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Demand for Indigenous Systems of Healthcare in India: Multinomial Logit Estimation of the AYUSH Treatment and Medicine

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Abstract: Though allopathic treatments and medicines are widespread and often sought in India, the indigenous non-allopathic systems of medicine are also extensively practised and sought for treatment, at least commonly for non-curable ill health. The increasing healthcare costs of the modern corporate type of hospitals and the less expensiveness of local herbal medicines drive the use of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy) hospitals for treatments of chronic diseases, acute illness episodes, maternity health care and catastrophic health expenditure. Within the AYUSH healthcare system, there are state-wise differentials in the use of AYUSH systems of medicine. This paper analyses the demand for the AYUSH healthcare system in India using the 68th round (2011-2012) of NSSO data for the four southern states of India, applying the multinomial logit method to estimate the number of visits to the AYUSH hospitals by household members. The estimated results show that the relative probability of choosing the AYUSH treatment and the number of visits to AYUSH hospitals is influenced significantly by the cost of medical expenditure, wealth/income/landholding, household size and composition and region. The occupation, household headship and community of the household have no significant effect on the use of AYUSH hospital healthcare in southern India.

Keywords: Healthcare, medical expenditure, indigenous medicine, AYUSH treatment, hospital visits, multinomial logit

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Introduction

India is the second largest populated country with millions of people having multiple health issues and seeking proper healthcare. At the same time, India has also a vast variety of healthcare systems, generally classified as the allopathic/western/English system of medicine and the non-allopathic/traditional/indigenous/ Indian system

of medicine. While the modern healthcare system is a curative form, the indigenous system of healthcare is largely preventive healthcare since the Indian system is said to have a holistic approach. Within the non-allopathic Indian system, the AYUSH system of medicines consists of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy. The Indian system of medicine is of great antiquity with a vast reservoir of natural flora and fauna and ancient texts and knowledge from great sages or yogis for a healthy living valued with a long and unique cultural history, It also amalgamates the best of influences that came in from contact with other civilisations, be it Greece (resulting in Unani medicine) or Germany (Homoeopathy) or Indian scriptures/sages which gives the science of Ayurveda, Siddha, Yoga and Naturopathy.

The AYUSH system of medicine has certain advantages. Primarily, the AYUSH which is based mostly on indigenous herbal plants, unlike the chemical-based allopathic drugs, is safe, has no side-effects, is non-toxic, cost-effective, and does not produce lifestyle disorders. As an indigenous system of medicine with natural forms, it has more of a holistic approach to the body for the cure and stimulates the self-healing capacity of the body. The preventive aspect of AYUSH consists of personal hygiene, regular, daily and seasonal regimes, appropriate social behaviour, and use of rejuvenating materials/food and drugs. The AYUSH treatment also prevents certain psychosomatic disorders/diseases and improves individual resistance and ability to endure stressful situations. Moreover, AYUSH treatment is a cost-effective drugless and non-invasive therapy. The ultimate goal of this system is to create a balance between man and his environment.

The Indian systems of medicine play an important role in achieving the national health goal of reducing maternal mortality rate and infant mortality rate, malnutrition and anaemia. The AYUSH system of medicine has been preferred by people for various kinds of acute illness and repeating episodes of it, such as cough, cold, fever, gastritis, arthritis, asthma, migraine, injury, heart disease, diabetes and hypertension, and in managing the non-communicable diseases. Also, women use the AYUSH system for maternity healthcare. Different empirical studies have found that a significant proportion of India's population adopts the various non-allopathic systems of medicine (NSSO, 1992). People who use non-allopathic medicines find it more effective in the long run and they rarely report having any negative reactions or side effects (Chandrasekhara et al. 2002).

Given the importance of the AYUSH system of medicine and its widespread practice in India, a dedicated Ministry of AYUSH was set up in 2014 with the objective of promoting the ancient AYUSH medical systems through cost-effective AYUSH services, strengthening educational systems, facilitating the enforcement of quality control of Ayurveda, Siddha, Unani and Homoeopathy (ASU&H) drugs and

sustainable availability of ASU&H raw materials. Over the years, AYUSH dispensaries have increased at a rate of 0.8% per annum, the AYUSH sector is growing at 20% from year to year, and India is the second largest exporter of AYUSH and herbal products.

In India, the AYUSH system of treatment has been followed since time immemorial, particularly in southern India. The ayurvedic treatment is more prevalent in the southern states of Kerala and Karnataka, Unani is popular in Andhra Pradesh, Karnataka and Tamil Nadu, Homoeopathy is widely practised in Kerala, Andhra Pradesh and Tamil Nadu, and the Siddha system is more acquainted in the southern part of India, especially in Tamil Nadu and the practice of Yoga is gaining more acceptance all over India. Tamil Nadu is dominated by Siddha hospitals due to the historical nature of the Siddha system of medicine developed by Siddhars in Tamil Nadu.

Despite the vast growth and availability of modern allopathic medicines in both public and private healthcare industry, for many in many places in India, the Indian systems of medicine continue to be the only kind of medicine whining the physical and financial reach of the patient. Therefore, it is important to understand the factors that determine the use of the AYUSH healthcare system in India. Therefore, the main objectives of this paper are to understand the trends and patterns of household use of AYUSH healthcare and to identify the determinants of the choice of AYUSH hospital healthcare by households in India. Using the 2011-2012 68th round NSSO data on household consumption expenditure and the use of AYUSH hospitals by households and applying the multinomial logit method, this paper estimates the number of visits to AYUSH hospitals. The empirical estimates reveal that the relative probabilities of the choice of AYUSH treatment and the number of visits to AYUSH hospitals are influenced significantly by the cost of medical expenditure, wealth/income/landholding, household size, household composition and region, while occupation, headship and community of the household have no significant effect on the utilisation of AYUSH hospital healthcare in India.

Data and Methodology

The AYUSH healthcare utilisation pattern is examined for all of India using the household consumption expenditure data and the AYUSH hospitals visits by households are analysed for four southern states – Andhra Pradesh, Karnataka, Kerala and Tamil Nadu – where the AYUSH system of medicines is widely practised with large number of AYUSH hospitals and beds. The NSSO 68th round data consists of 22,095 household observations from the four states, out of which 6847 households use the AYUSH system of medicine. The medical expenses include both institutional and non-institutional medical expenses. Empirically the multinomial logistic regression has

been used to model the use of AYUSH healthcare by the households as the choice of AYUSH healthcare as well as the number of visits to AYUSH hospitals for treatment is a categorical variable. The number of visits is also unordered because the data pertains to the household level data and the number of visits to AYUSH hospital is reported for the whole household and not for individual household members.

The dependent variable is the decision or choice on the number of visits to AYUSH hospital. It is taken as how often the members of the household visit an AYUSH hospital for treatment in the past 30 days. The data on visits to AYUSH hospital includes nil visits to more than three visits. The independent variables included in the paper are medical expenditure, which includes institutional and non-institutional medical expenditure for 30 days. The non-institutional medical expenditure is the expenditure made as an outpatient and is taken as an indicator for households with acute illness episodes. The institutional medical expenditure is the expenditure incurred as an inpatient and is taken as an indicator of catastrophic health expenditure and maternal health expenditure. The land possessed by the household is taken as an indicator of the income/wealth status of the household as well as the utilisation pattern of AYUSH by households.

As household size increases people may tend to use AYUSH healthcare than other forms as the indigenous system of medicine is cost-effective. However, the number of visits to AYUSH hospitals may differ based on household size. The difference in AYUSH hospital visits between rural and urban households is captured by the region variable. People in urban areas use more of AYUSH healthcare as they have a holistic approach, but rural people also use AYUSH healthcare because of the easy availability and culture. The other independent variables considered are the type of occupation, household type, gender of household head, age composition of the household, social group, and state and religious dummies. Table 1 presents the definition, measurement and justification for inclusion of the variables in this study.

Table 1: Description of Variables

Variable	*Definition*	*Measurement*	*Justification*
No. of visits to AYUSH hospital	Number of visits to AYUSH hospital by members of a household	No visit, once, twice or thrice and more than thrice dummies	Dependent variable
Ln(Medexp)	Total medical expenditure (institutional and non-institutional)	Logarithm of total medical expenditure (institutional and non-institutional)	A measure for acute illness episodes in the household

Variable	*Definition*	*Measurement*	*Justification*
HHSize	Number of members in the family	Number of persons in the household	As the family size increases, households may prefer to use AYUSH as it is less expensive
Land	Land possessed by the household	Land possessed by the household (hectares)	A measure of wealth and income
Region	Urban and rural area	Rural = 1, Urban = 0	Urban and rural differences in visits to AYUSH hospital
State	Karnataka, Andhra Pradesh, Kerala and Tamil Nadu	State dummies	Prevalence of AYUSH medication
Religion	Hindu, Islam, Christian and Others	Religion dummies	Religious influence of AYUSH due to tradition
Social group	Scheduled Tribe, Schedule Castes and Others	Social group dummies	AYUSH medication use varies across social groups. AYUSH is common among ST households
Occupation	Self-employed, Wage/salaried, Casual labour and Others	Occupation dummies	AYUSH medication Differentials by occupation and affordability
Household members in age groups	Child (0-14), Young (15-30), Adult (31-60), Elder (60+ years)	Age group dummies	Effect of demographic factors in choosing the number of visits to AYUSH hospital
Male head of household	Head of the household	If household head is male=1, 0 otherwise	Decision on the visit AYUSH hospital depends on the gender of the head

Multinomial Logistic Regression Method

A logistic regression model is specified as:

$$y_i + \beta_0 + \beta_1 x_i + u_i \quad (1)$$

where y_i is the dependent categorical/choice variable and x_i is a set of explanatory variables. When y_i ranges over a limited category, say J choices, the probabilities for the j choices are given by:

$$\Pr(y_i = j) = e^{\beta_j x} / (1 + \Sigma e^{\beta_j x}) \quad (2)$$

For the multinomial logistic regression model, the linear component is equated to the log of odds of j^{th} outcome compared to the J^{th} outcome. That is, considering the j^{th} category to be omitted or the baseline category, the logits of the first J-1 categories are constructed with the baseline category in the denominator as:

$$\log\left[\frac{\pi_{ij}}{\pi_{iJ}}\right] = \log\left[\frac{\pi_{ij}}{1+\Sigma_{j=1}^{J-1}\pi_{ij}}\right] = \Sigma_{k=0}^{K}\beta_{jk}x_{ik} \qquad i=1,....,N;\ j=1,...J-1 \tag{3}$$

Solving for π_{ij} gives:

$$\pi_{ij} = \frac{e^{\Sigma_{k=0}^{K}\beta_{jk}x_{ik}}}{1+\Sigma_{j=1}^{J-1}\Sigma_{k=0}^{K}\beta_{jk}x_{ik}} \qquad j<J \tag{4}$$

$$\pi_{iJ} = \frac{1}{1+\Sigma_{j=1}^{J-1}e^{\Sigma_{k=0}^{K}\beta_{jk}x_{ik}}} \tag{5}$$

The dependent variables follow a multinomial distribution with J categories. Thus, the joint probability density function is given by:

$$f(y\,|\,\beta) = \prod_{i=1}^{N}\left[\frac{n_i!}{\Pi_{j=1}^{J}}\Pi_{j=1}^{J}\pi_{ij}^{y_{ij}}\right] \tag{6}$$

The likelihood function expresses the unknown values of β in terms of known fixed constant values for y. To maximise equation (6) with respect to β the factorial terms that do not contain any of the π_{ij} terms can be treated as constants. The log-likelihood function for the multinomial logistic regression model can be written as:

$$L(\beta) = \Sigma_{i=1}^{N}\Sigma_{j=1}^{J-1}(y_{ij}\Sigma_{k=1}^{K}\beta_{jk}x_{ik}) - n_i\log\left(\frac{1}{1+\Sigma_{j=1}^{J-1}e^{\Sigma_{k=0}^{K}\beta_{jk}x_{ik}}}\right) \tag{7}$$

By maximising equation (7), the estimates of β are obtained. The estimated results are to be interpreted as the relative risk ratio since the estimates are e^{β} rather than β.

Empirical Analysis

Table 2 presents the utilisation pattern of the AYUSH system of healthcare in the four southern states of India. It can be observed that nearly one-third of households (6848 of 22095 or 31%) used AYUSH healthcare in the last 30 days of the NSSO survey. Out of these observations, the medical expenditure is available for 5606 observations. About 81.86% of these households used the AYUSH treatment, but nearly 68.16% of the households who have used the AYUSH system of healthcare have not visited the AYUSH hospitals. Nearly 16.2% of households have visited the AYUSH hospital once, 11.33% two to three times, and 4.32% more than thrice visited the AYUSH hospitals.

Table 2: AYUSH Healthcare Utilisation

State	*AYUSH use*	*No. of visits to AYUSH hospital*				
		Nil	*Once*	*2-3 times*	*>3 times*	*Total*
Andhra Pradesh	2207 (31.99)	1594 (88.46)	123 (6.83)	61 (3.39)	24 (1.33)	1802 (81.65)
Karnataka	815 (19.91)	477 (66.16)	111 (15.40)	95 (13.18)	38 (5.27)	244 (51.15)
Kerala	1566 (35.12)	374 (9.79)	542 (38.71)	391 (27.93)	93 (6.64)	1400 (89.40)
Tamil Nadu	2260 (34.02)	1376 (81.76)	132 (7.84)	88 (5.23)	87 (5.17)	307 (22.31)
Total	6848 (30.99)	3821 (68.16)	908 (16.20)	635 (11.33)	242 (4.32)	5606 (81.86)

Note: Percentage figures in parentheses.

From Table 3, it is observed that the mean medical expenditure of those households who have used AYUSH healthcare has been Rs. 950 and its log value is 5.864. The households who have used AYUSH, but have not visited the AYUSH hospitals have incurred a mean medical expenditure of Rs. 788. The mean medical expenditure of households who visited the AYUSH hospital once has been Rs.1298 and for those who visited more than thrice has been Rs. 1459.

Table 3: Summary Statistics of AYUSH Medical Expenditure

Variable	*AYUSH use*	*No. of visits to AYUSH hospital*			
		Nil	*Once*	*2-3 times*	*>3 times*
Medical expenditure (Rs.)	950.22 (4362.81)	788.31 (4594.25)	1298.05 (3350.91)	1233.16 (2258.71)	1459.12 (6037.90)
ln(Medical expenditure)	5.864 (1.294)	5.702 (1.239)	6.208 (1.356)	6.208 (1.318)	6.234 (1.332)
N	5606	3821	908	635	242

Note: standard deviations in parentheses.

Table 4 presents the multinomial logistic regression estimates. In general, the results reveal that the cost of medical expenditure, wealth/income/landholding, household size and composition and region are the significant determinants of household visits to the AYUSH hospitals. The occupation of the household, household head and even community of the household has no significant effect on the use of AYUSH hospitals. The log of medical expenditure, the presence of an adult member in the family, and households residing in Karnataka and Kerala have a statistically significant positive effect, while the presence of a child and young member in the family and

households in rural areas have a significant negative effect on the visit to the AYUSH hospital once compared to no visits. For one percentage increase in the log of medical expenditure, the relative probability of a visit to AYUSH hospital once is 14% higher compared to no visit. The presence of adult persons in households increases the relative probability of visits to AYUSH hospitals by 33%. The relative probability of choosing to visit AYUSH hospital once rather than no visit is 3 times and 16 times higher for households in Karnataka and Kerala respectively compared to households in Andhra Pradesh. The relative probability of visiting an AYUSH hospital once is 18% lower for rural households compared to urban households and the presence of a child and young members in the family reduce the choice of visiting an AYUSH hospital by 16% and 19% respectively compared to the presence of elderly in the family.

Table 4: MNL Regression Estimates of Number of Visits to AYUSH Hospital

Variable	*Visited once vs no visit*		*Visited twice or thrice vs no visit*		*Visited more than thrice vs no visit*	
	Coefficient	*z-value*	*Coefficient*	*z-value*	*Coefficient*	*z-value*
ln(Medexp)	1.142* (0.038)	4.01	1.145* (0.043)	3.61	1.236* (0.067)	3.91
Land	0.999 (0.0003)	0.71	0.999** (0.0005)	1.97	0.999** (0.0003)	2.08
HHSize	1.035 (0.028)	1.26	1.003 (0.032)	0.09	1.077*** (0.047)	1.71
Male head	1.044 (0.119)	0.38	1.009 (0.128)	0.07	1.106 (0.212)	0.51
Child	0.846*** (0.085)	1.68	0.978 (0.113)	0.19	0.850 (0.140)	0.98
Young	0.815** (0.078)	2.11	0.808** (0.088)	1.97	0.685** (0.106)	2.43
Adult	1.339** (0.201)	1.98	1.212 (0.202)	1.16	1.745** (0.482)	2.02
Rural	0.827** (0.074)	2.11	0.739* (0.075)	2.96	0.923 (0.134)	0.55
Karnataka	3.001* (0.431)	7.65	5.41* (0.947)	9.65	5.328* (1.435)	6.21
Kerala	16.70* (2.075)	22.65	24.70* (3.901)	20.31	13.09* (3.247)	10.37
Tamil Nadu	1.166 (0.154)	1.16	1.536** (0.264)	2.49	3.886* (0.915)	5.76
Self employed	0.920 (0.146)	0.52	0.923 (0.161)	0.45	0.986 (0.256)	0.05
Wage/ salaried	1.072 (0.173)	0.43	0.895 (0.160)	0.62	0.849 (0.227)	0.61

Variable	*Visited once vs no visit*		*Visited twice or thrice vs no visit*		*Visited more than thrice vs no visit*	
	Coefficient	*z-value*	*Coefficient*	*z-value*	*Coefficient*	*z-value*
Casual labour	0.835 (0.144)	1.04	0.775 (0.147)	1.34	0.849 (0.237)	0.58
Hindu	0.854 (0.144)	1.05	0.907 (0.149)	0.59	0.936 (0226)	0.27
Muslim	0.828 (0.146)	1.06	0.769 (0.152)	1.32	0.883 (0259)	0.42
Other religion	3.082 (2.756)	1.26	6.307** (5.115)	2.27	0.0004 (0.003)	0.02
ST	0.613 (0.201)	1.49	0.303** (0.160)	2.26	0.728 (0.383)	0.60
SC	0.815 (0.119)	1.39	0.839 (0.141)	1.03	0.785 (0.184)	1.03
Constant	0.041* (0.013)	10.26	0.027* (0.009)	10.22	0.003* (0.001)	10.43
Log-likelihood	-4375.477					
LR Chi-square	1771.23					
Prob.>Chi-square	0.000					
N0. Of observations	5606					

Note: Standard deviations in parentheses. Coefficient estimates are relative risk ratios. *, **, *** Significant at 1, 5, 10% levels.

In the case of households visiting more than once the AYUSH hospitals, the log of medical expenditure, households in Karnataka, Kerala and Tamil Nadu and households belonging to non-major religions have a positive relative probability ratio, while the presence of a young member in the family, the household in the rural sector and household belonging to schedule tribe have a negative probability of visiting AYUSH hospital twice or thrice compared to no visits. The relative probability of choosing to visit AYUSH hospital twice or thrice rather than no visits is 14% higher, for a 1% increase in medical expenditure, 53% higher for a household in Tamil Nadu compared to households in Andhra Pradesh. The relative probability of choosing to visit AYUSH hospital twice or thrice rather than no visits is 5 times and 24 times higher for households in Karnataka and Kerala respectively compared to households in Andhra Pradesh. The relative probability of choosing to visit AYUSH hospital twice or thrice rather than no visits is 6 times higher for households belonging to non-major religions compared to Christian households.

The relative probability of choosing to visit AYUSH hospital twice or thrice rather than no visits is lower by 27% for rural households compared to urban households, 70% for scheduled tribe households compared to households belonging to other social

groups, and the presence of a young member in the family reduces the choice of visiting an AYUSH hospital by 20% compared to the presence of an elderly member in the family.

The log of medical expenditure, household size, households from Karnataka, Kerala and Tamil Nadu, male-headed families and the presence of an adult in the family has a positive effect while the presence of a young member in the family and land-possessed have negative effects on visiting AYUSH hospitals more than three visits compared to no visits. The relative probability of choosing to visit AYUSH hospital more than three visits rather than no visits is 23% higher for a percentage increase in medical expenditure, and 7% higher for an increase in the household size. The relative probability of choosing to visit AYUSH hospital more than thrice rather than no visits is as high as 5 times, 13 times and 3 times for households in Karnataka, Kerala and Tamil Nadu respectively compared to households in Andhra Pradesh. The male-headed households have a 10% higher probability of visiting AYUSH hospitals more than three times compared to a female-headed household and the presence of an adult member in the family increases the probability of three times visit AYUSH hospital by 74% compared to the presence of an elderly member in the family.

Conclusion

The Indian systems of medicine continue to attract patronage from the Indian population, even though there has been a tremendous increase in the Western healthcare style hospitals and the widespread demand for allopathic care. Indigenous medicine and its practices have been largely described as preventive non-allopathic healthcare and applied for chronic and non-curable illnesses. This non-allopathic medicinal system is common for acute illness episodes and also for maternity health care and catastrophic health expenditure. The increasing medical expenditure through corporate western allopathic health systems drives the households to choose the local systems of healthcare which are less expensive and easily available in their locality. Recognising the significance of the traditional healing system, the Government of India has established a dedicated ministry, the Ministry of AYUSH, to promote the ancient healthcare systems of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy. Many state governments have also established AYUSH hospitals. The AYUSH system of healthcare is more prevalent in southern India, particularly among religious, regional and traditional households. The AYUSH medicines are largely produced from herbs and minerals by indigenous methods and have fewer side effects. To a significant extent, there is a global market for AYUSH products and the Indian exports of AYUSH medicines are steadily expanding.

Given the large-scale prevalence and practice of AYUSH healthcare in India, this paper attempts to study the trends and patterns of AYUSH hospitals and the determinants of household demand for AYUSH healthcare. In order to assess the use of the AYUSH healthcare system, this paper analyses the number of visits to AYUSH hospitals by household members. This paper uses the 68th round (2011-2012) of NSSO data on the use of AYUSH hospitals by households for the four southern states of India - Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. Empirically, the multinomial logit method is used to estimate the number of visits to AYUSH hospitals. The trends and patterns in AYUSH hospitals show that with the advent of the AYUSH hospitals, people gradually increased their usage of the AYUSH system of healthcare. Within the AYUSH healthcare system, there are state-wise differentials in the use of Ayurveda, Unani, Siddha and Homoeopathy systems of medicines. The Yoga system is widely practised.

The estimated results show that the choice of visits to AYUSH hospitals is influenced by the cost of medical expenditure, wealth/income/landholding, household size and composition and region. From the empirical results, it is also observed that urban households use more AYUSH medicines and use AYUSH hospitals more compared to rural households, which may be due to the easy access to these hospitals in cities. The relative probability of choosing to visit AYUSH hospitals by scheduled tribe households is low. The presence of elderly members in the family has a positive effect on visiting AYUSH hospital compared to the presence of young members in the family, implying that older people prefer AYUSH treatment for their healthcare. The occupation, headship and community of the household have no significant effect on the use of AYUSH hospitals.

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