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Patient Preferences For Multi-cancer Early Detection Tests: A Discrete Choice Experiment (DCE)

National Comprehensive Cancer Network® (NCCN®)
Thursday, March 31, 2022 – Saturday, April 2, 2022
Live Virtual Event - Annual Conference (nccn.org)

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INTRODUCTION

- Cancer remains the second leading cause of death in the US.[1]
- The reignited "Cancer Moonshot" has a goal of decreasing the cancer death rate by at least 50%.[2]
- While detecting cancer sooner can enable more effective treatment options, improve patient outcomes, and reduce mortality, common screening practices only cover five cancer types.
- Emerging blood-based multi-cancer early detection (MCED) tests can detect a variety of cancer types across stages—with a range of sensitivity, MCED test specificity, and the ability to predict cancer signal origin.
- To date, little is known about patients' preferences for MCED tests. United States (US).

OBJECTIVE

- This study aimed to quantify preferences for attributes of blood-based MCED tests among the US population ages 50 to 80.

KEY RESULTS

- Despite significant heterogeneity in cancer screening preferences, attributes related to test accuracy were important across classes.

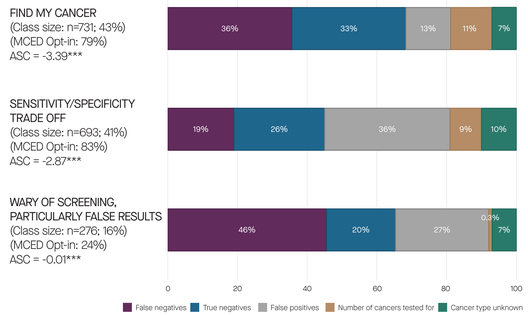
Figure 2. Sample Choice Task

Assume in a population of 10,000 people age 50 to 80, 120 of these people have cancer. All 10,000 take screening A and B. Which of these options do you prefer?

Characteristic	Screening A	Screening B	No Screening
Number of people screened	10,000 people	10,000 people	I would choose not to get screened (*You would not find out any information about whether you have cancer*)
Test says the person may have cancer, but they do NOT have cancer (*false positives*)	70 people incorrectly told they have cancer	70 people incorrectly told they have cancer	
Detection of cancer cases (*true positives and false negatives*)	120 people with cancer: 56 cancer cases detected 56 cancer cases missed 8 not screened (detects 50% of cancer cases tested)	120 people with cancer: 21 cancer cases detected 4 cancer cases missed 95 not screened (detects 84% of cancer cases tested)	
Cancer type unknown	11% unknown cancer type	0% unknown cancer type	
Number of cancers tested for	20 types of cancer	1 type of cancer	
Please make your choice:	☐	☐	☐

- A total of 1,700 US adults between ages 50 and 80 participated (Table 1), and 13,600 cancer screening options were observed.
- Participants preferred one of the two possible screening options over no screening 90% of the time.
- Significant preference heterogeneity was observed, and latent class modeling identified three preference classes (Figure 3), which differed in their overall willingness to undertake cancer screening, attitudes toward cancer screening, preferences for the attributes, and in some personal characteristics. These classes were labeled as follows: Class 1: "Find my Cancer" (n=731; 43%); Class 2: "Specificity/Sensitivity Trade-Off" (n=693; 41%); Class 3: "Wary of Screening; Particularly False Results" (n=276; 16%); (Figure 3).
  - "Find my Cancer" individuals were strongly interested in screening, while also being highly focused on maximizing the identification of cancer cases (i.e., the sensitivity of the test — more true positives and fewer false negatives).
  - "Sensitivity/Specificity Trade-off" individuals often opted into MCED screening and gave much more consideration to false Negatives, potentially explaining the reduced average willingness to opt in.
  - "Wary of Screening; Particularly False Results" individuals were similarly concerned about false negatives, and consistently reported that the side effects/harms of screening were significant factors in their decisions. This often resulted in the decision not to opt into screening, particularly when the specificity was low.

Figure 3. Relative Attribute Importance by Latent Classes



*** p<.001; ASC = Alternative specific constant, negative values indicate a preference to opt in to select a screening option; MCED opt in values represent the proportion of participants who opted into an MCED test with the following profile (over no screening): *70 false positives, 42 true positives, 35 false negatives, 11% cancer type unknown, 50 types of cancer.*

Bars represent the RAI of each of the five attributes among members of that latent class. Larger bars represent greater importance relative to the other attributes presented in the DCE.

- The RAI indicated that the rank order of attribute importance varied by latent class (Figure 3). However, across all latent classes, participants preferred higher accuracy (fewer false negatives and false positives, more true positives), and screenings that detected more cancer types and had a lower likelihood of "cancer type unknown."
- Overall, 71.9% of participants reported that they would prefer to receive the MCED test in addition to their currently recommended cancer screenings. This proportion varied by latent class.

LIMITATIONS

The results of this study should be interpreted in consideration of the following limitations:

- This survey was administered online to participants recruited through online panels. The extent to which this sample represents the general population ages 50 to 80 in the US is unclear, as the sample may have been more highly educated, and racial and ethnic minorities were less well represented.
- The choices in the survey were made without specific input from the participants' physicians, in real-world decision contexts, many participants might be heavily reliant on their doctors' opinions and recommendations.

CONCLUSIONS

- There is significant heterogeneity in cancer screening preferences. However, the majority of participants preferred MCED screening, and the accuracy of these tests is important.
- While the majority of participants preferred adding an MCED test to complement current cancer screenings, a small and specific subset of individuals who value attributes differently are significantly less likely to opt in.
- Offering an MCED screening test as part of the standard of care to individuals between ages of 50 and 80 is likely to be well received by the majority of this population.
- Based on the current study results, a multi-cancer early detection test represents a viable approach to population-based cancer screening.

METHODS

- An online discrete choice experiment (DCE) was conducted among US adults age 50 to 80 to measure the influence of five attributes: true positives, false negatives, false positives, likelihood of the cancer type unknown, and number of cancer types detected (Figures 1 and 2).
- The survey included four sections: 1) introduction to the DCE's attributes and levels, 2) DCE choice tasks and validity tests, 3) questions about experiences and perceptions of cancer screenings, and 4) sociodemographic and clinical questions.
- The survey was qualitatively pilot-tested in 10 one-on-one cognitive interviews to confirm the relevance of the attributes and levels, and assess comprehension. After these interviews, minor adjustments were made to the DCE's wording and presentation order. Following the cognitive pilot interviews, a quantitative pilot was conducted among 303 participants.
- All study participants were recruited through a panel research vendor.
- Data were analyzed using latent class multinomial logit models to explore preference heterogeneity, and relative attribute importance (RAI) was obtained for each class.

Figure 1. Attribute Descriptions and Levels

Characteristic	Description	Levels
Test incorrectly says a person has cancer, but they do NOT (*False positive*)	A false positive result means that the screening says the person may have cancer when the person does not have cancer.	70, 500, 1500*
Detection of cancer cases (*true positives and false negatives*)	Screenings differ in how accurate they are at detecting existing cancer cases. Some cancers do not have screening tests, and sometimes screening tests do not detect when someone has cancer. A true positive result means that the test correctly says that the person has one of the screened-for cancer types A false negative result means that the test missed one of the screened-for cancer types, but the person does in fact have that cancer.	True positive: 21, 42, 56, 83** False negative: 4, 25, 35, 56**
Cancer type unknown	When the screening detects cancer, sometimes the cancer type is unknown (i.e., the doctor cannot tell the site/location where the cancer originated). In this case, your doctor may recommend additional diagnostic tests for specific cancers, or they may recommend that you repeat this same screening in a few months.	0% unknown cancer type† 5% unknown cancer type 11% unknown cancer type
Number of cancers tested for	Some screenings only test for one type of cancer. Other screenings may test for multiple different cancer types in a single test. The screening options that you will choose from this survey will screen for either 1, 8, 20, or 50 different cancer types.	1, 8, 20, 50

*Levels representing 99.3%, 95.0%, and 85.0% specificity, respectively. **Eighty-three true positives and 56 false negatives were not shown in combination, as this would result in more than 120 detectable cancer cases.
†When only one cancer type is screened for, cancer type unknown was restricted to 0%.

Table 1. Sociodemographic and Characteristics and Previous Screening/Cancer Experiences

Characteristic	Overall (N=1700)
Age (in years), Mean (SD) [Min-Max]	63.30 (8.02) [50-80]
Gender, n (%) female	924 (54%)
Hispanic or Latino ethnic background	40 (2%)
Racial background, (%)	
White	1,562 (92%)
Black or African American	65 (4%)
Asian	54 (3%)
Other	19 (1%)
Education, (%)	
High school or less	393 (23%)
Associate degree, technical or trade school	384 (23%)
Bachelor's degree (BA, BS)	530 (31%)
Graduate degree (MA, MS, MBA, PhD, JD, MD)	393 (23%)
Health insurance, (%)	
Employer-provided insurance	593 (35%)
Self-purchased insurance	153 (9%)
Veterans Affairs/military healthcare	92 (5%)
Medicare	833 (49%)
Medicaid or another state program	137 (8%)
Other	12 (1%)
None	66 (4%)
Doctor ever recommended screening tests? (% yes)	1,569 (92%)
Past cancer screening experience? (% yes)	1,331 (78%)

Characteristic	Overall (N=1700)
Ever received positive result on cancer screening test? (% yes)	266 (20%)
Ever received false positive result on cancer screening test? (% yes)	100 (38%)
Ever been diagnosed with cancer in past? (% yes)	173 (10%)
Family history of cancer? (% yes)	1,056 (62%)
Family history of cancer diagnosed before age 50? (% yes)	312 (30%)
Visit to any type of doctor within the past 12 months? (% yes)	1,475 (87%)
Factors influencing choice to receive screening tests, % yes	
Out of pocket cost	466 (27%)
Doctor recommendation	1,203 (71%)
Family history of cancer	929 (55%)
Finding out a friend/acquaintance has cancer	114 (7%)
General health status	612 (36%)
How healthy I feel	406 (24%)
Insurance coverage	702 (41%)
Potential side effects/harms of the screening or follow-up testing	335 (20%)
Presence of symptoms	969 (57%)
Worry/peace of mind	677 (40%)
Other	5 (0%)
Age*	5 (0%)
Ease/convenience of test*	4 (0%)
Willingness to receive any type of cancer screening in future, (%)	
Yes	1,452 (85%)
No, I do not plan to get any cancer screenings	92 (5%)
I don't know/unsure	156 (9%)

Abbreviations: SD=Standard deviation; Q1=First quartile; Q3=Third quartile. [a] Percent has been adjusted for sex to reflect the proportion of female participants receiving a pap smear (702/924). [b] Percent has been adjusted for sex to reflect the proportion of male participants receiving PSA testing (369/776). * Retrieved from text answers.

References

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2. The White House. Fact Sheet: President Biden Reignites Cancer Moonshot to End Cancer as We Know It. February 2022. Accessed 17 February 2022: https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/02/fact-sheet-president-biden-reignites-cancer-moonshot-to-end-cancer-as-we-know-it/?utm_source=lin

Disclosures

HG, MR, and NK are employees of Evidera, which provides scientific consulting and other research services to pharmaceutical, device, government, and other non-government organizations. MS is an advisor for Grail and Evidera. KC, AK, and EF are employees of GRAIL, LLC, a subsidiary of Illumina, Inc., with equity in Illumina, Inc.

Acknowledgements

The authors would like to thank the Cancer Support Community for their valuable insights on the design and patient-centeredness of the survey used in this study.