellner et al., 2013; Lu et al., 2016). They are also used in healthcare and have been already considered to be an effective cue to preventive actions (Eibich & Goldzahl, 2020). A good invitation letter should be not only a reminder, but it should also offer information that helps to make the desired decision. For example, people who are avoiding the unpleasant topic of cancer could be unaware of any good news in this field, which leads to further information avoidance (Miles et al., 2008).

We based our approach on the idea that reminders and nudging people to create plans have been shown to have positive effects on prevention take-up rates (Dai et al., 2017; Milkman et al., 2013). We perceive the questionnaire itself as a form of reminder, assuming that by reading about the possibilities of prevention and asking about prevention-related questions, the respondents are reminded about its importance and may be motivated to undergo the examination. Moreover, low take-up rates can be driven by the lack of the knowledge about the disease in risk population (Deniz et al., 2017). Consequently, based on Carman & Kooreman (2014), we test the effects of positive and negative faming, .i.e., when the potential benefits of the preventive screening are presented and when the potential negative impacts of the disease are presented. Last but not least, in the reciprocity treatment, we focus on the relationships with the close people, arguing that by being responsible, the respondent gains more time with the loved ones.

2.1 Background information on colorectal cancer and preventive screenings

The large intestine is the last part of the digestive tract. Most cases of colorectal cancer start as small clumps of cells called adenomatous polyps. Over time, some of these polyps can become cancer. Of all cancers, colorectal cancer is best treated in the early stage, when the tumor is caught only in the lining of the intestine. Colorectal cancer is the most common cancer worldwide. Polyps are often asymptomatic, therefore doctors recommend regular screening tests as prevention. Signs and symptoms of advanced colon cancer include changes in bowel habits, like diarrhea, constipation, and changes in stool consistency that last for more than four weeks. Hidden rectal bleeding or blood in the stool, persistent abdominal cramping pain and flatulence also occur. The patient has a feeling after toileting that the bowel is not emptying completely, and he or she feels weakness or fatigue. Unexplained weight loss is also common. However, these symptoms do not always mean colon cancer, but it should be ruled out unequivocally. In most cases, it is not clear what causes colon cancer. It may be inherited gene mutations that increase the risk. Studies of large groups of people have shown a link between the typical 'Western' diet and an increased risk of colorectal cancer. Such diets are high in smoked meats, industrially processed meat products and low in fiber. This negatively affects the microbes that live in the colon, causing microscopic inflammation that can lead to cancer (Anticancer Fund, 2016).

Currently, there are two main methods in preventive screening. These are the fecal occult blood test (FOBT) and primary screening colonoscopy. A patient from the targeted risk population is eligible to the FOBT test every two years. Performing this test is without any complications and painless. It is basically just a stool sample, in which traces of blood, invisible to the naked eye, can then be detected chemically (an admixture of blood may indicate a malignant tumor of the bowel). The sample for the test can be taken with a dedicated sampling kit provided by a general practitioner, but in the comfort of one's own home, privately and stress-free in a few minutes. The sample is then delivered to the general practitioner's surgery where the machine is used to assess the level of blood present in the stool. A less precise option is a FOBT home kit that the patient evaluates on her own, which will either confirm or refute the presence of blood in the stool but will not determine its level. However, this test is for guidance purposes only to the patient themselves and is not approved as an official method of preventive screening for colon cancer (as bleeding in the stool can also be caused by other health problems, such as the presence of polyps, Crohn's disease, or diverticulitis). The second option is to undergo a primary screening colonoscopy, which only needs to be performed once every ten years and is considerably more reliable. Thanks to the sensitive optical system, the doctor observes a realistic picture of the colon on the monitor and can safely detect diseases that even an X-ray would not reveal, and in some cases even prevent surgery, for example by removing polyps directly during the examination. The procedure takes approximately 20 minutes, and the patient is informed in detail about all the steps that follow. Analgesics or sedatives are used to relieve any discomfort or pain (Anticancer Fund, 2016).

3. Methodology

We conducted an online survey experiment to identify reasons for colorectal cancer screening avoidance by comparing characteristics and attitudes of 'proactive' and 'inactive' (in terms of prevention) respondents, and to test the causal effect of three different formulations of motivational text that can be used in invitation letters sent by insurance companies. Three months after the main survey, a short follow-up survey was administered to collect information about respondents' stated behavior regarding prevention screening during those three months.

3.1 Identifying and comparing proactive and inactive respondents

The questionnaire included a set of questions on personal characteristics of respondents, to identify those respondents with proactive attitudes towards prevention screenings and respondents with inactive attitude, so that we can compare them. Before that, we started with screening questions to avoid asking people who were personally affected by the disease, and then we asked for prior knowledge of it and later of the screening options. Then, regardless their prior knowledge, we provided one screen with baseline information on the disease and the screening options to everybody, so that they had the same starting point towards the rest of the questions. The identification of the proactive and inactive groups was based on their answers to three questions, where the inactive group answered that they have not gone to any in the relevant timeframe and do not plan to do so in the near future.

For the comparison of the proactive and inactive respondents we measured several sets of attitudinal variables. The first set was aimed at subjective perceptions of risk associated with the disease, because the inactivity may be well explained just by wrong beliefs about the danger avoidance poses. To do so, we measured and compared subjective perceptions of risk of getting the disease, both own risk and a general risk of a person on the scale from 0 to 10. We also asked for their guess of the expected survival rate of patients in the early stage (1. stage) and in the terminal stage (4. stage) of the disease on the scale from 0 to 100.

The second set of variables are the attitudes to risk and time, because the inactive group may exhibit either myopic or overly risk-seeking behavior, which would rationalize their behavior even if they were well aware of the objective chance of getting it. A myopic individual may heavily discount the future when the full costs of the disease will materialize, and therefore rationally not acting in the present. Similarly, an overly risk-seeking person may just prefer the gamble the disease poses and the utility from this gamble may exceed the utility of getting screened. In this line of reasoning, we measured individuals' risk and time preferences using one incentivized ordinal and one non-incentivized qualitative measure.

The incentivized measure of time preferences and risk preferences used a staircase procedure after Falk et al. (2022)[1], which is validated, quick, interactive, and easy to understand for the respondents. The staircase method is composed of a 5-question module that can divide the participants into 32 groups based on their preferences. In every question in the risk-module, the respondents were asked to choose between a sure amount that was kept constant and a lottery with an equal chance of winning or losing. The winning amount in the lottery changed according to the decisions of the respondent. For the time-preferences module, respondents decided whether to get a small amount of money now or a larger amount in 6 months. The amount paid now stayed constant and the amount paid in 6 months varied across the set of questions. Out of all, 10 participants were randomly selected to be actually paid according to one of their answers in randomly chosen module of the two, in addition to their regular fee for filling-in the questionnaire.

[1] The modules programmed in OTREE are available for download at https://github.com/scerioli/Global-Preferences-Survey; see also https://www.briq-institute.org/global-preferences/about .

Another set of questions was designed to identify a plain financial barrier of screening avoidance, because some people may just feel like the associated financial costs are too high. Importantly, knowing this is very valuable for insurance companies because such barrier may be relatively easy to overcome by, e.g., handing out vouchers of a certain amount. This barrier was measured using the well-known concept of willingness to pay (WTP) for a screening (a colonoscopy and a fecal occult blood test) (Hanemann, 2003), that we extended to willingness-to-be-paid (WTBP), when the WTP was negative. To measure WTP/WTBP for a screening we used again a staircase procedure with 5 questions dividing participants in 32 groups with different WTP/WTBP.

The reasons for inactivity may be stemming from distrust towards general practitioner or healthcare in general, or due to privacy reasons. The survey thus included questions on perceived trust toward (i) the respondent's physician, (ii) healthcare in Slovakia, and (iii) scientific findings and progress in healthcare in general. The answers were on the scale from 0 to 10. We also asked if they would use the option to undergo a FOBT screening at a different GP than at their regular one.

Hassle/transaction costs may also create a barrier to screening accessibility, and some may find it easier to overcome them than others. We included questions about respondents' accessibility of healthcare, both subjective measure, on the scale from 0 to 10, and objective measure in minutes of traveling to their physician. We also asked if they would welcome help with scheduling of appointments for screenings, and if the FOBT sampling kit for GP evaluation was available in their pharmacy, because this would save one trip to the GP's practice. Importantly, we also included one treatment arm where we offered the FOBT home kit to be sent to their address.

We also included questions on individual lifestyle that focused on habits connected to the risk of the disease, such as frequency of consuming fried food, fiber, and alcohol, frequency of smoking, and of exercising. To account for inflation, we also asked how much EUR they think they will need in six months to buy the same grocery shopping that costs 50 EUR now.

We expected that the proactive and inactive groups will differ in all of the above, and that the comparison of these blocks will help determine the likely reasons for passivity and absence at the prevention check-ups of inactive group. We also asked questions about the reasons of current (not) planned steps to get preventive screenings, including if they had received an invitation letter sent by insurance companies.

3.2 Treatments

Apart from a simple comparison of the proactive and inactive types of respondents, which reveals just correlations but not the much-needed causality, we implemented three between-subject information treatments persuading the respondents to go to a screening, and an orthogonal treatment which was an offer of a free FOBT home kit to be sent to their address. Primarily, we aimed at the reaction of the inactive group, but we were also interested in how the proactive group would react.

The information treatments were administered at the end of the questionnaire, after all attitudinal questions were asked. The first information treatment T1 was focused on the principle of intergenerational kindness and reciprocity, stating that a person should undergo prevention not only for themselves, but also for their beloved ones, to be able to spend more time with them. The second treatment T2 framed the information in a positive way, presenting prevention as good news in all cases, as it is better to be aware of being healthy but also discovering the disease in the early stage. The last treatment, on the other hand, framed the information about importance of prevention of colorectal cancer in a negative way, highlighting the risk of getting the disease and a lower chance of surviving in the late stage of the disease. After the information treatment, a free FOBT home kit was offered to be mailed to the respondent´s home address to a randomly chosen half of the respondents. This reveals whether there is an interested in such screening method with virtually no hassle costs at all, because a common

approach of the insurance companies is to mail a FOBT sampling kit to all clients in the target age group, without any evidence if this is actually useful strategy or not. The individual treatments are listed below:[2]

T0: Control group – no text is displayed to the participants

T1: Reciprocity

Be responsible not only to your health, but also to your loved ones who care about you, and do not shy away from important prevention. Health care is there for you too, so do not hesitate to take advantage of it. Get a preventive check-up so you can see your grandchildren grow up. Do it for your loved ones, you will not regret such a decision. Call your general practitioner as soon as possible.

T2: Positive framing

It is important to note that all possible results of this examination are essentially good: A negative finding confirms that you are healthy, and if you are positive, the good news is that you will begin treatment much sooner than if you had waited until the onset of your first symptoms. This will increase your chances of success in fighting the disease by up to nine times. Take advantage of the fact that your health insurance offers you the opportunity to take part in both types of preventive screening free of charge. Call your doctor as soon as possible.

T3: Negative framing

Delaying this test can be very bad news, because with a late diagnosis of colon cancer there is only a 10% chance that you will be cured. The longer you delay, the more you significantly reduce your chances of survival with a positive finding. Slovaks are one of the European nations most at risk of colon cancer. It is the second most deadly cancer in our country and causes around two and a half thousand deaths a year, mainly among people of your age. Call your doctor as soon as possible.

Apart from the text treatments, we also employed an offer of a free FOBT home kit to be sent to respondents´ address in an orthogonal design. After displaying one of the four text treatments (T0-T3), we asked a subset of 178 respondents whether they would like to receive a free FOBT home kit. A FOBT was subsequently sent by post to each respondent who accepted this offer. We did not have access to the addresses or identity of these respondents, and the mailing procedure was completely executed by the marketing agency to assure personal data protection.

NO-FOBT: no text is displayed

FOBT: *As part of this questionnaire, we offer you the opportunity to request a free home FOBT (fecal occult blood test) to be sent directly to your home. With a FOBT you can check your health status painlessly, quickly and in the comfort of your own home in a few minutes. This type of test is self-assessed and provides information only for you but is not a full form of examination and does not replace an examination by a doctor. Please note that this test is not a test for cancer and bleeding stools may have other causes (such as the presence of polyps, Crohn's disease, or diverticulitis). This test is painless, quick, and free!*

3.3 Outcome variables

We measured two sets of outcome variables. The first set of variables were asked directly after the presentation of treatment(s) and the questions relate to the *intentions* to undergo any type of prevention, the *perceived danger* of colorectal cancer, and the *impressions* of a preventive check-ups.

The second set is related to the effectiveness of the information treatment interventions and was measured in the follow-up survey three months after the baseline: whether a respondent has undergone

[2] The real look of the treatments in the online survey can be found in Appendix.

any prevention screening of colorectal cancer in between of the two surveys and, if applicable, which type of prevention it was.

3.4 Hypotheses

Our **hypothesis 1** was that people are more likely to undergo prevention when they are exposed to any of our treatment interventions – i.e., if they are reminded of reciprocity, positive or negative aspects of prevention. Therefore, we expected subjects in treatments T1-T3 to be more likely to report they have undergone any type of prevention than in the control group T0 without any text presented to persuade them, as measured by answers in the follow-up questionnaire.

Our **hypothesis 2** was that people are more likely to undergo a preventive screening (as reported in the follow-up survey) if we offer them a free home-kit of fecal occult blood test. We expected them to be more likely to use this test if it is offered for free and sent to them by mail, lowering their transaction costs. We also hypothesized that in the long-run, this could be the first step that will make them more likely to participate in other types of screening that are more reliable, especially colonoscopy.

Hypothesis 3 was that we expected the treatment interventions T1-T3 to immediately increase intentions to do any type of prevention, increase the mean perception of perceived danger and increased share of people reporting that prevention screening is important to undergo, compared to T0.

3.5 Procedures

The data were collected in two waves. In the first wave that was organized in August 2022, the main online survey was executed with a random variation in which treatment intervention text was shown in a between-subjects design. The respondents were randomly allocated into one treatment group on an individual level. The main survey was programmed in OTREE (Chen et al., 2016) and lasted about 25 minutes. We reached the target population with the help of marketing agency Median s.r.o. who administered the data collection for us.

Before the survey started, we informed respondents on one screen about the aim of the study, confidentiality of the provided information, the survey approval of the Ethics Committee of Faculty of Social Sciences of Charles University in Prague and the Ministry of Health of Slovakia. After presenting this information, we asked for their consent with the terms of participation in the study.

At the end of the survey we offered respondents a space for general feedback. A little more than 10% left comments and the messages were almost entirely positive. Almost one third of the comments expressed thanks and almost one quarter of respondents, who left a comment, said the topic was interesting for them. Almost every sixth respondent who left a comment stated, that the survey was beneficial for them.

3.6 Sample

The sample for the online survey experiment consisted of 808 respondents of age 50 to 65 years from Slovakia, who qualify as a target population for colorectal cancer screening programs. The sample was provided by the marketing agency Median through which the survey experiment was administered. The online sample is representative of the targeted population of the Slovak Republic by sex, age, and region of residence with small deviations, and roughly representative of the online population of the Slovak Republic also by education and the size of place of residence, but with larger deviations in these categories (underestimation of lower education and small municipalities). The follow-up survey was completed by 725 respondents, which gives a 90% re-test rate. Table 1 and

Table 2 summarize randomization check across individual treatment groups.

Table 1: Randomization Check for Experimental Treatments T0-T3

Variable	T0	T1	T2	T3	Full sample	p-value from joint orthogonality test of treatment arms
Female	0.546	0.537	0.540	0.566	0.547	0.941
Age	56.845	57.060	57.579	57.157	57.159	0.421
Region 1 - Bratislava	0.116	0.114	0.134	0.101	0.116	0.790
Region 2 - Trnava	0.092	0.090	0.119	0.111	0.103	0.715
Region 3 - Trenčín	0.053	0.090	0.079	0.101	0.080	0.329
Region 4 - Nitra	0.130	0.114	0.114	0.106	0.116	0.892
Region 5 - Žilina	0.126	0.124	0.104	0.136	0.123	0.796
Region 6 – Banská Bystrica	0.174	0.104	0.124	0.182	0.146	0.075
Region 7 - Prešov	0.145	0.199	0.129	0.111	0.146	0.074
Region 8 - Košice	0.159	0.164	0.198	0.152	0.168	0.613
Education - unfinished primary education	0.000	0.000	0.000	0.000	0.000	-
Education - finished primary education	0.000	0.005	0.010	0.015	0.007	0.324
Education – high school without graduation	0.150	0.104	0.193	0.146	0.149	0.100
Education – high school with graduation	0.478	0.458	0.431	0.444	0.453	0.798
Education – higher professional education	0.039	0.055	0.030	0.045	0.042	0.642
Education - university	0.329	0.378	0.337	0.348	0.348	0.738
City	0.126	0.129	0.144	0.111	0.127	0.812
No. of respondents	207	201	202	198	808	-

Note: T0 – T3 denote the type of treatment, i.e., T0 – control group, T1 – reciprocity, T2 – positive framing and T3 – negative framing

Table 2: Randomization Check for Treatments A-B

Variable	FOBT	NO-FOBT	Full sample	FOBT vs. NO-FOBT	p-value from joint orthogonality test of treatment arms
Female	0.533	0.561	0.547	-0.027	0.434
Age	57.168	57.149	57.159	0.019	0.953
Region 1 - Bratislava	0.128	0.104	0.116	0.024	0.284
Region 2 - Trnava	0.089	0.117	0.103	-0.028	0.195
Region 3 - Trenčín	0.086	0.074	0.080	0.012	0.532
Region 4 - Nitra	0.111	0.122	0.116	-0.010	0.643
Region 5 - Žilina	0.143	0.102	0.123	0.041	0.072
Region 6 – Banská Bystrica	0.143	0.149	0.146	-0.006	0.820
Region 7 - Prešov	0.148	0.144	0.146	0.004	0.865
Region 8 - Košice	0.151	0.186	0.168	-0.035	0.178
Education - unfinished primary education	0.000	0.000	0.000	0.000	-
Education - finished primary education	0.005	0.010	0.007	-0.005	0.410
Education – high school without graduation	0.141	0.156	0.149	-0.016	0.534
Education – high school with graduation	0.447	0.459	0.453	-0.012	0.729
Education – higher professional education	0.042	0.042	0.042	0.000	0.988

Education - university	0.365	0.330	0.348	0.035	0.291
City	0.131	0.124	0.127	0.007	0.772
No. of respondents	405	403	808	808	-

Note: FOBT denotes the orthogonal treatment when the FOBT was offered, while NO-FOBT denotes the group when the FOBT was not offered. Full sample includes all the participants without consideration of FOBT treatments. Column FOBT vs. NO-FOBT depicts the difference between the orthogonal treatments.

4. Results

Observable characteristics

We regress the characteristics of respondents on two variables: (i) if they reported that they have not gone to a screening in the relevant recent time period (for a colonoscopy it is every 10 years and for a fecal occult blood test it is every 2 years) – *without prevention yet*, and on (ii) those who have not gone to a screening and are not even planning to do so in the future – the *inactive.*

First, we estimate the association of socio-demographic characteristics with the two variables. Column 1 of Table 3: Regression – socio-demographics shows a negative effect of age on chance of not having done a prevention screening: for every year of age, the probability of prevention increased by 0.7% (p=0.062), which is reasonable as with higher age people had more chances to get screened. We did not detect any effect of gender, size of the residential city or specific region.

Table 3: Regression – socio-demographics

	(1)	(2)
VARIABLES	without prevention yet	inactive
Female	0.0513	0.0430
	(0.0359)	(0.0351)
Age	-0.00721*	-0.00500
	(0.00386)	(0.00379)
City over 100,000 inhabitants	-0.0561	-0.0501
	(0.0507)	(0.0494)
Education – high school without graduation	0.0209	0.151
	(0.209)	(0.203)
Education – high school with graduation	-0.0448	0.0640
	(0.206)	(0.199)
Education – higher professional education	-0.0938	-0.0353
	(0.221)	(0.213)
Education – university	-0.0933	0.00226
	(0.207)	(0.200)
Region	-0.00372	0.00296
	(0.00741)	(0.00725)
Constant	0.974***	0.814***
	(0.232)	(0.228)
Observations	807	807
R-squared	0.015	0.016

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Perceived risk of getting disease, mortality

Consequently, in Table 4 we compare the subjective perceptions of danger the disease poses of active and inactive respondents. First note that there is no significant difference in perceived *general* risk, i.e., in the guessed risk that an average person in population will get the colorectal cancer, but participants active in prevention stated that they perceive a higher *personal* risk of the disease compared to participants inactive in prevention. One point increase of perceived personal risk on scale from 0 to 10 is associated with 3.19 % (p=0.001) increase in probability of being screened for colorectal cancer.

Similarly, there is no difference in expected survival rate of patients in the late stage of colorectal cancer but the participants active in prevention stated they expected higher survival rate of patients in the early stage of the colorectal cancer. One point increase of expected survival rate in the early stage on scale from 0 to 100 is associated with 0.155% (p=0.050) increase in probability of being screened for colorectal cancer (Table 4: Regression – perceived risk and expected survival rate). This may be the reason they are more motivated to undergo preventive check-ups, believing they can still do something about the disease.

Table 4: Regression – perceived risk and expected survival rate

VARIABLES	(1) without prevention yet	(2) inactive	(3) without prevention yet	(4) inactive
Perceived *general* risk of getting colorectal cancer	0.000685	-4.05e-05	-0.00428	-0.00495
	(0.0119)	(0.0117)	(0.0121)	(0.0120)
Perceived *personal* risk	-0.0319***	-0.0260***	-0.0309***	-0.0253***
	(0.00940)	(0.00922)	(0.00952)	(0.00935)
Expected survival rate for early stage	-0.00155**	-0.00196**	-0.00144*	-0.00184**
	(0.000791)	(0.000778)	(0.000784)	(0.000778)
Expected survival rate for late stage	0.000540	0.000687	0.000375	0.000490
	(0.000921)	(0.000900)	(0.000911)	(0.000899)
Education – high school without graduation			0.0129	0.160
			(0.217)	(0.199)
Education – high school with graduation			-0.0670	0.0624
			(0.214)	(0.195)
Education – higher professional education			-0.121	-0.0466
			(0.228)	(0.209)
Education – university			-0.113	0.00934
			(0.215)	(0.196)
Female			0.0523	0.0431
			(0.0355)	(0.0350)
AGE			-0.00793**	-0.00570
			(0.00385)	(0.00379)
Constant	0.648***	0.609***	1.238***	1.101***
	(0.0793)	(0.0796)	(0.237)	(0.235)
Observations	807	807	806	806
R-squared	0.024	0.022	0.039	0.035

Robust standard errors in parentheses. Linear probability model.

*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Trust in GP, healthcare, science

Second, Table 5 shows a significant effect of trust on the decision to undergo preventive check-ups. Respondents active in prevention trust scientific evidence in general more as well as they trust more their general practitioner, which may be reflected by their trust in healthcare in Slovakia.

Table 5: Regression – the effect of trust

VARIABLES	(1) without prevention yet	(2) inactive	(3) without prevention yet	(4) inactive	(5) without prevention yet	(6) inactive
Trust in Slovak healthcare	-0.0198**	-0.0194**	-0.0156*	-0.0146*	-0.00665	-0.00593
	(0.00827)	(0.00820)	(0.00828)	(0.00827)	(0.00902)	(0.00891)
Trust in general practitioner	-0.0187**	-0.0187**			-0.0193**	-0.0188**
	(0.00799)	(0.00785)			(0.00850)	(0.00832)
Trust in science			-0.0315***	-0.0315***	-0.0273***	-0.0275***
			(0.0102)	(0.0101)	(0.0103)	(0.0102)
Constant	0.656***	0.613***	0.727***	0.681***	0.789***	0.742***
	(0.0541)	(0.0541)	(0.0672)	(0.0670)	(0.0716)	(0.0712)
Observations	807	807	777	777	777	777
R-squared	0.028	0.029	0.031	0.031	0.038	0.037

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Hassle, transaction costs

Third, Table 6 reveals that healthcare is more accessible for respondents active in prevention, measured both subjectively, on the scale from 1 to 10, and in minutes of traveling to a doctor or to a hospital. The active participants were also more likely to postpone a doctor visit due to covid-19 pandemics, which can be a result of them being more likely to have an appointment.

Table 6: Regression – access to healthcare

VARIABLES	(1) without prevention yet	(2) inactive
Accessibility of healthcare	-0.0270***	-0.0246***
	(0.00761)	(0.00760)
Postponed doctor visit due to covid-19	-0.0755**	-0.0791**
	(0.0349)	(0.0345)
Constant	0.684***	0.625***
	(0.0701)	(0.0706)
Observations	807	807
R-squared	0.020	0.019

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Willingness to pay / to be paid

Furthermore, we measure the differences between the active and inactive respondents in their WTP/WTBP for i) a colonoscopy and ii) a fecal occult blood test evaluated by a doctor, as we varied the hypothetical price of these two examinations. As shown in histograms in

Figure 1 and Figure 2 and Table 7, we find that the respondents active in prevention are on average more willing to pay for the screening procedure than the participants inactive in prevention, which is in line with our original expectations.

Table 7: Differences in WTP for screening

VARIABLES	(1) without prevention yet	(2) without prevention yet	(3) not interested in prevention in future	(4) not interested in prevention in future
WTP for colonoscopy	-0.00843***		-0.0101***	
	(0.00195)		(0.00190)	
WTP for FOBT evaluated by doctor		-0.00740***		-0.0106***
		(0.00243)		(0.00237)
Constant	0.517***	0.600***	0.497***	0.641***
	(0.0292)	(0.0633)	(0.0285)	(0.0617)
Observations	807	807	807	807
R-squared	0.023	0.011	0.034	0.024

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Figure 1: Willingness to pay for colonoscopy

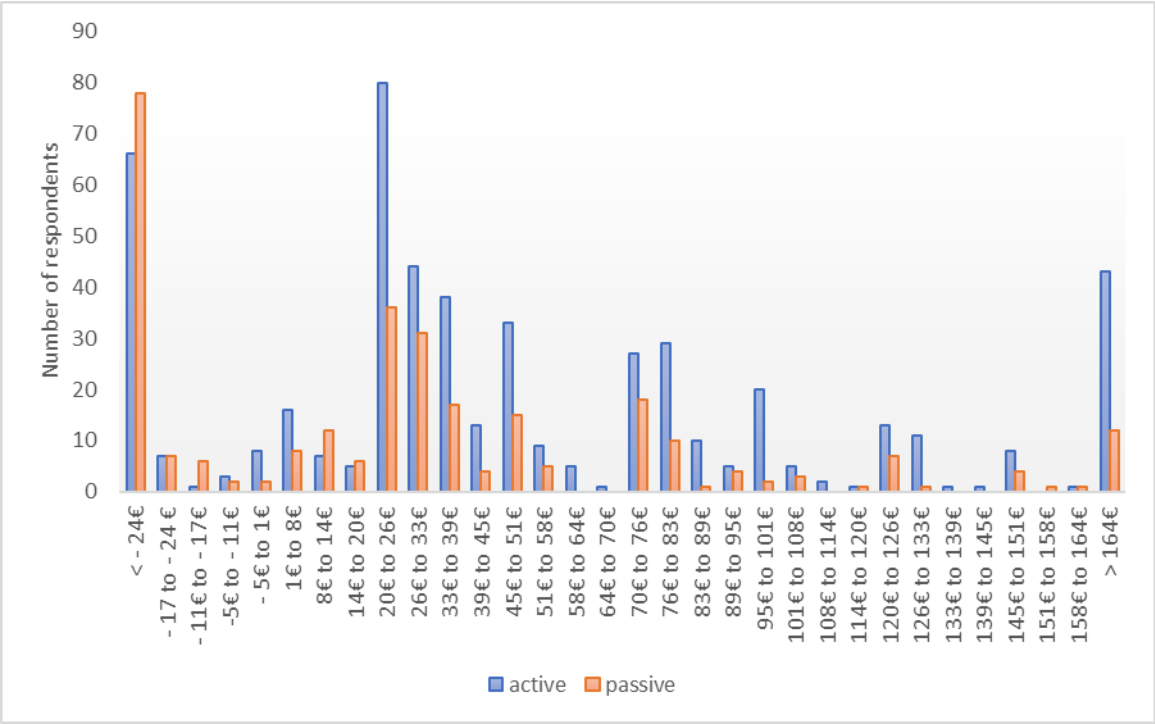
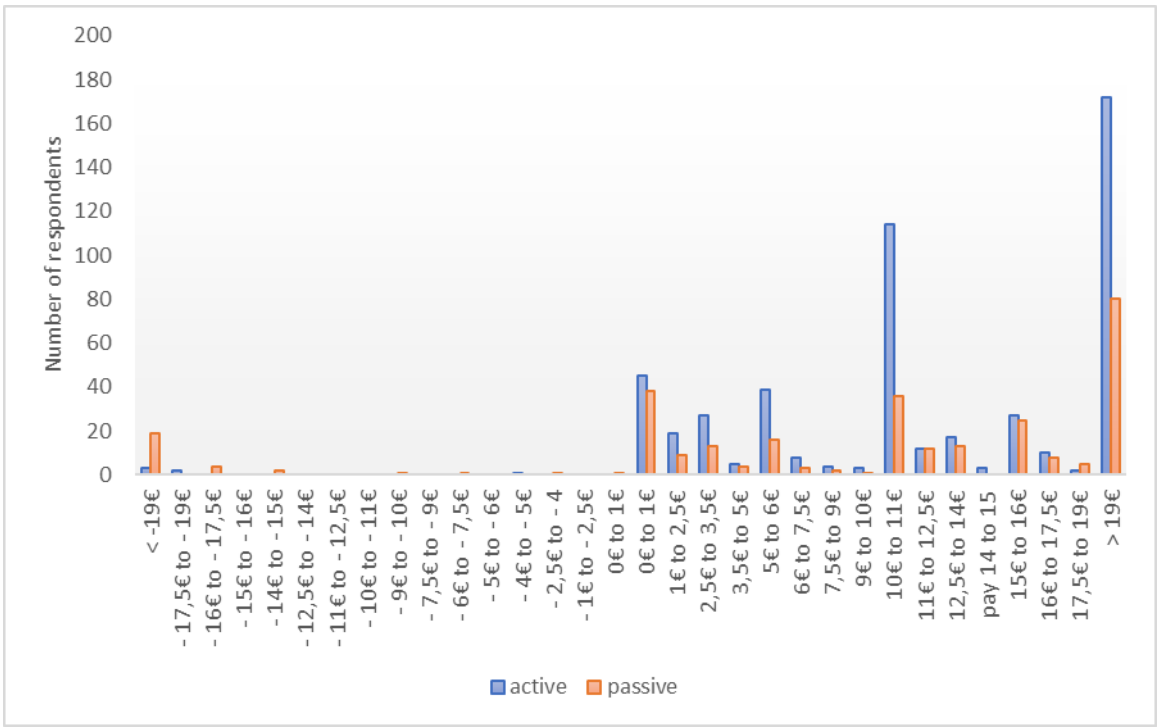


Figure 2: Willingness to pay for a FOBT evaluated by GP



Lifestyle and risk and time preferences

According to the answers to questions about subjective evaluation of healthiness of one's diet, a frequency of consummation of fruit and vegetables, fried food and alcohol, smoking habits and exercise habits, there is no significant difference in lifestyle of the patients active in prevention and the ones inactive in prevention. Based on subjective evaluation of risk and time preferences as well as series of incentivized questions designed to evaluate one's risk and time preferences there is no significant difference between risk and time preferences of the respondents active or inactive in prevention for colorectal cancer.

Stated reasons for inactivity

Respondents who stated they have not undergone any type of prevention and they are not planning to do so in the future were asked about the reason for avoiding preventive screening for colorectal cancer. Stated reasons can be divided into four groups based on theories explaining this behavior. The first theory expects that for some people the utility of not knowing the result is higher than the utility of the result (Caplin & Leahy, 2001). According to the second theory people may just not pay enough attention to the problem of preventive screening for diseases (Gillman et al., 2021). Another possibility is that people are afraid of the procedure itself or are unable to attend to it. The fourth group consists of people who were not able or not willing to state the reason for avoiding screening procedures. Amount of respondents who stated individual reasons in the first survey and in the follow-up survey are shown in Table 8. In the follow-up survey we asked specifically about the reasons why the respondents did not undergo any type of screening in the last three months.

Table 8: Stated reasons for screening avoidance

Stated reason	The first survey, August 2022		The follow-up survey, November 2022	
	Number of observations	Percentage	Number of observations	Percentage
Don't know	55	18,21%	55	26%
Just planning	55	18,21%	23	11%
Don't think it's important	42	13,91%	31	15%
Worried about the test procedure	35	11,59%	34	16%
Don't have time	30	9,93%	30	14%
Worried about the result	21	6,95%	11	5%
Postponed (pandemic)	18	5,96%	0	0%
Don't want to answer	15	4,97%	15	7%
Not offered to them	11	3,64%	0	0%
Did it once before	9	2,98%	4	2%
Not able to do so	6	1,99%	5	2%
No confidence in doctor	5	1,66%	4	2%

Information campaigns

An invitation letter sent by an insurance company was associated with higher active prevention of the participants, but it is possible it was more likely remembered by the participants more interested in prevention (Table 9). Claim that the participant did not receive the letter is associated with 18,6% (p=0.0337) increase in probability of being inactive in prevention for colorectal cancer.

Table 9: Regression – letter from insurance group

VARIABLES	(1) without prevention yet	(2) inactive
Did not receive the letter	0.101***	0.186***
	(0.0354)	(0.0337)
Education – high school without graduation	0.0216	0.185
	(0.214)	(0.195)
Education – high school with graduation	-0.0420	0.101
	(0.211)	(0.191)
Education - higher professional education	-0.0813	0.0220
	(0.225)	(0.204)
Education - university	-0.0815	0.0548
	(0.211)	(0.192)
Female	0.0510	0.0400
	(0.0356)	(0.0345)
AGE	-0.00754**	-0.00582
	(0.00382)	(0.00369)
Constant	0.805***	0.477*
	(0.304)	(0.278)
Observations	807	807
R-squared	0.024	0.052

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: without prevention yet denote participants who reported that they have not gone to a screening in the relevant recent time period and inactive denote participants who have not gone to a screening and are not even planning to do so in the future

Appeal of suggested hassle reductions

Unsurprisingly, all suggested steps to increase the screening attendance were more appealing to the participants active in prevention than to the participants inactive in prevention (Table). Nurses helping with scheduling of an appointment were the most appealing measure, which would be appreciated by 66,79% of all participants. Idea, that people who are not participating in preventive screenings should be paying for treatments of the disease themselves, was quite unpopular, it was the only one unappealing to more participants than appealing to (27,88% vs 14,00%).

Table 10: Appeal of possible improvements

Hassle cost reduction measure	**Appealing**	**Unappealing**
Help with scheduling appointment	66,79%	4,09%
Tests available in pharmacy	62,33%	5,20%
Anonymity	32,09%	8,18%
Self-payment without prevention	14,00%	27,88%

Information treatments assessment

In question Q100 we asked respondents to subjectively evaluate the *persuasiveness* of the presented treatment texts. There was no significant difference between them, none of the treatments were perceived as significantly more or less persuasive (Table 11). The proactive group rated all texts by 1 point higher than the inactive group on a 11-point scale.

Table 11: Regression – Subjective persuasiveness of treatments

	(1)
VARIABLES	q100 - persuasiveness
Treatment 2	-0.135
	(0.407)
Treatment 3	-0.629
	(0.421)
Active in prevention	1.055***
	(0.349)
Constant	6.753***
	(0.313)
Observations	222
R-squared	0.045

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Causal effects of treatment interventions – intentions to get screened

Table 72: Regression – willingness to get screened (T1-T3)presents the results of our between-subject information treatments on stated intentions to get screened (Q101). All the treatments were perceived as similarly persuading, but the reciprocity treatment (T1) was the only one that has a marginally significant and positive effect. Participants were by 0.6 more likely on a 0-10 scale to answer they are planning any preventive steps against the disease if they were included in T1 group and if the elicitation of their risk preferences was indicating lower preference for risky actions.

Table 72: Regression – willingness to get screened (T1-T3)

	(1)	(2)	(3)
VARIABLES	q101 - *intentions*	q101 - *intentions*	q101 - *intentions*
time preference		-0.0108	-0.00747
		(0.0128)	(0.0133)
risk preference		-0.0336*	-0.0400**
		(0.0203)	(0.0198)
treatment 1	0.618*	0.640*	0.387
	(0.364)	(0.365)	(0.379)
treatment 2	0.0133	0.0394	-0.167
	(0.382)	(0.380)	(0.394)
treatment 3	0.180	0.267	0.0870
	(0.387)	(0.391)	(0.401)
active prevention	1.937***	1.911***	1.944***
	(0.276)	(0.280)	(0.293)
Constant	5.891***	6.386***	9.707***
	(0.270)	(0.390)	(2.129)
Controls – observable chars.	NO	NO	YES
Observations	296	296	295
R-squared	0.141	0.155	0.225

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Observable characteristics include Age, Female, Region, size of municipality, and education.

The participants were also more likely to take any preventive steps against the disease if they were offered a fecal occult blood test kit for home use. But if we control for the preventive step being specifically the fecal occult blood test for home use (asked in Q102), there is no effect of the offer of the test kit on making any other steps (Table 83).

Table 83: Regression – willingness to get screened (T1-T3 and FOBT)

	(1)	(2)	(3)
VARIABLES	q101 - *intentions*	q101 - *intentions*	q101 - *intentions*
time preference		-0.0109	
		(0.0128)	
risk preference		-0.0335*	
		(0.0201)	
Female		-0.0556	
		(0.270)	
treatment 1	0.587	0.615*	0.650*
	(0.366)	(0.368)	(0.361)
treatment 2	0.00523	0.0318	0.136
	(0.374)	(0.373)	(0.365)
treatment 3	0.194	0.286	0.288
	(0.383)	(0.390)	(0.370)
active prevention	1.963***	1.942***	1.988***
	(0.273)	(0.281)	(0.275)
FOBT offered	0.639**	0.640**	0.366
	(0.262)	(0.261)	(0.282)
FOBT chosen as future step			0.893***
			(0.282)
Constant	5.575***	6.099***	5.292***
	(0.287)	(0.424)	(0.291)
Observations	296	296	296
R-squared	0.158	0.172	0.186

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Intended exact steps

Regarding exact steps the participants were planning to take, it seems that the participants are less likely to undergo a fecal occult blood test evaluated by a doctor if we offer them the test for home evaluation, even though it is a considerably less accurate test than the test evaluated by a doctor, which they were informed about. They are more likely to undergo the home-evaluated fecal occult blood test, if we offer the free home kit to them, but interestingly, they are less likely to undergo this procedure if they were in the treatment group with the positive framing (T2). According to our results, none of our treatments had any effect on participants' decisions to undergo a colonoscopy (Table 94).

Table 94: Regression – specific screening options

VARIABLES	(1) FOBT evaluated at home	(2) FOBT evaluated by a doctor	(3) colonoscopy
Treatment 1	-0.0697	-0.00187	0.0471
	(0.0784)	(0.0775)	(0.0413)
Treatment 2	-0.146*	0.0346	0.0261
	(0.0767)	(0.0744)	(0.0355)
Treatment 3	-0.106	0.0109	0.0286
	(0.0785)	(0.0743)	(0.0415)
Active prevention	-0.0283	0.382***	0.0841**
	(0.0594)	(0.0550)	(0.0388)
Constant	0.316***	0.493***	0.0279
	(0.0636)	(0.0620)	(0.0302)
Observations	296	296	296
R-squared	0.114	0.162	0.027

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Perceived danger of cancer

The participants answered they are feeling more at risk of the colorectal cancer, if they were in the group of the reciprocity treatment (T1) and if they were more willing to wait (according to our incentivized elicitation of their time preferences), but those effect are not significant if we control for their feelings of a personal risk stated in the beginning of the questionnaire (Table 105). There was found no effect of treatments on opinions how necessary are preventive check-ups in general - *impressions*.

Table 105: Regression – perceived danger of colorectal cancer

VARIABLES	(1) q103 – *perceived danger*	(2) q103 - *perceived danger*	(3) q103 - *perceived danger*
Treatment 1	0.442*	0.443*	0.163
	(0.230)	(0.231)	(0.154)
Treatment 2	0.278	0.281	0.0988
	(0.224)	(0.224)	(0.162)
Treatment 3	0.284	0.294	0.119
	(0.223)	(0.223)	(0.166)
Time preference		-0.00332	-0.00537
		(0.00778)	(0.00568)
Risk preference		-0.00360	-0.0130*
		(0.0109)	(0.00772)
Female		-0.233	-0.174
		(0.160)	(0.115)
Active prevention	1.133***	1.119***	0.764***
	(0.172)	(0.173)	(0.130)
FOBT offered	0.0760	0.0827	0.179
	(0.205)	(0.205)	(0.142)
Personal risk			0.713***
			(0.0295)
Constant	3.414***	3.644***	0.935***
	(0.199)	(0.285)	(0.221)
Observations	807	807	807
R-squared	0.058	0.061	0.503

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Taken steps in following period of 3 months

In the follow-up questionnaire, which followed 3 months after the first survey, the participants were asked whether they did take any steps towards prevention in past three months (between the surveys), specifically home evaluated FOBT test, FOBT test evaluated by a doctor or colonoscopy, or at least have already scheduled an appointment with a doctor or they have appointment specifically for a colonoscopy. There is no significant effect of any of our treatments on their claimed actions in the period of three months. However, respondents were more likely to use FOBT at home if we had offered them the FOBT home kit to be delivered by mail. Interestingly, they were also less likely to undergo colonoscopy if we had offered them the FOBT home kit (Table 116: Regression – taken steps towards screening for colorectal cancer in period of three months). It may imply that tests evaluated at home are appreciated type of screening, but they may discourage people from more precise tests or procedures.

Table 116: Regression – taken steps towards screening for colorectal cancer in period of three months

VARIABLES	(1) Q201 – any taken steps	(2) Q201 – any taken steps	(3) Q201 – any *taken steps*	(4) *Q201 – taken step: colonoscopy*
time preference		0.000333		
		(0.00176)		
risk preference		0.00283		
		(0.00240)		
treatment 1	0.0229	0.0233	-0.00418	-0.0295
	(0.0510)	(0.0511)	(0.0465)	(0.0211)
treatment 2	0.00846	0.00945	-0.0157	-0.000726
	(0.0510)	(0.0510)	(0.0471)	(0.0248)
treatment 3	0.0550	0.0583	0.0420	-0.0243
	(0.0510)	(0.0511)	(0.0474)	(0.0224)
active prevention	0.190***	0.190***	0.196***	0.0509***
	(0.0370)	(0.0371)	(0.0353)	(0.0128)
FOBT offered			-0.0213	-0.0337***
			(0.0402)	(0.0112)
FOBT chosen as taken step			0.661***	
			(0.0257)	
Constant	0.276***	0.241***	0.226***	0.0348**
	(0.0419)	(0.0610)	(0.0413)	(0.0160)
Observations	723	722	723	723
R-squared	0.036	0.038	0.193	0.026

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

Although the preventive screening for colorectal cancer is reimbursement from health insurance for the risk population of age 50-65 in Slovakia, the take-up rate remains still low around 30% (Health Government, 2018). In this paper, we present the results of the large online survey experiment run in Slovakia in August 2022, in which we explored various motivations and barriers for people to participate in the screening program. The survey experiment was conducted on a representative sample of 808 Slovak respondents, who are all part of the target group for colorectal cancer screening.

This study is the first to compare characteristics and attitudes of respondents 'proactive' and 'inactive' in prevention of colorectal cancer. The questionnaire included a set of questions on personal characteristics of respondents to identify those two types, followed by sets of questions to compare them. Active attitude of participants, who have undergone screening already or have been planning to do so without our intervention, is associated with more willingness to pay for both types of screening, Fecal occult blood tests (FOBT) evaluated by a doctor as well as screening colonoscopy. As we expected, active participants are also more likely to trust their practitioner and healthcare system in Slovakia, but also more likely to trust in scientific progress in healthcare in general. Higher activity in prevention is also correlated with higher accessibility of healthcare, measured both subjectively and in minutes. Higher activity is also associated with a higher perceived personal risk of getting the disease. More surprising may be the finding, that active participants are more likely to expect higher survival rate in early stage of the colorectal cancer disease and, what is important, these expectations are more accurate, than expectations of passive participants. That implies there may be room for enlightenment of population regarding survival rate of fatal diseases diagnosed at early stages. Active participants were also more likely to claim that they received the letter from their insurance company about the screening for colorectal cancer, which may be good news for the insurance companies regarding effectiveness of the invitation letters.

Invitation letters may use different framing of the important message offering the colorectal cancer screening; therefore we tested the causal effect of some of them. In the end of the survey, we tested three different formulations of motivational text in the context of persuasion to undergo screening. As a baseline treatment we reminded participants of the colorectal cancer and its symptoms as well as screening programs. In the first treatment we focused on intergenerational reciprocity (T1), in the second treatment we offered positive view on all possible results of the screening (T2) and in the third treatment we emphasized the danger of the colorectal cancer for the target group (which includes all of our respondents) (T3). As orthogonal treatment we randomly offered FOBT (fecal occult blood test) home kit to some of the participants. FOBT is also distributed by insurance companies and effectiveness of this practice have been yet not evaluated.

In our first hypothesis we expected that all our treatments (T1-T3) would increase perceived danger of the colorectal cancer, impression of the importance to get screened, intentions to get screened and actual steps taken to get screened in the following three months. But we did not find any effect of the treatments on impression of the importance to get screened, nor on perceived danger of the disease if we control for the initial perceived personal risk stated by the participants in the beginning of the survey. We found a marginally significant positive effect of the first treatment (T1) on the intentions to get screened, but those intentions were probably not carried out, because we found no effect of the treatments on the actual stated steps taken in the following three months.

We also expected that our orthogonal treatment, offered FOBT home kit, would increase all of the outcome variables (perceived danger, impression of the importance of prevention, intentions to undergo screening and actually undergoing screening) in our second hypothesis. According to our results, offering FOBT home kit had an effect only on intentions about using the FOBT evaluated at home and did not affect any other plans regarding screening. We found a highly significant effect also on undergoing this type of prevention in the following three months. Against our expectations, offering

FOBT home kit decreased the probability of undergoing more precise type of screening, specifically screening colonoscopy. Tests evaluated comfortably and quickly at home may be appreciated by patients, but they may discourage them from more precise (and therefore usually more unpleasant) types of screenings. To confirm this suggestion is left to future research.

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Appendix

Figure 3. T2 positive framing - the real look of the treatments in the online survey (Slovak text)