ORIGINAL ARTICLE

A STRUCTURAL EQUATION MODEL OF THE DETERMINANTS OF HEALTH CARE IN THE SURVEYED HOUSEHOLDS IN RURAL AREA OF DHARWAD DISTRICT, KARNATAKA STATE, INDIA

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ABSTRACT

Introduction: Health and health care need to be distinguished from each other for no better reason than that the former is often incorrectly seen as a direct function of the latter. Hence, the good health confers on a person or groups freedom from illness and the ability to realize one's potential. However, a few studies had shown that health care is associated with socio-economic, demographic and ecological factors which are diverse and interrelated. Therefore, the purpose of this study to examine the causal relationships among factors determining how much care people are willing to purchase.
Method: A systematic random sample of 1408 persons interviewed from 320 households, in which 453 persons were reported with health problems. Out of this, 235 persons were reported with medical health problems and 218 persons were reported with oral health problems during reference period of study. The data on different factors were collected through direct personal interview method. The causal relationships were established by structural equation modeling (SEM) method using SPSS and AMOS statistical software.

Results: The SEM fitted to the medical and oral health care data adequately. The results indicated that, the age of sick person, duration of illness episode (in days) and the total number of visits made to source of health care during the reference period had significant effect on medical health care expenditure ($p<0.05$). But, the duration of illness episode (in days), total number of visits made to source of health care during the reference period and distance of care from the residence of the household (in km) had significant effect on oral health care expenditure ($p<0.05$).

Conclusions: The duration of illness episode (in days) and the total number of visits made to source of health care during the reference period are the main contributors to both medical and oral health care expenditure in surveyed households in rural area of Dharwad district, Karnataka State, India. It is proposed that to increase in the demand for health care, efforts should be made to reduce the duration of illness, the distance traveled by the sick person or patient and also the number of visits to health care providers. It may lead to improved health status at lower expenditure.

Key Words: Structural Equation Model, Medical and Oral Health care, Sick person

INTRODUCTION

Medical and oral health care are fundamentally different from the usual commodities like, food clothes, or any other commodity, which purchased by an individual. In the consumption of medical and oral health cares are, for rationally to hold, the consumer must be ill and most individuals would prefer no to be. This simple fact has significant consequences for the economic analysis of health care. A large number of marketable commodities affect on health; are only consumed on the presumption that it has investment benefits in good health status.

Health care is critical investment for personality development in present society. National Health (Public) policy for health has been based on implicit assumptions of health care as a basic right to which people should not be denied access on grounds of inability to pay or other socio-economic and others reasons. However, the resources provided by the government to achieve better health status through the provision of high priority of primary health care services for the vast majority of the population have been insufficient. The continued trend of increases in the cost of health care as well as growth of population that all persons of the society deserve adequate health

care have spurred economists and other social scientists to study the health care including oral health care sector of the economy extensively. This study looks for to recognize which factors are influencing in determining how much care people are willing to procure. Few studies are found in literature relating to study the determinants of health care sources utilization[1-6]. Thus, the regression analysis is a popular methodology for determining the influences of factors on health care in many sciences including medical and oral health sciences. The strength of regression analysis is the ability to capture direct effects or multiple relationships simultaneously, while providing a simple and fast estimation results. Some times the indirectly factors play a significant role on health care. Hence, the regression analysis is not an appropriate method to determine the indirect effects of factors. Hence, in this article used the applications of Path Analysis or Structural Equation Modeling (SEM). SEM as a statistical technique has increased in popularity since it was first conceived by Wright[7-8]; a biometrician who developed the path analysis method to analyze genetic theory in biology. SEM enjoyed a renaissance in the early 1970s, particularly in sociology and econometrics[9] and later spread to other disciplines, such as psychology, political science, and education[10]. It was believed that the growth and popularity of SEM was attributed to a large part to the advancement of software development that have made SEM readily accessible to substantive researchers who have found this method to be well-suited to addressing a variety of research questions[11]. Some examples of such software include LISREL (LInear Structural RELations), EQS, AMOS (Analysis of Moment Structures) and MPlus. Therefore, the main purpose of this study was to use SEM to develop a model that offers a plausible explanation for direct and indirect relationships of factors on health care expenditure separately for medical and oral health care expenditure.

MATERIALS AND METHODS

Subjects

The study was conducted to determine the factors influential in determining the demand for medical and oral health care in the surveyed households in rural area of Dharwad district, Karnataka State, India. The Dharwad district is situated in northern part of Karnataka state, India. It included four taluka places according 2001 population census namely Dharwad, Navalgund, Kundgol and Kalghatagi taluka. A total of 16 villages were selected randomly (random number method) from four taluka places (4 villages selected from each taluka place). Later, systematic random samples of 80 households were selected in each taluka place (20 from each village). Finally a total of 1408 rural area persons interviewed from 320 households, in which 453 persons were reported with health problems. Out of this, 235 persons were reported medical health problems and 218 persons were reported oral health problems during reference period of study. Before collection of data, the author was explained about the study and taken the consent from the head of the family. Further the data on different factors were collected through personal interview method. The interview was conducted with head of the household or knowledgeable person in the family, who could be able to respond. The study is based on lay reporting of the illness and not on a clinical examination.

Demand for Health Care

The demand for health care (medical and oral health care separately) depends on the existence and perception of physiological needs of the individual along with willingness to meet the felt needs and ability to secure health care[6]. In demand for health care, the physiological need is measured by the age of the sick person (in years) (X1). The perception need is measured by one variable i.e. duration of illness episode (in days) (X2). The willingness to meet felt need by securing health care is reflected by five variables relating to no of visits, distance of care from the residence, education of sick person, family size and family monthly income. Education is measured by one variable i.e. education of the sick person (X5). A visit made to source of care is measured by total number of visits made to source of health care during the reference period (X3). Proximity of health care services is measured by distance of care from the residence of the household (in km) (X4). Family size is measured through the total number of living persons in the household (X6). Finally, ability to secure health care is represented by one economic variable measured through only household's monthly income (X7).

Total expenditure on health care (medical health cares expenditure (Y1), oral health cares expenditure (Y2)) influenced by explanatory variables and expenditure includes expenditure incurred during the reference period only, on all components of direct expenditure i.e. Doctors fees, Medicines, Test charges, Hospital fees and indirect expenditure i.e. Transportation on accompanying persons etc.

Selection of variables

Taking into consideration the data available for the analysis, the expenditure on medical (Y1) and oral health care (Y2) is taken as two different response variables and seven factors were taken as explanatory variables. Among 7 explanatory variables, four variables have been chosen as intermediate variables (direct effective) namely age of the sick person (X1), the duration of illness episode (in days) (X2), the total number of visits made to source of health care during the reference period (X3) and the distance of care from the residence of the household (in km) (X4). The three variables were taken as a indirect effective variables of health care i.e. the education of the sick person (X5), the total number of living persons in the household (X6) and the household monthly income (X7). The numerical data were obtained for all these variables with sufficient care and response rate have been

observed more than 97% in all households, it leads to quality of analysis.

Statistical analysis

The correlation matrix was generated using Pearson's 'r' to determine the relationships between and among explanatory variables with medical health care expenditure and oral health care expenditure. The presence of explanatory variables with very strong relationships with response variable prevents an SEM solution. Statistical analysis was performed using SPSS for Windows Version16.0 (SPSS; Chicago, IL, USA)[12]. Further analysis on SEM was performed using Analysis of Moment Structure Version 5.1 (AMOS: ADC, Chicago, IL, USA)[13]. The main focus was on testing hypotheses about relationships among the variables in the structural model. The criteria for assessing the structural model are the same as the measurement model using standardized regression estimates (B). Evaluation of structural model involves use of fit indices[14-16]. The chi-square statistic provides a test of the null hypothesis, ensuring that the theoretical model fits the data. If p-values are more than 0.05 indicate a good fit. A root mean square error of approximation (RMSEA) value close to 0.06, and adjusted goodness-of-fit index (AGFI) and comparative fit index (CFI) values close to 0.9 indicate acceptable fit of the model. The AMOS also allows the use of modification indices to improve the model fit by drawing a correlation function between the identified variables[17-18]. All the hypothesized paths in the conceptual model (Figure 1 and Figure 2) were tested and included in the structural model.

RESULTS

The relationships between explanatory variables and predictor variable i.e. medical health care expenditure are shown in Table 1. It clears that, the age of sick person, the duration of illness, the number of care visits, the distance of care from the residence, education of sick person and household's monthly income were significantly and positively correlated with medical health care expenditure ($p<0.05$). However, the relationship of number of members living in a family (family size) with medical health care expenditure was found to be negative and statistically significant ($p<0.05$). The significant relationships among explanatory variables were also estimated (Table 1).

Correspondingly, the correlations between explanatory variables and oral health care expenditure are shown in Table 2. It clears that, the age of sick person, duration of illness, number of care visits, education of sick person and family monthly income were significantly and positively correlated with oral health care expenditure ($p<0.05$). But, the relationship of distance of care from the residence and number of members living in a family (family size) with oral health care expenditure was found to be negative and statistically significant ($p<0.05$). The significant relationships among explanatory variables were also estimated (Table 2).

THE STRUCTURAL MODEL

Medical Health care expenditure

Similarly, a path diagram of the structural model of factors that influence medical health care expenditure is shown (Figure 1). All paths that were significant or not significant are shown in the diagram. The RMSEA was 0.049, AGFI 0.76, and CFI 0.88, all of which indicated an acceptable fit. The chi-square value for the structural model was 13.1401, $p=0.1564$, with degrees of freedom of 9 ($p>0.05$). Therefore, the SEM model of factors that influence medical health care expenditure was significant. This model was better fit to medical health care expenditure.

Table 1: Correlation coefficients among explanatory variables and medical health care expenditure

Variable	X1	X2	X3	X4	X5	X6	X7
Y1	0.2261*	0.8872*	0.6582*	0.2821*	0.6553*	-0.5829*	0.4444*
X2	0.2973*	1.0000					
X3	0.6412*	0.5937*	1.0000				
X4	0.1170	0.2870*	0.1829*	1.0000			
X5	0.4927*	0.5737*	0.8143*	-0.0838	1.0000		
X6	-0.1155	-0.5067*	-0.6601*	0.1954*	-0.5631*	1.0000	
X7	0.5139*	0.3873*	0.8709*	0.0429	0.7651*	-0.7033*	1.0000

*$p<0.05$

The direct effect of age of the sick person (in years) duration of illness episode (in days) and total number of visits made to source of health care during the reference period on medical health care expenditure was found to statistically significant. It means that, the impact or influence of these variables on medical health care expenditure of sick person is statistically significant ($p<0.05$). At the same time as, the direct effect or influence of education of the sick person on total number of visits made to source of health care during the reference period and distance of care from the residence of the household (in km); total number of living persons in the household on duration of illness episode (in days) and total number of visits made to source of health care during the reference period; household's monthly income on total number of visits

made to source of health care during the reference period and distance of care from the residence of the household (in km); education of the sick person and household's monthly income on duration of illness episode (in days) are found to statistically significant ($p<0.05$).

Oral Health care expenditure

A path diagram of the structural model of factors that influence oral health care expenditure is shown (Figure 2). All paths that were significant or not significant are shown in the diagram. The RMSEA was 0.056, AGFI 0.78, and CFI 0.824, all of which indicated an acceptable fit. The chi-square value for the structural model was 16.5494, $p=0.0562$, with degrees of freedom of 9 ($p>0.05$). Therefore, the SEM model of factors that influence oral health care expenditure was significant. This model was not better fit as compared to SEM model of medical health care expenditure.

The direct effect of duration of illness episode (in days), total number of visits made to source of health care during the reference period and distance of care from the residence of the household (in km) on oral health care expenditure was found to statistically significant. It means that, the impact or influence of these variables on oral health care expenditure of sick person is statistically significant ($p<0.05$). Whereas, the direct effect or influence of education of the sick person on number of visits made to source of health care during the reference period; total number of living persons in the household on duration of illness episode (in days) and number of visits made to source of health care during the reference period; household's monthly income on age of the sick person (in years) and distance of care from the residence of the household (in km); education of the sick person and household's monthly income on duration of illness episode (in days) are found to statistically significant ($p<0.05$).

Table 2: Correlation coefficients among explanatory variables and oral health care expenditure

Variable	X1	X2	X3	X4	X5	X6	X7
Y1	0.3810*	0.7194*	0.6081*	-0.1384*	0.7489*	-0.6994*	0.4625*
X2	0.2331*	-					
X3	0.5473*	0.2534*	-				
X4	0.0814	-0.1747*	0.2869*	-			
X5	0.1861*	0.3522*	0.7005*	0.0276	-		
X6	-0.2878	-0.3726*	-0.7233*	-0.0344	-0.6999*	-	
X7	0.4280*	-0.0015	0.8083*	0.3096*	0.6852*	-0.6856*	-

*$p<0.05$

DISCUSSIONS AND CONCLUSIONS

Over a period of time, some factors contributing to health care among different populations are well established. An understanding of these factors is essential for planners and policy-makers when designing and implementing intervention and preventive programs. Structural equation modeling was chosen; because of it identifies causal or underlying relationships among hypothesized constructs, rather than simple associations among explanatory variables with response variable. It is a painstaking approach to determining the systematic and statistical significance of the covariance between each construct and outcome in a path diagram (Figure 1 and Figure 2). The path diagram also shows the sequence of constructs and distinguishes collinearlity between the predictors, supporting the causal confirmation. The variables such as age of sick person, duration of illness, number of care visits, education of sick person and family monthly income have significant and positive relationship with oral health care expenditure. Also the age of sick person, duration of illness, number of care visits, distance of care from the residence, education of sick person and family monthly income have significant and positive relationship with medical health care expenditure.

This study has recognized three determinants as the predictors of medical health care expenditure of sick persons are: age of the sick person, the duration of illness episode (in days) and the total number of visits made to source of health care during the reference period. Similarly, the three determinants as the predictors of oral health care expenditure of sick persons observed are: the duration of illness episode (in days), the total number of visits made to source of health care during the reference period and the distance of care from the residence of the household (in km). This indicates, the duration of illness episode (in days) and the total number of visits made to source of health care during the reference period are the main contributors to both Medical and oral health care expenditure in surveyed households in rural area of Dharwad district, Karnataka State, India.

It concluded from this study is that the available health care facilities are not able to meet the expectations of the people; hence people have to travel long distances to get the desired health care in the region. It is also evident from the study that the duration of illness is important enough in explaining expenditure on health care and due to this more number of visits are required. Therefore, it is proposed that to increase in the demand for health care, efforts should be made to reduce the duration of illness, the distance traveled by the sick

person or patient and also the number of visits to health care providers. All these efforts may be possible through delivery of better quality services, increased out-rich of services and effective oral health education. It may lead to improved health status including both Medical and oral health at lower expenditure.

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