Preferences for Colorectal Cancer Screening Tests: Differences Between Insured and Uninsured Beneficiaries of Iranian Health Transformation Plan

Vajiheh Ramezani Doroh,[1] Alireza Delavari,[2] Mehdi Yaseri,[3] Sara Emamgholipour Sefiddashti,[1] and Ali Akbari Sari[1, *]

[1]Department of Health Management and Economics, School of Public Heath, Tehran University of Medical Sciences, Tehran, Iran
[2]Digestive Oncology Research Center, Digestive Disease Research Institute, Tehran University of Medical Sciences, Tehran, Iran
[3]Department of Epidemiology and Biostatistics, School of Public Heath, Tehran University of Medical Sciences, Tehran, Iran

[*] *Corresponding author*: Ali Akbari Sari, Department of Health Economics and Management, 4th Floor, New Building, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-2188989120, Fax: +98-66462267, E-mail: akbarisari@tums.ac.ir

Abstract

Background: Study of individual preferences about different aspects of colorectal cancer screening tests can improve the compliance of people for these tests.

Objectives: This study aimed to explore the differences in the preferences of average risk populations with different insurance coverage regarding the colorectal cancer (CRC) screening tests.

Methods: Individual preferences were identified by a standard questionnaire that was completed by 500 people within the age of 50 to 75 and referred to a large government teaching hospital in Tehran between September 2016 and January 2017. Standard discrete choice models and conditional logit were used for analysis.

Results: The final attributes were the test process, pain, place, sensitivity, interval, preparation, complications risk, reduced mortality rate, and cost. The result of conditional logit regression demonstrated that having complementary insurance coverage had a significant effect on individuals' preferences.

Conclusions: This study suggests that different insurance coverage may lead to heterogeneity of preferences for CRC screening tests.

Keywords: Colorectal Cancer, Screening, Discrete Choice Experiment, Insurance, Health Transformation Plan, Iran

1. Background

Each year about 1 million new cases of colorectal cancers are identified and more than half of them lead to patient deaths (1). In Iran the most prevalent type of digestive system cancer is colorectal cancer (2). Various interventions are used for prevention, diagnosis, and treatment of colorectal cancers (CRCs). There is also a wide range of tests that are commonly used for screening of CRC, especially in people with average and high risk of CRC (3, 4). Each screening test has its own advantages and disadvantages (5). It is therefore important to identify and select the best and the most effective screening test for each population group. This will help improve the compliance of people for these tests, which seems to be very low in many countries (6, 7). It is argued that there are a number of reasons for the low participation of individuals in the CRC screening programs including individual opinion that the tests are not useful, and might be lethal (7). In order to screen colon cancer, many countries use various diagnostic tests based on the local guidelines authorized (8). In Iran, no systematic program for delivering the screening services of colon cancer has been implemented so far (9, 10). People preferences are an important factor that influences the compliance of CRC screening tests. The preferences might be influenced by many other factors, including test type, location, accuracy, demographic and socio - economic characteristics of the individuals, and health insurance. It is argued that the type of insurance coverage could affect the preferences of people regarding the various characteristics of the screening tests. Usually, if people are covered by an insurance coverage the screening costs would be decreased and as a result the people selecting the screening tests would pay more attention to other aspects affecting their preferences such as the test accuracy, mortality, and pain (11-13). In Iran, a health sector reform was implemented in 2014. One of

the goals defined for the government in this plan was to expand the basic insurance coverage for the population so that those having no insurance coverage would be covered by the free of charge health insurance (14). Basic Iranian health insurance schemes do not cover all CRC screening tests. Moreover, all costs of CRC screening tests are not covered by these schemes for all individuals. Therefore complementary health insurance might play an important role (15-18). The existence of an insurance coverage is one of the main factors affecting the people preferences for choosing the various types of health services, especially the preventive services (11, 12). In the present study, the preferences of population with an average CRC risk were identified and compared for different tests, after the implementation of the health sector reform in population that were covered and not covered by the complementary health insurance.

2. Methods

2.1. Study Design and Sample

This study was a cross-sectional survey that was carried out in Tehran. The study sample was 500 individuals within the ages of 50 to 75 who referred to a large governmental teaching hospital between September 2016 and January 2017.

2.2. Data Collection and Measurement

The participants' preferences about various attributes of the 6 selected CRC screening tests (total colonoscopy (TC), stool DNA test, fecal immunochemical test (FIT), guaiac - based fecal occult blood test (gFOBT), double contrast barium enema (DCBE), and flexible sigmoidoscopy (FS) were determined by discrete choice experiment (DCE) method. First, we reviewed literatures and selected 14 attributes of CRC screening tests. Then, a checklist was developed and based on the importance of these attributes for CRC screening users, a sample of 15 gastroenterologists (GI) specialists rated all these selected attributes on a scale of 1 (the attributes did not have importance for individuals in choosing CRC screening tests) to 5 (the attributes were of high importance for individuals in choosing CRC screening tests). In the next step, average score of attributes were computed and 9 attributes were selected. The optimum levels of each selected attribute were identified (Table 1). The final attributes were the process of the test, pain, place, frequency, preparation, complications risk, reduced mortality rate, sensitivity, and cost. In order to identify scenarios and reduce the number of them, an experimental design (that maximizes D - efficiency criteria) was constructed. Respondents selected from a generic choice set

that was binary (Choice1: A vs. B). The optimal design included 36 choice sets. Choice sets of test preferences were divided into 5 blocks (4 blocks with 7 choice sets and 1 block with 8 choice sets). Each block was filled by 100 individuals. The final questionnaire had 2 parts (socio - demographic questions and test preference questions).

2.3. Statistical Analyses

Conditional logit model was applied to explore test attributes (e.g. pain, place) on individual's utility from the tests for both insured and uninsured groups. The basic theory of experimental designs is the random utility theory. This theory supposes that the utility of every individual (i) is function from the choice of a hypothetical scenario "j". Modelling individual preferences through this theory provides a well - established conceptual framework. In this framework, the utility of a certain scenario defines based on its attributes:

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

The utility of individual (i) from scenario (j) is represented by U. The estimation of coefficients for various levels of every attributes was shown with β. These coefficients indicate the importance that a certain respondent gives to a specific level. The effect of immeasurable variables on a specific scenario (j) for the person (i) was specified by , which is the random parameter.

A total of 95% is considered as the significant interval. Analyses were conducted using SAS version 9.4.

The study protocol was approved by Ethics Committee of Tehran University of Medical Sciences.

3. Results

3.1. Socio - Demographic Results

The mean age of insured and uninsured participants was 61.68 and 59.25 years, respectively. A total of 65.2 (163 out of 250) insured respondents were men. Other socioeconomic characteristics of respondents are shown in Table 2.

3.2. Conditional Logit Analysis of Preferred Attributes of Two Insurance Groups

The conditional logit results revealed that insured individuals preferred all modalities of CRC screening over a CRC screening test that required 1 sample of stool. The highest odds ratio was related to Enema test (OR = 1.84, 95% CI: 1.84, 2.30, P =< 0.0001). This means that the odds of taking the enema test was 84% more than 1 sample FOBT. The odds ratio of taking the tube test with a sedative drug was 1.61 (95% CI: 1.30, 2.01, P =< 0.0001) compared to 1 sample FOBT. In the next level insured individuals preferred 2

Table 1. Final Set of Attributes and Associated Levels Used in DCE Survey

Attribute	Levels
Process	1 stool sample
	2 stool samples
	3 stool samples
	A flexible tube that has a little camera is inserted into your rectum and through your colon; the test do not has sedation
	A flexible tube that has a little camera is inserted into your rectum and through your colon, the test has sedation
	Air and a white liquid are injected into your colon through a tube that is inserted into your rectum and through your colon and as the liquid moves through your colon X - rays are taken
Pain	Little pain or discomfort able
	No pain or discomfort able
Place	Home
	Hospital
Frequency	Every year
	Every 5 years
	Every 10 years
Preparation	No preparation
	Avoid certain foods and medications
	Laxative
	Enema
Mortality Reduction	Mortality risk won't change
	10 out of 100 people can be survived
	40 out of 100 people can be survived
Sensitivity	3 out of 10 people with cancer
	5 out of 10 people with cancer
	7 out of 10 people with cancer
Complication Risk	No one
	1 out of 1000 people
	10 out of 1000 people
Cost	800000 Rials
	2000000 Rials
	4000000 Rials

samples of stool, tube test without sedative drug, and finally 3 samples of stool, respectively. In insured individuals, doing the test at the hospital leaded to decrease odds ratio of test acceptability (OR = 0.78, 95% CI: 0.69, 0.87, P =< 0.0001). For this group, non-modalities of preparation actions had a significant effect on these individuals' utility. The positive signs of coefficients for reduction of the mortality due to early detection of CRC through screening and sensitivity indicated that participants preferred a test that had a high mortality reduction and had a high accuracy (OR = 1.004, 95% CI: 1.0002, 1.008, P = 0.04 & OR = 1.15, 95% CI: 1.11, 1.20, P =< 0.0001). Further increase of the complication due to doing the test through screening was associated with a significant decrease in the likelihood of acceptance of a test (OR = 0.96, 95% CI: 0.95, 0.97, P =< 0.0001). Individuals were willing to accept a decrease in the likelihood of undergoing a procedure to lower the risk of complication by CRC screening test. Free pain screening test have a statistically significant influence on insured individuals utility compared with a painful one. The frequency and cost attributes did not have a statistically significant impact on the utility of insured individuals from

Table 2. Characteristics of the Surveyed Population (N = 500)

Characteristics			Number	Mean/Percent	Std. Err. (95% Conf. Interval)
Sex	Insured	Male	163	65.2	-
		Female	87	34.8	-
	Uninsured	Male	120	55.81	-
		Female	95	44.19	-
Age	Insured		250	61.68	7.30
	Uninsured		215	59.25	7.52
Marriage	Insured	Married	209	83.6	-
		Divorced - widow	34	13.6	-
		Single	7	2.8	-
	Uninsured	Married	183	85	-
		Divorced - widow	25	12	-
		Single	7	3	-
Education	Insured		250	8.75	5.17
	uninsured		215	5.07	4.77

CRC screening test (Table 3).

However, individuals without insurance coverage did not show any difference between various screening modalities except for tube test with sedative drug, which significantly influence preferences of these participants. At the confidence interval of 95%, other significant attributes for this group of respondents were preparation action that involved enema, reduced mortality rate, sensitivity, and price of CRC screening test. However, by increase of confidence interval to 90%, frequency of testing and process of testing that involved tube test without sedative drug had a significant effect on selection of a CRC screening test (Table 4).

4. Discussion

To our knowledge, in this study, we provide the first DCE assessment of the Iranian population preferences for CRC screening tests between different insurance groups. Our study demonstrated that the test characteristics that significantly influenced individual preferences were different between insured and uninsured groups.

The results of our study showed that respondents with complementary insurance coverage had utility from all CRC screening modalities over a test that involved 1 sample of fecal; however, those without a complementary insurance coverage only desired the procedure that involved tube test with sedative drug over 1 sample stool. The importance attached to enema test by Insured respondents was the most significant. In the next level they preferred

the tube test with the sedative drug, 2 samples of stool, tube test without sedative drug, and finally 3 samples of stool, respectively. Another study reported similar results to our findings. In their study, the state policy of mandates CRC screening coverage with health insurance was associated with probability of endoscopy (colonoscopy and sigmoidiscopy) utilizations among US adults aged 50 to 64 (11). In another study, insurance coverage caused a gap in CRC screening among different Medicare beneficiaries. Their results revealed those individuals without a usual source of care had a lower CRC screening rate compared with other groups. Their findings suggested that expansion of access to CRC screening tests through insurance program could increase tests utilization (12). Wolf et al., (2006) revealed different results. In their study insurance fully covered all tests. Their result showed an overwhelming preference for FOBT (19).

At confidence interval 90%, both groups showed a significant disutility regarding the place of taking a certain CRC screening test at the hospital. Testing at the hospital had a negative influence on the likelihood of test selection by these groups.

In our study, uninsured participants did not prefer a test that needed preparation action like enema. In contrast to uninsured individuals, the insured ones did not show any significant difference toward various preparation modalities (CI = 95%). Inconsistent with a previous study regarding CRC screening preferences, our uninsured respondents were not interested in bowel preparation (20, 21).

Table 3. Insured Individuals' Preferences for CRC Screening Test Using Conditional Logit Model

Attributes	Β Coefficient	SE	P Value	Odds Ratio	95% Confidence Limit
Process					
Enema test	0.61	0.11	< 0.0001	1.84[a]	1.48 – 2.30
Tube test with sedative drug	0. 48	0.11	< 0.0001	1.61[a]	1.30 – 2.01
Tube test without sedative drug	0. 32	0. 12	0.009	1.38[a]	1.08 – 1.75
Three sample	0.30	0.11	0.005	0.35	1.09 - 1.67
Two sample	0.43	0.11	< 0.0001	1.54[a]	1.23 - 1.92
One sample	0	-	-	-	-
Place					
Hospital	-0.25	0.06	< 0.0001	0.78[a]	0.69 - 0.87
Home	0	-	-	-	-
Preparation					
Diet	0.08	0.09	0.37	1.09	0.91 - 1.30
Enema	- 0.11	0.09	0.22	0.90	0.76 - 1.07
Laxative	0.12	0.09	0.22	1.12	0.93 - 1.35
Nothing	0	-	-	-	-
Frequency	- 0.004	0.009	0.63	0.99	0.98 - 1.01
Mortality reduction	0.004	0.002	0.04	1.004[a]	1.0002 - 1.008
Sensitivity	0.14	0.02	< 0.0001	1.15[a]	1.11 - 1.20
Complication	-0.04	0.007	< 0.0001	0.96[a]	0.95 - 0.97
Cost	-0.001	0.001	0.3	0.99[a]	0.99 - 1.00
Pain					
Yes	-0.14	0.07	0.04	0.87	0.76 - 0.99
No	0	-	-	-	-
Model statistics					
Number of responses			3668		
Number of respondents			250		
Log likelihood			-1500.10		

[a] $P \leq 0.05$

One of the key drivers of individuals' preferences for CRC screening tests of both groups was reduction of CRC mortality. Further risk reduction of CRC mortality leaded more utility. Our result revealed that insured and uninsured participants considered the scientific information about different CRC screening tests. Presenting information like this may increase CRC screening uptake based on our finding. The results of the other study proved our findings (22).

Our study demonstrated that the likelihood of selecting a CRC screening test that could correctly detect more individuals with CRC, was more in both groups.

Unlike individuals with insurance coverage, free pain screening test did not have a different influence on uninsured individuals compared with painful one.

At P - value of 0.05, the frequency attribute did not significantly have an impact on the individuals' preferences. However, at confidence interval 90%, uninsured participants preferred a certain test that had a longer interval. In other words, uninsured individuals took into account the time interval of testing. It is consistent with the previous research. Insured individuals compared to uninsured respondents were significantly more likely to have undertaken screening within the recommended time of intervals (23). There could be some explanation for our finding. Barriers related to availability of CRC screening tests may

Table 4. Uninsured Individuals' Preferences for CRC Screening Test Using Conditional Logit Model

Attributes	Β Coefficient	SE	P Value	Odds Ratio	95% Confidence Limit
Process					
Enema test	0.02	0.14	0.9	1.02	0.78 - 1.33
Tube test with sedative drug	0.34	0.13	0.01[a]	1.41	1.09 - 1.81
Tube test without sedative drug	0.23	0.14	0.09[b]	1.26	0.97 - 1.65
Three sample	0.17	0.12	0.16	1.19	0.93 - 1.52
Two sample	0.18	0.14	0.19	1.20	0.91 - 1.58
One sample	0	-	-	-	-
Place					
Hospital	-0.23	0.06	< 0.0001	0.79[a]	0.7 - 0.90
Home	0	-	-	-	-
Preparation					
Diet	- 0.002	0.10	0.98	0.99	0.81 - 1.22
Enema	- 0.23	0.10	0.02	0.8[a]	0.62 - 0.97
laxative	0.02	0.11	0.83	1.02	0.83 - 1.26
Nothing	0	-	-	-	-
Frequency	0.02	0.01	0.06	1.02[b]	0.99 - 1.04
Mortality reduction	0.007	0.002	0.001	1.007[a]	1.003 - 1.01
Sensitivity	0.11	0.02	< 0.0001	1.12[a]	1.07 - 1.18
Complication	- 0.06	0.008	< 0.0001	0.99[a]	0.93 - 0.95
Cost	- 0.006	0.001	< 0.0001	0.99[a]	0.992 - 0.996
Pain					
Yes	- 0.06	0.07	0.38	0.94	0.81 - 1.08
No	0	-	-	-	-
Model statistics					
Number of responses		3034			
Number of respondents		215			
Log likelihood		- 1126.80			

[a]P ≤ 0.05
[b]P ≤ 0.1

be a reason. Another reason may be the cost nature (time and money consuming) associated with insurance coverage of this group.

Complications of CRC screening test had a statistically significant influence on participants with insurance coverage and without insurance coverage. Further increase of individuals who had complication due to taking a test was associated with a statistically significant decrease in the likelihood of acceptance of a test.

Cost of CRC screening modalities had a statistically significant effect on uninsured individuals. However, this effect for this group was low. Our results are in contrast with

other studies findings (24, 25). Pignone et al., (2014) found that cost of CRC screening test was considered a very important attribute (24).

Our study revealed that CRC screening preferences varied significantly with the complementary insurance status of respondents. The comparison of insured participations' and uninsured participations' preferences for CRC screening tests indicated that they had a high degree of disagreement.

Interestingly, respondents with complementary insurance coverage were more likely to have all CRC screening modalities over 1 sample. The uninsured people tend to

use cheaper screening CRC tests, therefore, costs should be considered in designing insurance coverage for covering CRC screening test in order to reach optimal uptake of CRC screening program. Furthermore, expansion of insurance coverage for a CRC screening program will be optimal if effectiveness (reduction of mortality by early detection of CRC) and sensitivity (the power of test in cancer detection) of the test is high. Insurance coverage of CRC screening modality, which is taking place at home, and tests without preparation action like laxative may improve acceptability of tests.

Taken together, our results suggest that a critical factor for improving screening rates among average - risk individuals is health insurance coverage. It should be acknowledged that different insurance coverage may lead to heterogeneity of preferences for CRC screening tests. Therefore, In this case, the preferences of health insurance beneficiaries should be used as the main argument to encourage CRC screening. As noted, one of the most crucial considerations in how to design and develop a program effectively is incorporating how individuals value different healthcare interventions. Therefore, CRC screening tests that are included in a certain insurance scheme should be designed based on the individuals' preferences. Lack of awareness regarding the preferences of health insurance beneficiaries may influence effectiveness and acceptance of covered CRC screening tests. Considering preferences of target individuals will likely increase the uptake of CRC screening program in the years to come.

4.1. Study Limitations

Our study had some limitations. Firstly, it was carried out in the city of Tehran and preferences of other cities were not examined, therefore, the study results must be interpreted with caution. Second, the limitation of our study was that we did not determine preferences of CRC screening tests provider. Several factors may be a potential barrier in CRC screening. As another study carried out in Iran showed, providers' recommendation was one of them (9). This means that eliciting preferences of this group is necessary.

Acknowledgments

Footnote

Conflict of interest statement: The authors declare that they have no conflict of interest.

References

1. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, et al. GLOBOCAN 2012 v1. 0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11. Lyon, France. International Agency for Research on Cancer. globocan; 2013.

2. Fakheri H, Janbabai G, Bari Z, Eshqi F. The epidemiologic and clinical-pathologic characteristics of colorectal cancers from 1999 to 2007 in Sari, Iran. *Journal of Mazandaran University of Medical Sciences*. 2008;**18**(67):58–66.

3. Katz ML, Tatum C, Dickinson SL, Murray DM, Long-Foley K, Cooper MR, et al. Improving colorectal cancer screening by using community volunteers: results of the Carolinas cancer education and screening (CARES) project. *Cancer*. 2007;**110**(7):1602–10. doi: 10.1002/cncr.22930. [PubMed: 17665496].

4. Moattari M, Rouzitalb M, Saber Firoozi M, Zare N. The effect of educational intervention on the knowledge and participation of administrative health personnel in colorectal cancer screening program at Shiraz University of Medical Sciences Shiraz 2003. *Research in Medicine*. 2009;**33**(1):47–54.

5. Kistler CE, Hess TM, Howard K, Pignone MP, Crutchfield TM, Hawley ST, et al. Older adults' preferences for colorectal cancer-screening test attributes and test choice. *Patient Prefer Adherence*. 2015;**9**:1005–16. doi: 10.2147/PPA.S82203. [PubMed: 26203233].

6. Lemon S, Zapka J, Puleo E, Luckmann R, Chasan-Taber L. Colorectal cancer screening participation: comparisons with mammography and prostate-specific antigen screening. *Am J Public Health*. 2001;**91**(8):1264–72. [PubMed: 11499116].

7. Benning TM, Dellaert BG, Dirksen CD, Severens JL. Preferences for potential innovations in non-invasive colorectal cancer screening: A labeled discrete choice experiment for a Dutch screening campaign. *Acta Oncol*. 2014;**53**(7):898–908. doi: 10.3109/0284186X.2013.877159. [PubMed: 24456499].

8. Groothuis-Oudshoorn CG, Fermont JM, van Til JA, Ijzerman MJ. Public stated preferences and predicted uptake for genome-based colorectal cancer screening. *BMC Med Inform Decis Mak*. 2014;**14**:18. doi: 10.1186/1472-6947-14-18. [PubMed: 24642027].

9. Salimzadeh H, Eftekhar H, Delavari A, Malekzadeh R. Psycho-social Determinants of Colorectal Cancer Screening in Iran. *Int J Prev Med*. 2014;**5**(2):185–90. [PubMed: 24627745].

10. Salimzadeh H, Bishehsari F, Delavari A, Barzin G, Amani M, Majidi A, et al. Cancer risk awareness and screening uptake in individuals at higher risk for colon cancer: a cross-sectional study. *BMJ Open*. 2016;**6**(12):13833. doi: 10.1136/bmjopen-2016-013833. [PubMed: 27998901].

11. Cokkinides V, Bandi P, Shah M, Virgo K, Ward E. The association between state mandates of colorectal cancer screening coverage and colorectal cancer screening utilization among US adults aged 50 to 64 years with health insurance. *BMC Health Serv Res*. 2011;**11**:19. doi: 10.1186/1472-6963-11-19. [PubMed: 21272321].

12. O'Malley AS, Forrest CB, Feng S, Mandelblatt J. Disparities despite coverage: gaps in colorectal cancer screening among Medicare beneficiaries. *Arch Intern Med*. 2005;**165**(18):2129–35. doi: 10.1001/archinte.165.18.2129. [PubMed: 16217003].

13. Calderwood AH, Wasan SK, Heeren TC, Schroy P3. Patient and Provider Preferences for Colorectal Cancer Screening: How Does CT Colonography Compare to Other Modalities?. *Int J Canc Prev*. 2011;**4**(4):307–38. [PubMed: 25237287].

14. Moradi-Lakeh M, Vosoogh-Moghaddam A. Health Sector Evolution Plan in Iran; Equity and Sustainability Concerns. *Int J Health Policy Manag*. 2015;**4**(10):637–40. doi: 10.15171/ijhpm.2015.160. [PubMed: 26673172].

15. Davari M, Haycox A, Walley T. The Iranian health insurance system; past experiences, present challenges and future strategies. *Iran J Public Health*. 2012;**41**(9):1–9. [PubMed: 23193499].

16. Aryaie M, Roshandel G, Semnani S, Asadi-Lari M, Aarabi M, Vakili MA, et al. Predictors of Colorectal Cancer Survival in Golestan, Iran: A Population-based Study. *Epidemiol Health*. 2013;**35**:2013004. doi: 10.4178/epih/e2013004. [PubMed: 23807907].

17. Enjezab B. Cancer Screening Practice among Iranian Middle-aged Women. *Journal of Midwifery and Reproductive Health*. 2016;**4**(4):770–8.

18. Bidouei F, Abdolhosseini S, Jafarzadeh N, Izanloo A, Ghaffarzadehgan K, Abdolhosseini A, et al. Knowledge and perception toward colorectal cancer screening in east of Iran. *Int J Health Policy Manag*. 2014;**3**(1):11–5. doi: 10.15171/ijhpm.2014.48. [PubMed: 24987716].

19. Wolf RL, Basch CE, Brouse CH, Shmukler C, Shea S. Patient preferences and adherence to colorectal cancer screening in an urban population. *Am J Public Health*. 2006;**96**(5):809–11. doi: 10.2105/AJPH.2004.049684. [PubMed: 16571715].

20. Howard K, Salkeld G, Pignone M, Hewett P, Cheung P, Olsen J, et al. Preferences for CT colonography and colonoscopy as diagnostic tests for colorectal cancer: a discrete choice experiment. *Value Health*. 2011;**14**(8):1146–52. doi: 10.1016/j.jval.2011.07.012. [PubMed: 22152186].

21. van Dam L, Hol L, de Bekker-Grob EW, Steyerberg EW, Kuipers EJ, Habbema JD, et al. What determines individuals' preferences for colorectal cancer screening programmes? A discrete choice experiment. *Eur J Cancer*. 2010;**46**(1):150–9. doi: 10.1016/j.ejca.2009.07.014. [PubMed: 19683432].

22. Marshall DA, Johnson FR, Kulin NA, Ozdemir S, Walsh JM, Marshall JK, et al. How do physician assessments of patient preferences for colorectal cancer screening tests differ from actual preferences? A comparison in Canada and the United States using a stated-choice survey. *Health Econ*. 2009;**18**(12):1420–39. doi: 10.1002/hec.1437. [PubMed: 19191268].

23. Matthews BA, Anderson RC, Nattinger AB. Colorectal cancer screening behavior and health insurance status (United States). *Cancer Causes Control*. 2005;**16**(6):735–42. doi: 10.1007/s10552-005-1228-z. [PubMed: 16049812].

24. Pignone MP, Crutchfield TM, Brown PM, Hawley ST, Laping JL, Lewis CL, et al. Using a discrete choice experiment to inform the design of programs to promote colon cancer screening for vulnerable populations in North Carolina. *BMC Health Serv Res*. 2014;**14**:611. doi: 10.1186/s12913-014-0611-4. [PubMed: 25433801].

25. DeBourcy AC, Lichtenberger S, Felton S, Butterfield KT, Ahnen DJ, Denberg TD. Community-based preferences for stool cards versus colonoscopy in colorectal cancer screening. *J Gen Intern Med*. 2008;**23**(2):169–74. doi: 10.1007/s11606-007-0480-1. [PubMed: 18157581].