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ORIGINAL ARTICLE

Classifying the Reasons Men Consider to be Important in Prostate-Specific Antigen (PSA) Testing Decisions: Evaluating Risks, Lay Beliefs, and Informed Decisions

Michelle E. McDowell, Ph.D · Stefano Occhipinti, Ph.D · Suzanne K. Chambers, Ph.D

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Abstract
Background Despite uncertainty regarding the benefits of prostate cancer screening, many men have had a prostate-specific antigen (PSA) test.
Purpose This study aims to identify classes of reasons guiding men's decisions about prostate cancer screening and predict reasoning approaches by family history and prior screening behaviour.
Methods First-degree relatives of men with prostate cancer (n=207) and men from the general population (n=239) of Australia listed reasons they considered when deciding whether to have a PSA test.
Results Responses were coded into 31 distinct categories. Latent class analysis identified three classes. The evaluation of risk information cues class (20.9 %) contained a greater number of men with a family history (compared with control and overcome cancer/risk class; 52.7 %). Informed decisions and health system class (26.5 %) included a lower proportion of men who had had a PSA test and greater proportions of highly educated and married men.
Conclusion Understanding the reasons underlying men's screening decisions may lead to a more effective information provision and decision support.

Keywords PSA test · Family history · Decision making

Prostate cancer is the most frequently diagnosed cancer in men worldwide [1], and the high incidence of prostate cancer has been attributed in part to the early and increased detection of cancers through prostate-specific antigen (PSA) testing [2]. Although recent evidence suggests that screening is associated with a reduction in mortality (~20 %), there are also a number of risks such as the overdiagnosis and overtreatment of screen-detected cancers [3, 4]. In this view, the US Preventive Services Task Force recently updated its recommendation statement on screening for prostate cancer to recommend against early detection screening on the basis that the potential harms outweigh the possible benefits [5]. These formal recommendations differ to those of other health groups and authorities who advocate for individualised informed decision making where patients consider information about the risks and benefits of screening and treatment outcomes, as well as their personal values [6, 7]. However, screening decisions often do not meet the criteria for informed decision making [8]. For example, men tend to have poor knowledge about prostate cancer screening issues and report only minimal discussion of such issues with their physician [9–12]. Furthermore, despite many health authorities not endorsing routine population-based screening for many years [13–17], a large proportion of men have and continue to undergo tests to screen for prostate cancer [11, 18, 19].

M. E. McDowell (✉) · S. Occhipinti
Griffith Health Institute, School of Applied Psychology, Griffith University, Mount Gravatt, QLD 4111, Australia
e-mail: M.McDowell@griffith.edu.au

S. Occhipinti
e-mail: S.Occhipinti@griffith.edu.au1

M. E. McDowell · S. Occhipinti · S. K. Chambers
Behavioural Basis of Health, Griffith Health Institute, Griffith University, Mount Gravatt, QLD, Australia

S. K. Chambers
e-mail: Suzanne.Chambers@griffith.edu.au

S. K. Chambers
Centre for Clinical Research, University of Queensland, St Lucia, QLD, Australia

Research in this area has to date focused on identifying why men are or are not screened for prostate cancer and ascertaining if they are making informed decisions about testing (e.g. [19–22]). Much of this research has focused on identifying socio-demographic and psychosocial predictors with a variety of patient characteristics found to be associated with increased screening behaviour. For example, older age, greater access to healthcare, prior discussion with a physician, and a positive family history predict screening behaviour, and there is mixed evidence for the role of risk perceptions as a predictor (e.g. [23–26]). However, there is a lack of examination of *why* these factors relate to increased screening behaviour; how these predictors relate to one another; or how to differentiate men who are more or less likely to go for screening. For example, it is not clear why men with a family history are more likely to go for screening: because of family pressures following a relative's diagnosis; because they are more likely to be prompted to access healthcare or speak to a physician; because familial risk influences health cognitions or motivations toward health behaviour more broadly; or a combination of these reasons. In fact, there is some evidence to suggest that more robust predictors of screening behaviour in such men include the consideration of the behaviours of friends and acquaintances in the broader social network [27].

Identifying the reasons why men do or do not go for prostate cancer screening can elucidate the decisional processes, motivations, or health-related cognitions to target in decisional interventions. Decision interventions aim to facilitate decision making based on patient preferences and values, yet many interventions focus on information provision and fail to incorporate patient values and preferences in designing decision tools [28]. This oversight is problematic, particularly given that broader underlying beliefs about cancer, preventive health behaviours, and the health system can influence how new health information is processed [29]. For instance, even after extensive information and counselling about the risks and benefits of prostate cancer screening, men report underlying beliefs to dismiss the information, such as a profound fear of cancer or a general distrust of statistics [29]. Without understanding the factors that guide a patient's health behaviours, decisional interventions that focus on improving knowledge and understanding of disease-specific information may not be effective in incorporating or addressing patient's preferences and values.

Previous approaches to understanding why men participate in prostate cancer screening treat men who have been screened as a distinct group from men who have not. However, the goals for performing a health behaviour (e.g. to look after oneself) are not simply the opposite of those for not performing the health behaviour (e.g. to not look after oneself) [30]. Rather, people appraise a decision situation based on information that is salient or available to them at the time of the decision and do not necessarily consider all possible alternatives or outcomes [31]. Studies examining illness causal attributions suggest that people make health decisions based on information that may not be shared by others but is considered important for the decision making of the individual, such as reference to personal or lay health beliefs [32]. Furthermore, examining the process by which a person makes a choice between alternatives can reveal how prior knowledge and experience are represented and applied in people's thought processes [33]. Accordingly, an approach to advance our understanding of the information men use in their health decisions is to elicit the reasons behind their decision to be screened for prostate cancer and examine reasons that cannot otherwise be elucidated from structured measures.

Classifying the Reasons Behind Prostate Cancer Screening Decisions

Men may provide a multitude of reasons that they consider being important to their decisions about being tested for prostate cancer. In one of the few studies to elicit and categorise the reasons why men held either positive or negative views about PSA testing for prostate cancer, Gattellari and Ward [34] identified approximately 30 different types of meaning categories that could be categorised based on participant responses. These reasons were broad and diverse and included positive reasons such as reassurance or as a precautionary measure, and negative attitudes about testing owing to a general mistrust of doctors. One approach to examine the multiple reasons men may provide to is to explore whether there are similar underlying health cognitions or mindsets that can be modelled from these reasons. For example, although many men tend to report holding positive attitudes towards PSA testing [23, 35], no studies have examined whether these attitudes are part of a broader health mindset where such men tend to hold positive attitudes towards screening tests or preventive health behaviours in general. In this regard, there has been a recent interest in identifying whether individuals with different mindsets toward health behaviour (e.g. stage of behaviour change) can be characterised by different health cognitions [36, 37] with a goal to identify how these broader categories or mindsets may be better targeted by decisional interventions that seek to address divergent approaches to health behaviour.

An analytical approach to facilitate the examination of multiple pieces of information and to identify whether there is an underlying structure inherent in the data is latent class analysis. Latent class analysis is a statistical technique, similar to factor analysis, which examines the interrelationships between observed categorical items to identify whether there is an unobserved latent variable that explains associations between the items [38]. Latent class analysis

is used to identify whether smaller, homogenous subgroups of related cases or latent classes better represent or encompass multiple pieces of categorical information. Furthermore, individuals can be assigned to a particular category or class of the latent variable and class membership can be predicted by characteristics of the individual (e.g. positive family history). This process is advantageous in that it allows for the identification of individual or group characteristics that are associated with the different approaches to prostate cancer testing decisions and may facilitate the adjustment of decisional intervention strategies to individuals or subgroups of patients. Men who have previously been tested for prostate cancer may report different or distinct sets of reasons to men who have not been tested, as may men with or without a family history of prostate cancer. For instance, men with a family history of prostate cancer are not consistently found to participate in prostate cancer testing owing to a perception of being at high risk but rather, their decisions seem to be shaped by alternative motivations that include the broader context in which this information is processed, such as in reference to the experiences of their family members [26]. People who have previously contemplated genetic testing for a disease report more affective-based reasons for genetic testing compared with people who have never contemplated testing [39]. The present study takes an analytical modelling approach to elucidating the characteristics of men who do and do not participate in early detection screening for prostate cancer.

Research Questions

The present study seeks to address the following research questions. First, what are the reasons men consider to be important to their decisions about being tested for prostate cancer? Second, are there different patterns or subsets of reasons or motivations that men consider, and do they represent distinct underlying mindsets or decision-making approaches? Third, are different subsets of reasons associated with existing subgroups of men such as men who have previously been screened compared with men who have not and men with a family history compared with no family history?

Method

Participants

A sample of men with a first-degree family history of prostate cancer and men from the general population of Queensland, Australia (population men) were recruited for the study as part of a broader study examining how men make decisions about prostate cancer screening. Details of recruitment and study protocols are outlined in McDowell et al. [11, 27], and details of the sample of men who completed the computer-assisted telephone interview for the current study are summarised briefly below. First-degree relatives were recruited from their probands (affected relatives). The probands were participating in ProsCan, a decisional intervention randomised controlled trial for men with prostate cancer [40, 41]. Probands who were diagnosed with prostate cancer prior to the age of 65 were asked for permission to contact their unaffected male first-degree relatives. First-degree relatives were eligible if they were aged between 40 and 65 years, had basic English literacy, lived within Australia, and did not have a prior history of cancer. A market research firm recruited a convenience sample of population men based on identical eligibility criteria (population men who reported a first-degree family history of prostate cancer were excluded from the sample; $n=32$). The study was funded by the Cancer Council Queensland and ethical clearance was obtained from the Griffith University Research Ethics Committee. Permission to contact first-degree relatives was obtained from the probands for 293 first-degree relatives of whom 207 participated in the present study (70.6 % consent rate). Of the 246 population men who answered all eligibility questions, 239 (97.2 % consent rate) completed the study (440 households were identified as having a man in the eligible age range of whom 106 were ineligible and for 88 households the potential participant was away for the study duration).

Materials and Procedure

Eligible participants completed the computer-assisted telephone interview guided by research officers. The telephone interview was part of a larger study and took around 35 min to complete.

Background Variables and PSA Testing Behaviour Partici pants completed socio-demographic information (age, marital status, income, work status, education, ethnicity, and country of birth) and were asked to indicate whether they had ever had a PSA blood test for the purposes of testing for prostate cancer (*yes* or *no*).

Screening Reasons The procedure for eliciting reasons for or against prostate cancer screening was based on the methods used by Wroe et al. [39] and Shiloh et al. [42] to examine genetic testing decision making. Similar to Wroe et al., participants were read the following question: *When deciding whether or not to have a blood test for prostate cancer, what did you consider to be important in your decision?* Interviewers were instructed to write down verbatim the reasons the participants stated and to clarify any statement for which the meaning was not clear. Each statement was recorded in the

order in which it was mentioned to the interviewer. Multiple reasons were elicited from participants to allow for the decision process to be guided by the participant rather than to have the investigator determine decision-relevant material. The interviewers were asked to elicit up to five statements for each participant, if possible.

Data Coding Scheme

Development of Coding Scheme A coding scheme was developed to capture the content of the reasons listed by participants, and the development of category units followed both deductive and inductive processes. First, prior research on prostate cancer screening was used to develop categories consistent with known risk factors for prostate cancer, predictors of prostate cancer screening, and attitudes towards health behaviours (e.g. the participant considers risk factors such as their age or family history of prostate cancer, or they stated their doctor recommended that they get tested). Furthermore, current prostate cancer screening recommendations were used as a basis for developing categories about the prostate cancer screening test and to identify possible lay beliefs about prostate cancer and screening outcomes (e.g. the participant states a belief that early detection reduces the likelihood of experiencing treatment side effects). Second, a sample of the reasons stated by participants in the present study was used to generate a more exhaustive list of reason-meaning categories that represented those reasons relevant to the participants but had not been identified in prior research on prostate cancer screening. A total of nine categories representing 31 coding units were generated and are presented in Table 1.

Data Coding and Scoring Two independent coders received a de-identified and randomised list of statements and coded each statement according to a binary coding scheme where the statement met the criteria for the category (presence) or did not (absence). Category units were not mutually exclusive, and statements could be coded multiple times as fitting multiple category units. To facilitate the coding of prostate cancer screening categories, coders were provided with an information sheet containing basic information about prostate cancer risk factors and screening recommendations based on Wolf et al.'s [43] guidelines. The information sheet served to provide a factual, unbiased report of current recommendations for the early detection of prostate cancer to coders. Coders were blind to the research hypotheses and were unaware of family history as a characteristic of the group of men whose transcripts they were coding. The two coders coded 100 % of the statements so that the reliability of the coding categories could be determined.

Owing to poor reliabilities for the coding categories 7.4 (*discomfort of the test*) and 8.3 (*no need for prostate cancer testing*; kappa, <0.05 for each category) and the small number of statements coded according to these categories by either coder (less than five statements in total), the two categories were dropped. The mean kappa for the remaining 29 categories was 0.68 (median=0.68; range, 0.44–0.93) indicating good to excellent agreement. Kappa was ≥0.60 for 19 of the categories (66 %). Following initial reliability analyses, coders met with the research team to clarify interpretations of coding categories and the two coders discussed discrepancies between the coding of statements to reach concordance.

Statistical Analyses

Latent class analysis using Mplus version 6 [44] was applied to determine whether there were homogenous groups or subpopulations of individuals identifiable from the patterns of screening reasons. The model parameters are probabilities of being in a class and the probabilities of meeting each criterion or coding category-given class membership. Identification of the most parsimonious and best-fitting model was determined by lower values on the Bayesian information criterion (adjusted for sample size), higher values for entropy (an indication of the misclassification error), and interpretability of the findings. A single undifferentiated model was estimated and successively more complex models with more classes were compared until a best-fitting model was identifiable. Individuals were assigned to a class based on posterior probabilities such that an individual was assigned to the class with the highest estimated probability of their being in a given class. Posterior probabilities are conceptually similar to factor scores in factor analysis [45]. Multinomial logistic regression using Stata version 12 examined whether background variables (e.g. socio-demographics, first-degree relative status, and prior PSA testing behaviour) predicted class membership.

Results

Sample Demographics

The majority of participants were married or in a de facto/cohabitation relationship (82.3 %), employed full time (70.0 %), had completed some form of tertiary education or trade certificate (66.8 %), earned greater than or equal to $60,000/year (53.6 %), and were born in Australia compared with outside of Australia (84.3 %).[1] In comparison to the 2006 Census data from the Australian Bureau of Statistics for Queensland, we note that the current sample tends to

[1] See McDowell et al. (11) for detailed table of participant characteristics by sample group.

Table 1 Category units for coding screening reasons

Category of meaning	Category unit	Example statements
1. Perceptions of risk		
An evaluation of one's risk of being diagnosed with prostate cancer	1.1 Family history	Because of the history in our family
	1.2 Age	I am getting to that age
	1.3 Symptoms	It was important to know what was going on because of some urinary symptoms
	1.4 Lifestyle or other	I am very healthy and do not go to the doctor
	1.5 Evaluation of risk	I was definitely in a higher risk group
	1.6 Prevalence of prostate cancer	High incidence of prostate cancer in males
2. Early detection		
Statements that prostate cancer screening is beneficial because of beliefs about early detection, health attitudes or beliefs about the outcomes of prostate-specific antigen (PSA) tests	2.1 Early detection	The early detection of it is the most important thing
	2.2 General positive health attitude	Being well informed about my overall health
	2.3 Enhance survival	To prolong my life
	2.4 Screening as information to take action	To give me information so I can act if I need to
3. Resolution of uncertainty		
Participant wants to know the outcome of the PSA test for reassurance value or to clarify an anticipated outcome	3.1 Peace of mind/seek reassurance	To do it to have peace of mind
	3.2 Want to know	Just to find out if I did have prostate cancer or not
	3.3. Outcome as clarification	I needed to be certain there was no cancer
4. Social influence		
Influenced to get a PSA test by people in one's social group or by the media	4.1 Doctor recommendation	Doctor said I had to do it
	4.2 Family or friend recommendation	Dad told me to keep an eye and be tested
	4.3 Family pressures or considerations	To keep dad happy
	4.4 Media influence	I saw a program on TV where they interviewed a doctor from John Hopkins who said the blood test was a lot of hogwash
5. Cancer representations		
Reference to the cancer experiences of a friend or relative as a reason for ordering a PSA test	5.1 Friend/relative cancer experience	Having a cousin that was not that much older die of it
	5.2 Family or friend comparison	I did not want to be like my father leaving everything to the last moment because by the time he was diagnosed it was aggressive
6. Lay beliefs		
Includes beliefs or theories about the causes of cancer including behaviours, personalities, environmental factors, or beliefs that are not backed up by scientific evidence	6.1 Lay beliefs about prostate cancer and role of testing	To make sure that I don't get it
	6.2 Lay beliefs about prostate cancer screening or treatment outcomes	I would like to get it early enough to be able to use dietary controls to slow the process and reduce necessary treatment
7. PSA testing		
Reference to the convenience or discomfort of the PSA test, holds positive attitudes about prostate cancer screening, or considers evidence pertaining to the benefits of early detection screening	7.1 Convenience of testing	I thought it was less of a bother to have a PSA test than to have a digital exam
	7.2 Evidence for/against PSA testing	I was led to believe the blood test was more thorough than the other tests; From what I've heard and read most men die with it than from it
	7.3 Positive attitudes towards testing	I am strongly in favour of testing
	7.4 Discomfort of the test	I do not like the idea of the physical test
8. Barriers to testing		
Reference to barriers to ordering a PSA test	8.1 Barriers	I do not go to the doctor generally

Table 1 (continued)

Category of meaning	Category unit	Example statements
	8.2 Never thought about it	Have not really thought about it before
	8.3 No need for prostate cancer testing	I do not need the test at this stage
	8.4 No need for the blood test, specifically	Digital rectal examination is the better way to go
	8.5 Avoidance of testing	I know it has to be done and I know I will have to do it but I just keep chickening out
9. Concern with testing		
Concern about prostate cancer, the PSA test, or an anticipated outcome or screening	9.1 Concern	It does scare you so you have to find out

be composed of men who were more likely to be born in Australia, married, report a high income, and are less likely to be employed full time [46]. The first-degree relatives were more likely than population men to be born in Australia ($F(1, .)=20.43$; $p<0.0001$)[2] and to identify with a British/Scottish/Welsh/Irish ethnicity compared with other ethnicities ($F(1, .)=9.28$; $p=0.002$). First-degree relatives (M=54.0, SD=7.47) were older on average than population men (M=52.5, SD=7.37; $F(1, 442)=4.63$; $p=0.032$). More than half of men had had a PSA test ($n=290$, 65.0 %) and first-degree relatives were more likely than population men to have ever had a PSA test ($n=172$; 84.3 % versus $n=118$; 51.3 %, respectively; $\chi^2=53.13$; $p<0.000$).[3]

Frequency of Reasons and Determination of Coding for Analyses

All men listed at least one reason they considered when deciding whether or not to have a blood test for prostate cancer (see Table 2). However, men did not tend to state more than two reasons. Observation of the data collection process suggested that the limited number of statements was a result of participants simply not reporting multiple reasons (e.g. stating that no further reasons were relevant) rather than difficulties with the question or the process by which research officers attempted to elicit reasons. As shown in Table 2, first-degree relatives and men who had previously had a PSA test were more likely to list multiple reasons compared with the population men and men who had not had a PSA test, respectively. Given that the aim of the study was to elicit and classify the content of decision-relevant reasons as generated by the participants themselves, the individual reasons were collapsed such that any mention of a coding category for reason one through to reason five would be coded as the presence (versus the absence) of that category, and this collapsed variable was used in subsequent analyses.

As shown in Table 3, the most frequently mentioned reasons listed by first-degree relatives were coded into the categories 1.1 (*family history*), 2.4 (*screening as information to take action*), and 6.1 (*lay beliefs about prostate cancer and testing*). For population men, 2.2 (*general positive health attitude*), 1.2 (*age*), and 2.1 (*early detection*) were the most common reasons mentioned. For men who had previously had a PSA test, 1.1 (*family history*), 2.2 (*general positive health attitude*), and 6.1 (*lay beliefs about prostate cancer and testing*) were mentioned most frequently whereas for men who had not previously had a PSA test, 8.1 (*barriers*), 1.2 (*age*), and 2.2 (*general positive health attitude*) were the most common reasons listed.

Latent Class Analysis

Models with one to five latent classes were estimated. Fit indices did not clearly identify a single best-fitting model but rather suggested that either a three (i.e. based on lowest sample-size-adjusted Bayesian information criterion) or a four (i.e. based on highest entropy) class model was the most appropriate fit. Accordingly, examination of the Vuong–Lo–Rubin test and the Lo–Mendell–Rubin-adjusted likelihood ratio test (both $p=0.52$) and the bootstrapped parametric likelihood ratio test [47] ($p=0.05$) comparing the four- to the three-class model suggested that three classes were better than four. Furthermore, model estimates for the three- and four-class models were examined to select the most interpretable model based on classes with substantive meaning. On this basis, the three-class model was selected. The conditional probabilities for the items across the three classes are presented in Table 4. Individuals were assigned to a class based on posterior probabilities. The properties of the three classes are discussed below.

Class 1—Evaluating Risk Information Cues (n=93; 20.9 % of Participants) The evaluating risk information cues class was characterised by coding categories that indicated the

[2] Analyses were run following multiple imputation (see [27]), hence degrees of freedom for error are not always available for F statistics (in such cases, a decimal point is included in the reporting of degrees of freedom).
[3] Twelve participants did not know if they had ever had a PSA test

Table 2 Total number of reasons listed by participants (by first-degree relative status and prior screening)

No. of reasons	Proportion of FDR *N* (%)		Proportion PSA test *N* (%)[a]		Total *N* (%; *N*=446)
	FDR (*N*=207)	PM (*N*=239)	Yes (*N*=290)	No (*N*=144)	
1	60 (29.0)	153(64.0)	110 (37.9)	95 (66.0)	213 (47.8)
2	68 (32.9)	69 (28.9)	97 (33.4)	37 (25.7)	137 (30.7)
3	53 (25.6)	13 (5.4)	57 (19.7)	9 (6.3)	66 (14.8)
4	24 (11.6)	3 (1.3)	23 (7.9)	3 (2.1)	27 (6.1)
5	2 (1.0)	1 (0.4)	3 (0.1)	–	3 (0.7)

FDR first-degree relatives, *PM* population men, *PSA* prostate-specific antigen test

[a] Excludes the 12 participants who did not know whether they had a PSA test

Table 3 Frequency of coding categories (presence or absence) collapsed across all reasons

Category of meaning	Category units	Frequency of category *N* (%)		Frequency of category *N* (%)[a]	
		FDR (*N*=207)	PM (*N*=239)	Prior PSA (*N*=290)	No PSA (*N*=144)
1. Perceptions of risk	1.1 Family history	73 (35.3)	4 (1.7)	68 (23.5)	7 (4.9)
	1.2 Age	31 (15.0)	32 (13.4)	41 (14.1)	19 (13.2)
	1.3 Symptoms	12 (5.8)	17 (7.1)	19 (6.6)	9 (6.3)
	1.4 Lifestyle or other	16 (7.7)	9 (3.8)	16 (5.5)	9 (6.3)
	1.5 Evaluation of risk	14 (6.8)	5 (2.1)	13 (4.5)	5 (3.5)
	1.6 Prevalence of prostate cancer	5 (2.4)	3 (1.3)	7 (2.4)	1 (0.7)
2. Early detection	2.1 Early detection	23 (11.1)	29 (12.1)	44 (15.2)	8 (5.6)
	2.2 General positive health attitude	31 (15.0)	39 (16.3)	56 (19.3)	13 (9.0)
	2.3 Enhance survival	13 (6.3)	12 (5.0)	20 (6.9)	5 (3.5)
	2.4 Screening as info to take action	39 (18.8)	6 (2.5)	41 (14.1)	4 (2.8)
3. Resolution of uncertainty	3.1 Peace of mind/seek reassurance	18 (8.7)	13 (5.4)	22 (7.6)	9 (6.3)
	3.2 Want to know	26 (12.6)	15 (6.3)	32 (11.0)	9 (6.3)
	3.3 Outcome as clarification	17 (8.2)	21 (8.8)	32 (11.0)	6 (4.2)
4. Social Influence	4.1 Doctor recommendation	15 (7.3)	17 (7.1)	22 (7.6)	7 (4.9)
	4.2 Family or friend recommendation	10 (4.8)	1 (0.4)	10 (3.5)	–
	4.3 Family pressures or considerations	20 (9.7)	10 (4.2)	26 (9.0)	4 (2.8)
	4.4 Media influence	11 (5.3)	7 (2.9)	10 (3.5)	8 (5.6)
5. Cancer representations	5.1 Friend/relative cancer experience	22 (10.6)	2 (0.8)	21 (7.2)	3 (2.1)
	5.2 Family or friend comparison	5 (2.9)	–	5 (1.7)	1 (0.7)
6. Lay beliefs	6.1 Lay beliefs about prostate cancer and testing	37 (17.9)	25 (10.5)	55 (19.0)	6 (4.2)
	6.2 Lay beliefs prostate cancer screening/tx	16 (7.7)	5 (2.1)	19 (6.6)	1 (0.7)
PSA testing	7.1 Convenience of testing	6 (2.9)	4 (1.7)	10 (3.5)	–
	7.2 Evidence for PSA testing	13 (6.3)	8 (3.4)	15 (5.2)	6 (4.2)
	7.3 Positive attitudes towards testing	9 (4.4)	6 (2.5)	12 (4.1)	3 (2.1)
7. Barriers to testing	8.1 Barriers	7 (3.4)	15 (6.3)	1 (0.3)	20 (13.9)
	8.2 Never thought about it	5 (2.4)	7 (2.9)	–	11 (7.6)
	8.4 No need for the blood test	2 (1.0)	2 (0.8)	2 (0.7)	2 (1.4)
	8.5 Avoidance	5 (2.4)	–	1 (0.3)	4 (2.8)
8. Concern	9.1 Concern	9 (4.4)	5 (2.1)	7 (2.4)	6 (4.2)

FDR first-degree relatives, *PM* population men, *PSA* prostate-specific antigen test

[a] Excludes the 12 participants who did not know whether or not they had a PSA test

Table 4 Conditional probabilities for the three-class model

Category unit	Class 1 Evaluating risk-information cues (n=93 (20.9 %))	Class 2 Control and overcome cancer/risk (n=235 (52.7%))	Class 3 Informed decisions and health system (n=118 (26.5 %))
1.1 Family history	*0.495*	0.128	0.000
1.2 Age	*0.408*	0.064	0.079
1.3 Symptoms	0.084	0.042	*0.096*
1.4 Lifestyle or other	*0.125*	0.018	0.076
1.5 Evaluation of risk	*0.183*	0.007	0.000
1.6 Prevalence of prostate cancer	*0.048*	0.000	0.030
2.1 Early detection	0.043	0.126	*0.158*
2.2 General positive health attitude	0.181	*0.226*	0.000
2.3 Enhance survival	0.000	*0.107*	0.000
2.4 Screening as info to take action	0.014	0.109	*0.156*
3.1 Peace of mind/seek reassurance	0.000	*0.133*	0.000
3.2 Want to know	0.036	*0.156*	0.009
3.3 Outcome as clarification	0.035	*0.148*	0.000
4.1 Doctor recommendation	0.122	0.008	*0.158*
4.2 Family or friend recommendation	*0.081*	0.014	0.000
4.3 Family pressures or considerations	0.002	*0.127*	0.000
4.4 Media influence	*0.147*	0.017	0.000
5.1 Friend/relative experience	*0.203*	0.020	0.000
5.2 Family or friend comparison	*0.046*	0.000	0.014
6.1 Lay beliefs about prostate cancer and testing	0.079	*0.233*	0.000
6.2 Lay beliefs prostate cancer screening/tx	0.011	*0.080*	0.011
7.1 Convenience of testing	0.024	0.010	*0.046*
7.2 Evidence for prostate-specific antigen testing	0.051	0.017	*0.103*
7.3 Positive attitudes towards testing	*0.069*	0.028	0.016
8.1 Barriers	0.013	0.000	*0.177*
8.2 Never thought about it	0.000	0.000	*0.102*
8.4 No need for the blood test	*0.023*	0.000	0.015
8.5 Avoidance	0.011	0.010	*0.013*
9.1 Concern	*0.085*	0.025	0.000

To facilitate class interpretation, classes with largest conditional probability for the category are set in italicized

individual considered factors that would contribute to their risk or likelihood of prostate cancer or the individual drew on information cues from their broader environment. Five of the six categories in the risk perception coding unit (see Table 1) were found to have high probabilities in the evaluating risk information cues class compared with other classes. Statements concerned having (or not having) a family history (category 1.1), considering age as a reason for screening (category 1.2), making evaluations based on current lifestyle factors (category 1.4), considering the prevalence of prostate cancer (category 1.6), and a general tendency to evaluate one's own risk (category 1.5). In addition, statements covered the contribution of a family member or friend's experience of cancer (category 5.1) and consideration of risk or screening information the individual recalled having been mentioned in the media (category 4.4). Individuals were also likely to mention that they considered whether their doctor had (or had not) recommended testing (category 4.1), and participants held positive attitudes towards prostate cancer screening (category 7.3) and health behaviours generally (category 2.2).

Class 2—Control and Overcome Cancer/Risk (n= 235; 52.7 % of Participants) Individuals in this class tended to endorse a cancer model characterised by lay beliefs about prostate cancer, and the role of screening and treatment (e.g. the lay belief that prostate cancer screening could be a form of preventative measure and would lead to a better outcome; categories 6.1 and 6.2). Individuals made statements that suggested prostate cancer screening would provide them

with information that would allow them to deal with or overcome their cancer status, such as wanting to know (category 3.2) or use the test to clarify one's cancer status or an anticipated outcome (category 3.3) or to obtain peace of mind or reassurance from the test (category 3.1). Individuals also made statements that suggested they held positive attitudes towards looking after their health generally (category 2.2), that they thought screening was a form of early detection (category 2.1) and would increase their chances of living longer (category 2.3), or that they listened to family pressures or considered their family when thinking about their health (category 4.3).

Class 3—Informed Decision Making and Health System (n= 118; 26.5 % of Participants) The informed decision making and health system class was characterised by statements suggesting that individuals used or sought information or guidance from a health professional to make a decision about prostate cancer screening. Statements included those where an individual considered whether a doctor had recommended (or had not recommended) the test (category 4.1), the individual stated that they had never thought about or made a decision to test (category 8.2), or that they experienced barriers, such as lack information or awareness of the test (category 8.1). Participants were also likely to mention evidence pertaining to the efficacy of the PSA test (category 7.2). Similarly, participants reported considering relevant screening cues, such as the presence or absence of symptoms (category 1.3), one's current age (1.2), and lifestyle factors (e.g. current health status; category 1.4). Individuals also indicated a reason for PSA testing was for early detection reasons (category 2.1) and that the prostate cancer screening test provided them with information as a means to take action (category 2.4). By contrast, individuals in this class were less likely to mention categories that involved positive attitudes to health behaviour more generally, lay beliefs about testing and treatment, or influence by external sources of information other than a health professional (e.g. media and family members).

Multinomial Regression Analysis on Latent Classes

A multinomial logistic regression examined whether class membership was predicted by family history status and having ever had a PSA test. Prior to main analyses, the relationship of potential socio-demographic covariates to class membership was examined. Marital status and education were significant predictors of class membership and were retained in the regression analysis. As shown in Table 5, the greatest proportions of men were in the control and overcome cancer/risk class (class 2), and this class was used as the referent. First-degree relatives were more likely than population men to be in the evaluating risk information cues class (class 1) versus the control and overcome cancer/risk class (class 2). Men who had had at least one PSA test in their lifetime were less likely to be in the informed decisions and the health system class (class 3) versus the control and overcome cancer/risk class (class 2). Married and highly educated men (university education versus less than or equal to junior high school) were also more likely to be in the informed decisions and the health system class (class 3) compared with the control and overcome cancer/risk class (class 2). Table 6 lists the proportions of participants assigned to each class according to each predictor. The overall model was significant (likelihood ratio $\chi^2(12)=31.77$; $p=0.002$).

Discussion

This is the first study to elicit and model participant-derived reasons related to the decision to participate in prostate cancer screening. Reasons were classified statistically into three distinct classes. Each class can be shown to represent a different complex of reasons and suggests that the approach to decisions about prostate cancer screening is not a homogeneous process or the same for all men. Class membership was predicted by family history status and prior screening behaviour, and by some socio-demographic factors, and supports the premise that different subgroups of men are more likely to apply certain mindsets, sets of cognitions, or motivations as part of the decision process.

Distinct Classes of Reasons

The largest class was the control and overcome cancer risk class (class 2) where men tended towards wanting to know the outcomes of the PSA test result and is consistent with previous studies that suggests the test outcome provides some reassurance value [34, 48]. Men in the control and overcome cancer risk class appeared to seek information that would lower their uncertainty about having or being diagnosed with prostate cancer, such as stating that the outcome would clarify that they did not have prostate cancer. Furthermore, the categories associated with this class suggest that men are applying a specific mental model about the role of cancer screening as a preventive health behaviour or are seeking reasons that defuse perceived negative outcomes. Lay beliefs about screening as a cancer prevention strategy are coherent with work by Huber and colleagues [49] on what they term a risk-defusing operator. When reasoning about a risky decision that involves uncertainty, individuals seek information or alternatives that allow them to have some control over potential negative outcomes or to make worst-case plans. For example, people seek information pertaining to pre-event risk-defusing operators (e.g. is there a possibility of vaccination against the disease)

Table 5 Results from the multinomial regression analysis predicting class assignment (n=429)[a]

Class	Parameter estimates	β (SE)	RRR (95 % CI)
1	FDR	0.74 (.28)**	2.09 (1.21–3.62)
	PSA—yes	−1.29 (.30)	0.85 (0.47–1.54)
	Married[b]	−0.01 (.32)	0.99 (0.52–1.86)
	Education—senior[c]	0.23 (.45)	1.25 (0.52–3.04)
	Education—trade certificate[c]	−0.04 (.33)	0.96 (0.50–1.85)
	Education—university[c]	0.31 (0.37)	1.36 (0.66–2.79)
	Intercept	−1.29 (0.42)	
2	Reference		
3	FDR	−0.04 (.26)	0.96 (0.58–1.59)
	PSA—yes	−0.60 (0.26)*	0.55 (0.33–.92)
	Married[b]	0.86 (0.37)*	2.35 (1.14–4.87)
	Education—senior[c]	0.31 (0.46)	1.36 (0.55–3.36)
	Education—trade certificate[c]	0.54 (0.35)	1.72 (0.87–3.39)
	Education—university[c]	1.09 (0.37)**	2.96 (1.43–6.12)
	Intercept	−1.59 (0.46)	

FDR first-degree relatives (reference group is population men), *RRR* relative risk ratio of being in the class compared with the reference class, *PSA* prostate-specific antigen test

*p<0.05; **p<0.01

[a] Excludes the 12 participants who did not know whether or not they had a PSA test and 5 participants with missing data on socio-demographic items

[b] Reference is single/widowed/divorced

[c] Reference is junior high school or less

or post-event risk-defusing operators (e.g. is there an acceptable treatment if the negative outcome occurs).

Two of the categories most associated with the control and overcome cancer risk class (class 2) are consistent with the use of pre-event and post-event risk-defusing operators. Category 6.1 (*lay beliefs about prostate cancer and testing*) incorporated statements that suggested the PSA test was a form of prevention against prostate cancer or that the PSA test provided some control over developing prostate cancer: *early detection to prevent anything, to minimise the risk of prostate cancer in later life,* or *so you can detect the early traces*. Furthermore, statements coded under category 6.2 (*lay beliefs about prostate cancer screening and treatment outcomes*) include those that suggest the PSA test would lead to more acceptable treatment outcomes despite current scientific evidence not wholly supporting the outcome: *if it can be neutralised maybe I could keep my sexual function*. Owing to these lay beliefs about the role of cancer screening, it is not surprising that the larger proportion of men to formulate these statements were those who had previously had a PSA test compared with those men who had not.

The largest proportions of first-degree relatives were classified as being in the control and overcome cancer risk class (class 2) where risk factors were not mentioned with a high probability. This finding highlights why men with a family history of prostate cancer should not be treated as a homogenous group whose approach to screening decisions is centred on an assessment of familial risk. Rather, first-degree relatives assigned to this class appeared to focus less on evaluating their risk but on the PSA test providing confirmation or reassurance regarding their cancer status and the ability to prevent or overcome cancer through early detection. Furthermore, the tendency for men in this class to focus on the capability of the screening test to reduce uncertainty and provide reassurance is coherent with health behaviour theories that posit that individuals appraise health threats in connection with coping procedures. For instance, the common sense model of self-regulation of health and illness [50] proposes that individuals formulate and select coping procedures that are perceived to provide some control over and reduce the health threat. Participating in prostate cancer screening may allow men to reappraise the threat of prostate cancer in the context of their coping behaviour, such as their decision to participate in what they perceive to be a preventive health behaviour. Accordingly, this explanation may account for why such a large proportion of men with a family history did not provide reasons that focused on their risk or threat of cancer.

Although the control and overcome cancer risk class reasons were indicative of an uncertainty reduction approach or beliefs about screening as a mechanism to prevent cancer and to enhance survival, approximately one third of

Table 6 Proportion of participants assigned to each class by groups

Class	FDR (N (%))		PSA test (N (%))		Married (N (%))		Education (N (%))			
	FDR	PM	Yes	No	Married	Not married	Less than or equal to junior	Senior	Trade certificate	University
1	48 (62.4)	35 (37.6)	65 (72.2)	25 (27.8)	73 (78.5)	20 (21.5)	21 (22.8)	11 (12.0)	34 (37.0)	26 (28.2)
2	103 (43.8)	132 (56.2)	159 (69.1)	71 (30.9)	187 (80.6)	45 (19.4)	56 (23.9)	29 (12.4)	101 (43.2)	48 (20.5)
3	46 (39.0)	72 (61.0)	66 (57.9)	48 (42.1)	107 (90.7)	11 (9.3)	16 (13.6)	13 (11.0)	50 (42.4)	39 (33.0)

FDR first-degree relatives, *PM* population men, *PSA* prostate-specific antigen test

men assigned to this class had not previously had a PSA test. Thus, there may be a disconnect between the reasons men provide and their actual screening behaviour. This explanation is consistent with the findings of a similar study that examined the connection between social-cognitive variables (e.g. motivational self-efficacy) and stage theories of health behaviour change where existing measures of health behaviour stage did not correspond with the cognitive mindsets identified using similar modelling techniques [37].

Men with a family history of prostate cancer were more likely than population men to be in the evaluating risk information cues class (class 1, compared with the control and overcome cancer/risk; class 2), and this finding is reflected in the high probability of mentioning family history as a reason associated with PSA testing decisions. The evaluating risk information cues class was the smallest class comprising approximately one fifth of participants and was characterised by a general assessment of risk and consideration of external sources of information. Family history, age, and lifestyle factors that may contribute to an increase (or decrease) in risk were mentioned, as was a category associated with the explicit evaluation of risk. Furthermore, consistent with the tendency for people to draw on personal experience or salient information around them to make judgements that involved risk or uncertainty [51], statements referred to information obtained from the media, a doctor, or the cancer experiences of friends or relatives. Positive attitudes toward health behaviours and the PSA screening test specifically were also associated with this class and similarly relate to an assessment of risk and decisions about health behaviours (e.g. *I think at a certain age you should start being tested*).

At first, the composition of the informed decisions and the health system class (class 3) appeared to contain distinct categories that would indicate different decisional approaches. However, examination of the statements contained within the reason categories elucidates a general mindset or decisional approach associated with information needs, decisional control, and guidance from health professionals. For instance, doctor recommendation (e.g. category 4.1) is a predictor of prostate cancer screening in previous research [23, 24, 26] and many of the statements found in category 8.1 (*barriers* category) indicated that men had not spoken to a doctor or been informed about the PSA test. Furthermore, this relationship is supported by the finding that a greater proportion of men who had not previously had a PSA test were assigned to this class (class 3, compared with the control and overcome cancer/risk class; class 2). Thus, there appears to be a connection between these reasoning categories such that respondents refer to the role of the doctor in making a recommendation about prostate cancer screening as a basis for their decision making.

Similarly, statements associated with barriers to testing included statements about not going to or having a regular doctor, not knowing or having enough information about the test, and wanting to make an informed decision and are associated with statements coded under category 8.2 (*never thought about it* (testing)) where participants reported not thinking about or not having made a decision. Participants in this class were also likely to consider information concerning evidence for prostate cancer screening such as the accuracy of the test, current public debate and scientific evidence toward testing, and information from their doctor about the conclusiveness of the test. A desire to be adequately informed about this health decision may explain the greater proportion of highly educated (versus low educated) participants found in this class (compared with the control and overcome cancer/risk class; class 2) who are more likely to seek a greater role in health decision making [52].

In this connection, individuals in the informed decisions and the health system class (class 3) stated that early detection was a factor associated with prostate cancer screening and that screening would provide information that would inform subsequent health behaviours. For example, screening would allow one to monitor PSA levels or to take action should the result be positive. Prostate cancer screening was seen to provide information value and provide individuals with information to use for future health decisions (e.g. *I wanted to start a benchmark where I could compare over time so that if I did get it I could be treated early*). The tendency for statements in this class to relate to ongoing contact with the health system may also explain why men who were not married were underrepresented in this class. Unmarried men access lower-quality health care [53] and report a lack of health locus of control compared with married men [54]. Additional research is needed to clarify this relationship.

Breadth and Frequency of Screening Reasons

Consistent with the findings of a similar study that examined the reasons people listed for and against predictive testing for disease [39], men provided only a limited number of reasons, suggesting that fewer decision-relevant reasons are identified by participants in more naturalistic or person-focused decision tasks. Furthermore, the extensive set of coding categories generated to accommodate the breadth of reasons suggests that men employ a broad range of decision processes to make screening decisions. Although attempts were made to reduce or collapse the number of coding units prior to the analysis of the data, the distinctiveness of each category prevented any data reduction that would maintain the underlying meaning of the broad range of statements. Future research should explore whether the reasons identified by men in the current study would be endorsed by the broader general male population if assessed quantitatively (e.g. assessed in a series of Likert-type scales)

and whether a similar distribution of responses would be found. Finally, this study identified reasons that were salient or important to men that may not otherwise be evident in structured research designs. Given that men appeared to focus only on a few salient reasons, future research may investigate ways to convey a few key pieces of information central to prostate cancer screening decisions to patients and to explore how patients incorporate the information into their decision process.

Limitations

When given the opportunity to list reasons associated with prostate cancer screening decisions, men did not list many reasons. Although the elicitation process may not have been conducive to stimulating thoughts about testing for prostate cancer, verbal reports from interviewers suggest men did not offer multiple reasons either for or against testing, despite appropriate encouragement. In particular, the low number of statements reflecting reasons not to be screened could be reflective of the composition of the sample and the fact that the majority of men had previously screened for prostate cancer. Furthermore, seeking to encourage and elicit reasons from men does not mean that participants provided all reasons associated with their decisions and the reasons identified by men may not reflect the actual information used in screening decisions, as people are often poor at verbalising the thoughts or processes that contribute to their judgements [55]. For instance, the lack of emotion-based reasons reported by participants (e.g. category 9.1 (*concern*) included only 3 % of all reasons mentioned) may also have been a result of the elicitation process (computer-assisted telephone interview) which may not have been conducive to the expression of emotions. Alternatively, emotion-based reasons may be more evident at certain stages of the decision process (e.g. prior to a screening appointment) and less likely to be recalled over time. Future research would benefit from examining the decision-making process at the time of the decision to understand the reasons that lead to subsequent screening behaviour. For example, the utilisation of qualitative methods that focus on the verbalisation of thoughts (e.g. process tracing methods such as verbal protocol analysis) [56] applied close to the time of a decision may be better suited to capture such content.

A selection bias owing to the recruitment of first-degree relatives from their probands may mean that the current sample is more likely to be composed of relatives who have greater awareness of prostate cancer and PSA testing and presents a possible caveat to the generalisability of the results. Furthermore, the results of the present study are unlikely to generalise to decisions involving the consideration of a digital rectal examination. Consistent with the focus of many prostate cancer screening guidelines on the PSA test (e.g. [5]) and the greater prevalence of PSA testing (versus digital rectal examinations), the present study focused on the PSA test. Accordingly, the reasons for participating in a digital rectal examination may be different to those of the PSA test, and the results of the present study would be unlikely to generalise to digital rectal examinations.

Implications for Informed Decision Making

The results of the current study suggest that people may not consider multiple pieces of information to reach a health decision but rather, decision making can be characterised by underlying motivational structures that do not frequently incorporate the consideration of complex health information. This finding has been reported previously with regards to treatment decisions for men with prostate cancer [57]. Despite mounting evidence that people do not make decisions based on a systematic decisional process, informed decision-making tools (e.g. decision aids) are largely information based and ignore the potential for patients to make judgements based on lay or intuitive conceptualisations of cancer and health behaviours. Despite the emphasis on patient preferences and values in informed decision-making guidelines, few decisional interventions actually incorporate or evaluate patient preferences and values in decision making [28, 58]. The importance of addressing these issues is highlighted by the finding that over a quarter of the men in our study reported a desire to be informed and guided by health professionals in their decision making. We propose that a promising avenue for future research would be to explore men's existing mental models of prostate cancer and early detection screening in the context of their general beliefs about health behaviour. Furthermore, future research could explore how health professionals can use patient's existing health beliefs as a basis for integrating new information to enhance patient understanding.

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