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Discrete choice experiment on educating value-based healthcare

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ABSTRACT

Introduction Identifying costs and values in healthcare interventions as well as the ability to measure and consider costs relative to value for patients are pivotal in clinical decision-making and medical education. This study explores residents' preferences in educating value-based healthcare (VBHC) during postgraduate medical education. Exploring residents' preferences in VBHC education, in order to understand what shapes their choices, might contribute to improved medical residency education and healthcare as a whole.

Methods A discrete choice experiment (DCE) examined which conditions for educating VBHC are preferred by residents. DCE gives more insight into the trade-off's residents make when choosing alternatives, and which conditions for educating VBHC have the most influence on residents' preference.

Results This DCE shows that residents prefer knowledge on both medical practice *as well as* the process of care—to be educated by an expert on VBHC *together* with a clinician. They prefer limited protected time to conduct VBHC initiatives (thus while at work) and desire the inclusion of VBHC in formal educational plans.

Conclusion When optimising graduate and postgraduate medical education curricula, these preferences should be considered to create necessary conditions for the facilitation and participation of residents in VBHC education and the set-up of VBHC initiatives.

INTRODUCTION

For decades, steadily increasing healthcare expenditures have been challenging the sustainability of the healthcare sector.¹ Cost-effectiveness, high-value cost-conscious care and value-based healthcare (VBHC) fundamentally consider costs and outcomes, relative to each other. Based on the definition of Porter (2010), value, adopted from economics, considers the output relative to the input, for example, health gain relative to unit costs.² Cost-effectiveness analyses compare the relative value of different healthcare interventions.³ In popular words: the themes all address 'getting bang for the healthcare buck'. In an attempt to increase cost-considerations at patient-level as part of medical decision-making, VBHC should become incorporated in medical residency education.

Therefore, knowledge of costs and value of healthcare interventions is crucial in the provision of care and clinical decision-making. However, knowledge of VBHC is often not formally included in graduate and postgraduate medical education

curricula.^{4,5} As residents are tomorrow's healthcare professionals, and training is known to influence physician's behaviour, postgraduate medical education should benefit from the inclusion of VBHC-principles and methods to help ensure the healthcare sectors' sustainability.^{6–8}

Residents acknowledge the importance of VBHC and think that training institutions are responsible to address this topic.⁷ Some of the leading national physician associations, such as The American College of Physicians and the American Board of Internal Medicine, share this view, resulting in the development of curricula that promote VBHC.^{18–10} Additionally, incorporating VBHC in postgraduate medical education has shown to be effective regarding training and stimulating non-medical (CanMEDs) competencies, thereby positively affecting the development of skills as medical expert, leader, communicator and collaborator.^{11,12}

Nonetheless, in contrast to the observed rise in the number of VBHC curricula guidelines, incorporation of VBHC educational interventions into postgraduate medical education curricula lags behind.^{8,13} Research has shown that even if a formal VBHC educational programme is in place, a substantial number of residents is still not involved in the related activities. This lack of involvement might be due to insufficient time to participate in the projects or lack of awareness of the activities organised.⁸ Aiming to increase involvement made us wonder whether we have enough understanding of the conditions residents consider important, motivating them to participate in education on VBHC.

Based on economic principles, comparing postgraduate education with a commodity and subsequently assessing the value of that commodity, it is indeed necessary to consider the customers' perspective.¹⁴ Otherwise said, to develop a commodity (ie, postgraduate medical education programmes on VBHC), that is of relevance to its users (ie, meeting the needs and preferences of residents), educational developers need to consider the preferences of their users to better meet the needs of the residents and develop options that matter to them. One of the methods to measure preferences is the discrete choice experiment (DCE).¹⁴ Based on these findings, we can tailor the way postgraduate medical education on VBHC is provided and suggest how different aspects in educating VBHC might be optimised.

Thus, choices residents make in medical education are influenced by their preferences for alternatives provided to them. By presenting them options, consisting of multiple attributes with different



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levels, we aim to assess the value residents place on each attribute, relative to the other, when making their ultimate choice. By quantifying the values respondents place in these attributes, the following research question is addressed: 'Which of the attributes for educating value-based healthcare in postgraduate medical education is the most influential?'

METHODS

Contextual information: the Netherlands

In the Netherlands, medical school takes 6 years, after which recently graduated physicians apply for residency training also known as postgraduate medical education. Residency training is organised in one of the eight healthcare education and training regions in the Netherlands. These regions contain diverse healthcare organisations such as university medical centres, educating hospitals and specialised clinics. This study was conducted in the south-east education and training region (in Dutch: OORZON), training approximately 800 residents in 35 medical disciplines.¹⁵

Case description: the south-east region

Since 2006, a nationwide competency-based framework, based upon the CanMEDS framework, is used to train residents in both medical and non-medical competencies in postgraduate medical education.^{12 16} Additionally, as an attempt to further train residents' competencies, VBHC is labelled one of the core themes incorporated in the regional residency training. A wide range of educational methods can be applied in medical practice. One can think of structured educating (such as simulations and journal clubs) and clinical educating (during rounds or at the patient's bedside), addressing and referring to VBHC where possible.

In our region (OORZON), education on VBHC mainly consists of interactive sessions. These are designed to flexibly incorporate the whole concept of efficiency in healthcare and emphasise the importance of critically examining whether treatments add value to the patient into the existing transdisciplinary educational structure (eg, an academic half-day morning workshop or preclinical conference). The sessions include small-group interactive learning and diverse didactic components, such as the inclusion and conduction of a local initiative on VBHC. These could include initiatives regarding misuse or overuse of diagnostic treatments and testing, or inappropriate location or facilitation of care or processes of care. Despite our efforts, perceived deficiencies in current educating of VBHC were stated by practising residents in postgraduate medical education. Among others, evaluations yielded limited time and lack of participation of clinicians.

Study sample

Based on the S-estimate (sample size) of the Bayesian efficient design, 163 respondents were sufficient to estimate significant parameters for a main effect model. Paper-based questionnaires were distributed on site during different meetings for residents (ie, trainings, morning rounds, referrals, etc) by one of the researchers. The three versions (ie, blocks) of the questionnaire were equally distributed among the residents resulting in an equally distributed response rate. No questionnaire was excluded because of missing data. The questionnaire, in Dutch, can be retrieved via the first author upon request.

The study is approved by the NVMO Ethical Review Board (NERB file number: 774), which operates commissioned by the Netherlands Association for Medical Education (NVMO).

What is a DCE?

A DCE is a stated preference method, which means that study participants are presented hypothetical choice sets or scenarios, characterised by attributes and their associated levels.¹⁷ Respondents are asked to select their preferred hypothetical scenario or choice.^{18 19} As such, the DCE assumes that the satisfaction or utility respondents derive from a product or service depends on the levels of the characteristics or attributes of that product or service; and that respondents choose the alternative which gives the highest satisfaction/utility.²⁰ The DCE methodology has been used in different populations, such as patients, measuring preferences for certain healthcare interventions,^{21 22} or clients, exploring preferences in marketing^{23 24} but also within the field of education.¹⁴ A recent paper by Cleland *et al* elaborated on a small number of DCEs that have been used to elicit preferences on educational issues and early career choices, linked to medical education.¹⁴ Nonetheless, the use of DCEs is relatively limited in the field of postgraduate medical education.

Study design: attributes and levels

An important step when conducting a DCE is the use of qualitative research to inform the design.²⁵ First, a reflection of recent studies was used to gain insight in stimulating factors for VBHC in postgraduate medical education.^{4 14 26} Then, two focus group meetings with residents from different medical disciplines were organised to reflect upon conditions they consider important when incorporating VBHC in educational activities. In sum, questions on VBHC, educating methods on cost-considerations, value and clinical decision-making were asked. Purposeful maximum variation sampling of residents in the south-east region was used, representing a range of demographics (type of healthcare organisation, years in training, speciality, experience with VBHC), resulting in a total of 11 participants. The information derived from the focus groups resulted in a list of six attributes. The details are presented in [table 1](#).

Discrete choice design

Based on the six attributes and their levels, a pilot design was created without any priors since there was yet no information available about the actual value of the attributes. The results and feedback on the pilot questionnaire led to some changes. Attribute 5: 'outcomes' was excluded because it was considered overlapping with the attribute 'knowledge'. Attribute 6: 'support' as a separate attribute in terms of material and personal support was excluded because the levels did not discriminate enough compared with those of the attributes knowledge (what) and provision of knowledge (who). Based on the final four attributes (see [table 1](#), attributes 1–4) and the prior values of the pilot study, a new design was generated using the software Ngene version 1.2.1.²⁷ A fractional factorial (Bayesian efficient main effect) design was created because a full factorial design would have resulted in 81 hypothetical scenarios (four attributes with three levels (3⁴)). In the final design, 18 choice sets were generated. To reduce the cognitive burden on respondents, blocking was applied; resulting in three questionnaires with each six choice sets. An example of a choice set is shown in [table 2](#).

DCE-questionnaire

The first part of the questionnaire described the objective of the study and explained the rationale behind the DCE. Then, the

Table 1 Attributes and levels

Attribute number	Attribute name	Level 1	Level 2	Level 3
1	VBHC knowledge domain	Knowledge on medical practice like cost-effectiveness of a treatment or patient-reported outcomes	Knowledge on process of care like waiting time	Combination of knowledge on medical practice and process of care
2	VBHC knowledge provision	By an expert on VBHC	By a clinician	By both an expert on VBHC and a clinician
3	Available time while at work	1 day or 2 half days	2 days or 4 half days	No time available while at work (ie, leisure time)
4	Perpetuation of the theme VBHC in medical education*	In educational plans	As a precondition for audits	Not in educational plans and not as a precondition for audits
5	VBHC outcomes	Organisational: collaboration with other hospitals or specialist	Educational: increasing learning curves	Future possibilities: work on new innovative VBHC initiatives
6	Support	Material	Personal	Combination of material and personal

*Educational plans describe in detail the learning goals and competency development aims for medical residents. Audits are conducted to assess and analyse the learning climate of medical residency education and whether residents are being trained according to their individual learning goals. VBHC, value-based healthcare.

Table 2 Example of a choice set

Imagine you would set up and conduct a local initiative on value-based healthcare. Which situation would you prefer?		
	Situation A	Situation B
VBHC knowledge domain	Combination of knowledge on medical practice and process of care	Knowledge on process of care
VBHC knowledge provision	Provided by a VBHC expert	Provided by a clinician
Available time while at work	No time available while at work	1 day or 2 half days
Perpetuation of the theme VBHC in medical education	Theme not in educational plans and not as a precondition for audits	Theme included in educational plans but not as a precondition for audits
Which situation would you prefer?	–	–

VBHC, value-based healthcare.

attributes and their levels were explained. Subsequently, participants were asked to answer six questions (choice sets) in which they had to choose between two similar alternatives (or scenarios) that are described based on attributes, differing only in the levels allocated to these attributes (see table 1) (table 2 gives an example of a choice set). The contextual information was that they were asked to imagine that they would set up and conduct a local initiative on VBHC. Finally, some background characteristics were asked like age, medical discipline, years of training and a short feedback form

regarding the DCE technique. A complete example of DCE-questionnaire can be retrieved via the first author on request.

Data analysis

The data were analysed with a multinomial logit regression model using Nlogit version 5.²⁷ Since all variables are categorical, effect coding was used to determine the influence of the attribute levels on the residents' preferences.²⁸ The reason for using effect coding is that the variables do not take a zero value for the base level but minus one. The advantage of effect coding is that a unique utility value can be estimated for the base level unlike in the case of a dummy coded variable where the base level is confounded with the overall grand mean.^{28 29}

The following utility function was estimated:

$$V = \beta_0 + \beta_1 \text{knowledge} + \beta_2 \text{who} + \beta_3 \text{time} + \beta_4 \text{educational plans} + \varepsilon$$

where 'V' is the utility deriving from choosing alternative A over B or vice versa, β_0 = constant and β_1 – β_4 are the coefficients reflecting the influence of a particular attribute level on the utility score. The sign of the coefficient shows whether respondents prefer (positive) or do not prefer (negative) the particular level of the attribute compared to the reference level. The relative importance of the attributes is calculated by dividing the difference in utility between the highest and lowest level of an attribute by the sum of differences in utility of all attributes.³⁰

RESULTS

A total of 197 residents were invited to participate and returned the completed questionnaire. Most respondents started residency training between 3 and 5 years ago and had limited to no experience with VBHC initiatives. Table 3 shows the respondents' background characteristics.

Results of the DCE

In general, it took residents 7.5 min to complete the questionnaire. Most of the respondents stated that the questions of the DCE were clear. Few respondents indicated that it was hard to make choices or were unfamiliar with the framing of the questions.

Table 4 describes the main results from the multinomial logit regression model, showing the influence of the attribute levels on the residents' preferences for conditions related to VBHC in postgraduate medical education.

Residents value a combination of knowledge on medical practice and process of care in a positive way ($\beta=0.589$). Moreover, solely providing knowledge on efficiency related to medical practice (eg, cost-effectiveness of treatments or reduction of complaints), or on processes of care (eg, waiting time) is valued negatively. Residents' satisfaction increases when 1 day or 2 half days is available for VBHC-education while at work (*the when*) ($\beta=0.451$). However, 2 days or more is not significant, while having no time available is valued negatively by residents. The combination of an expert in VBHC and a clinician providing knowledge on VBHC (*the who*) positively affects the residents' utility ($\beta=0.382$). The inclusion of VBHC in educational plans '*the where*' was valued less ($\beta=0.270$). Nonetheless, residents value the levels negatively when stated that VBHC is solely a precondition for audits, or when VBHC is lacking as a theme in both educational plans and as a precondition for audits. The relative importance results show that available time is considered

Table 3 Respondents' main characteristics

Healthcare organisation	University hospital	133(68%)
	Teaching hospital	43 (22%)
	Rehabilitation clinic	7 (4%)
	Psychiatric organisation	9 (5%)
Specialty	Unknown	5 (3%)
	Anaesthesiology	15 (8%)
	Cardiology	9 (5%)
	Cardiothoracic surgery	1 (0.5%)
	Clinical chemistry	1 (0.5%)
	Clinical genetics	2 (1%)
	First aid	1 (0.5%)
	Gastroenterology	1 (0.5%)
	Geriatrics	1 (0.5%)
	Hospital pharmacy	9 (5%)
	Internal medicine	13 (7%)
	Neurology	15 (8%)
	Neurosurgery	4 (2%)
	Obstetrics and gynaecology	11 (6%)
	Oral and maxillofacial surgery	4 (2%)
	Orthopaedics	14 (7%)
	Otorhinolaryngology	6 (3%)
	Paediatrics	19 (10%)
	Pathology	7 (4%)
	Plastic surgery	4 (2%)
Psychiatry	13 (7%)	
Pulmonary medicine	8 (4%)	
Radiology	6 (3%)	
Rehabilitation medicine	11 (6%)	
Rheumatology	3 (2%)	
Surgery	9 (5%)	
Urology	4 (2%)	
Unknown	6 (3%)	
Starting year residency	2008	1 (0.5%)
	2010	1 (0.5%)
	2011	8 (4%)
	2012	18 (9%)
	2013	27 (14%)
	2014	33 (17%)
	2015	28 (14%)
	2016	29 (15%)
Experienced with VBHC initiatives	Yes	60 (30%)
	No	131 (67%)
	Unknown	6 (3%)

VBHC, value-based healthcare.

the most important attribute (32%), closely followed by the provision of knowledge (29%), then who teaches the knowledge on VBHC (23%) with perpetuation of the theme VBHC in medical education (16%) as least important.

DISCUSSION

This study explores residents' preferences in educating VBHC during postgraduate medical education. Exploring residents' preferences in VBHC education, in order to understand what

Table 4 Regression results showing the influence of attributes on residents' utility

Attributes and levels	Coefficient	SE	RI	
What	► Knowledge on medical practice	-0.33162*	0.05770	29%
	► Knowledge on process of care	-0.25706*	0.05671	
	► Combination of knowledge on medical practice and process of care (reference)	0.58867*	0.05811	
When	► Available time of 1 day or 2 half days while at work (reference)	0.45085*	0.06749	32%
	► Available time of 2 days or 4 half days while at work	0.12037	0.09902	
	► No time available while at work	-0.57121*	0.08092	
Who	► Knowledge provided by an expert on VBHC	-0.04055	0.06575	23%
	► Knowledge provided by a clinician	-0.34184*	0.06054	
	► Knowledge provided by both an expert on VBHC and a clinician (reference)	0.38239*	0.06460	
Where	► Theme included in educational plans (reference)	0.26982*	0.05860	16%
	► Theme as a precondition for audits	-0.24332*	0.08106	
	► Theme not in educational plans nor as a precondition for audits	-0.02651	0.06091	

* \leq Significance at 1% level | Log-likelihood: 698.72 | Number of observations: 1182 | Number of individuals: 197.

Reference level effect coding: $-1 \times (\text{sum of the coefficients of the other two levels})$. RI, relative importance.

shapes their choices might contribute to improved medical residency education and healthcare as a whole. Based on the preferences of 197 residents, we could identify different conditions. Before VBHC education takes off, incorporation of combined knowledge provision of VBHC (*the what*) was preferred in relation to medical practice and the process of care. VBHC training in postgraduate medical education needs to be executable in limited protected time, thus while at work (*the when*), and taught and inspired by an expert on VBHC combined with a clinician (*the who*) and incorporated in educational plans (*the where*).

Although of limited use in this field of medical education thus far,¹⁴ DCEs proved to be useful to value residents' preferences on VBHC education methods. This study sought input from practising physicians (ie, residents in postgraduate medical education) on perceived deficiencies in current educating of VBHC. At the same time, we sought recommendations for necessary content to include in future postgraduate medical education accommodating more to the resident's needs and preferences, and thereby making it more sustainable. Since we were primarily interested in which aspects residents find important when setting up and conducting a local VBHC initiative, we decided not to include an opt-out. In addition, because at the moment no different types of VBHC initiatives exist, defining relevant levels for an opt-out would have been difficult. Our study contributes to the field by adding evidence of preferences to needs, from frontline medical residents to educators.

Several qualitative studies have shown that resident-participation in educational methods improves when the method is tailored to residents' preferences, resulting in increased effectiveness of the educational method.^{31 32} The importance of knowledge transmission in educational methods on VBHC has been highlighted earlier. Knowledge provision on healthcare efficiency should be incorporated in medical practice and the process of care.²⁶ Further, several studies discuss that one should

not only focus on the components of an educational message but also need to make sure it is told by the right person(s). In addition, residents' acceptance of an educational method depends on those who provide the information.³³ Finally, including different disciplines maximises residents' learning.³⁴ These findings are in line with our significantly valued findings on knowledge provision by a combination of experts with different backgrounds (ie, an expert on VBHC in combination with a clinician). Additionally, readily observable in practice, residents closely collaborate with each other and residents' workloads are directly related to each other. Adjustments in one's own workload immediately leads to changes in other residents' workload.³⁵ Days off from clinical practice for VBHC education might potentially endanger colleagues' workload, which thereafter might lead to higher job demands.^{35 36} The finding that residents value the inclusion of VBHC in educational plans positively confirms that they consider it an important topic that should be part of postgraduate medical education.⁷ However, VBHC as a precondition for audits is not preferred. This might perhaps be due to the assumption that the inclusion in educational plans is less strict and binding compared to the theme being a precondition in postgraduate medical education quality assurance and audit procedures.

Strengths and limitations

A wide range of residents (ie, specialities and year of residency training) were included, making the study's findings representative for the whole group of residents especially compared to a limited number of other studies on VBHC education for residents in which the majority only included residents of one specific specialty.^{7 31 36} Furthermore, our study focused on guidance provision in education and the actual educating of VBHC, and not solely on providence of guidelines to foster VBHC.^{37 38} Although the setting was limited to one region in the Netherlands, the way Dutch medical education is organised as well as the latest developments in Dutch medical education, such as the increasing focus on residents' CanMEDS competencies, are comparable with other countries.^{6 16} This makes our study results applicable to a broader audience within postgraduate medical education and VBHC education.

CONCLUSION

The results of this DCE show that residents prefer to have knowledge on both medical practice *as well as* the process of care, to be educated by an expert on VBHC *together* with a clinician, to receive 1 day or 2 half days protected time, thus while at work for, educational purposes, and inclusion of VBHC in educational plans. With the results of this study, necessary conditions can be created to facilitate residents in

Main messages

- ▶ DCE methodology has the potential to address similar (VBHC-) education topics in order to provide more refined information than some traditional approaches.
- ▶ Facilitate residents in VBHC education and setting up VBHC initiatives by incorporation knowledge provision of VBHC in relation to medical practice *as well as* the process of care.
- ▶ Improve resident-participation in VBHC education by guarding 'limited protected time', thus while at work, to conduct VBHC-initiatives.

Current research questions

- ▶ How can we expand training in VBHC from postgraduate medical education to medical education at undergraduate level?
- ▶ Accounting for the limited protected time residents prefer, which educational methods to provide knowledge on VBHC are present or need further development?
- ▶ Can further research outline whether adjustments in medical education on VBHC, accounting for the preferences derived from the DCE, align with satisfaction scores in educational practice?

training and setting up VBHC initiatives, resulting in improved resident-participation. Comparable educational methods on VBHC elsewhere should take residents' preferences into account as well. This will improve both medical residency education and healthcare as a whole.

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Contributors CYGN, LAS, WNKAVM, BABE made substantial contributions to the design and conception of the study. CYGN and LAS were mainly involved in the acquisition of data. BAB took the lead in data analysis. From the residents' perspective, SEMV and RHLH helped the other authors with the interpretation of data. LPSS, LAS and WNKAVM further elaborated on the interpretation of the data. All authors revised the article for important intellectual content, where CYGN and BABE took the lead, mainly for the revisions. All authors approved the final version of the manuscript being submitted.

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