Characterising Patients' Preferences for Information in Doctor-Patient Interactions#

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Abstract: This study involved 108 diabetic patients from a public hospital. The conjoint analysis was used in characterising patients' preferences for information during clinical consultations. The results showed that patients gave priority to the quality of information transferred, represented by clear explanation and active listening from the doctor. Besides, information regarding treatment was preferred to information on diagnosis and illness. Preferences also varied across patients based on their socio-economic characteristics.

Keywords: Conjoint analysis, doctor-patient interaction, information, preferences
JEL classification: D12

1. Introduction

Health care markets are characterised by high levels of uncertainty, such as patients' uncertainty about effectiveness of medical treatments. Under conditions of uncertainty, accurate information becomes a valuable commodity. For that reason, medical care markets are actually markets for information. Information fosters an understanding of one's health status that may reduce uncertainty, alleviate concerns and improve health. As such, seeing a doctor is initiated partly for the purpose of obtaining health information. According to Arrow(1963), "When there is uncertainty, information or knowledge becomes a commodity…information in the form of skilled care, is precisely what is being bought from most physicians."

Information *per se* is therefore possible to be included as an economic commodity in the patient's utility function. To understand the underlying preferences that determine a patient's choice selection for medical services, hence the patient's utility function, information is one of the most important attributes that needs to be considered. "Health *per se* is to a large extent information" and to elicit preferences of the patient, it is obvious that information is one of the most important attributes that need to be taken into consideration (McGuire *et al*. 1992).

The objective of this study is to characterise patient preference for information during consultation with the doctor. It seeks to understand the informational effects as well as the underlying preferences that determine the patient's choice selection in patient-doctor interaction, hence, the patient's utility function. This is an important aspect within the patient-doctor relationships because misperception of the patient's utility function will not allow the course of treatment and design of contract to be optimised.

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An exploratory study was carried out in a public hospital, focusing on diabetic patients. With close consultation between patients and doctors, effective treatment can be achieved through information dissemination resulting in greater awareness and improved patient education. The disease can thus be better controlled and patients can lead a better quality of life. A study carried out by Embong (1990) showed that in the treatment of diabetes, educating patients and providing information are crucial but are neglected in Malaysia. The treatment of diabetes thus provides an appropriate setting for this study where much of the success in treatment depends on overcoming the information asymmetry problem.

2. Literature Review

2.1. Quality and Quantity of Information

A patient's preference on a visit to a doctor depends largely on the confidence the patient has in the doctor. Most patients infer this according to the characteristics of the interaction (Labson 2000), which mainly relates to the types and quality of information transferred, to make their judgments. Labson suggests that the characteristics of patient-doctor interaction include:

i. Did the doctor appear to listen and understand the symptoms, history, and the degree of concern of the patient?
ii. Did the doctor appear to organise the information and relate it in a sensible and easy to understand manner?
iii. Could the doctor recognise and answer the patient's questions about the illness, diagnostic considerations and treatment options?

Patients usually have limited ability to process medical information. Therefore, information must be transferred to the patients in an unbiased, clear and simple way. As stated in Lee (1995), the propensity to interpret medical information determines the direction of asymmetric information between the patient and the doctor. The value placed on information depends on whether it is understood. McQuire et al. (1992) pointed out that it is important to distinguish information from knowledge. The doctor may provide information (quantity of information) but it will not always be converted to knowledge, that is, information that is understood and retained for at least a period of time by the patient (quality of the information). The doctor listens to get information from patients. He should establish an atmosphere conducive for patients to feel their views are valued and needed. A basic way of doing this is to be willing to listen to patients (Vick and Scott 1998; Scott and Vick 1999; Scott et al. 2002).

Other than the quality of information being transmitted, past studies have also given attention to the types and quantity of information. Types of information mainly include information on illness, diagnosis, medication and treatment (Hall *et al.* 1988; Hall and Dornan 1988; Street 1991; Carr and Donovan 1998; Charles *et al.* 1999). Makoul *et al.* (1995) identified that information given by the doctor is the patient's main source of information about prescription medicines. Although information on the dose and timing of doses is usually printed on the label which is usually provided when the medicine is dispensed, patients may still want confirmation from the doctor, particularly if they have anxieties about taking the medicine. Charles *et al.* (1999) suggested that only doctors know how to transfer scientific information to patients in an accurate and unbiased way especially concerning the treatment risks and benefits.

2.2. Patients' Utility Function

As assumed by William (1988), the patient's utility could be maximised by the doctor providing all the necessary information to the patient. The issue thus arises as to the kinds of necessary information that should be provided by the doctor. William (1985) showed that health outcomes could be measured using marginal cost per QALY (Quality Adjusted Life Years) as the sole factor in the patient utility function. Culyer (1989) too indicated that the outcome of treatment in the health care system is the only factor that constitutes patient utility function. Their views are consistent with the expected utility theory where the entities of choice are solely characterised by their probability distribution over potential outcomes. Such probability distributions are called consequences. For von Neumann and Morgenstern, this consequentialism is the main underlying hypothesis of expected utility theory (McGuire *et al.* 1992). It is the outcomes or the consequences that bear utility.

However in medical care, besides the outcome of treatment, patients are also concerned with the actual process of care. For example, an evaluation of antenatal care screening (Mooney and Lange 1993) criticised the 'consequences utility approaches' for ignoring factors beyond health outcomes (that is, whether the fetus is aborted) that are important to women in the provision of the service. These factors identified by Mooney and Lange were the value of information and reassurance. They suggested that women get utility from reduced uncertainty and perhaps just from knowledge (information given by the doctors). Such utility is called the 'process utility'.

3. Framework of Analysis

In specifying patients' utility in consuming services offered by a doctor, the relative importance of attributes representing types of information and how effectively the information was transferred during clinical consultation were considered. The conjoint analysis technique was used to establish the relative importance of these attributes as well as for estimating the trade-offs patients made between attributes (Marginal rate of substitution).

Patients were asked to make a series of pairwise choices between two hypothetical alternatives of visits to the doctor described by different levels of attributes. The choice selection process can be seen as a comparison of two indirect utility functions, as postulated in the random utility maximisation theory. The random utility maximisation theory explains the randomness in the patient's utility such as unobserved taste variations or attributes. The mixed logit regression was used in estimating the patient utility function. This method is useful as it accounts for the problem of correlation within choices made by the same patient.

3.1. Conjoint Analysis

Conjoint analysis is a stated preference technique derived from demand theory which is widely used in marketing literature. Stated preference data comprise the answers people give to hypothetical choices, as opposed to revealed preference data that reflect their actual choices about real decisions. In this study, the conjoint analytical framework was described in stages that included establishing the attributes, assigning levels to the attributes, establishing preferences and estimating the utility function.

3.1.1. Establishing the Attributes

The key characteristics or attributes were identified based on different aspects of information transfer when patients interacted with their doctors during consultation. In this analysis, the two aspects focused on were the quality and quantity of information transferred. The quality of information transfer was represented by two attributes: one for simplicity of the message and one for active listening. Simplicity of the message refers to clear and easy to understand explanations from the doctor. Active listening indicates the doctor's willingness to listen to the patient. There were three attributes identified to represent the quantity of information transfer: information on illness, information on diagnosis and information on treatment/medication.

In relation to diabetic care, information on illness includes discussions on symptoms, prevention, cause of illness, family history, consequences due to uncontrolled sugar level, information on diet, weight watch, other health complications due to diabetes, type I and type II diabetes, risk factors such as smoking status, high cholesterol and triglyceride levels. Information on diagnosis includes examination findings on sugar level, blood pressure level, discussion on the sugar and blood pressure levels and discussion on physical examination. Information on treatment/medication includes types of medication, dosage, side effects, advice on taking of medication, treatment risks and benefits, and monitoring injection for type I diabetes. Table 1 shows the summary of the attributes identified and the studies on which they were based, together with the levels of attributes.

3.1.2. Assigning Levels to the Attributes

The levels of attributes were simplified and presented to the respondents as follows:

Attributes	Levels of attributes
Being able to talk to doctor	Doctor seems to listen
	Doctor does not seem to listen
Doctor's explanation	Easy to understand
	Difficult to understand
Information regarding illness	A lot
	A little
Information regarding diagnosis	A lot
	A little
Information regarding treatment/medication	A lot
	A little

3.1.3. Establishing Preferences

With five attributes being considered and two levels of attribute each, a full factorial design produced 32 possible scenarios. Since, the number is not that large, all the possible scenarios were used in the study.

Patients were presented with hypothetical scenarios involving different levels of attributes and requested to make pairwise comparison choices. The pairwise comparison method, compared to other methods such as ranking and rating, was found to closely resemble real life decisions. It has also been preferred to ranking and rating in health care studies (Ryan and Farrar 2000). This method requires the respondent to make comparisons between two choices of visits to the doctor.

Table 1: Attributes and levels of attributes

Theoretical basis of attribute	Actual attribute used	Levels of attribute
Information transfer from patient to doctor (Hall and Dornan 1988; Vick and Scott 1998; Scott and Vick 1999; Labson 2000; Scott *et al*. 2002)	Being able to talk to the doctor	1. Doctor seems to listen 2. Doctor does not seem to listen
Information transfer from doctor to patient (Hall *et al.* 1988; Street, 1991; Carr and Donovan 1998; Charles *et al.*1999)	Information regarding illness	1. Doctor gives a little information on illness 2. Doctor gives a lot of information on illness
Information transfer from doctor to patient (Hall *et al.* 1988; Street, 1991; Carr and Donovan 1998; Charles *et al.*1999)	Information regarding diagnosis	1. Doctor gives a little information on diagnosis 2. Doctor gives a lot of information on diagnosis
Information transfer from doctor to patient (Hall *et al.*1988, Street 1991; Carr and Donovan 1998; Makoul *et al.* 1995; Charles *et al.* 1999; Stevenson *et al.*2000)	Information regarding treatment/medication	1. Doctor gives a little information on treatment/ medication 2. Doctor gives a lot of information on treatment/ medication
Explanation of the information transferred (McGuire *et al.* 1992; Vick and Scott 1998; Labson 2000; Scott and Vick 1999)	Doctor's explanation of information	1. Doctor's explanation is difficult to understand 2. Doctor's explanation is easy to understand

To normalise the comparisons, a constant scenario (Visit A) as shown in the table below was selected among the 32 scenarios. Visit A must not be a totally dominant scenario whereby the attributes describing it have a combination of high and low levels. The remaining 31 scenarios were compared with Visit A. Patients may feel tired or bored if they were asked to make 31 pairwise comparisons each. As such, those scenarios were randomly allocated into five sets of questionnaires, sets 1 to 5. Respondents who were given questionnaire sets 1 until 4 had to make 6 pairwise comparisons, the rest who answered questionnaire set 5 had to make 7 pairwise comparisons. Below is an example where one of the 31 scenarios (that is, Visit B) being compared to the constant scenario, Visit A. Visit A was used as the constant scenario for all the pairwise comparisons made in this study.

An example of a choice set:

	Visit A	Visit B
Being able to talk to the doctor	Doctor seems to listen	Doctor seems to listen
Information regarding illness	A little	A lot
Information regarding diagnosis	A lot	A little
Information regarding treatment/ medication	A lot	A lot
Doctor's explanation	Difficult to understand	Easy to understand

Which visit do you prefer?

Visit A	
Visit B	

5.1.4. Data Collection

The sample was obtained by indirect sampling whereby the randomness in the data can still be preserved. Let say there are i=1,2………N diabetic patients in that particular hospital. Let us assume further that they are distributed over blocks of five days, according to some distributions such as characteristics of patients. Unless, the hospital assigns males on certain days and females on other days, or Malays on Mondays and Wednesdays, Chinese on Tuesdays and Thursdays, which is not the case, the sample of one of the five days can be taken as a random sample. The characteristic distribution on any of the five days is representative of the overall distribution of the characteristics of the population.

Diabetic patients were identified with the help of the hospital staff in charge. In the public hospital involved in this study, those patients had to go for their blood-sugar test before seeing the doctor. Two research assistants were employed and trained to help in guiding the respondents to answer the questionnaire. The help provided by these research assistants is important because they could communicate well in the local dialect. Verbal consents were obtained from the identified diabetic patients to answer the questionnaire. All the patients identified did not object to the request made upon them. The fieldwork was carried out in year 2000 and it took about two weeks to be completed.

Since there were five sets of questionnaire, a conscious effort was made to get more or less an equal number of patients to answer each set. The first part of the questionnaire required the patients to rank their perceptions on the importance of all the attributes used in this study based on the Likert scale of 1 to 5. Patients were requested to make the pair-wise comparisons in the second part of the questionnaire. Most of the respondents were found to be not familiar with the pairwise comparison method. Each scenario was explained clearly to the respondents before they made the selections. The sample profile is given in Table 2.

Table 2: The sample profile

Variables	Public Hospital
Age (AGE) (in years)	56.5278
Occupation (OCCU)	
1. Home maker/ retired	49(45.4)
2. Fisherman, small farmer, odd job worker, petty trader	14 (14)
3. Manual worker, factory worker, sales assistant	8 (7.4)
4. General services worker, general office administrator, technician, teacher, nurse	27 (25)
5. Businessman, merchant, wholesaler	4 (3.7)
6. Private and government sectors executive and professional	6 (5.6)
Education level (EDU)	
1. Below primary	21(19.4)
2. Primary	36(33.3)
3. Secondary up to form 5	27 (25)
4. Form 6/certificate/diploma	10 (9.3)
5. Degree/professional qualification	14 (13)
Race (RACE)	
1. Malay	93(86.1)
2. Chinese	15(13.9)
3. Others	-
Gender (GENDER)	
1. Male	50(46.3)
2. Female	58(53.7)
Years suffering from diabetes (YEAR) (in years)	7.3059
Uncontrolled/controlled* (CONT)	
1. Uncontrolled	46(42.6)
2. Controlled	62(57.4)

Note: Mean values are given for continuous variables. Frequency and percentage in parentheses are provided for the rest of the variables.

* uncontrolled if the amount of glucose in the blood is at 6.8 mmol/L or more with fasting and 8 mmol/L or more without fasting.

3.2. Random Utility Theory

In this study, patients' choices were modeled based on Lancasterian consumer theory (Lancaster 1966), that patients' choices can be explained by the underlying attributes of the visits to the doctors. In order to include the random variability in choices, the random utility theory was employed. The random utility theory is a well-tested behavioral theory of consumer choice which specifies that consumers will choose the options that maximise their utility and that the influences on utility consist of two components, one that is observable and the other which is unobservable.

Patients obtained utility from their interactions with their doctors during clinical consultations. It is assumed that patients made their choices on visits to the doctor based on different aspects of information transfer during doctor-patient interactions. Five different aspects of information transfer or attributes were identified to explain the patient's utility function. The attributes were: clear explanation from the doctor, doctor's willingness to listen, information on illness, information on diagnosis and information on treatment/ medication.

The random utility theory allows the patient to choose either visit *A* or non-*A* and pick the one that yields a higher utility. This theory has a similar assumption with the consumer theory that assumes that the consumer is rational. But unlike the consumer theory, a demand function cannot be derived from the utility maximisation problem when choices are discrete. Instead of working with demand functions, the random utility theory implies working directly with the utility functions.

In this study, the discrete choice made by the patient on different visits to the doctor was modeled as the difference between two indirect utility functions (functions of the attributes of the alternatives). Each utility function was associated with a different scenario of a visit to the doctor:

Assuming that the utility function for visit *A* is

$$U_A = U(C_A)$$

and the utility function for visit *B* is

$$U_B = U(C_B)$$

U represents the patient's utility function, C_A and C_B the characteristics or the attributes of visit *A* and visit *B* respectively.

Based on the random utility theory, a patient will choose visit *B* over visit *A* if

$$U(C_B) > U(C_A)$$

Total utility is separated into two components: first, the non random or the deterministic component and second, the random component. The deterministic component comprises the five attributes identified earlier. The random component accounts for the unobserved elements in the patient's choice behaviour such as unobserved taste variations and unobserved attributes. These unobserved factors were introduced into the utility functions using error terms e_A and e_B

$$U_A = V(C_A) + e_A$$

and

$$U_B = V(C_B) + e_B$$

The error term e_A represents unobserved elements in the utility function for visit *A* and e_B accounts for unobserved elements in utility function for visit *B*. The random utility model can be specified in different ways depending on the distribution of the error terms. If the error terms are independently and identically drawn from an extreme value distribution (IID), the model is then specified as multinomial logit (McFadden 1974).

The random utility approach allows the inclusion of socio-economic characteristics of patients into the model to account for variation in taste (Ben-Akiva and Bierlaire 1999; Scott and Vick 1999). The characteristics included in the utility functions were patient's age, gender, race and education level, represented by factor *s*. The deterministic components of the utility function now consist of the five attributes and the characteristics of the patients:

$$U_A = V(C_A, s) + e_A$$

and

$$U_B = V(C_B, s) + e_B$$

Visit *B* will be chosen over visit *A* if

$$[V(C_{B,}\ s) + e_B] > [V(C_A, s) + e_A] \qquad (1)$$

The estimated utility in moving from visit *A* to visit *B* is represented by

$$\Delta V = [V(C_{B,}\ s) + e_B] - [V(C_A, s) + e_A] \ \ldots\ldots\ldots \qquad (2)$$

The model to be estimated can be written with discrete choice *i* made by respondent *j* as

$$U_{ij} = \alpha + \sum_a \beta_a D_{aij} + \sum_t \theta_t D_{aij} S_{rj} + e_{ij} \qquad (3)$$

$i = 1$ if visit *A* is chosen, 0 otherwise
$j = 1,2,\ldots\ldots.n^{th}$ patients
α is the constant term of the model
a represents the a^{th} attribute
β_a are the coefficients of D_{aij}
D_{aij} represents the difference between the levels of each attribute in visit A and visit B
θ_t are the coefficient of interaction terms $D_{aij} S_{rj}$, t is the t^{th} interaction term
$D_{aij} S_{rj}$ are the interaction terms between the attributes (D_{aij}) and patients' socio-economic characteristics (S_{rj}), r is the r^{th} socio-economic characteristic
e_{ij} is the error term capturing random variation across discrete choices

The dependent variable U_{ij} represents the difference in the utility between visit *A* and visit non-*A*. In the process, the socio-economic characteristics, term *s*, which was removed, appears in the interaction terms. Since it is the choice selected by the patients that was observed, the dependent variable was coded 1 if visit *A* was chosen; and 0 if visit non-A was chosen. The values of the independent variables were the difference between the levels of attributes in visit *A* and visit non-*A*. The coding of the independent variables is given in Table 3.

The value of *a*, that is the number of attributes, ranges from the first attribute to the fifth attribute identified earlier. The value of *i* is the alternative chosen, either visit *A* or visit non-*A*. S_{rj} represents the r^{th} socio-economic characteristic of respondent *j*.

3.3. *The Mixed Logit Model*

As stated earlier, if the error terms (e_{ij}) in Equation 3 are IID, the model is specified as multinomial logit, implying that the choice probabilities of the model will be tied to the independence from irrelevant alternative (IIA) property. The IIA assumption is equivalent to assuming that the e_{ij} are independent between *i* alternatives, that is, the unobserved factors affecting patient's choices for visit A are not correlated with the unobserved factors affecting his or her taste for visit B. Where a larger number of closely related alternatives are considered, this assumption is not applicable.

Table 3: Coding of the main attributes

Independent variable	Visit *A* (Fixed)	Coding	Visit non-*A*	Coding	Value of independent variable (*Daij*), difference [*A* minus non-*A*)
Being able to talk to doctor	Doctor seems to listen	2	Doctor seems to listen	2	0
			Doctor does not seem to listen	1	1
Information regarding illness	A little	1	A lot	2	-1
			A little	1	0
Information regarding diagnosis	A lot	2	A lot	2	0
			A little	1	1
Information regarding treatment/ Medication	A lot	2	A lot	2	0
			A little	1	1
Doctor's explanation	Difficult to understand	1	Easy to understand	2	-1
			Difficult to understand	1	0

In this study, each patient was asked to make several pairwise comparisons and observations from the same respondent are usually correlated. For example, to some patients, a particular attribute may have great influence on their choices, while for others this attribute may be less important. Each respondent has his or her priority for certain attributes that leads to correlation across the utility of alternatives for that respondent. This may cause the respondents to violate the IIA assumption. Such violation is known as random taste variation, since 'taste' either for the attributes of alternatives or for the relationship between respondents' characteristics and alternatives varies randomly across respondents.

The mixed logit model relaxes the assumption that the unobserved portions of utility are IIA by specifying the unobserved portions of the utility as a combination of the IID and another distribution g that can take any form (Revelt and Train 1998). It is able to estimate the heteroskedasdicity and correlation of the unobserved portions of utility through the parameters that describe this general distribution. The model allows efficient estimation when there are repeated choices by the same respondent (Revelt and Train 1998). It assumes that data within subjects or clusters are dependent. The mixed logit model has also been proven to be able to estimate any random utility model to any desired degree of accuracy through appropriate choice of explanatory variables and distributions for the unobserved portions of the utility (McFadden and Train 2000).

The patient's utility function in the form of a discrete choice model was developed based on the random utility theory. The utility function can be written in the following form. Each patient j is presented with an alternative i, visit A or visit non-A

$$U_{ij} = \beta_j X_{ij} + \varepsilon_{ij}$$

U_{ij} is the utility obtained by patient *j* from alternative *i*
β_j represents a vector of coefficients
X_{ij} represents a vector of the individual-specific attributes for patient *j* and alternative-specific attributes for alternative *i*
ε_{ij} is a random disturbance

The individual-specific attributes for patients included in this study are the socio-economic characteristics such as age, gender, race and education level. The alternative specific attributes, on the other hand, are the five attributes discussed earlier, that is, clear explanation from the doctor, doctor's willingness to listen, information on illness, information on diagnosis and information on treatment/medication. Therefore the term $\beta_j X_{ij}$ represents the deterministic part of the utility function.

Since coefficients represented by β_j may vary randomly across patients, another additional form of disturbance η_j, was introduced into the utility function

$$\beta_j = b + \eta_j$$

where

b is the population mean
η_j is the stochastic deviation which represents the individual's taste relative to the average tastes in the population

Therefore, the utility function under the mixed logit model can be specified as

$$U_{ij} = bX_{ij} + \eta_j X_{ij} + \varepsilon_{ij}$$

where

b is a vector of coefficients
X_{ij} is a vector of observed portion or deterministic part of the utility
$\eta_j X_{ij}$ is a vector of unobserved portion or random effects
ε_{ij} denote another unobserved portion or the error terms

In a mixed logit framework, ε_{ij} is IID (as in standard logit), while η_j can have any distribution such as normal or uniform distribution (Hedeker 1999). It is through the stochastic portion of η that the model accounts for the correlation among alternatives.

Reproducing the model to be estimated in Equation (3) with an additional unobserved portion u_j

$$U_{ij} = \alpha + \sum_a \beta_a D_{aij} + \sum_t \theta_t D_{aij} S_{rj} + u_j + e_{ij} \tag{4}$$

This estimated model could be presented in the mixed logit form. The fixed effects or the deterministic part of the utility function consist of the five main attributes and the interaction terms represented by ($\sum_a \beta_a D_{aij} + \sum_t \theta_t D_{aij} S_{rj}$). The unobserved portion, u_j, with a distribution of any form, represents taste variation across respondents and the error term e_{ij} are IID. The dependent variable, U_{ij}, represents the choices made by patients on the visits to the doctor.

Before the final analysis, a more parsimonious model has to be formed due to the large number of possible interaction terms. All these possible terms were entered into the model and a stepwise procedure was used to eliminate variables with high *p*-value. Only independent variables with *p*-values less or equal to 0.10 will be included into the final model.

In this study, the MIXNO (Hedeker 1999) programme was used for estimating the mixed logit model in equation (4) that represents the patient's utility function. This programme provides maximum marginal likelihood estimates for the mixed-effects nominal logistic regression or the mixed logit models. Such models have proven to be suitable for analysis of correlated nominal response data such as correlation due to repeated choice made by the same respondents.

Under MIXNO for fixed effects regression, all the observations were treated as independent, or in other words, there is no random effect. It is equivalent to performing a multinomial logistic regression analysis where there is no taste variation across respondents (that is, $u_j = 0$ in Equation 4). When zero random effects are requested, MIXNO indicates that the number of observations is the same as the number of level-1 observations. For example, if there are fifty respondents and each of them has to make six pairwise comparisons, the total observations will be three hundred. The zero random effect model, that is, the analysis at level-1 assumes that the total number of observations is three hundred and all of them are independent of each other. When a random effect is included, MIXNO will include another level of analysis, that is, level-2. The total number of observations in level-2 in this example is fifty, which is equivalent to the number of respondents. Users can select either normal or uniform distribution for the random effects via the PRIOR option.

4. Findings

Table 4 shows the three main-effects models. The standard logit model treated all the observations as independent; ignoring the possible correlation within choices made by the same patient. This fixed-effects analysis in MIXNO programme is the simple multinomial logistic regression where the number of observations is only at level-1. Comparing the log likelihood values of both the mixed logit models at about -273 with the fixed-effects model of –279.05, supported the inclusion of the random subject effect. The likelihood ratio (the difference between the log likelihood statistics for the models), the likelihood ratio test statistic is about 6 (df=1), rejected the null hypothesis of the coefficient of the random effects equal to zero. The intra-cluster correlation (ρ) of 0.22 for the random effect model indicated a correlation of responses by the same respondent.

Table 4: The main-effects models

Attributes	Standard logit model (Fixed effects)		Mixed logit model (Random effects Distribution: normal)		Mixed logit model (Random Effects Distribution: uniform)	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
LISTEN	2.28(0.25)	0.00	2.56(0.29)	0.00	2.55(0.28)	0.00
INFILL	0.67(0.19)	0.00	0.71(0.22)	0.00	0.70(0.22)	0.00
INFDIAG	0.93(0.20)	0.00	1.13(0.25)	0.00	1.14(0.24)	0.00
INFTREAT	0.80(0.19)	0.00	0.86(0.23)	0.00	0.87(0.23)	0.00
EXP	3.39(0.26)	0.00	3.91(0.33)	0.00	3.89(0.33)	0.00
Random effect	-		0.95(0.22)	0.00	0.21(0.05)	0.00
Total patients	108		108		108	
Total observations	670		670		670	
ρ	–		0.22		–	
Log likelihood	-279.05		-273.03		273.12	

Note: 1. Values in parentheses are the standard errors.
2. *p*-values for the fixed effects are 2-tailed
3. *p*-values for the random effect is 1-tailed
4. Random effect variance term is expressed as a standard deviation.

The first mixed logit model in Table 4 assumes a normal distribution for the random effects, whereas the second mixed logit model assumes a uniform distribution (rectangular) for the random effect. Both the models yielded very similar results.

Discussion of results only focuses on the mixed logit model with normal random effect distribution. The parameter estimated for all the five main attributes indicated high significance levels at *p*-values less than 0.01. The magnitude of these parameters represents the relative importance of the attributes that form the patients' utility function. Clear and easy to understand explanation (EXP) from the doctor was the most important attribute to patients when they choose the visits to the doctor. Active listening from the doctor (LISTEN) was also an important characteristic which patients preferred. These two attributes that represented the quality of information were relatively more important than the quantity or types of information. Among the three types of information, patients from the private hospital chose information on diagnosis and medication/treatment rather than information on illness.

Since none of the attributes was in monetary form, the value of willingness to pay (WTP) was not applicable in this analysis. However, the marginal rate of substitution (MRS) between attributes that represent the extent of the importance of one attribute in relation to another can be obtained. The MRS was calculated by dividing the values of coefficients of the variables of interest. For example, the outcomes indicated that clear explanation (EXP) from the doctor was 1.53(3.91/2.56) times more important than LISTEN and 5.51(3.91/0.71) times more important than information regarding illness.

4.1. Model with Interaction Terms

A parsimonious model with interaction terms was obtained using the backward elimination procedure. This reduced model, given in Table 5, presents a better picture of the nature of preferences, accounting for the variation in preferences across socio-economic characteristics. The log likelihood value of –258.58 indicates that the inclusion of interaction terms fitted the model better compared to the main-effects (the likelihood ratio test statistic is about 15 (*df*=4)). The estimated intra-cluster correlation value of 0.20 further confirms the suitability of the random mixed-effects model used in the analysis.

Table 5: Model with interaction terms

Attributes	Mixed logit model (Random effects distribution: normal)	
	Coefficient (Std. error)	*p*-value
LISTEN	-	
INFILL	0.74 (0.22)	0.00
INFDIAG	1.33 (0.25)	0.00
INFTREAT	0.91 (0.23)	0.00
EXP	3.61 (0.47)	0.00
EXPGEN	2.33 (0.62)	0.00
EXPEDU	-1.28(0.42)	0.00
EXPRACE	3.24 (0.55)	0.00
LISTENGEN	1.79 (0.32)	0.00
Random effect	0.77 (0.25)	0.00
Total patients	108	
Total observations	670	
ρ	0.20	
Log likelihood	-258.58	

Note: 1. *p*-values for the fixed effects are 2-tailed
2. *p*-values for the random effect is 1-tailed
3. Random effect variance term is expressed as a standard deviation

Inclusion of the interaction terms has some impact on the relative importance of the main attributes. LISTEN became insignificant as a variable by itself after adding in the interaction terms. The reduced model suggests that this attribute is relatively more important to a certain groups of respondents only. The highly significant and positive sign of the coefficient for LISTENGEN revealed that female patients compared to male patients had a stronger preference for active listening from the doctor.

The interaction term EXPGEN indicates that female patients had a stronger preference for simplicity of the message from their doctors compared to male patients. Lower educated patients also indicated a stronger preference for the doctor who gave easy-to-understand explanations compared to patients with higher educational levels. The positive sign of coefficient for EXPRACE suggests that the Chinese patients preferred clear explanations from their doctor, compared to the Malay patients. The notations and coding for the independent variables in Tables 4 and 5 are as follows:

Independent variables	Notation
Active listening from the doctor	LISTEN
Information regarding illness	INFILL
Information regarding diagnosis	INFDIAG
Information regarding treatment/medication	INFTREAT
Clear and easy to understand explanation	EXP
Educational level: Primary & below (code 0); Secondary & above (code 1)	EDU
Malay (code 0); Chinese (code 1)	RACE
Male (code 0), Female (code 1)	GEN

5. Discussion

This study indicates that information per se is an important factor that must be considered in patients' utility functions. In their choice selections, patients revealed that the quality aspects of information, that include clear explanation and active listening from their doctors, were more important compared to the quantity and types of information. Amongst the amount and types of information, information on illness was the least important compared to information on diagnosis and medication/treatment.

Models with interaction terms allow the inclusion of the socio-economic factors which indicated that preferences could also vary across patients. The outcomes from these models allow the doctors to act in the patients' interest emphasising certain characteristics for certain groups of patients. For example, the data in this study indicated that the doctor should pay more attention to what the female patients have to say, compared to the male patients.

The conjoint analysis technique was used to demonstrate how respondents were willing to trade-off between characteristics in the service provided. This can be represented in the form of the trade-off and opportunity cost among the different characteristics of the service received. This is useful information for design of mechanisms when a decision has to be made regarding the optimal way to provide a service within limited resources. Estimated parameters in the model that represent the relative importance of different characteristics in the patients' utility function allow policy makers to observe the individual impact of each characteristic on the overall benefit. In particular, the outcome of this study shows those aspects of communication that need to be given priority when doctors with limited consultation time interact with their patients.

Table 6: Importance of the attributes of a visit to the doctor based on a Likert Scale

Attributes	Mean values of Likert scale 1 to 5
Doctor listens to what you have to say	4.10
Doctor gives information regarding illness	4.26
Doctor gives information regarding diagnosis	4.22
Doctor gives information regarding treatment/medication	4.25
Doctor explains clearly	4.17

Note: Likert scale ranges from strongly disagree (1) to strongly agree (5)

The commonly used Likert scale and most other conventional survey methods often produce little distinction among the relative importance of attributes because respondents will often insist that all attributes are very important to them. As shown in Table 6, patients agreed that all the five attributes were important to them. These were ranked more or less equally important where patients either agreed or strongly agreed that all the five attributes were important. The Likert scale results reveal that patients perceived attribute INFILL as the most important characteristic in a visit to the doctor but the conjoint approach showed otherwise.

In the Malaysian health care delivery system, particularly in the public sector, a doctor is typically assigned for a patient. The patient is rarely given the opportunity to choose the doctor with the characteristics of the visit that the patient prefers. However, the results of this investigation could be used as a guideline for the doctor, who is usually constrained by limited consultation time, to identify those aspects of communication that may increase a patient's utility most.

With the principal-agent relationships at the core of a health care delivery system, patient choice of an agent also assumes great significance. Although this issue receives very little attention in the Malaysian context, it is a prominent feature of health care systems in most of the developed nations and would be compatible with our national health system in the future. It has been proven that the nature and quality of the patient-doctor relationship affect not only the patient/doctor satisfaction but also patient's self-care and health outcomes (Stewart 1995; Krupat *et al.* 2000). The mediating factors are the exchange of information and the communication involved. Allowing patients to choose and change their doctors may create an important competitive pressure that provides doctors with incentives to improve quality of patients' care and services.

Reforms in the health care systems frequently focus on getting an efficient payment or reimbursement system that could optimise the utilisation of health care resources and at the same time, aim to improve the quality of care. As indicated in most literature on incentives for quality improvement, the focus is usually on the impact of the reimbursement system. However, in today's organisation of health care, the reimbursement system is structured to accommodate incentives for the providers, taking into account providers' preferences, and patients' needs and preferences have often been a secondary consideration (Showstack *et* *al.* 2003). A 'performance-based' payment system, as implicated in the principal-agent theory, should produce a more efficient patient-centred care services. Such a system establishes indicators on performance that makes clear what principals want and that which gives the agents financial incentives for achieving the defined performance targets (Eichler *et al.* 2001)

It will be a great challenge for the Malaysian government to devise an innovative system that will ensure an equitable and efficient health care provision to the people. As in the design of an effective reimbursement system, there are several objectives that are equally desirable, but generally mutually irreconcilable. There is no such thing as a unique optimal reimbursement system. Therefore, an efficient reimbursement system should be used flexibly to match the changing priorities and market conditions, accompanied by effective supervision to minimise the distortion due to the nature of the market.

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