



Using Discrete Choice Experiment to Determine Willingness to Pay for Interferon-Beta Drugs by Multiple Sclerosis Patients

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Abstract

This study explores the effects of Interferon- β characteristics such as country of origin, injection frequency and method, monthly cost, effectiveness, and side effects on multiple-sclerosis patients' willingness to pay. For this purpose, MS patients with a history of using Interferon- β were studied from the three major Isfahan MS centers. Choice sets were designed with a combination of attributes and levels. The variables in this experiment included interferon- β with different levels assigned to each of its attribute. Patient preferences and willingness to pay were calculated through Discrete Choice Experiment. The statistical population consisted of 358 patients deemed eligible for the study. They responded to the questionnaire and took part in interviews. Results showed that the highest willingness-to-pay value of US\$ 223 as determined by MS patients belonged to a change of effectiveness from moderate to high. Side-effects and ease of use ranked next among patient preferences. Country of origin recorded the lowest value of the willingness-to-pay parameter. Evaluation of MS patients' preferences as reflected in their willingness to pay plays an important role in patient's adherence to treatment to achieve more effective results. Due to the variety of drugs in this category, it is necessary to identify and prioritize those features that are of interest to patients and that increase their utility relative to IFN- β drugs.

Keywords: willingness-to-pay, Interferon- β , Discrete Choice Experiment, multiple-sclerosis, patients, Conjoint Analysis

1. Introduction

Recent years have witnessed an increasing interest in assessing patient preferences for healthcare programs. Accounting for patient preferences in treatment decisions, in general, and in drug administration, in particular, may

lead to upgraded patient utility, improved adherence to treatment, and enhanced treatment effectiveness [1, 2]. Therapeutic decisions are, therefore, becoming a multipartite process that will lead to significant modifications in the physician-patient relationship [3]. Patient

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preferences for treatments and drugs are influenced by features related to the disease, the medication prescribed, and patient's characteristics [4]. When choosing drugs of preference, patients need to take into account such widely varied factors as efficacy, safety, ease of application, and suitability [5]. Since injectable treatments are potentially challenging to patients [6], it is of utmost importance to consider patient preferences in a participatory decision-making model employed in the management of MS[7].

The discrete-choice experiment (DCE) is a useful and commonly used method for evaluating patient preferences. It helps to quantify patient preferences for a series of treatment pairs[4, 8]. In such experiments, patients are asked to express their preferences for a number of proposed product profiles; the preferences might be made up of a combination of attributes and levels that describe the treatment in question or alternatives [9, 10]. If the price or its proxy is also represented in the model attributes, it might be calculated as willingness to pay (WTP) [11].

WTP, expressed in monetary units, is defined as the maximum amount of money a

patient would pay for their health and the intervention related to its consequences[12]. The value of WTP estimates lies in their potential benefits to decision makers as they help provide a standard and practical method for exploring patient preferences and identify the factors affecting them [12, 13].

The choice-based conjoint methods and willingness to pay (WTP) methodology have been extensively used to assess preferences in MS treatments. Most of these studies have focused on patient preferences for disease-modifying treatment [2, 8, 14, 15], selection of injection devices[9], or a choice between oral or injection administration of medication[10]. The data thus collected have been exploited to calculate general or patient-centered WTP [13, 16].

The lack of such studies reported by the healthcare and pharmaceutical sectors in Iran, on the one hand, and the importance of sustained and continued treatment by Multiple Sclerosis patients, on the other, prompted the present study to evaluate MS patients' willingness to pay for IFN- β products using the discrete choice experiment in Isfahan, Iran, from December 2015 to May 2016.

1. Materials and Methods

The Conjoint Analysis (CA) method was used to explore and evaluate the willingness to pay for IFN- β drugs among MS patients in Isfahan Province, Iran. The advantage of the conjoint analysis lies in its requirement by participants to make trade-offs between choices in a fashion similar to the decisions they normally make in practice. The method has

proved successful in evaluating preferences for a variety of health interventions [4, 17]. Conducting the analysis presupposes identification of hypothetical treatments in terms of attributes and their associated levels. For the purposes of this study, the choices available and the descriptions for each treatment attribute and level were derived from: i) review of the relevant literature and the ISPOR guidelines for the use of Conjoint Analysis in healthcare studies [3, 14, 15, 17, 18]; ii) soliciting expert views from academics and professionals working in the fields of pharmacoeconomics, neurology, and clinical pharmacy; and iii) conducting a pilot study. Based on the findings from each of these activities, the following attributes and associated levels were ultimately identified and defined: IFN- β 's country of origin (Iran or elsewhere), monthly cost (US\$ 0–33, 33–132, and 132–231), administration and injection frequency (muscular injection, once a week; subcutaneous injection, three times a week; and subcutaneous injection, every other day), efficacy as reflected in the reduced frequency of relapses; disease and disability progression (moderate and high), side effects including common symptoms such as flu-like ones and skin reactions at the injection site (low and medium), and finally, ease of application (easy and hard).

A questionnaire was accordingly designed and administered to patients at three MS units throughout Isfahan (Isfahan MS Center, MS Clinic at Kashani Hospital, and MS Clinic at Al-Zahra Hospital). A multicenter survey was conducted using face-to-face interviews with

structured questionnaires to collect data on the socioeconomic characteristics, treatment, and choice sets.

The criteria used in the selection of patients for the study included: aged at least 15 years old, a diagnosis of MS (based on filed data available at the Office of the Deputy for Treatment, Isfahan University of Medical Sciences), history of IFN- β use, and patient's consent to participate in the survey. The study proposal was reviewed and approved by the Institutional Ethics Committee of the Faculty of Pharmacy, Nursing, and Midwifery, Shahid Beheshti University of Medical Sciences. Each participant expressed their full consent in writing and was given the right to withdraw anytime during the interview. Each interview took approximately 20–30 minutes to complete.

Identification of patient preferences was accomplished by using the discrete choice experiment in the logit model of the JMP® 10.0.0 software (SAS Institute Inc., 2012). In the DCE, the probability of the j^{th} choice for each C_i in the choice set where there are $n_i=2$ possible choices is defined as follows^[19]:

$$P(j) = \frac{\exp(X'_{ij}\beta)}{\sum_{k \in C_i} \exp(X'_{ik}\beta)}$$

The dependent variable was the treatment choice and the independent ones were the levels for each attribute which were taken to be normally distributed^[8, 20]. 'Preference weights' were calculated using the estimated parameters for attribute levels and the presence of price or cost in the assumed attributes made it possible to estimate the willingness to pay for each attribute [11].

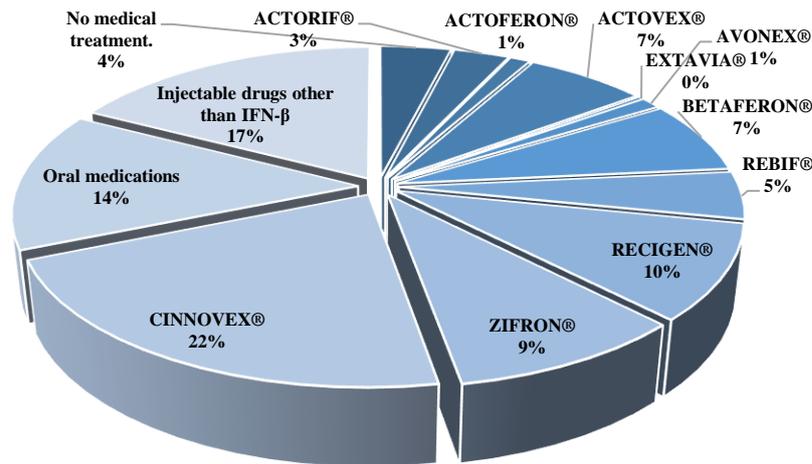


Figure 1. Current treatment of MS patients.

3. Results and Discussion

A total number of 358 patients, 68% of whom were married, responded to the questionnaire, participated in the interviews, and finished the survey. The whole statistical population had a female to male ratio of about 3.7. Most of the participants had received some level of education; 36.87% held high school diploma degrees and 28.21% held undergraduate degrees. Women with a high school diploma accounted for the majority of patients; it was not, therefore, surprising that almost 47% were housewives and had no jobs. The patients aging between 20-30 years accounted for the dominant age group of the patients and the average age of the whole population was 34.75 years (SD= 9.05). The interviewees had a minimum age of 16 and a maximum of 67 years. The mean period since diagnosis was 7.76 years (SD= 5.62) and the mean treatment duration was 7.12 years (SD=5.38). Examination of the participants' basic and supplementary insurance coverage revealed that while all had basic insurance

coverage, about 60% received healthcare services under the social security system and that 65% of these people had no supplementary insurance policy contracts.

The data from the patient's current treatment showed that Cinnovex® (22%), the non-interferon injectable (17%) and oral (14%) drugs, accounted for the largest share of the medication administered. For 65% of the study population, INTF-B was the the main treatment drug followed by Cinnovex® (22%), Recigen® (10%) and Ziferon® (9%). Figure 1 presents the details of the current treatments.

The logit model was employed to estimate and calculate the coefficient for each variable. The split coefficient of each feature was used to calculate an absolute factor price feature – that is, the amount of money each person is willing to pay, for each unit change in the attributes. Our findings indicated that most MS patients were willing to pay US\$ 222.63 dollars if the extra payment would lead to a change in treatment effectiveness from medium to high. Side effects and ease of application came next

in patient priority preferences for which they were willing to pay US\$ 181.61 and 135.96, respectively (Table 1).

Theoretical validity of the results was confirmed by obtaining consistent coefficients against theoretical principles. Apparent validity

was secured by conducting a pilot study on a subset of the participants and further edited to eliminate any remaining uncertainties in the interpretation of the data^[21]. Reliability of patient satisfaction with the survey was determined using the following three tests: 1)

Table 1. Willingness to pay results estimated by the logit model.

Attributes	L-R ChiSquare	DF	Prob>ChiS q	WTP (\$)
Country of origin Iran vs. Foreign	1.829	1	0.1763	24.15
Administration and frequency muscular -once a week vs. subcutaneous -3 times a week subcutaneous -3 times a week vs. subcutaneous -every other day	32.910	2	<.0001*	77.41 42.67
Effectiveness Medium vs. high	115.960	1	<.0001*	222.63
Side effects Low vs. medium	141.568	1	<.0001*	181.61
Ease of injection Easy vs. hard	65.657	1	<.0001*	135.96

Table 2. Marginal utility of each level of each attribute.

Attributes	Levels	Marginal	Marginal Utility
Country of origin	Iran	-0.55965	
	Others	-0.68298	
Administration and frequency	muscular -once a week	-0.55965	
	subcutaneous -3 times a week	-0.95485	
	subcutaneous -every other day	-0.73672	
Effectiveness	Moderate	-0.55965	
	High	0.57855	
Side effects	Low	-0.5597	
	Moderate	-1.4883	
Ease of injection	Easy	-0.5597	
	Hard	-1.2541	

The Chi-square test, the values and probabilities obtained from the Whole Model Test (271/01 and $<0/0001$) confirming the overall significance of the regression model; 2) Lack of Fit Test, the results of which together with the Chi-square and probability values (252/58 and $<0/0001$) showed that the variables in the model were sufficient and that there was no need to add a new variable; and 3) the Wald Test, the results of which for all the coefficient probability values were found to be less than 5%, indicating that all the coefficients in the model logit time were non-zero. Country of origin from among the selected attributes, however, is not significant in the model.

Marginal utility of each level of each attribute is reported in Table (2). Clearly, the greatest change in marginal utility belongs to treatment effectiveness which changes from $-0/56$ to $+0/57$, almost by $1/13$ unit (which is equal to the coefficient obtained for effectiveness in the logit model). For moderate side effects, marginal utility has its lowest value in all the cases investigated.

Some previous studies showed that the treatment effectiveness variable played the key role in patient preferences if it is included among other attributes. They hypothesized that the effectiveness variable is of particular importance to MS patient preferences^[9, 22].

4. Conclusion

Conjoint studies simultaneously take several attributes into account. This allows researchers to develop more complex decision making models [10]. Hence, this model was used in this study to include patients' willingness to pay as

a variable and to explore its effects on treatment adoption^[13]. Another advantage of conjoint studies is that they are capable of prioritizing attributes according to the importance attached to them as reflected by patient WTP scores. Patients' awareness of such different attributes as treatment effectiveness, side effects, and dosing frequency have significant effects on MS patients' adherence to injectable treatment^[1]. It is, therefore, essential to identify patient preferences in order to tailor medication type and frequency appropriately.

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