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Women's preferences for cervical cancer screening: A study using a discrete choice experiment

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Objectives: Recent policy recommendations for cervical screening include liquid-based cytology. This new approach could improve laboratory throughput, reducing the waiting time for test results. New guidelines also standardize the interval for screening, with women aged 25–50 offered screening every 3 years and women aged 50–64 every 5 years. Quantitative evidence on the preferences of women for alternative screening programs is limited; this study, therefore, elicits such preferences.
Methods: A postal questionnaire using a discrete choice experiment was mailed to 2,000 women in the Tayside Health Board region of Scotland.
Results: A response rate of 44 percent from those women who had previously had a smear was achieved. Women had a significant positive preference for reductions in recall rates and waiting time for results. Women preferred more frequent screening, particularly those aged 50+. Expected reductions in the chance of recall from the conventional Pap smear to the new liquid-based cytology were associated with a willingness to pay of £41. Women aged 50+ would be willing to pay £42 to increase the frequency of screening from every 5 to every 3 years. Service characteristics did not influence screening participation.
Conclusions: Guidance to move to liquid-based cytology will meet women's preferences for fewer repeat cervical smears and should reduce waiting time for results. However, proposals to increase screening intervals for those aged 50+ are inconsistent with the preferences for this age group. From a policy perspective, our study results suggest that the changes in attributes of the service such as unsatisfactory smear rates and frequency of screening, will improve service efficiency without affecting participation rates.

Keywords: Cervical screening, Preferences, Choice

In terms of malignant diseases, efforts at preventing cervical cancer have shown some success in the Western world (2). In common with many countries, the United Kingdom's (UK) national screening program for cervical cancer historically has used the Pap smear test, which spreads the sample over a glass slide and adds preservative before being sent for laboratory examination. However, policy guidance from the National Institute for Health and Clinical Excellence (NICE) has resulted in the gradual rolling out of liquid-based cytology, where the brush or spatula used to collect cervical cell samples is rinsed or broken off into a vial of preservative fluid (4). The perceived advantages of this new approach are a reduction in sample loss and the removal of cellular debris such as blood. Compared with the Pap smear, liquid-based cytology is expected to provide better quality smear samples. This improvement should reduce the number of inadequate

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smears, in turn reducing the number of repeat smears (5,11). Furthermore, liquid-based cytology smear samples are easier to read and could improve laboratory throughput, reducing the average waiting time for test results (6).

The National Health Service (NHS) Cancer Screening Programme has also changed its recommendations on optimal screening frequency. Previously, all women aged 25 to 64 in England and 20 to 60 in Scotland were eligible for a cervical smear test every 3–5 years. New research on the effectiveness of screening intervals has suggested varied intervals based on age. Using a mathematical model, it was found that lowering the screening interval in women aged 25–49 is likely to mean an 18 percent reduction of the cumulative lifetime incidence of cervical cancer compared with screening practice before 2003 (10). As such, National recommendations for England and Wales will now be screening every 3 years for those aged 25–49 and every 5 years for those aged 50–64.

Despite these suggested changes, information on the preferences of women for different screening intervals and other attributes (characteristics) of cervical screening remains limited. Information on which screening attributes are considered the most important by women could be used to further improve the cervical screening program, and increase screening uptake. As such, this paper presents the results of a study designed to elicit women's preferences for alternative cervical screening programs. More specifically, consideration is given to the importance of different dimensions of cervical screening programs, and how respondents trade between these dimensions.

METHODS

Questionnaire Development

To explore women's preferences for alternative cervical screening options, a discrete choice experiment (DCE) was conducted. A DCE is a quantitative survey method and is based on the premises that any good or service can be described by its characteristics (or attributes) and the extent to which an individual values a good or service depends upon the levels of these attributes. The technique can be used to estimate the relative importance of the different attributes, how respondent's trade-off between these attributes, and willingness to pay (WTP), a monetary measure of benefit, if a price proxy is included as an attribute. DCEs have been applied in several healthcare areas, including eliciting patient preferences for alternative locations of ultrasound scanning, evaluating alternatives within randomized controlled trials, and establishing general practitioner preferences for different practice jobs (8;13;14).

Essentially, a DCE presents respondents with several hypothetical choices and they are asked to choose their preferred option. Each choice comprises several attributes, with corresponding levels, varied across choices. Factorial experimental designs are used to construct the choices, with each presenting a different combination of realistic attribute levels (7).

Table 1. Attributes and Levels in the Discrete Choice Experiment

Attributes	Levels of attributes	Variable name
Time between smears	1, 3, 5 years	YEARS
Time for results	5, 7, 10, 18, 21, 28 days	DAYS
Chance of being recalled	11, 15, 17, 20 (%)	RECALL
Chance of abnormality	3, 5, 8, 10 (%)	ABNORM
Chance of dying from cervical cancer	.4, .5, .8, 1.3, 1.5, 2.0 (%)	DYING
Cost of the smear	2, 7, 8, 20, 30, 35, 40, 60 (£)	COST

The attributes were defined according to both policy questions raised about the provision of Pap smear cervical screening and literature on what is important to women in the provision of cervical screening (thus, quality was broadly defined). Six attributes were included: frequency of screening, waiting time for results, changes in chances of having an abnormality, chances of being recalled, chances of dying from cervical cancer, and price proxy (cost of a smear).

The price proxy, "cost of a smear," was included to provide an indirect measure of WTP. Having chosen the attributes, levels were assigned to them, which were based on policy recommendations and statistics from the Grampian Health Board Primary Care Department and the Information Statistics Division of the Scottish Executive Health Department. Table 1 presents the attributes and associated levels used in the DCE.

When using the DCE approach, i.e., different combinations of attributes and levels are presented to respondents and they are asked to make choices. The combination of attributes and levels above generated 3,072 possible cervical screening programs ($4^5 \times 3^1$). Computer software techniques were used to generate thirteen discrete choices (1;15). Piloting suggested that thirteen choices were too many; therefore, the choices were randomly split into two questionnaires, one with six and the other with seven choices.

Within the choices, respondents were given the option of not undergoing either of the offered screening programs. This no-screening option was important because nonattendance is a realistic alternative in screening. Indeed, 3.5 year coverage has fallen slightly since 2002, with 71.2 percent of women attending in 2001–2002 and 70.3 percent in 2003–2004 (NHS Cervical Screening Review, 2004). Therefore, including this no-screening option allowed us to investigate the extent to which the screening program characteristics on offer influence a women's decision to participate in screening or not. The no-screening option could also inform policy in terms of ways to increase cervical screening uptake. Therefore, each woman could choose

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• Question 2	Option A	Option B
Time between smears (years)	1	3
Time for results (days)	21	10
Chance of being recalled	20 %	17 %
Chance of abnormality	8 %	3 %
Chance of dying from cervical cancer	1.5 %	1.5 %
Cost of each smear (£)	5	30

	Prefer Option A	Prefer Option B	Prefer no screening
Which Option would you prefer? (*tick one box only*)	☐	☐	☐

Figure 1. Example of DCE choice.

"Option A," "Option B," or "no-screening." These choices involved different combinations of the attributes and levels. Figure 1 shows an example of one of the choices within the DCE.

Two of the choices in each questionnaire were used to examine internal consistency (respondents understanding of the questionnaire), as they had a screening option which was clearly "superior" to the others. If a respondent fails to choose the superior option as the preferred option, this could reflect the respondent's difficulty in understanding the experiment. However, it is important to distinguish between a random error and a more systematic error. Current practice in discrete choice experiments is to allow respondents to fail one consistency choice check, but if both checks are failed, this finding is regarded as a basic misunderstanding of the experiment and the individual is not included in the regression analysis. Finally, the questionnaire collected information on respondents' characteristics.

Data Analysis

Descriptive statistics were analyzed in the statistical package SPSS. The preference results were analyzed using a nested logit model, carried out in the statistical package LIMDEP. This regression model is appropriate where there are more than two options in a choice (Option A, Option B, and no-screening) and the options may not be perfect substitutes for each other. In particular, in this DCE, it is possible that the two screening options (A and B) could have more in common with each other than the no-screening option. The nested logit model explicitly explores the decision to choose between a screening option and the no-screening option. This is all captured through what is termed the IV (inclusive value) parameter and can indicate to what extent the decision to screen or not is influenced by the screening attributes on offer (9).

The IV parameter takes on a value between 0 and 1. If all three options on offer are seen as equal alternatives to each other, the IV parameter will be estimated at a value of 1. An IV parameter between 0 and 1 suggests that women view the two screening options as being more similar to each other than they are to the no screening option. An IV parameter of 0 indicates that women view the two clinics as complete substitutes for each other, and they do not compete with the no-screening option. In this situation, any change in the attributes of one screening clinic will only affect the probability of attending that clinic and the other clinic, with no effect on the probability of the no-screening option. This suggests that the characteristics of a screening option have no impact on the proportion of women undertaking screening. Tests for significance were performed using a Wald test.

Consideration was also given to what factors, in addition to the characteristics of the screening program, influence participation and benefit from screening (Table 2). With respect to choosing whether or not to be screened, variables modeled included the following: age; women's experience of the Pap smear test, measured directly by asking whether the women had ever had a smear (HADSMEAR) and indirectly by asking if the women knew of anyone who had ever had an abnormal smear (KNOWAB); and the number of dependent children (under 16 years of age, CHILDREN), as having dependent children may indicate some measure of responsibility to participate in preventative measures, such as screening.

With respect to the benefit from screening, preferences for frequency of screening was modeled according to age and income. Age was examined with respect to preferences for the time between smears attribute (YEARS). Given recent government policy regarding intervals for screening (25–49 year olds being screened every 3 years, and 50+ every 5 years), two groups were created, under 50 and 50+. In

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Table 2. Respondent Characteristics

Personal characteristics	Mean (SD)	Variable name
Age in years	37.52 (10.32)	AGE
Age under 50 (1/0 dummy variable)	.838 (.37)	AGEunder50
Age 50 and over (1/0 dummy variable)	.162 (.37)	AGE50andup
Has had a cervical smear (1/0 dummy variable)	.927 (.26)	HADSMEAR
Know of someone having abnormal smear (1/0 dummy variable)	.675 (.47)	KNOWAB
Have dependent children (<16) in household (1/0 dummy variable)	.430 (.50)	CHILDREN
Stated preference for female to take cervical smear (1/0 dummy variable)	.829 (.38)	WHOF

addition, we hypothesized that higher income women would put a lower value on the price proxy (COST, reflecting diminishing marginal utility of income). This theory was tested by segmenting the income variables into three groups: (<£6,000); (£6001–£15,000) and (£15,001+), with the COST attribute analyzed according to these groups.

Sample and Setting

The study population was a sample of women in the Tayside Health Board region of Scotland. A stratified general population sample of 2,240 was identified from the cervical screening call and recall system attached to the Community Health Index (12). This sample contained three groups of women; those who had previously had a smear with normal results, those who had previously had a smear but had abnormal results (noncancerous), and those who had never had a smear. This latter group was added because we knew that some women were not attending screening, and we wanted to examine whether they perceived that cervical screening was not worthwhile to them (did not value screening). It was recognized that this particular group may have a lower response rate than those who had had a smear test in the past. To reflect population smear test experience in the final sample, this particular group of women were over mailed and accounted for one third of all questionnaires sent.

A pilot questionnaire was mailed to 240 of this sample. The main study was mailed to the remaining 2,000, with a pre-paid return envelope included. Each group was randomly allocated a questionnaire containing either six choices or seven choices. If women did not wish to take part in the study, they were encouraged to return a slip stating this. Two reminders were sent: the first including a letter, and the second a letter and another copy of the questionnaire.

RESULTS

Allowing for changes of address and women returning the questionnaire uncompleted (because screening was not relevant, for example after hysterectomy), 641 usable questionnaires were received. This comprises 583 questionnaires (44 percent response rate) from the group of women who had experienced a smear test previously and as expected a much lower response rate of 8 percent from the group of women who had never had a smear. This rate corresponds to a total survey response rate of 32 percent, of which 91.5 percent have had some experience of a smear test and 8.5 percent had never had a smear test.

Thirteen respondents failed both consistency tests and were excluded from further analysis. Individuals with missing values for their respondent characteristics were also dropped (47), as were four individuals who failed to answer any discrete choices (4). This resulted in 3,737 observations from 577 respondents, and their characteristics are presented in Table 2. Respondents were representative of women in Scotland in terms of the age distribution. The mean age of respondents in our sample was 37 years of age, whereas for females in Scotland, between 20 and 60 years of age, it is 39 (3).

Of these 3,737 observations, 108 provided a "no screening" preference response. This corresponds to 27 women who at some point in their responses indicated that they would "prefer no screening."

Table 3 reports the discrete choice modeling results. The estimated IV parameter was insignificant at the 5 percent level, indicating that the attributes offered by the screening programs did not influence a women's decision to choose a screening option or not. Thus, the decision to screen or not was taken independently of the programs offered. This finding suggests that altering the screening characteristics offered to women will have no impact on uptake. It is important, therefore, to examine factors likely to influence a women's decision to undergo cervical screening.

The decision to choose the "prefer no screening" option was related to screening experience. Although there was no statistical difference between those who had been screened and those who had not in terms of respondent characteristics such as age and income, if a woman had screening knowledge, either directly or indirectly (knowing someone with an abnormal smear), they were more likely to choose the A or B screening options than "prefer no screening." Women preferring a female to perform the procedure were more likely to choose a screening option, possibly reflecting the invasive nature of the procedure. Having dependent children did not significantly influence the decision to screen or not, and neither did age.

For those choosing screening, the signs on the attributes relating to the screening program were all statistically significant. The negative signs on all attributes indicate that the higher the attribute, the less likely the woman was to choose

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Table 3. Discrete Choice Modeling Results

Variable	Coefficient	Standard error	*p* value	Marginal WTP for a unit change[a]
Choose not to be screened				
CONSTANT(β_0)	−.255	.909	.779	–
AGE (β_1)	.001	.010	.308	–
HADSMEAR (β_2)	−2.32	.231	.001	–
KNOWAB(β_3)	−.414	.204	.042	–
CHILDREN(β_4)	.057	.220	.795	–
WHOF (β_5)	−1.08	.221	.001	–
Utility from screening				
YEARS (α_{1a}) × AGEunder50	−.324	.036	.001	£13.50
(α_{1b}) × AGE50andup	−.505	.081	.001	£21.04
DAYS (α_2)	−.034	.005	.001	£1.42
RECALL (α_3)	−.129	.014	.001	£5.37
ABNORM (α_4)	−.067	.010	.001	£2.79
DYING (α_5)	−1.246	.112	.001	£51.92
COST (α_6)	−.024	.002	.001	–
IV parameter (screen)	.015	.163	.927	–
➢ Number of observations 3,147				
➢ Chi-squared 5,112.4				
➢ *p* value .001				

Note: $\text{Utility}_{(\text{option A, option B, no-screen})} = \alpha_{1a}\text{YEARS} \times \text{AGEunder50} + \alpha 1_b \text{YEARS} \times \text{AGE50andup}; + \alpha_2\text{DAYS} + \alpha_3\text{RECALL} + \alpha_4\text{ABNORM} + \alpha_5\text{DYING} + \alpha_6\text{COST} + e$; $\text{NoScreen/screen} = \beta_0 + \beta_1\text{AGE} + \beta_2\text{HADSMEAR} + \beta_3\text{KNOWAB} + \beta_4\text{CHILDREN} + \beta_5\text{WHOF} + u$.
[a] $\alpha_{i/} - \alpha_6$, where i refers to the attribute of interest.
WTP, willingness to pay; IV, inclusive value.

that alternative. For example, the higher the cost of a screening program or the longer the wait for the results, the lower the chance that a program was chosen.

In terms of how important the attributes were to women, a percentage change in the chance of dying from cervical cancer was the most important, followed by a 1-year reduction in the frequency of screening. A unit change in the cost (£) of a smear was the least important attribute, with a day's change in time for results the second least important. A 1 percent change in the chance of an abnormality and the chance of being recalled were both in the middle range of importance.

The ratio of coefficients for any two attributes provides information on how much of one attribute an individual is willing to give up for an improvement in another. In particular, if the ratio uses the coefficient on the price proxy (cost) as the denominator, this approach gives the relative value in monetary terms. This provides an estimate of how much money the respondent is willing to pay for a unit change in that attribute, for instance, the value in £'s of a 1-day reduction in waiting time for results. Column 5 of Table 3 reports the estimates of willingness to pay as measured by unit changes in the attributes of the screening service. This finding can be converted into estimated values corresponding to predicted changes in screening characteristics with a move from the Pap smear to liquid-based cytology. Recent evidence, produced for NICE on liquid-based cytology indicates a reduction in the number of inadequate smear samples from an average of 9 percent for the Pap smear to 1.4 percent for liquid-based cytology (4). Our analysis of women's preferences for screening service attributes indicates that such a reduction in the chance of recall is associated with a willingness to pay of £41 per smear ((9–1.4) × 5.37).

It could be suggested that the lower rate of inadequate samples with liquid-based cytology will result in a reduction in the volume of samples to be analyzed by laboratories. In addition, liquid-based cytology is associated with an increase in slides screened per minute. These factors should result in a reduction in the backlog of smear samples to be processed, with an associated reduction in reporting times for smear results (4). For instance, if liquid-based cytology leads to a 1-week reduction in time spent waiting for the results, this corresponds to a willingness to pay of £10 per smear (7 × 1.42).

No significant relationship was found between income and the price proxy. A significant difference (at the 5 percent level) was found between the values placed on the frequency between tests for those above and below 50 years of age. Those aged 50 and over had a stronger preference for a reduced length of time between smears, compared with younger age groups. This finding is contrary to the new policy recommendations where the over 50's have longer gaps between tests than the younger group.

In terms of frequency of screening, the difference in strength of preference between age groups can be illustrated by comparing the willingness to pay for a reduction in time between smear tests, using the estimates from Table 3. Women under 50 years of age are willing to pay £27 (2 × 13.50) to reduce the time between smear tests by

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2 (from 5 to 3) years, compared with the older age group willing to pay £42 (2×21.04) to reduce the time between smears by the same amount.

DISCUSSION AND CONCLUSIONS

This study has presented the results of a study eliciting women's preferences for cervical screening attributes. Previous research in this area has tended to be qualitative in nature rather than quantitative; hence, this research contributes toward filling this information gap. Whereas women's preferences were elicited before liquid-based cytology was introduced, the flexibility of the DCE approach allows preferences for new services to be valued.

For our study, all questionnaire attributes were seen as important to women when considering alternative screening programs. In terms of new cervical screening policy recommendations, these results suggest that liquid-based cytology could meet women's preferences for a lower recall rate after unsatisfactory smears, with a benefit being the positive value that women place on a shorter waiting time for results. However, with respect to screening interval, the new policy proposals for 3-year screening intervals up to age 50 and thereafter every 5 years are inconsistent with the preferences of those over 50 years of age. Indeed women over 50 in our study had a significant additional disutility (less satisfaction) in increasing time between smears, and had a stronger preference for more frequent screening than younger women. Therefore, those who are most averse to longer intervals between cervical screens are those having the greatest time between screens under the new proposals.

The response rate may appear low. However, given a third of the women we sampled had never had a smear, we anticipated a lower response rate from this group. In addition, with respect to age, respondents are representative of women in Scotland (15). As such, we hope that our results are generalizable outside the Tayside region of Scotland.

It is recognized that the general finding that women preferred more frequent screening could potentially be due to overoptimism about the actual benefits of shorter screening intervals. However, in this study, we did not explore women's beliefs about the trade-off between frequency of screening and reduction in cancer risk and did not ask the women to provide information on what they perceived their risk of developing and dying from cervical cancer was. Future work should explore this aspect in more detail.

The result that no significant relationship was found between the price proxy and income may be explained by respondent's perceptions of their personal risk of developing cervical cancer. Given that we did not collect information on perceived risk, we could not test this question directly. However, we did test for this indirectly by examining if "experience," as measured by whether a woman had undergone a smear (HADSMEAR) or knew of anyone who had an abnormal smear (KNOWAB), was related to income. However, no relationship was found, and future work should investigate this issue further.

Expected reductions in the chance of recall from the conventional Pap smear to the new liquid-based cytology are associated with a willingness to pay of £41. From an economic perspective, questions regarding whether such a change is an efficient use of health service resources relate to (i) Do benefits outweigh costs? And, if so, (ii) How does the ratio of costs to benefits compare with other policy changes where costs outweigh benefits? Future research is needed here.

Future research should also explore further the reasons why some women still do not attend for screening. According to a recent report from the NHS Cervical Screening Programme, the reasons for not attending vary. Research has indicated that some women find it difficult to make time for their appointment, whereas others believe they are at low risk of cervical cancer (Department of Health, 2004).

The results from our study suggest that the attributes of the cervical screening itself are not influencing the decision to undergo screening. There are arguably two main ways to lower cervical cancer risk, increase the effectiveness of the smear process for those already participating and encourage more women to attend for screening. Evidence from NICE (2) indicates the new liquid-based cytology process is likely to improve the former, but our study suggests that there is no evidence that the new screening process will improve the latter.

POLICY IMPLICATIONS

The findings presented in this study suggest that, from a policy perspective, attempts to change the attributes of cervical screening programs, such as recall and frequency of screening may not affect attendance. That is, those who are not currently being screened are unlikely to start attending due to recent policy recommendations. Instead it suggests that only those who are currently undergoing screening will be influenced by such policy changes.

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