A2

Pilot Study for Assessment of Health State Utilities Associated with False-Positive Cancer Screening Results

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BACKGROUND AND OBJECTIVE

- Early cancer detection and intervention can significantly improve patient outcomes and reduce mortality rates.[1] A simple procedure that can detect multiple types of cancer could significantly improve patient outcomes. One such possible procedure uses plasma cell-free DNA (cfDNA) to identify cancer via a simple blood draw.[2]
- An effective cfDNA-based cancer screening test would ideally detect a variety of cancers across stages, predict cancer signal origin, and have very high specificity (i.e., a very low rate of false positive [FP] results).
- When evaluating multi-cancer early detection (MCED) tests, it will be important to consider the incidence rate and impact of FP results, which can have a psychological impact on patients. To incorporate the impact of FP results into cost-effectiveness models to determine the value of novel cancer screening approaches, health state utilities representing FPs will be needed.
- **A vignette-based pilot utility elicitation study was conducted in May-July 2021 to test health state vignettes and procedures that could be used to estimate the disutility associated with FPs.**

METHODS

Study Design

- Vignette-based time trade-off (TTO) utility interviews were conducted with a sample of general population respondents in the United Kingdom. Interviews were conducted virtually using videoconferencing software.
- The pilot study was completed in three phases to allow for edits to the health states between each phase.

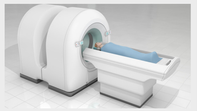
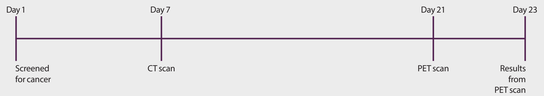
Participants

- This study was conducted with a sample of general population participants who were required to be at least 18 years old; have access to a computer or tablet for the video conference interview; and currently reside in England or Scotland.

Health State Development

- Health states were drafted based on:
  1. Published literature on cancer screening procedures
  2. Interviews with five clinicians (pulmonologist, radiologist, anesthesiologist, and two oncologists).
  3. Interviews with an academic professor who works with the UK National Screening Committee to advise the UK government on appropriate cancer screening procedures for the UK population.
  4. The current pilot study in which the health states were tested with a general population sample in the UK.
- Health states were drafted in an iterative process, with multiple rounds of expert interviews occurring before the pilot study and between pilot study phases to address concerns encountered during pilot interviews.
- Ten health states were drafted (see example in Figure 1 and list of health states in Figure 2).
  - Health state A described cancer screening with negative results.
  - All other health states described an FP experience including routine screening, the initial positive result, follow-up diagnostic testing, and the final negative result.
  - Follow-up diagnostic testing included a computed tomography (CT) scan, magnetic resonance imaging (MRI), positron emission tomography/computed tomography (PET-CT), mammogram, breast ultrasound, and a colonoscopy.
  - Images were provided to illustrate each test.
  - The total time from initial screening to the negative result was provided, along with a timeline illustrating the sequence and duration of events.

Figure 1. Sample Health State E2: Pancreatic with PET-CT

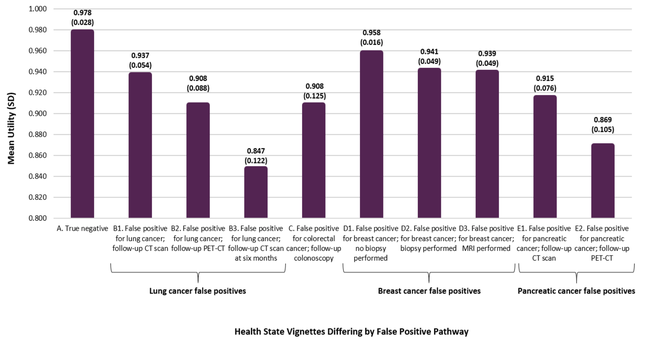
Cancer Screening	As part of a routine health check, you are screened for cancer.
Screening Result	• The screening results suggest you may have pancreatic cancer. Therefore, more testing is needed.
CT Scan	• You attend an appointment for a scan of your abdomen (called a CT scan). This scan will create an image of your pancreas. • One hour before the procedure, you drink a bad-tasting liquid. This will help create a more detailed image of your pancreas. ○ This liquid causes some diarrhea and cramping. • The full procedure takes about 60 minutes. The scan itself takes a few minutes. During this time, you lie on your back in a large, ring-shaped machine. ○ In preparation for this scan, you receive an intravenous (IV) injection of dye (called contrast) which helps create a more detailed image of your pancreas. – This means that a needle is inserted into a vein in your arm, and fluid flows into your body. – During the injection of the dye, you may feel flushed or lightheaded. • This appointment requires you to take a few hours off work. • This scan takes place about one week after receiving your initial screening results. 
PET-CT Scan	• As a final precaution, you attend an appointment for a scan of your full body (called a PET-CT scan). This scan will create a detailed image of your entire body. This scan occurs about two weeks after the CT scan. • You may not eat any sugar for 24 hours before the scan. • The full procedure takes about four hours. ○ Prior to the scan, you receive an intravenous (IV) injection of radioactive sugar which helps create a more detailed image of your pancreas. – This means that a needle is inserted into a vein in your arm, and fluid flows into your body. ○ Then you wait 60-90 minutes. ○ When it is time for the scan, you lie on your back in a large, ring-shaped machine. This scan takes 30-60 minutes, and you must remain as still as possible during this time. • This appointment requires you to take at least a half-day off work. 
Resolution	• Two days after the PET/CT, you are told that no sign of pancreatic cancer was detected. • There were about 23 days from the time you received results from the first screening to the results from the PET-CT scan. For these 23 days, it was uncertain whether you might have cancer.
Timeline	

Procedures

- Participants first completed an introductory ranking task. Then, participants valued the health states in a TTO task with a 1-year time horizon. After completing the TTO portion of the interview, the participants also completed a demographic and clinical information form.
- Types of cancer included lung, colorectal, breast, and pancreatic. Men did not value breast cancer health states. Therefore, women valued 10 health states whereas men only valued seven.

RESULTS

Figure 2. Mean Health State Utilities*



*Breast cancer health states were only presented to women. Therefore, women valued 10 health states and men valued seven. For the A, B, C, and E health states, N = 30. For the D health states, N = 15

Sample Description

- A total of 30 participants completed the TTO utility elicitation (see demographics in Table 1).

Table 1. Demographic Characteristics (N=30)

Demographic Characteristics	Descriptive Statistics
Age (mean (SD); years)	45.8 (14.5)
Min age (years)	20
Max age (years)	70
Male (%)	50.0
Average/minimum/maximum minutes to complete (female)	47.3/30/82
Average/minimum/maximum minutes to complete (male)	37.7/15/71

Table 2. Mean Health State Utility Values (N=30)

Health States	Follow-up Procedures Described in Health State	Number of Days of Uncertainty about Cancer Diagnosis, as Described in Health State	Disutility of Each FP Experience (i.e., utility difference from health state A)
A. Cancer screening with negative result	-	-	-
B1. False Positive for lung cancer without head or neck involvement	CT Scan	10	-0.040
B2. False Positive for lung cancer with possible head or neck involvement	CT Scan; PET-CT	25	-0.069
B3. False Positive for lung cancer with a follow-up scan	CT Scan	185	-0.131
C. False Positive for colorectal cancer	Colonoscopy	14	-0.069
D1. False Positive for breast cancer; no biopsy performed	Mammogram/Ultrasound (at same visit)	10	-0.022
D2. False Positive for breast cancer; biopsy performed	Mammogram/Ultrasound/ Biopsy (at same visit)	10	-0.039
D3. False Positive for breast cancer; MRI performed	Mammogram/Ultrasound (at same visit); MRI	20	-0.042
E1. False Positive for pancreatic cancer; follow-up CT scan	CT Scan	9	-0.063
E2. False Positive for pancreatic cancer; follow-up PET-CT	CT Scan; PET-CT	23	-0.108

Health State Rankings

- Health state A (true negative) was ranked as most preferable by 29 of the 30 participants. The other participant in the first round of interviews ranked health state A last because she was concerned by the language stating, "while the screening test is not perfect," and stated that she would prefer to have the follow-up tests described in all the other health states to feel reassured that she did not have cancer.
- Rankings for the FP health states varied. For female participants, health state D1 (breast cancer without biopsy) was most commonly ranked as most preferred, and B3 (lung cancer with six-month follow-up) was most commonly least preferred. For male participants, E1 (FP of pancreatic cancer resolved relatively quickly with only a CT scan) was most commonly ranked as most preferred, while B3 was most commonly ranked lowest.

Health State Utilities

- Mean (SD) utilities are presented in Figure 2 and Table 2. As expected, health state A (true negative) had the highest utility at 0.978 (0.028). Utilities of the FP health states ranged from 0.847 (0.122) for B3 (lung cancer with a six-month follow-up) to 0.958 (0.016) for D1 (breast cancer with no biopsy performed).
- Disutilities of the FP health states (i.e., utility difference from health state A) ranged from 0.022 for D1 (breast cancer with no biopsy performed) to 0.131 for B3 (lung cancer with a six-month follow-up).

CONCLUSIONS

- In general, utilities followed logical patterns, with greater disutility associated with longer duration of uncertainty about the cancer diagnosis and greater perceived severity of the suspected cancer.
- Respondent feedback suggests that all participants had a good general understanding of the health state content. Interviewers identified edits to clarify some of the health state content. Edits were made based on phases 1 and 2, and the health states used in phase 3 appear ready for use in a larger utility elicitation study.
- One inherent limitation of all vignette-based utility elicitation studies is that the resulting utilities are based on perceptions of the health states rather than personal experience.[3]
- Another limitation of the current vignette study is that there is considerable variability of patient experience with these procedures, making it unlikely that any of the timelines for these FP pathways are truly applicable to all patients. Timelines were developed using the best judgment of the study team, based on published literature and interviews with cancer screening experts.
- **Utilities gathered using these health state vignettes in a larger valuation study may be useful in cost-effectiveness analyses assessing different methods of cancer screening.**

References

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3. Matza LS, Stewart KD, Lloyd AJ, Rowen D, Brazier JE. Vignette-based utilities: Usefulness, limitations, and methodological recommendations. Value Health. Jun 2021;24(6):812-821.

Disclosures

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