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# Principal-Agent Relationship in Medical Care: Eliciting Patients' Preferences in Patient-Doctor Relationship

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ABSTRACT

*As implicated in principal-agent theory, responding to patients' needs and preferences should be the fundamental objective and be taken into consideration in designing of a health care financing system. This study attempts to characterize the patient's preferences for information, thus the utility function, during clinical consultation. An empirical study was carried out in the context of a Malaysian health care setting involving 108 and 50 diabetic patients from a public and a private hospital respectively. Results from the analysis showed that diabetic patients from both the hospitals gave priority to the quality rather than the quantity of information transferred. Socio-economic characteristics of the patient were introduced into the model in the form of interaction terms explained how preferences varied across patients.*

ABSTRAK

*Mengikut teori prinsipal-ejen, bertindak mengikut kehendak serta keperluan pesakit harus dijadikan objektif asas dan diambil kira dalam pembentukan system pembiayaan perkidmatan kesihatan. Kajian in bertujuan untuk mencirikan fungsi utiliti pesakit dengan merujuk kepada pilihan mereka terhadap maklumat yang diberikan oleh doktor semasa perjumpaan klinikal. Satu kajian empirik tentang perkhidmatan kesihatan di Malaysia melibatkan 108 dan 50 pesakit kencing manis masing-masing dari sebuah hospital kerajaan dan swasta telah dijalankan. Keputusan analisis ke atas pilihan pesakit dari kedua-dua hospital yang terlibat menunjukkan mereka memberi keutamaan kepada kualiti dibandingkan dengan kuantiti maklumat sifat-sifat sosioekonomi pesakit yang telah dimasukkan dalam penganalisaan dalam bentuk* interaction terms *dapat menerangkan perbezaan dalam pilihan pesakit dari latar belakang yang berbeza.*

## INTRODUCTION

In a typical principal-agent relationship, the principal hires another party called the agent to perform a certain task. The agent is chosen from a population of agents that are willing to undertake the required task; provided that the agent's utility exceeds a particular cut off point known as the reservation utility level.

If the agent is willing to perform the task, he has a choice of several actions. Suppose the set of action is given by $A = (a_1, a_2, \ldots\ldots a_n)$ where the actions are ordered as $a_1 < a_2 < \ldots\ldots < a_n$. We can then interpret the $a$'s as efforts expended by the agent in performing the task required by the principal. The agent derives utility from the compensation he receives, $w$, and the effort he puts in $a$. His utility can thus be described by $U(w,a)$, where

$$U_w(w,a_i) > U_w(w,a_j), \quad \text{for } i < j.$$

The principal, on the other hand, prefers the agent to expend as much effort as possible. In a typical case, the agent's choice of the effort set, $a_n$, is not directly observable by the principal. This is the moral hazard situation in the principal-agent relationship. The principal needs to define a contract or a payment scheme such that the contract, $w$, yields high enough utility for the agent to exceed his reservation level while at the same time inducing the agent to expend high enough effort level, which is preferred by the principal.

The principal cannot offer a fixed payment to the agent, even if the wage level yields utility beyond reservation level, since there is no assurance that the agent will actually choose the high effort level. The principal too cannot tie wages to the agent's effort level directly since the agent's effort is not directly observable. Furthermore, monitoring the agent's efforts to ensure that the maximum level could be obtained is also very costly.

The economics literature is well developed in the area of mechanism designs and incentives within the agency theory. Spence & Zeckhauser (1971), Ross (1973) and Mirrlees (1975) are among the pioneers in the application of agency theory in insurance markets.

In general, agency problems focus on how the principal can design an incentive contract that can induce the agent to undertake actions that will maximize the principal's utility. The agent who has the informational advantage over the principal will make the choice of whether or not to accept the contract. Although both parties have different interests, their objective is similar in that they want to maximize their independent utility functions (see for example MacDonald, 1984).

Consider agency in the market for medical care. As a consequence of the asymmetry of information between the patient and the doctor, the patient (principal) has to delegate authority to the doctor (agent) to take an action (for example, make medical treatment decisions) for the patient. The patient's inherent lack of medical knowledge makes it difficult for the patient to evaluate the quality of medical care services offered by the doctor. Thus, the patient does not know whether the doctor is using his knowledge in the interest of the patient or not.

There is a critical difference between the patient-doctor type of agency problem and more typical agency situations such as those found in insurance or labor markets. Patients usually do not define contracts with their doctors. The patient's ability to evaluate the agent's actions through the devising of contract is also clearly limited. A third party such as the government or the insurance companies, usually designs the contract in medical care. Nevertheless, as suggested in the agency theory, the main consideration in such mechanism designs is still the patients' needs and preferences. In medical care, therefore, it is important to understand the needs and preferences of patients, as reflected in their utility function, before any incentive mechanism can be effectively designed.

This study seeks to understand the underlying preferences for information that determine the patient's choice selection during clinical consultation, 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 optimized.

An exploratory study was carried out in the context of a Malaysian health care setting; that is in both the public and private hospitals. The study only focuses on diabetic patients. In Malaysia, Embong (1990) stated that educating patients is the most important but unfortunately the most neglected aspect of diabetic management. This largely includes information given by doctors. Doctors tend to find an easy way out of prescribing medication rather than spending time providing important related medical information to patients.

## PATIENT'S UTILITY FUNCTION AND INFORMATION

The standard agency theory assumes that utility functions of the principal and the agent are independent (MacDonald 1984) and both parties will attempt to maximize their utility functions. However, in medical care, the physician's and patient's utility functions are interdependent, where it is generally recognized that the physician acts, to some extent, in the patient's interest (Evans 1984). Therefore, in medical care the emphasis should be on establishing the nature of the patient's and doctor's utility functions before exploring the optimal reward schedules in order to achieve efficient patient-doctor relationship (Mooney and Ryan 1993).

The doctor is responsible for detecting the needs of the patient and subsequently providing the best treatment in terms of quality and quantity. The doctor's competence in treating a patient is based on different components: technical expertise, interpersonal skills and ability to transfer information. Studies such as Williams and Calnan (1991) found that the doctor's behavior is the most important factor in the patient's utility function while Lee and Kasper (1998) suggested that the doctor's technical ability is the most important factor. Others (Wartman et al. 1983; Kaplan et al. 1989; Kaplan et al. 1996; Levinson et al. 1997), on the other hand, suggest that the patient's perception of the quality of care and the quality of life is positively related to the doctor's ability to transfer relevant information to the patient.

As assumed by William (1988), the patient's utility could be maximized 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 forms the patient utility function. Their views are consistent with the expected utility theory where the entities of choice are solely characterized 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 & Lange 1993) criticized the 'consequences utility approaches' for ignoring factors beyond health outcomes (i.e. 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) itself. Such utility is called the 'process utility'.

## INFORMATION AS A COMMODITY

Health care markets are characterized 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 (Arrow, 1963). To understand the underlying preferences that determine a patient's choice selection for medical services, hence the principal's utility functions, information is one of the most important attributes that need 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).

## QUALITY AND QUANTITY OF INFORMATION

The characteristics of patient-doctor interaction are mainly related to the types and quality of information transferred Labson (2000) which include whether:

1. the doctor listens and understands the symptoms, history, and the patient's degree of concern?
2. the doctor appears to organize the information and relate it in a sensible and easy to understand way?
3. the doctor recognizes and answers the patient's questions about the illness, diagnostic considerations and treatments options?

The value placed on information depends on whether it is understood or not. 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). Doctor listens to get information from patients. He should establish an atmosphere conducive for patients to feel their views are valued and needed. One basic way of doing this is to be willing to listen to patients.

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 regarding illness, diagnosis, medication and treatment (Hall et al. 1988; Street 1991; Carr & Donovan 1998; Charles et al. 1999). Makoul et al. (1995) identified that information given by the doctor as patients' main source of information about prescription medicines. Although information on the dose and timings 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.

## METHODS

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 presented with hypothetical scenarios involving different levels of attributes and requested to make pairwise comparison choices. The pairwise comparison method, when 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 & Farrar 2000). This method requires the respondent to make comparisons between two choices of visits to the doctor.

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 huge, all the possible scenarios were used in the study. To normalize the comparisons, a constant scenario (visit *A*) 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.

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

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

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 | |

In this study, patients' choices were modeled based on Lancasterian consumer theory (Lancaster 1971); 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 maximize their utility and that the influences on utility consist of two components, one that is the nonrandom or the deterministic component and the other which is the random component.

The deterministic component ($C_A$, $C_B$) comprises the five attributes identified earlier. The random component accounts for the unobserved elements in the patient's choice behavior such as unobserved taste variations and unobserved attributes. These unobserved factors were introduced into the utility functions using error terms $e_A$ and $e_B$.

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 & 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

$$[V(C_B, s) + e_B] > [V(C_A, s) + e_A]. \quad \text{...(1)}$$

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

$$\Delta V = [V(C_B, s) + e_B] - [V(C_A, s) + e_A]. \quad \text{...(2)}$$

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

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

$i = 1$ if visit $A$ is chosen, 0 otherwise
$j = 1,2,\ldots\ldots.n^{th}$ patients

$\alpha$ is the constant term of the model

$a$ represents the $a^{th}$ attribute

$\beta_a$ are the coefficients of $D_{aij}$

$D_{aij}$ represents the difference between the levels of each attribute in visit A and visit B

$q_t$ are the coefficient of interaction terms $D_{aij} S_{rj}$ , $t$ is the $t^{th}$ interaction term

$\Delta_{aij} S_{rj}$ 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 socio-economic characteristics, term *s*, which were removed appear in the interaction terms. The dependent variable $U_{ij}$ represents the difference in the utility between visit *A* and visit non-*A*. Since it is the choice selected by the patients that was observed, the dependent variable was coded 1 if visit *A* is chosen; and 0 if visit non-A is 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 1.

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*.

In order to be empirically operational, the unobserved portions of the patients' utility function were specified as a combination of IID (Identically and Independently Distributed) and another general distribution. Such specifications allow the model to be operationalized as a mixed logit. The mixed logit model has proven to be an efficient tool in estimating the heteroskedasdicity and correlation of the unobserved portions of the utility function resulting from repeated choices made by the same respondent. The MIXNO program (Hedeker 1999) was used for estimating the mixed logit model in this study.

TABLE 1. Coding of the main attributes

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

## FINDING

The sample covers 158 diabetic patients, 108 from one public hospital and 50 from one private hospital. All the patients were presented and guided to answer six to seven pairs of choices of scenarios describing the visits to the doctor. The total observations were 670 and 310 for the public and private hospital samples respectively. MIXNO program defines these observations as level-1 observations and the level-2 observations are the number of patients.

Comparing the log likelihood values of both the mixed logit models with the fixed-effects model for both the samples supported the inclusion of the random subject effect. For example, for the public hospital sample, the likelihood ratio (the difference between the log likelihood statistics for the mixed and the fixed-effects models), the chi-square value at about 6 (df=1), rejected the null hypothesis of the coefficient of the random effects equal zero. Besides, the intracluster correlations (r) of 0.22 and 0.40 for the public and private hospital samples respectively indicated a correlation of responses by the same respondent.

TABLE 2. The main-effects models

| Attributes | Public Hospital | | Private Hospital | |
|---|---|---|---|---|
| | Coefficient | *p*-value | Coefficient | *p*-value |
| LISTEN | 2.56 (0.29) | 0.00 | 3.51 (0.53) | 0.00 |
| INFILL | 0.71 (0.22) | 0.00 | 1.35 (0.61) | 0.03 |
| INFDIAG | 1.13 (0.25) | 0.00 | 1.91 (0.48) | 0.00 |
| INFTREAT | 0.86 (0.23) | 0.00 | 1.89 (0.63) | 0.00 |
| EXP | 3.91 (0.33) | 0.00 | 5.88 (0.61) | 0.00 |
| Random effect | 0.95 (0.22) | 0.00 | 2.56 (0.29) | 0.00 |
| Total patients | 108 | | 50 | |
| Total observations | 670 | | 310 | |
| $\rho$ | 0.22 | | 0.40 | |
| Log likelihood | –273.03 | | –100.76 | |

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

Discussion of results only focuses on the mixed logit model with normal random effect distribution. Parameter estimated for all the five main attributes except for variable INFILL for the private hospital sample indicated high significant 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 from both the hospitals 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 both the hospitals chose information on diagnosis and medication/treatment rather than information on illness.

The marginal rate of substitution (MRS) between attributes that represents 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, data from the public hospital 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.

### MODEL WITH INTERACTION TERMS

The model with interaction terms presents a better picture of the nature of preferences; where it accounts for the variation in preferences across socio-economic characteristics. For the The log likelihood value of –258.58 indicates that the inclusion of interaction terms fitted the model better compared to the main-effects (chi-square value at about 15 (df=4)). The estimated intracluster correlation value of 0.20 further confirms the suitability of the random mixed-effects model used in the analysis. The inclusion of the interaction terms has also not altered the relative importance of all the five main attributes found in the main-effect model. Similarly, for the private hospital sample, the estimated intracluster correlation values and the –2logL statistics justified that random effects (assuming normal distribution) specification was appropriate in the analysis.

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

The interaction term EXPGEN (EXP*GENDER) indicates that female patients from the public hospital had stronger preference for simplicity of the message from their doctors compared to male patients. Lower educated patients also indicated stronger preference for the doctor who gives easy to understand explanation compared to patients with higher educational levels. The positive sign of coefficient for EXPRACE (EXP*RACE) suggested that the Chinese patients preferred clear explanations from their doctor when compared to the Malay patients.

TABLE 3. Model with interaction terms

| Attributes | Public Hospital Coefficient (Std. Error) | *p*-value | Private Hospital Coefficient (Std. Error) | *p*-value |
|---|---|---|---|---|
| LISTEN | – | | 3.79 (0.64) | 0.00 |
| INFILL | 0.74 (0.22) | 0.00 | 1.64 (0.22) | 0.00 |
| INFDIAG | 1.33 (0.25) | 0.00 | 2.05 (0.22) | 0.00 |
| INFTREAT | 0.91 (0.23) | 0.00 | 2.04 (0.22) | 0.00 |
| EXP | 3.61 (0.47) | 0.00 | 11.42 (0.22) | 0.00 |
| EXPGEN | 2.33 (0.62) | 0.00 | –1.38 (0.22) | 0.05 |
| EXPEDU | – 1.28 (0.42) | 0.00 | –4.28 (0.22) | 0.00 |
| EXPRACE | 3.24 (0.55) | 0.00 | – | – |
| LISGEN | 1.79 (0.32) | 0.00 | – | – |
| EXPAGE | – | – | –1.12 (0.48) | 0.02 |
| Random effect | 0.77 (0.25) | 0.00 | 1.38 (0.47) | 0.00 |
| Total patients | 108 | | 50 | |
| Total observations | 670 | | 310 | |
| ρ | 0.20 | | 0.37 | |
| Log likelihood | –258.58 | | –87.99 | |

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

Only three interaction terms were significant for the model using private hospital data. They were EXPAGE (EXP*AGE), EXPGEN and EXPEDU. All the interaction terms have negative relationships with the response variable. The negative sign of the coefficient for EXPAGE suggests that the relatively younger patients (average age was at 56.6) preferred clear explanations by the doctor during consultation. The interaction term EXPGEN has an opposite relationship in the preferences of private and public hospital diabetic patients. Male patients from the private hospital had stronger preference for simplicity of the message from their doctors compared to female patients, but data from the public hospital data indicated otherwise. The strong negative sign of the interaction term EXPEDU also conclude that patients with a lower level of education emphasized the importance of easy-to-understand and clear explanation from the doctor compared to patients with higher educational levels.

The conjoint approach not only allows the relative importance of the attributes of the visits to doctors to be identified but it can also be used to rank the overall benefits scores for all possible scenarios that describe the choices of the service. Table 4 shows the ranking of all the 31 scenarios of visits to the doctor from the private hospital sample. This ranking process was based on the change in utility when visit non-A was chosen over visit A. As expected, the 31st scenario described by all the five attributes set at

TABLE 4. Ranking of visits to the doctor by the private hospital diabetic patients

| Choice of scenarios | Attributes LISTEN | INFILL | INFDIAG | INFTREAT | EXP | Change in utility (ranking) | |
|---|---|---|---|---|---|---|---|
| 1 | no | little | little | little | difficult | –7.31 | (31) |
| 2 | no | little | a lot | little | easy | 0.49 | (14) |
| 3 | no | a lot | little | a lot | difficult | –4.07 | (27) |
| 4 | no | a lot | a lot | a lot | easy | 3.37 | (7) |
| 5 | yes | little | a lot | little | difficult | –1.89 | (20) |
| 6 | yes | a lot | little | a lot | easy | 5.32 | (4) |
| 7 | no | little | little | little | easy | –1.43 | (19) |
| 8 | no | little | a lot | a lot | difficult | –3.51 | (24) |
| 9 | no | a lot | little | a lot | easy | 1.81 | (12) |
| 10 | yes | little | little | little | difficult | –3.80 | (25) |
| 11 | yes | little | a lot | little | easy | 3.99 | (5) |
| 12 | yes | a lot | a lot | little | difficult | –0.54 | (17) |
| 13 | no | little | little | a lot | difficult | –5.42 | (29) |
| 14 | no | little | a lot | a lot | easy | 2.38 | (9) |
| 15 | no | a lot | a lot | little | difficult | –5.05 | (26) |
| 16 | yes | little | little | little | easy | 2.08 | (10) |
| 17 | yes | little | a lot | a lot | easy | 5.88 | (2) |
| 18 | yes | a lot | a lot | little | easy | 5.34 | (3) |
| 19 | no | little | little | a lot | easy | 0.46 | (15) |
| 20 | no | a lot | little | little | difficult | –5.96 | (30) |
| 21 | no | a lot | a lot | little | easy | 1.84 | (11) |
| 22 | yes | little | little | a lot | difficult | –1.91 | (21) |
| 23 | yes | a lot | little | little | easy | 3.43 | (8) |
| 24 | yes | a lot | a lot | a lot | difficult | 1.35 | (13) |
| 25 | no | little | a lot | a lot | difficult | –5.40 | (28) |
| 26 | no | a lot | little | little | easy | –0.08 | (16) |
| 27 | no | a lot | a lot | a lot | difficult | –2.16 | (22) |
| 28 | yes | little | little | a lot | easy | 3.97 | (6) |
| 29 | yes | a lot | little | little | difficult | –2.45 | (23) |
| 30 | yes | a lot | little | a lot | difficult | –0.56 | (18) |
| 31 | yes | a lot | a lot | a lot | easy | 7.23 | (1) |

Note: The attributes, the levels of attributes and visit A.

| Attributes | Levels of attributes | Visit A | |
|---|---|---|---|
| Being able to talk to the doctor | Doctor seems to listen | yes | yes |
| (LISTEN) | Doctor does not seem to listen | no | |
| Information regarding illness | A lot | a lot | little |
| (INFILL) | A little | little | |
| Information regarding diagnosis | A lot | a lot | a lot |
| (INFDIAG) | A little | little | |
| Information regarding treatment/medication | A lot | a lot | a lot |
| (INFTREAT) | A little | little | |
| Doctor's explanation | Easy to understand | easy | difficult |
| (EXP) | Difficult to understand | difficult | |

the best levels was ranked first. More useful comparisons can be made on scenarios with imperfect combinations of attributes. For example, comparing scenarios 2 (ranked number 14$^{th}$) and 5 (ranked number 20$^{th}$) indicated the importance of the attribute EXP with regards to attribute LISTEN.

## DISCUSSION

Patients' choice selections on visits to the doctor from both the hospitals indicated that they gave priority to the quality rather than the quantity of information transmitted. Being able to understand patients' relevant preferences and tastes allow doctors to act in their patients' best interests. It also provides useful information for incentive mechanism design where doctors can be encouraged to consider patients' preferences in the decision-making process.

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 emphasizing certain characteristics for certain groups of patients. For example, the public hospital data indicated that the doctor should pay more attention to what the female patients have to say as compared to the male patients.

The conjoint analysis technique was used to demonstrate how respondents were willing to trade 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. These are useful information for mechanism designs 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 outcomes of this study allow doctors, with limited consultation time, to identify the aspects of communication that need to be given priority when they interact with their patients.

Responding to patients' needs and preferences should be the fundamental objective of a health care system. As suggested by the principal-agent theory, patients' (the principal's) needs and desires are the main considerations in designing an effective incentive system. Such a system is performance-based where financial incentives are given to doctors (the agent) based on their achievements according to defined performance targets. However, much of the organization of health care delivery system is structured to accommodate incentives for the providers in the reimbursement system where patients' needs and desires are often not given the priority. A more patient-centered care includes patients' participations in a decision-making process and incorporates an understanding of patients' preferences and needs. Only if patient's preferences are known, can an incentive system be effectively designed to encourage doctors to consider patients' preferences in the decision-making process, thus achieving an efficient patient-doctor relationship and better health outcomes.

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