

*Araştırma Makalesi/Research Article*

## ANALYSIS WITH NESTED MULTINOMIAL LOGIT MODEL OF DEMAND FOR HEALTHCARE: AN APPLICATION IN KAYSERİ PROVINCE<sup>1</sup>

### SAĞLIK HİZMETLERİ TALEBİNİN NESTED MULTİNOMİNAL LOGİT MODEL İLE ANALİZİ: KAYSERİ İLİNDE BİR UYGULAMA

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#### Abstract

Determining the factors affecting the demand for healthcare services are important in terms of providing health services more effectively and a more efficient health system. In addition, effective provision of healthcare services is an important element in terms of basic socio-economic development of countries. The primary aim of this study is to determine the factors which affect the demand for healthcare services. In that framework, factors related to household's choice of applying to a healthcare facility because of a health problem and the factors related to household's healthcare facility choice are investigated using the data collected in Kayseri province with survey method. Within the scope of the study, Nested Logit Model was implemented to the data set using Full Information Maximum Likelihood (FIML) technique which estimates both decision levels simultaneously. According to the results obtained, the factors which affect the choice of applying to the healthcare facility were found as the educational level of the household head, severity of the disease and some health problem complaints. Among the factors which affect healthcare facility choice, educational level of the patient reduces the likelihood of applying to both public and private healthcare facilities. Furthermore, likelihood of applying to public healthcare facilities reduces with the age of the patient.


**Keywords:** Health, Demand for Healthcare, Discrete Choice Models, Nested Multinomial Logit Model, Kayseri, Turkey

#### Öz

Sağlık hizmetleri talebini etkileyen faktörlerin belirlenmesi sağlık hizmetlerinin daha etkin sunulması ve daha verimli işleyen bir sağlık sistemi açısından önemlidir. Ayrıca sağlık hizmetlerinin etkin sunumu ülkelerin temel sosyo-ekonomik gelişimleri açısından da önemli bir unsurdur. Bu çalışmada temel amaç sağlık hizmetlerine olan talebi etkileyen faktörleri belirlemektir. Bu çerçevede Kayseri ilinde anket yöntemi ile toplanan veriler kullanılarak, hanehalkının bir sağlık problemine bağlı olarak sağlık kuruluşuna başvuru tercihi ile ilişkili faktörler ve sağlık kuruluşu tercihleri ile ilişkili faktörler incelenmiştir. Veri seti Kayseri ilinde hanehalkı anket uygulaması ile oluşturulmuştur. Çalışma kapsamında veri setine her iki karar seviyesini aynı anda tahmin eden tam bilgiye dayalı maksimum olabilirlik (FIML) tekniği kullanılarak Nested Multinomial Logit Model uygulanmıştır. Elde edilen sonuçlara göre sağlık kuruluşuna başvuru tercihinin eğitim seviyesi, hastalık şiddeti ve bazı sağlık problemi şikayetleri bulunmuştur. Sağlık kuruluşu tercihinin etkileyen faktörlerden hastanın eğitim seviyesi hem kamu hem de özel sağlık kuruluşuna başvurma olasılığını azaltmaktadır. Ayrıca kamu sağlık kuruluşlarına başvurma olasılığı hastanın yaşı ile birlikte azalmaktadır.

**Anahtar Kelimeler:** Sağlık, Sağlık Hizmetleri Talebi, Kesikli Tercih Modelleri, Nested Multinomial Logit Model, Kayseri, Türkiye

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<sup>1</sup> Bu araştırma, Erciyes Üniversitesi Bilimsel Araştırma Projeleri Koordinasyon Birimi Koordinatörlüğü'nce kabul edilen SDK-2016-6737 numaralı proje kapsamında desteklenmiş; Doç. Dr. Eyyup Ecevit danışmanlığında Erciyes Üniversitesi Sosyal Bilimler Enstitüsünde yürütülen Kayseri ilinde Sağlık Hizmetleri Talebinin Belirleyicileri: Nested Multinomial Logit Model Analizi başlıklı doktora çalışmasından türetilmiştir.

## GENİŞLETİLMİŞ ÖZET

**Arka Plan:** Sağlık, ülkelerin gelişmişlik seviyeleri fark etmeksizin tüm toplumlarda daha kaliteli bir yaşam standardı için oldukça önemli bir unsurdur. Ayrıca bireylerin ve toplumların yaşam kalitesini artırmasının yanında ülkelerin ekonomik ve sosyal olarak gelişmelerine de önemli katkılar sağlamaktadır. Toplumsal refah için sağlıklı ve mutlu bireylerle ne kadar önemli ise sağlık hizmetlerinin tüm bireylere eşit ve etkin bir şekilde sunulması da o kadar önemlidir. Sürekli artan yaşam kalitesi beklentisi bireylerin sağlık hizmetlerine olan ihtiyaç ve taleplerini artırmaktadır. Artan talebin yerinde ve etkili bir şekilde karşılanabilmesi ise sağlıklı işleyen bir sağlık sistemi ile mümkün olmaktadır.

**Çalışmanın Amacı:** Sağlık hizmetleri talebi bireylerin ve toplumların sağlık düzeylerinin iyileştirilmesine katkı sağlayan faktörlerden biri olduğu için üzerinde önemle durulması gereken bir konudur. Buradan hareketle çalışmada temel amaç, sağlık hizmetleri talebini etkileyen faktörleri belirlemektir.

**Literatür:** Bireyler herhangi bir sağlık sorunu ile karşılaştıklarında sağlık hizmetlerini farklı sağlayıcılardan hangi sıklıkta, ne kadar ve nasıl talep edecekleri yönünde farklı tercihlerde bulunurlar. Bireylerin sağlık hizmetleri talebini oluşturan tercihlerinin nasıl gerçekleştiği yönünde farklı çalışmalar yapılmış olup bu yönde çeşitli modeller geliştirilmiştir. Sağlık hizmetleri talebine yönelik geliştirilen modellerin iki amacı bulunmaktadır. Birincisi sağlık hizmetleri talebi ile talebin oluşmasına neden olan faktörlerin belirlenmesi ve tahmin edilmesi, ikincisi talebin oluşmasına neden olan faktörlerin tanımlanması ve ölçülmesi ile talebi artırmaya veya azaltmaya yönelik politikalar oluşturmak ve bu politikaların olası etkileri üzerine değerlendirmeler yapmaktır (Feldstein,1966:128-165). Sağlık hizmetleri talebi genellikle doğrudan ölçülemediğinden sağlık hizmetlerinin kullanımı ve sağlık hizmetlerine yapılan harcamalar ile ilgili veriler talep ölçütü olarak kullanılmaktadır (Fuchs,1972: 62). Sağlık hizmetleri talep kavramı herhangi bir toplumdaki bireylerin sağlık hizmeti arama davranışlarıyla yakından ilişkilidir. Bireyler kamu veya özel herhangi bir sağlık kuruluşundan bir sağlık hizmeti almadan önce sağlık hizmeti ihtiyaçlarını algılamaktadırlar daha sonra sağlık hizmetini talep etmektedirler. Herhangi bir sağlık hizmeti ihtiyacı ortaya çıktığında ise bireyler sağlık hizmeti alıp almayacaklarına ve bu hizmeti nereden alacaklarına karar vermektedirler (Sarma,2003:9). Sağlık ekonomisi literatüründe, sağlık hizmetleri kullanımı konusundaki bu karmaşık karar verme süreçlerini modellemek için iki farklı yaklaşım kullanılmaktadır (Jack,1999: 55). İlk yaklaşımda tüketim kararlarının zamanlar arası bir modeli kullanılmakta, sağlık bir stok değişkeni olarak ele alınmaktadır. Bu yaklaşımda sağlık hizmetleri, sağlık stokunu iyileştirdiği ve verimliliği artırdığı ölçüde talep edilmektedir (Grossman,1972:223-235). Sağlık hizmetleri talebini modellemeye yönelik ikinci yaklaşım ise sağlık hizmetlerini iktisadi karar birimlerinin çok iyi belirlenmiş tercihlere sahip oldukları birkaç maldan sadece biri olarak ele almaktadır. Bu yaklaşım fayda maksimizasyonu çerçevesinde değerlendirilmektedir (Phelps,1992).

**Veri ve Yöntem:** Çalışmanın veri seti hane halkı anket yöntemi ile oluşturulmuştur. Kayseri iline bağlı beş büyük ilçede anketin yapıldığı dönemden itibaren son bir ay içerisinde bir sağlık problemi yaşamış bireylere uygulanmıştır. Yöntem olarak, bireyin iki karar seviyesini (sağlık hizmeti alma tercihi ve sağlık kuruluşu tercihi) aynı anda tahmin edebilen FIML yöntemi ile kesikli tercihlerin tahmininde kullanılan modellerden çoklu tercih modelinin bir uzantısı olan Nested Multinomial Logit Model kullanılmıştır.

**Bulgular ve Sonuç:** Çalışmada tahmin edilen modellerin sonuçlarına göre sağlık kuruluşuna başvuru tercihini etkileyen faktörler hanehalkı reisinin eğitim seviyesi, hastalık şiddeti ve bazı sağlık problemi şikâyetleridir. Sağlık kuruluşu tercihini etkileyen faktörlerden hastanın eğitim seviyesi hem kamu hem de özel sağlık kuruluşuna başvurma olasılığını azaltmaktadır. Ayrıca kamu sağlık kuruluşlarına başvurma olasılığı hastanın yaşı ile birlikte azalmaktadır. Çalışmadan çıkarılacak sonuçlar ise, hanehalkı reisinin eğitim düzeyi sağlık hizmetleri talebi üzerinde pozitif etkiye sahiptir. Dolayısıyla eğitim faktörünü, sağlık hizmetlerine olan talebin belirleyicilerinden sayabiliriz. Aynı şekilde hastalık şiddeti bireyin sağlık hizmetleri talebini etkileyen bir diğer faktördür. Hastalığının şiddetinin arttığını düşünen birey sağlık hizmeti talep etme konusunda daha istekli olmaktadır ve sağlık hizmeti talebi artmaktadır. Hanehalkındaki yetişkin sayısı ile birlikte sağlık hizmetleri talebi azalmaktadır. Bu durum hanehalkındaki üretken olmayan veya herhangi bir gelir getirmeyen bağımlı bireylerden ve dolayısıyla hane halkının gelirinin azalmasından kaynaklanıyor olarak ifade edebiliriz. Hanehalkının bir sağlık problemi ortaya çıktığında sağlık hizmetlerinden kolayca faydalanabilmesi için ekonomik erişilebilirliği artıran sosyal yardım ve destek politikalarının daha etkin bir şekilde uygulanması ve bu bağımlı nüfusun iş gücüne katılımını sağlayacak şekilde geliştirilmesi gerekmektedir. Sağlık hizmetleri talebinin hanehalkı bireyinin sağlık problemi şikâyetlerine göre değişiklik göstermesi de elde edilen bir diğer önemli faktördür. Yapılan analiz sonucunda bireyin sağlık hizmeti talep etme olasılığını artıran böbrek rahatsızlığı, kalp hastalığı, cilt hastalıkları gibi şikâyetlerin bir sağlık kuruluşundan ve bir uzman hekim tarafından hizmet alınmasını gerektiren şikâyetler olduğu görülmektedir. Şikâyetlere bağlı olarak sağlık hizmetleri talebi ile ilgili önerilerde bulunabilmek için birçok faktörün göz önünde bulundurulması gerekmektedir. Ortaya çıkan sağlık problemi şikâyeti için sağlık kuruluşuna başvurma olasılığında bu şikâyetin şiddeti, sıklığı, belirtileri ve yoğunluğu yanında bireyin kendisinin ve ailesinin hastalık algısı çok önemlidir. Bu algı ile sağlık durumunun doğru değerlendirilebilmesi için daha önce belirtildiği üzere bireylerde ve toplumda sağlık bilincinin oluşturulması ve sağlık farkındalığının sağlanması gerekmektedir.

## INTRODUCTION

Health is quite an important factor for a higher quality life standard in all societies regardless of development levels of the countries. In addition to increasing the quality of life of individuals and societies, health contributes significantly in the economic and social development of countries, because social welfare is possible with healthier and happier individuals. Moreover, another important factor in terms of social welfare is delivering healthcare services effectively and equally to all individuals in the society. Increasing quality of life expectations cause an increase in the individuals' need and demand for healthcare services. The increase in demand leads to the problem of not being able to use limited resources effectively. Since accomplishing the desired development in healthcare sector depends on using the resources allocated to healthcare services effectively, it is important to examine the supply and demand components of the healthcare sector. As the demand for healthcare services is one of the factors which enables improvement of the health status of the individual and society and therefore increases social welfare, we can say that demand component is in a more determinative position in healthcare sector.

The concept of healthcare service demand is closely related to the healthcare seeking behaviour of individuals in any society. Before getting healthcare services from any public or private healthcare facility, individuals must perceive their needs for healthcare service and then demand healthcare services for these needs. When a need for healthcare services arises, individuals decide whether they are going to get healthcare service or where to get this service. This decision-making process may become complicated because of having too little information about the healthcare services or having too much information about the healthcare services the cost, risks, benefits of healthcare services and opportunity cost of the goods other than healthcare services from friends, relatives, neighbours or doctors. The decision-making process of the individuals in relation to healthcare services is addressed within the framework of the demand for healthcare services and the factors which affect the demand are determined and estimated within this framework. Therefore, investigating the decision-making processes about the use of healthcare services and determining the factors which affect demand provide guidance in policymaking for the demand for healthcare services.

In recent years, the empirical studies on the demand for health care services in the literature are examined, it is seen that theoretical model of utility maximizing approach, which mostly addresses healthcare services as goods and analyses the demand according to types of healthcare facilities with the inclusion of various factors such as price, quality, time costs of the healthcare service and the income, age and educational level, tastes and choices of the individual in the fundamental utility analysis, is used (i.e. See: Heller P. S., 1982; Akin J. S., Guilkey, D. K., Denton, H., 1995; Glick, P., Razafindravonona, J. and Randretsa, I. 2000, Sahn, D. E., Younger, S. and Genicot, G. 2003, Muriithi, M. K. 2013, Mwabu, G., Ainsworth, M. and Nyamete, A. 1993, Gertler, P., Locay, L. and Sanderson, W. 1987; Sarma, S. 2009; Akin, J. S., Griffin, C. C., Guilkey, D. K. and Popkin, B. M. 1986; Bitran, R. 1989; Ellis, R. P. and Mwabu, G. 2004; Qian D., Pong, R. W., Yin, A., Nagarajan, K. V. and Meng, Q. 2009). This study is based on the theoretical model developed by Gertler, Locay and Sanderson (1987). Then this model Mwabu et al. (1993), Ssewanyana et al. (2006), Sahn et al. (2003) have been used in many studies.

Analyses on demand for healthcare services are conducted using survey data on individual or household level. In the literature, a significant part of the studies investigated the demand for healthcare services using discrete choice models in the econometric model and including numerous variables that affect demand in the analysis. The discrete choice models used are divided into two according to two-choice or multiple-choice dependent variables (Kjær, 2005, 37). Models with two choices (i.e. See: Yaylalı et al. 2012) are referred to as two-choice models and models with more than two choices are referred to as multiple choice models (i.e. See: Akin, J. S., et al. 1998; Gupta, I. and Dasgupta, P. 2002; Mwabu, G., et al. 1993; Gertler, P., Locay, L. and Sanderson, W. 1987; Bitran, R. 1989; Saraçoğlu, S. Öztürk, F. 2016; Bolduc, D., et al. 1996).

The literature that is discussed shows the importance of the utility maximization model theoretically and also the discrete choice models empirically in demand for healthcare service analysis. Accordingly, the theoretical and empirical studies on the demand for healthcare services in Turkey are quite scarce. Özkoç

(2013) analyzed the factors affecting health facilities choice in Turkey using Life Satisfaction Survey (Turkish Statistical Institute) for 2010. The study is very important in terms of its contribution to the literature, but it is theoretically limited. Therefore, this study contributes both theoretically and empirically to expand this limit in the literature.

Using the dataset obtained with household survey method in October 2017 in Kayseri province, this study investigates the factors which affect the demand for healthcare services in Kayseri provided that it is due to any health problem, with nested multinomial logit model analyses. Conducting empirical analysis with micro dataset and implementing nested logit model, which is one of the discrete choice models used commonly in freight, logistics, transportation and marketing fields, in the field of healthcare services can be considered as significant contributions of the study.

The rest of this paper is organized as follows. Following this introduction, we will discuss our data and empirical model in methods section. Then we present our empirical results in results section. Finally, in conclusion section concludes the paper.

## 1. MATERIALS and METHODS

The aim of this study is to determine the factors affecting the demand for health services. In this respect, in the empirical analysis of the study the data set obtained with survey method in October 2017 in Kayseri province was used. The population of the study is Kayseri. The sample size of the study was calculated using the formula proposed by Cochran (Kuunibe and Dary, 2012: 89). It is shown as follows;

$$n_0 = \frac{(t)^2 \times (p) (q)}{(d)^2} \quad [1]$$

According to this equation:

$n_0$ : Sample size

$t$ : The value for selected alpha level of .025 in each tail = 1.96

$p$ : The proportion of the sample that became ill and sought treatment

$q$ : The proportion that did not seek treatment.

$d$ : Acceptable margin of error for proportion being estimate

The sample size is calculated as 384 with 5% error margin. In the study, the number of questionnaires was determined to be 4000 because of the budget and access to the patient. 1348 questionnaires were taken into consideration. The sample of the study was formed in two stages. The first stage 'area sampling' method and the questionnaires were proportioned into the population of the districts. In the second stage, the data set was formed by the 'random sampling' method in the neighbourhoods determined with the lottery sampling. The questionnaire has been developed with the Prof. Germano Mwabu who has many important studies in this field after reviewing the relevant studies in the literature. The questionnaire contains individual's demographic features, socioeconomic features, disease features and the features of the healthcare facility that the individual applied to and there are 43 questions in total. This study consists of individuals who have experienced any health problems in the last month. Therefore, the questionnaire was applied to households who have experienced any health problems within the last month.

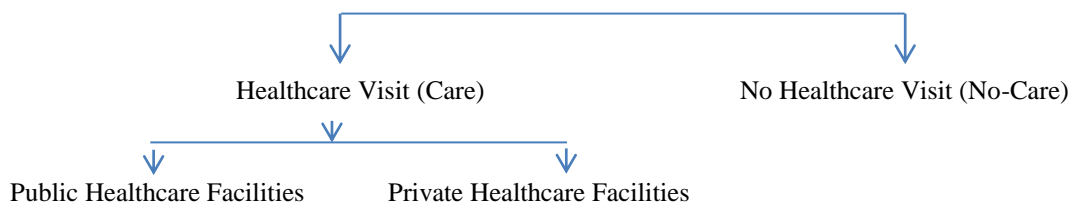
However, the data set was capture the first visits to health facilities. Also, choice of provider is limited to a first outpatient consultation. From this perspective, it is possible to say that the data set is adequate to analyse the demand for healthcare services. The data set was analyzed with Stata 13 program.

In this study, provider options are used as dependent variable to investigate the factors affecting the demand for health care. These options are used as three different dependent variables; not applying to a healthcare facility (including self-treatment), public healthcare facilities (family physician, university hospitals, research and training hospitals) and private healthcare facilities (private hospital/polyclinic and

private examination/physician). Dependent variables are categorical. When an individual is sick, the household prefers one of these choices including the choice of not applying to a healthcare facility. If the households have utilized from the public health facility or private health facility, the dependent variables take the value of 1 and if it has not utilized from any health services, it takes 0.

Discrete choice models which are used to analyse and estimate the alternative choice made by the decision maker from extensive and finite alternatives cluster (Koppelman and Bhat, 2006: 1) constitute the econometric model of the study. This model is based on random utility maximizing theory (Silberhorn et al., 2007: 3). For that reason, it is assumed that decision makers make a choice by examining all alternatives and considering the alternative which provides highest utility in the decision-making process in relation to choices (Carrasco and Dios Ortuzar, 2002: 197).

In this study, three different provider options, which are dependent variables, were estimated with nested logit model which is an extension of multinomial logit model, which is one of discrete choice models. The main idea of nested logit model which assumes that choice continues by means of “nested” choice clusters instead of considering all alternatives as components of a single choice cluster, is to group similar alternatives in nests by forming a hierarchical structure of alternatives (Silberhorn et al., 2007: 4). Simultaneous decision-making structure in the model in which three healthcare service options are focused using two-level nested logit model is shown as follows:



**Figure 1:** Nested Logit Structure - Two Level Decision Tree

There are the choices of applying (care) or not applying (no care) to a healthcare facility due to a health problem on the upper level of the model. In the lower level, there are two different choices; public healthcare facilities and private healthcare facilities.

Let’s assume that each one of I alternatives are grouped in k upper branches consisting of I<sub>k</sub> alternatives in the two-level nested logit model. The choice is first made between the k upper branches and then between the I<sub>k</sub> alternatives in the k upper branches chosen. According to this, choice probabilities can be shown as follows; P [Lower 0branch j, Upper branch k];

$$P_{jk}(V) = P_k(V) \cdot P_{j|k}(V) \tag{2}$$

In equation [2], P<sub>k</sub> indicates the marginal choice probability of k upper level. P<sub>j|k</sub> shows the conditional choice probability of j alternative between I<sub>k</sub> alternatives in k upper branch (Börsch Supan, 2012: 42).

$$P_{j|k} = \frac{e^{\beta X_{j|k}}}{\sum_{j=1}^{j_k} e^{\beta X_{j|k}}} = \frac{e^{\beta X_{j|k}}}{\exp(IV_k)} \tag{3}$$

$$P_k = \frac{e^{(\gamma z_k + \tau_k I_k)}}{\sum_{k=1}^K e^{(\gamma z_k + \tau_k I_k)}} \tag{4}$$

Equation [4] indicates the marginal choice probability of upper branch (k) of nesting structure.

$$IV_k = \ln \sum e^{\beta X_{j|k}} \tag{5}$$

In equation [5], IV<sub>k</sub>: inclusive value [IV], X: behaviours of individuals, z: choice features, τ: ‘dissimilarity parameter’ value and it is a measurement of correlation between random error terms according to unobservable features of choices and it is used to test random utility maximizing in nested logit models (Özkoç, 2013: 271). ‘Dissimilarity parameters’ are main parameters which ensures flexibility of nested logit model. They determine the differences between lower nests and the correlations between error terms in lower

nests (Börsch Supan, 2012: 42). Dissimilarity parameter value is restricted between 0 and 1. Different value of the parameter indicates the degree of difference between alternative couples in the nest (Koppelman and Bhat, 2006:163).

As a conclusion, nested logit model and marginal and conditional choice decisions are combined with a ‘nesting’ structure (Hensher et al. 2005). The only purpose of this transaction is to eliminate the violation of IIA assumption. Expected maximum utility of upper branch  $k$ , inclusive value ( $IV_k$ ), connects two decision levels and carries the impact of lower level decisions to upper levels (Silberhorn et al. 2007:4-5).

Table 1 (upper model) and Table 2 (lower model) gives information regarding the dependent and independent variables used in this study. The variables used in the study were decided by examining many studies in the related literature.

**Table 1: Variable (Upper Level) Definitions**

<b>Upper Level</b>	
<b>DEPENDENT VARIABLES</b>	
<b>Applying to healthcare facility</b>	Getting healthcare services from public or private healthcare facilities
<b>Not applying to healthcare facility</b>	Reference Category – Not getting healthcare services
<b>INDEPENDENT VARIABLES</b>	
<b>Household Head’s Age</b>	
Household Head’s Age	Household Head’s Age
<b>Household Head’s Gender</b>	
Female	=1 If household head is female, If Not=0
<b>Household Head’s Education Level</b>	
Illiterate	Reference Category
Primary Education	=1 If household head is a primary education graduate, =0 If not primary education graduate
High School	=1 If household head is a high school graduate, =0 If not high school graduate
University	=1 If household head is a university graduate, =0 If not university graduate
<b>Number of Adults in Household</b>	
Number of Adults	Number of Adults in Household
<b>Number of Children Below 15 in Household</b>	
Number of Children Below 15	Number of Children Below 15 in Household
<b>Severity of Disease</b>	
Mild	Reference Category
Moderate	=1 If disease is moderate, If Not=0
Severe	=1 If disease is severe, If Not=0
<b>Health Problem Complaints</b>	
Cold – Cough	Reference Category
Ear Nose Throat	Ear Nose Throat complaint=1, If Not=0
Abdomen and Stomach	Abdomen and Stomach disorder=1, If Not=0
Diarrhea Vomiting Fatigue	Diarrhea Vomiting Fatigue complaint=1, If Not=0
Psychologic Disorders	Psychologic Disorders=1, If Not=0
Kidney Diseases	Kidney Diseases=1, If Not=0
Eye Diseases	Eye related complaints=1, If Not=0
Tooth Diseases	Tooth related complaints=1, If Not=0
Headache	Headache complaint=1, If Not=0
Heart Diseases	Cardiovascular diseases complaint=1, If Not=0
Lung Diseases	Lung disorder=1, If Not=0
Skin Diseases	Skin diseases=1, If Not=0
Waist Neck Leg Diseases	Waist Neck Leg pain complaints=1, If Not=0
Fracture Dislocation	Fracture-dislocation-ligament injury complaints=1, If Not=0
Gynaecology	Gynaecology =1, If Not=0

Source: Own Survey

**Table 2: Variable (Lower Model) Definitions**

<b>Lower Level</b>	
<b>DEPENDENT VARIABLES</b>	
<b>Public Healthcare Facilities</b>	Family Physician, University Hospitals, Research and Training Hospital
<b>Private Healthcare Facilities</b>	Private Hospital/Polyclinic, Private Examination/Physician
<b>Not applying to healthcare Facilities</b>	Reference Category
<b>INDEPENDENT VARIABLES</b>	
<b>Patient's Age</b>	
Public – Patient Age	Age of the patient who chooses public healthcare facility
Private – Patient Age	Age of the patient who chooses private healthcare facility
<b>Patient's Gender</b>	
Public – Female	Gender of the patient who chooses public healthcare facility=1 if female, If Not=0
Private – Female	Gender of the patient who chooses private healthcare facility =1 if female, If Not=0
<b>Patient's Education Level</b>	
Illiterate	Reference Category
Public – Primary Education	Patient who chooses public healthcare facility is primary education graduate=1, If Not=0
Public – High School	Patient who chooses public healthcare facility is high school graduate=1, If Not=0
Public – University	Patient who chooses public healthcare facility is university graduate=1, If Not=0
Private – Primary Education	Patient who chooses private healthcare facility is primary education graduate=1, If Not=0
Private – High School	Patient who chooses private healthcare facility is high school graduate=1, If Not=0
Private – University	Patient who chooses private healthcare facility is university graduate=1, If Not=0
<b>Patient's Consumption</b>	
Consumption (log)	Consumption level after direct and indirect costs

**Source:** Own Survey

As explained in Table 1 and Table 2, most of the variables used in the study are dummy variables. In multinomial discrete choice models, one of the dependent variable categories is selected as the reference category. Similarly, one of the categorical variables in the independent variables is determined as the reference category. Other categories are compared with this reference category. Also, in the model it has been tested whether there are multicollinearity problems between variables. Different models have been tested and the final model has been reached.

## 2. RESULTS

In this section, the estimation results of the nested multinomial logit are discussed. In the nested logit model predicted by the FIML method, IV (inclusive value) parameters are used, which measure the correlation between error terms and to be in the range of 0-1, in order to test the random utility maximization (Akin,2002,1-7; Silberhorn et al. 2007,2-9). In this study, since the upper level model does not have sub-branches in the option of not getting healthcare services and there is only one option, inclusive value ( $\sigma$ ) is limited to one (1) (Özkoç ve Üçdoğruk, 2008,45). In case of to get healthcare service, the estimated inclusive value coefficient value is 0.971 and this value is statistically significant as the value is less than one and greater than zero. The 0.029 correlation coefficient ( $1-\sigma$ ) indicates that there is a more modest substitution between health facilities (public-private) than other (not applying healthcare facilities) options. The model is acceptable since the IV parameters of the model are within the specified ranges.

Table 3 and Table 4 present the estimation results for upper model and lower model. The tables show the estimated coefficients of the nested logit model. Although the coefficients help in analyzing how the probability of choosing any provider of healthcare service changes compared with the reference category, the marginal effects help in indicating the most important factor determining this probability of choice (Başar et al. 2018). In this study, the magnitude of the coefficients cannot be calculated. Since the marginal effect cannot be estimated, the signs and significance of the coefficients would reveal whether or not the model is able to explain the determinants of the choice of health care service providers.

**Table 3: Estimation Results of Upper Level Model**

DEPENDENT VARIABLE: Application to Healthcare Facilities		MODEL ESTIMATION		
INDEPENDENT VARIABLES	Coefficient	Z-Value	Probability	
<b>Severity of Disease</b>				
Moderate	0.403	2.99	0.003*	
Severe	1.498	7.33	0.000*	
<b>Number of Adults in Household</b>				
Number of Adults	-0.187	-3.26	0.001*	
<b>Number of Children Below 15 in Household</b>				
Number of Children Below 15	-0.0153	-0.22	0.829	
<b>Health Problem Complaints</b>				
Ear Nose Throat	0.421	1.73	0.084	
Abdomen and Stomach	-0.167	-0.72	0.473	
Diarrhea Vomiting Fatigue	0.489	1.66	0.097	
Psychologic Disorders	1.356	1.65	0.099	
Kidney Disorder	2.037	2.55	0.011*	
Eye Diseases	0.939	1.81	0.070	
Tooth Diseases	1.060	2.65	0.008*	
Headache	-0.634	-3.11	0.002*	
Heart Diseases	1.833	2.80	0.005*	
Lung Disease	1.416	1.25	0.213	
Skin Diseases	1.303	2.70	0.007*	
Waist Neck Leg Diseases	0.500	1.89	0.058	
Fracture Dislocation	2.292	3.87	0.000*	
Gynaecology	1.330	2.04	0.041	
<b>Household Head's Gender</b>				
Female	-0.002	-0.01	0.994	
<b>Household Head's Age</b>				
Age	0.003	0.45	0.652	
<b>Household Head's Education Status</b>				
Primary Education	3.115	3.73	0.000*	
High School	3.290	3.90	0.000*	
University	3.320	3.89	0.000*	

**IV Parameters**

Applying to Healthcare Facility (0,971)

Not Applying to Healthcare Facility (1)

Log likelihood: -1205.61

Wald chi2(35): 166.09

Prob > chi2: 0.0000

**Reference Categories:** Compared to those who do not apply to healthcare facility; the ones with mild disease, the ones whose sickness is cold-fever, illiterate male household heads.

\*p<.05

Source: Own Survey

Positive or negative coefficients which are statistically significant at the determined significance level (5%) increase or decrease the probability of application to healthcare facilities (Based on reference category).



Due to the structure of the model used, choice of ‘not applying to healthcare facility (no-care)’ was determined as reference choice. The results of the model are interpreted on the basis of this reference choice. According to estimation results, there is an increase in the probability of applying to healthcare facility as the severity of disease increases in the upper level of the model compared to not applying to healthcare facility. According to this result which is similar to the results obtained by Qian (2010), Ichoku and Leibbrandt (2003) and Guda (2007) in their studies, it can be said that perception towards severity of the disease plays a significant role in decision of applying to healthcare facility.

Number of adults in the household affects the probability of demanding healthcare service significantly and negatively. This result, which is compatible with the result in the study of Sarma (2009) indicates that the probability of demanding healthcare service decreases as the number adults in the household increases.

When health problem complaints are taken into consideration, while kidney disease, skin diseases, tooth diseases, heart diseases, waist-neck-leg complaints, fracture-dislocation and gynaecology complaints increase the probability of demanding healthcare services compared to cold complaint; headache complaint decreases the probability of demanding healthcare services.

It is seen that there is statistically significant and positive relationship between the education level of the household head and the probability of applying to healthcare facility. Having primary, high school and university level education increases the probability of applying to healthcare facility compared to being ‘illiterate’. Estimation results support current literature and indicate that education level increases probability of demanding healthcare service (i.e.see: Muriithi 2013; Cisse 2006; Lindelow 2003).

According to the results of the model, it is seen that number of children in the household, the age and gender of household head and ear-nose-throat, abdomen-stomach, diarrhea-vomiting-fatigue, psychological diseases, eye and lung disease complaints do not have significant impact on choice of applying to healthcare facility.

**Table 4: Estimation Results of Lower Level Model**

<b>DEPENDENT VARIABLE: Healthcare Facility Choice</b>		<b>MODEL ESTIMATION</b>		
<b>INDEPENDENT VARIABLES</b>	<b>Coefficient</b>	<b>Z-Value</b>	<b>Probability</b>	
<b>Public Healthcare Facilities</b>				
Gender	0.220	1.59	0.111	
Age	-0.019	-2.93	0.003*	
Primary Education	-2.712	-3.37	0.001*	
High School	-2.996	-3.63	0.000*	
University	-3.253	-3.52	0.000*	
Consumption (Log)	-0.000	-0.01	0.991	
<b>Private Healthcare Facilities</b>				
Gender	0.155	0.57	0.566	
Age	-0.012	-0.80	0.424	
Primary Education	-2.830	-3.00	0.003*	
High School	-2.766	-2.98	0.003*	
University	-2.616	-1.84	0.065	
Consumption (Log)	-0.202	-0.38	0.704	

**Log likelihood:** -1205.61    **Wald chi2(35):** 166.09    **Prob > chi2:** 0.0000

**Reference Categories:** Compared to those who do not apply to healthcare facility; illiterate and male patients compared to the ones who do not apply to healthcare facility.

\*p<.05

Source: Own Survey

Positive or negative coefficients which are statistically significant at the determined significance level (5%) increase or decrease the likelihood of preference of healthcare facilities. (Based on reference category).

As in the upper level of the model, reference choice in the lower level is determined as ‘not applying to healthcare facility (no-care)’. Estimation results of the model are made on the basis of reference choice. According the estimation results, the age of the individual is statistically significant and negative in the choice of applying to public healthcare facility. This result indicates that the demand for public healthcare facility decreases as the age of the individual increases. This result can be interpreted as that public healthcare facilities are mostly chosen for child healthcare.

The impact of individual’s education level is found statistically significant and negative in choice of applying both healthcare facilities compared to not applying to healthcare facility. Being primary education, high school and university graduate decreases the probability of demanding healthcare services from both public and healthcare facilities compared to being ‘illiterate’. In the study of Kermani et al. (2008), which is compatible with this study, increasing education level decreases the probability of applying to therapeutic healthcare services.

In the model results, it is seen that gender and consumption factors have no significant impact on the choice of applying to public healthcare facilities and gender, age and consumption factors have no significant impact on the choice of applying to private healthcare facilities.

## CONCLUSION

This study investigates the demand for healthcare services due to a health problem in Kayseri province with cross-sectional data. With this purpose, nested logit model was estimated with full information maximum likelihood methods in accordance with the data set and the factors which affect the demand for healthcare services are identified. Among these factors, the positive relationship between the education level of the household head and applying to a healthcare facility indicates that the demand for healthcare services will increase as a result of development of healthcare knowledge and acting more consciously in terms of health. In addition, providing higher profit by increasing efficiency may increase the income level.

According to the results obtained, one of the factors which affect the probability of demanding healthcare services is severity of disease. An individual who thinks that the severity of the disease increases is more willing to demand healthcare services and the demand for healthcare services increases. It was concluded that the demand for healthcare services decreases as the number of adults in the household increases. This may be caused by dependent individuals in the household who are not productive or do not bring any income and therefore the decrease in the household income. It can be said that more effective implementation of social aid and support policies which increases economic accessibility for household to benefit from healthcare services easily in case of a health problem and developing such policies to enable participation of this dependent population in labour.

It can be said that complaints such as kidney disease, heart disease, skin diseases, fracture-dislocation and tooth diseases which increase the probability of demanding healthcare services are complaints which require getting services from a healthcare facility or a specialist physician. The reason why probability of demanding healthcare services decreases in case of complaints such as stomach ache and headache may be the fact that these diseases are not taken seriously and neglected or considered to be treated with self-treatment method. In order to make suggestions about healthcare services depending on complaints, it is necessary to take many factors into consideration such as severity, frequency, symptoms and intensity of the complaints. Thus, both the individual will recover with the appropriate treatment and it will be ensured that healthcare system is used more effectively and efficiently by preventing unnecessary use, overuse or underuse of the healthcare system.

By extending the sample size of this study, more effective generalizable policies can be made towards demand for healthcare services by evaluating other factors such as quality, price and income which could not

be addressed here. It is thought that the study, which is thought to contribute in the literature in terms of the method used, will encourage other researchers to conduct studies on this subject.

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