COMMENTARY

Health preference research: An overview for medical radiation sciences

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Abstract

Understanding preferences of key stakeholders including patients, clinicians and policymakers can inform clinical practice, workforce and policy. It also allows health services to evaluate existing clinical practices, policies and procedures. This commentary aims to introduce medical radiation professionals to health preference research by describing commonly used preference methodologies, with a particular focus on discrete choice experiments. Relevant examples of health preference research will be highlighted to demonstrate the application of health preference research in medical radiation sciences.

Introduction

A recent movement in clinical practice has seen a greater emphasis placed on patient-centred care and individualised health care.[1,2] Delivering patient-centred health care has become such an important priority that large health care organisations, such as the National Health Service in the United Kingdom, are realigning health policies to be able to meet such an aim. The Australian Commission on Safety and Quality in Health Care defines patient-centred care as health care that is 'respectful of, and responsive to, the preferences, needs and values of patients and consumers'.[3] When health professionals, managers, patients, families and carers work together, costs are reduced, and health care safety and quality increase.[4] To deliver patient-centred care, patient preferences must be understood. Preferences drive the demand for products and services, and thus increasingly, health preference research is undertaken to elicit and understand these preferences.

As patient preferences are one of the underlying determinants of the demand for health care services, it is therefore important to understand and identify attributes of a service that are most conducive for uptake and compliance.[5] By measuring patient preferences, decision-makers can be better informed to evaluate current clinical practice and seek ways to improve the provision of patient-centred care.[6] Patient preference data enable policymakers to develop health services that best meet the demands of the patient population and inform health service planning.[6,7] Aligning health policy with patient preferences can improve patient uptake and increase satisfaction with health care programmes.[6,8,9]

This is no different in the medical radiation sciences (MRS), where health preference research holds enormous potential. This commentary aims to provide an introduction to and overview of health preference research in the context of MRS, with a particular focus on discrete choice experiments. As such, concepts will be demonstrated with published literature in both the diagnostic and therapeutic medical radiation sciences.

Health Preference Research – What is it and Why is it Important?

Health preference research aims to understand what respondents' value, as preference indicates value.

To estimate consumer preferences, two types of data can be used:

1 Revealed preferences, where preferences are inferred from the observed market choices of consumers
2 Stated preferences, where consumers indicate their choice in a hypothetical scenario

In health, consumer preferences are difficult to measure and may not be able to be inferred from revealed preference data for several reasons:

1 Many aspects of health care are not explicitly traded in competitive markets; because of public and private insurance, health care is often either consumed free or subsidised at the point of service, which means that we are not able to observe willingness to pay.[10]
2 The doctor–patient relationship (imperfect agency); a patient's consumption of health care is unlikely to be solely based on their preferences and more likely to be influenced by a better-informed doctor/medical professional (the problem of asymmetric information).[10]
3 Health care is not necessarily comparable; as health care is tailored to suit each patient's health needs and no patient is the same, it is difficult to compare between patients and determine the factors most relevant to a patient's decision-making.[9]

In addition, revealed preference data are only available for existing health interventions; however, policymakers often want to predict uptake of a new intervention. Revealed preference data are unable to provide information on health interventions that are not yet available on the market.[11]

Stated preference methods represent an alternate method of eliciting preferences. Most often in the form of a survey, stated preference methods ask individuals about what they would do (stated preference) rather than what they are observed to do (revealed preference) in a hypothetical choice situation.[11] This characteristic is why stated preferences are used in many health applications, where clinicians or policymakers are interested in preferences for new health care interventions.

There are a number of methods for investigating preferences. Table 1 presents the most common preference methodologies with examples from the literature. All methods presented in Table 1 can explore patient preferences; however, the method chosen depends on the research question, setting and population.

The remainder of this commentary will focus on discrete choice experiments (DCEs). In recent years, DCEs have become the most frequently applied method used to investigate preferences in health care.[12,13] Grounded in economic theory, the DCE methodology is a robust quantitative survey method used to elicit and model preferences.[14]

Discrete Choice Experiments

Discrete choice experiments (DCEs) are a robust methodology for eliciting and evaluating preferences of the respondents.[15] Respondents are presented with a series of choice sets (A vs. B) and asked to choose their preferred option in each. Alternatives (A or B) are described by a set of relevant characteristics (attributes), and individuals are asked to choose their preferred option. Figure 1 illustrates a simplified example of a choice set within a DCE. In this case, individuals choose between option A or B, each with 6 attributes and varying levels. The options differ in imaging modality (MR vs. CT), length of time in the scanner (1.5 vs. 0.5 hours) and cost ($300 vs. $100). By each participant completing multiple-choice sets (usually 8–16 but can be up to 30[9]) in which the levels are varied, a data set is generated that can be analysed to quantify preferences.

These compiled data can then be analysed to understand overall preferences of the population, and if a particular attribute and/or level is of greater importance. DCEs are based on Lancaster's economic theory of value, which assume individuals derive utility (satisfaction) from the main attributes of a good, and preferences (and thus utility) across goods/services are revealed through their consumption choices.[15,16] For example, in the choice set presented in Figure 1, a participant may choose Option A to avoid an injection, accepting both the increased time and increased cost. In this case, they have traded time and cost for their preferred mode of imaging.[15]

To undertake a DCE as an MRS practitioner, collaboration with a health economist with experience in DCEs is strongly advised, particularly for the design and analysis steps (highlighted in blue in Fig. 2). The main steps are outlined in Figure 2. The MRS practitioner's most important contribution to the DCE is in the development of the attributes and levels (highlighted in green in Fig. 2) to ensure clinical relevance and the interpretation of the results into clinical practice and/or policy updates. The design of a DCE is a complex mathematical matrix and requires DCE expertise and experience.[14]

It is important to note that the robust development of attributes/levels[17] and the design[14,18] of the DCE are crucial to allow for maximum statistical power and modelling. Careful consideration must be given to developing the attributes and levels, as these are ideally as close to reality as possible but nuanced enough to be able to accurately model the strength of preferences. The resultant DCE design is a complex statistical design,

Table 1. Common preference methods – illustrative example from literature.

Methods	Predominant type of preference	Brief explanation	Example from literature
Qualitative	Stated	This method elicits preferences in a qualitative setting (e.g. in a semi-structured interview or focus group). This relies on the participant being able to articulate their choice, which may be difficult in hypothetical situations.	Patient perceptions and preferences about prostate fiducial markers and ultrasound motion monitoring procedures in radiation therapy treatment[45]
Observational	Revealed	This method observes and quantifies the choices made in real life. While this is the most robust, it requires the choices to be readily available and therefore is not always practical in a health care setting, particularly when interested in new services.	*Hypothetical scenario:* Consented patients choosing between treatments as part of a pragmatic trial[46]
Quantitative	Stated		
Discrete Choice Experiments		Respondents are given a choice between two or more hypothetical scenarios, over a number of choice sets. The underlying theory of DCEs is that respondents will choose which attributes/levels they are willing to 'trade off' in making their choice, known as random utility theory.[15]	Preferences for portable ultrasound devices: A discrete choice experiment among abdominal aortic aneurysm surveillance patients and general ultrasound patients in England[38]
Conjoint Analysis		While similar to DCEs, conjoint analysis surveys are based on axiomatic theory of the respondent ranking all possible combinations of attributes and levels.[47]	Image quality preferences among radiographers and radiologists. A conjoint analysis[48]
Best-Worst Scaling		In best-worst scaling surveys, respondents are shown a subset of items and are asked to indicate the most preferred and least preferred from the list. Similar to DCEs, by completing a number of choice sets, the preferences can be analysed.	Eliciting Preferences for Clinical Follow-Up in Patients with Head and Neck Cancer Using Best-Worst Scaling[49]
Time to Trade-off		This method gives a choice between two alternative health states under certainty[50]: 1 A specified health state for a specified time, followed by death 2 A perfect health state (for a specified time less than in the first health state), followed by immediate death	Using a treatment trade-off method to elicit preferences for the treatment of locally advanced non-small-cell lung cancer[51]
Ranking/Rating		Respondents rank or rate their choice/s based on a Likert or similar scale, providing ordinal data about preferences. The advantage of this method is that it is relatively easy and efficient to both design and complete. However, this method does not allow for analysis of relative preferences or trade-offs that DCEs allow for.	Patient preferences for development in MRI scanner design: a survey of claustrophobic patients in a randomised study.[52]

which determines the combinations of attributes and levels of each choice set seen by the participant.

There are recognised limitations to discrete choice experiments, most notably, the cognitive burden required to complete the choice sets, as it requires the participants to consider the levels presented.[19,20] This is mitigated by the careful design of a DCE to only include the most relevant attributes and levels and piloting the DCE with a smaller population to ensure respondent comprehension and clarity.[21,22] One piloting method recommended is cognitive interviews.[21,23] Cognitive interviews, or think-aloud interviews, are a qualitative research method grounded in cognitive psychology theory,[24] where participants are asked to speak their thoughts when completing a task.[25] This method is commonly used in the development of DCEs in health and has been used in primary care,[26] palliative care[27] and cancer screening.[28] Cognitive interviews provide valuable insights into respondent comprehension and interpretation of DCE attributes.[29] It is common to adjust DCE attributes and levels after conducting cognitive interviews.

Following the collection of preference data, there are a number of statistical analyses that could be performed. The analysis of DCE data generally includes a series of regression analyses: conditional logistic model, multinomial logistic model and a mixed logit model.[30] Latent class analysis is also used to identify whether preferences within the study sample differ between

Scenario: Imagine that you are under investigation for back pain, and you are recommended to undergo some imaging. Which imaging procedure would you prefer?		
	Option A	**Option B**
Imaging modality	MRI	CT
Length of time in scanner (hours)	1.5	0.5
IV contrast required	No	Yes
Likelihood of requiring another imaging procedure	1/10	4/10
Out-of-pocket cost	$300	$100
Please select one:	○	○

Figure 1. Hypothetical example of a scenario and choice set used in a discrete choice experiment, developed by the authors to demonstrate a choice set.

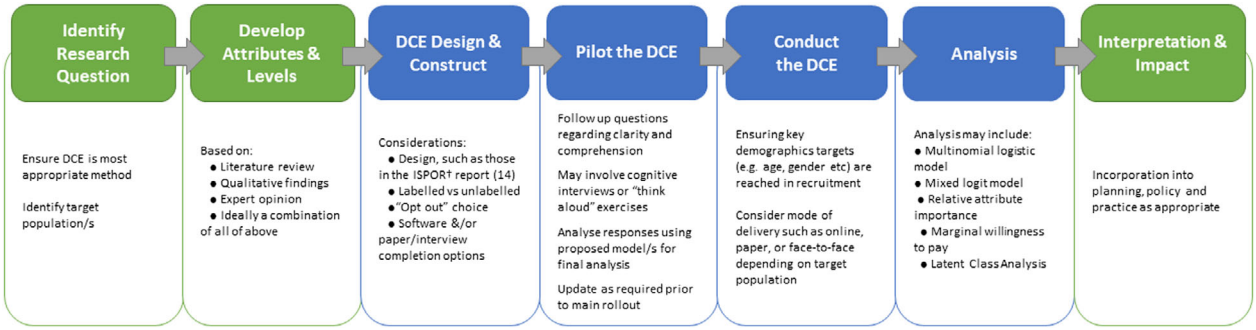

Figure 2. Broad stages of completing a discrete choice experiment (DCE), with the green steps highlighting where the MRS practitioner has the potential to take the leading role in a research team and blue steps highlighting where the MRS practitioner can work with a DCE expert/s. †ISPOR: The Professional Society for Health Economics and Outcomes Research.

individuals/groups, particularly around demographic factors.[40] By using the estimated coefficients from the regression analyses, relative attribute importance can be calculated, and marginal willingness to pay can be determined by using cost as a denominator, or other attributes such as time.[31,32]

Whose Preferences to Consider?

Selecting whose preferences to include is an important consideration and may include patients, general population (also referred to as 'community' or 'societal') and/or clinicians. In some preferences research, a combination of populations is surveyed to help understand differences in preferences (e.g. patients and clinicians). The populations will be guided by the overall study aim and implications to implementation and application to policy/practice. For very clinically focussed preference research, gaining insight into patient preferences can provide valuable evidence, as these respondents have experience with the clinical attributes/levels. Previous studies have found that experience of treatment impacts cancer patient's preferences.[33]

Examples of DCEs from the literature

To aid the understanding of DCE application in the MRS setting, three recent published studies were reviewed. While not intended to be an extensive or systematic literature review, the following examples will help illustrate the value of DCEs in radiation oncology and medical imaging. Indeed, much of the health preferences literature in the MRS setting to date focus more on the broader aspects of cancer care and treatment modality

preferences (for example, surgery, radiation therapy or active surveillance for prostate cancer treatment),[34] and very little preference literature around medical imaging. More broadly, there are few systematic literature reviews on preferences for cancer treatments.[35,36] A more detailed summary of methodological and outcome aspects for each of the example studies we are highlighting is provided in Table 2.

For patients facing the prospect of developing brain metastases due to their non-small-cell lung cancer (NSCLC) diagnosis, considerations for quality and quantity of life become an important focus of treatment selection. Prophylactic cranial irradiation (PCI) offers the ability to treat brain metastases (BM) in high-risk patients before they become clinically significant. The goal of which is to reduce the number of BM, leading to improved quantity and quality of life. While PCI is routine in patients diagnosed with small-cell lung cancer (SCLC), the benefits are not as well documented for advanced-stage NSCLC. As a result, Lehman et al performed a DCE on this patient group to determine whether they would choose PCI or not and the influencing factors.[37] In both stated and revealed preference methods, they found that patients were willing to accept toxicity as a consequence of PCI, for gain in brain metastases reduction. Importantly, the outcomes demonstrate that most patients are in favour of PCI and is a valuable intervention for them to be offered, particularly if PCI techniques include attempts to reduce neurotoxicity impacts through hippocampal sparing.

In a diagnostic imaging setting, Parsons et al investigated patients attending for either general abdominal ultrasound (US) or abdominal aortic aneurysm (AAA) US and questioned them on their preferences for how and where the US was performed and by whom.[38] The time between imaging and diagnostic results was also evaluated for patient preference. The study found that patients attending for general abdominal conditions preferred US imaging in a general practice clinic with a clinician who knew their medical history, while patients with AAA preferred the hospital setting. Prompt return of results was preferred by both groups. The results of this study provide suggestions for optimising patient care through appropriate referral to hospital or community-based US imaging, as well as the target group for portable US adoption in the wider health care setting.

Further, in an evaluation of clinicians' preferences, a DCE was performed by Brownell et al to elicit the preferences of general practitioners.[39] Specifically, the decision for urgent thoracic specialist review was evaluated using case study vignettes and an online survey to reveal stated preferences. An approach such as this demonstrates the wide applicability of DCE methods, particularly for understanding the decision-making factors of clinicians. In this case, the key decision factors were the presence of lung nodule spiculation, increasing nodule size and the radiology report accompanying the diagnostic images. The value of performing a DCE in this scenario is the identification of drivers for correct decision-making and using this to inform practice guidelines and policy.

How Health Preference Research Can Inform Policy and Practice

To employ a health preference method within your research and see the benefits of including both patient and clinician preferences, we recommend reviewing some of the key literature outlining the details of performing preferences research.[40–42] Additionally, collaborating with a health economist who can provide expert input in the development of the study is particularly important when using technical methods such as DCEs.[14,30]

Patients are more likely to cooperate and utilise a diagnostic/treatment procedure or service if it matches their preferences, and as a result, delivery of MRS procedures and services is often more efficient. An example of a DCE that explored preferences towards anxiety and depression screening in cancer care suggests that patient uptake would be further enhanced.[32]

While key stakeholder preferences alone do not dictate the delivery of optimal MRS practices, they do, however, help us to consider the delivery of patient-centred care. Preference research is increasingly utilised by policymakers in applications such as health technology assessments.[43] By understanding patient preferences, we can begin to reflect and evaluate whether existing services are patient-centred and are conducive for patient uptake.[42] In evaluating the external validity of DCEs by having respondents complete a DCE regarding a health care choice around influenza vaccinations (that is, stated preference) and then observing their health care choice (that is, revealed preference), only a 13% discordance between stated and revealed health care preference was observed.[44] In follow-up interviews with participants, where there was discordance present it was usually related more so to inhibitors including social norms, religion and phobias than to the health care itself.

There are many opportunities for health preference research within the MRS profession, particularly as the health care provided by both diagnostic and therapeutic MRS professionals is at the intersect of patient care and technological advances. Opportunities for future health preference research may include areas such as patient preferences for new/improved diagnostic scanning

Table 2. Summary of DCE examples presented.

	Lehman et al (2016)[37]	Parsons et al (2018)[38]	Brownell et al (2020)[39]
Aim	To determine patient preferences for prophylactic cranial irradiation (PCI) with respect to survival benefit, reduction in brain metastases and acceptable toxicity.	To understand preferences for abdominal aortic aneurysm (AAA) surveillance ultrasound, including how, where and by whom the ultrasounds are undertaken	To assess which factors influence general practitioners (GPs) to request urgent review for a lung nodule.
Country	Australia	England	Australia
Population and Sample Size	54 patients pre-treatment 46 patients post-treatment	223 patients undergoing AAA surveillance 301 general population patients – undergoing scanning for general abdominal conditions	GeneralpPractitioners 4160 randomly selected GPs were invited, 152 completed the survey
DCE Methods	D-optimal design	Efficient design for orthogonality	Orthogonal main effects plan
Design & Size	16 choice sets total	12 choice sets total	32 choice sets total
Attributes/ Levels	4 attributes, 4–5 levels	5 attributes with 2 levels	8 attributes, 2–8 levels
No. of Choice Sets Completed	15	12	8
Unlabelled/ Labelled or Opt Out Option	Choice between PCI or no PCI ('opt out')	Labelled choice, including opt out	Yes/No choice option
Administration	Face-to-face administration with trained nurse	Paper-based survey	Online survey
Main Analysis	Mixed logit regression	Conditional logit modelling	Multivariate logistic regression
Main Findings	Most important pre-treatment attributes: • Survival benefit >6 months • Survival benefit of 3–6 months • Avoiding ever problems with memory and self-care • Avoiding quite a bit of difficulty with memory • Maximally reducing brain metastases recurrence	AAA group preferred: • US performed in hospital General group preferred: • Portable US at general practice surgeries • Person performing the scan to know their medical history All patients preferred: • Scanning by specialist • Devices with lower risk of underdiagnosis • Receiving their results at the appointment where the scan takes place	Factors associated with request for urgent review: • Nodule spiculation • Larger nodule size • Presentation with haemoptysis or weight loss • Recommendation for review by the reporting radiologist • Female GP gender Other notable outcomes: • Significant variability in perceived sense of urgency in low-risk nodules (PanCan risk <10%) • Most GPs felt that a patient with haemoptysis and a normal chest CT did not require urgent specialist review, but that a patient with isolated mediastinal lymphadenopathy did.
Implications for policy/ practice	Consider offering PCI to all eligible NSCLC patients	Further review of current evidence on diagnostic accuracy and cost-effectiveness should be considered before adoption of routine clinical portable US use	Consider increased education on specialist referral urgency among GPs
Limitations	• Small sample size	• All participants are from a single centre	• Small sample size/return rate

(*Continued*)

Table 2. Continued.

	Lehman et al (2016)[37]	Parsons et al (2018)[38]	Brownell et al (2020)[39]
	• Some cognitive effects occur in both groups meaning these attributes are not fully discrete	• Possible age and self-selection bias • Limited participant understanding of test accuracy and the difference between false negative and false positives	• Vignettes were simple compared to complexity of real patients
Generalisability	• Small sample size and single centre study limit generalisability	• Generalisability not assessed but possibly limited due to single centre study	• Large number of vignettes used makes it more generalisable • Majority of states from around Australia included which also helps generalisability

protocols and technologies such as PET/MR; patient preferences for different fractionation protocols within radiation therapy (such as 39 vs. 20 vs. 6 fraction schedules for prostate cancer, with associated side effect risk profiles); and clinician preferences for advanced practice roles within both diagnostic and therapeutic settings.

Conclusion

Understanding preferences of key stakeholders in health can inform clinical practice and policy, not only when considering new technologies, procedures and services prior to implementation, but also in evaluating existing health services. Medical radiation practitioners are encouraged to incorporate preferences into their research, in collaboration with a health economist, to further enable the delivery of safe, high-quality patient-centred care.

Conflict of interest

The authors declare no conflict of interest.

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