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Demand for Medical Care in Urban Areas of Iran: An Empirical Investigation

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Abstract

The purpose of this paper is to empirically investigate the factors affecting demand for medical care in Iran the population for this study relates to the Medical Care Insurance Organization of Iran. For the sake of conducting the analysis a sample of 4260 individuals are chosen using a fuzzy sampling procedure.

The data was then analyzed using a multinomial logit model. The results show that price has had a negative sign and has been inelastic in all different choices for medical care (four different choices were assumed for each individual and their families). Income, health characteristics of the families and wealth proxies have expected signs though some with insignificant elasticities. The results are then used to assess the policy implications for the organization.

Keyword: Demand for health, Medical Care demand, Health economics in Iran, Fuzzy Sampling, Multinomial Logit Model, Household Demand for Medical Care, Iran's Medical Care Demand.

1- Introduction

Iran has a mix of public and private health care systems. The major providers of public health are The Ministry of Public Health and Care, Social Security

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Organization and National Health Insurance Organization. They operate clinics, hospitals, health centers and health posts in rural areas all over the country. The National Health Insurance Organization itself covers about 40 percent of the population of which the majority are rural peasants and farmers (about 20 million). Subscribers are assigned to four different funds in this particular organization. The Funds are known as: Government Employees Fund, Rural Fund, Especial Group Fund and the Self-employed Fund. Based on the premium charged to members and other sources of revenue, the organization has been facing losses during the past few years and this has made policy-makers re-evaluate their policies toward some more potentially revenue generating reforms.

The organization offers different options for delivering medical care to its members. Each member in the organization has to pay a premium for coverage. People usually have the option of referral to providers who have a contract with the Organization, in which case no additional costs are paid by the member except a minimal fee for visit or out-patient surgery. The other option is to seek medical care from non-contracted providers. In this case only a small portion will be paid by the organization.

With this very brief introduction of the health care system in Iran, the present paper deals with the determinants of demand for medical care related to members in two of the Health Insurance Organization's Funds (Government Employee Fund and Especial Group Fund). The magnitude and effect of each of the factors, especially those related to user fees or prices will provide an insight to the types of actions the organization may wish to follow for cost recovery and further prevention of losses.

The paper is organized in four parts. In the first part a brief discussion of the theoretical and empirical expectation of the demand for medical care and the factors affecting it will be discussed. The second part is devoted to data and variable specification. The third part covers model structure and finally empirical results are presented in part four followed by a brief conclusion.

2- Literature review

Throughout the world, the health sector is in trouble. Policies are usually ill-defined, systems are highly centralized and expenditures tend to be biased toward curative care rather than preventive care. For example, hospitals are built in urban areas, while rural areas lack basic health care clinics. Governmental budgetary support for health is faltering and in some cases actually declining in real terms, as countries struggle to exercise fiscal restraint in the face of poor economic performance and burgeoning debt. Government's promises for rapid improvement in health conditions continue to be made and these call for substantial increase in spending.

Tightened budgets have forced many developing countries to make painful choices regarding the financing and provision of their major social services. Governments as well as public insurance institutions in developing countries have begun to reevaluate the policy of providing uniform and heavy subsidies from the public purse, and have been considering the introduction of user fees so that consumers pay a larger share of the cost.

To cope with problems in the health sector and to suggest policies that may help the financing of the health care system without creating burdens on low-income groups, researchers have been investigating the determinants of health care demand and spending in developed countries (e.g. Di Matteo and Di Matteo 1998, Hitiris and Posnett 1992, Milne and Molana 1991, Kenkel 1990, Wideg 1988, Parkin, McGuire and Yule 1987, Manning et al. 1987, Wagstaff 1986, Colle and Grossman 1978, Newhouse 1977). These studies have identified qualitatively and quantitatively different problems and policy issues in those countries. It seems that the major policy problems in high-income countries are in the pillars of rising costs of medical care provision and the possible overuse of physician services and quality of care.

However, in low-income countries, the core problems relate to the access to facilities, the capturing of true demand patterns, demand creation and in general, how to ensure that basic health care services are used. These problems are coupled with a lack of funds to finance the health care system due to adverse macroeconomic conditions (Abel-Smith 1986). Consequently, a significant amount of research has also been devoted to the investigation of the determinants of the demand for medical care in developing countries (Akin, Guilky and Denton 1995, Sauerborn, Nougtara and Latimer 1994,

Gertler, Locay and Sanderson 1987, Dor, Gertler and Van der Gaag 1987, Akin et al. 1986, Musgrave 1983).

What most of these studies have shown is the fact that the behavior in medical markets is basically determined by the roles that physical need and life-cycle patterns play in peoples' lives. Circumstances such as accidents, pregnancies, and infections, often dominate health care consumption decisions. Many medical needs are age and sex specific, such as immunizations early in life, pregnancy care during fertile years for women, and the onset of degenerative diseases late in life.

The studies have also had a considerable amount of success finding a negative correlation between medical service use and the so-called "barriers to utilization". These barriers include such items as physical distance from households to facilities, cultural distance between patients and providers, the unavailability of drugs, the length of time spent waiting at facilities, and the unavailability of transportation.

Among different factors affecting the demand for medical care, economic factors such as user fees or prices play a very important role. But as will be discussed shortly, there have been circumstances that user fees (prices in this paper) have played a minor role contrary to our expectation. In general, the proponents of user fees implicitly assume that people are able and willing to pay for health care (Griffin 1989, and De Ferranti 1985). They argue that demand for health care is inelastic, so that the introduction of user fees would not lead to a significant decrease in utilization. But opponents point to studies that have found demand to be elastic, at least for the lowest income and age classes. They assert that charging for health care would push the most vulnerable segments of the population, i.e. the young and the poor, out of the professional health care sector. Their main concern is: "will user fees worsen existing social inequities in access to health care?"

But which of these views seem to be more relevant in practice? Both points of view find support in the literature. Some studies have reported inelastic demand, in the countries such as the Philippines (Akin et al. 1986), Malaysia (Heller 1982), Peru (Russel and Zschok 1986), and Rwanda (Shepard and Benjamin 1988); others have found demand to be elastic in Indonesia (Chernichovsky and Meesook 1986), the Ivory Coast (Gertler and Van Der Gaag 1990), Zaire (De Bethune, Alfani and Lahaye 1989), Ghana

(Waddington and Enyimayew 1989), and Swaziland (Yoder 1989). More recent work suggests that the overall elasticity estimates do not tell the whole story. For the Ivory Coast, Gertler and Van der Gaag estimated the arc elasticities of demand by income quartiles separately for children and adults. For adults, the elasticities varied between –0.38 for the highest income quartile and –1.83 for the lowest income quartile. For children the respective elasticities were -0.31 and –2.82. These results suggest that user fees can worsen pre-existing inequities in access to health care even when overall elasticity estimates are in the inelastic range.

The studies suggest that the potential of user fees for cost recovery differs and depend on the structure of the country under investigation. Researchers have proven that in most of the cases the demand is in the inelastic range with different magnitude of elasticities. The price elasticity would enable policy-makers to decide whether it is a useful means of increasing revenue for the system. This study is thus directed toward identifying factors affecting demand for medical care by mode of treatment in urban areas of Iran. The following sections are devoted to introducing empirical model, data and the results obtained in the study.

3- Empirical Model

My paper builds on the studies done by Gertler and Van der Gaag (1990). However, their studies are about demand for medical care in rural areas where the sample frames consist entirely of farm households, with very limited choice in health facilities. Price structure, opportunity cost and user fees structure in their studies are completely different with present studies. They basically used the department's median clinic and hospital fee paid by individuals in their sample as the monetary price.

My study focuses on the demand for medical care in urban areas where about 50 percent of the population is wage earners. Urban patients face a wider choice for health facilities than those living in rural areas. In Iran, there has been considerable cost recovery by user fees at both public and private health facilities (about 55%). Thus, the study focuses on general population's health of the biggest health insurance organization in Iran.

I developed a demand model under the assumption that sick individuals face a choice among self-treatment and several professional treatments. The

model is formulated as follows. Individual consumer i experiences an accident, illness or other medical problems. The individual must decide whether to obtain medical care, where to obtain it and what quantity of services to consume. The decision is made in order to maximize utility.

For the ith individual faced with J+1choice, suppose the utility of choices j is:

$$u_{ij} = \beta' x_{ij} + \xi_{ij}$$

If the consumer makes choice j, then U_{ij} must have been the maximum among the J+1 utility. Hence, the statistical model is driven by the probability that choice j is made, which is

Prob $[U_{ij} > U_{ik}]$ for all other k # j

The model is made operational by choosing a distribution for the disturbances. Let Y_i be a random variable indicating a choice made. It takes one of the value 0, 1, 2,... J. McFadden (1973) has shown that if and only if the J+1 disturbance are independent and identically distributed with the type I extreme value distribution:

$$F(\xi_{ij}) = \exp(-e^{-\xi_{ij}})$$

Then,

$$\text{prob} = (y_i = j) = \frac{e^{\beta' x_i}}{\sum_{j=0}^{j} e^{\beta' x_i}} \forall \quad j = 0,1,2,\ldots, j$$

If we assume that $X_{ij} = [Z_{ij}, W_i]$, then utility depends on Z_{ij}, the attributes of the choice j for individual i, and W_i, the characteristics of individual i. The attributes of the choice j, Z_{ij}, vary with choice and individual, while the individual characteristics W_i are the same for all choices and vary only across individuals. This leads to what Green (1993) calls the mixed model (a combination of the conditional Logit model and multinomial Logit model) or what Maddala (1983, P.44) calls a general model. A convenient normalization that solves the problem is to assume that $\beta_0 = 0$. Therefore, the probabilities are

$$\text{prob}(y_i = j) = \frac{e^{\beta_j' x_i}}{1 + \sum_{k=1}^{j} e^{\beta_k' x_i}}$$

$$\text{prob}(y = 0) = \frac{1}{1 + \sum_{k=1}^{j} e^{\beta_k' x_i}}$$

The model implies that we can compute J log-odds ratios by

$$\text{Ln} = \left(\frac{P_{ij}}{P_{i0}}\right) = \beta_j' x_i$$

We could normalize on any other probability as well and obtain

$$\text{Ln} = \left(\frac{P_{ij}}{P_{ik}}\right) = x_i'(\beta_i - \beta_K)$$

From the point of view of estimation, it is useful that the odds ratio, P_j/P_k, does not depend on the other choices, which follows from the independence of disturbances in the original model. From a behavioral viewpoint, this fact is not very attractive.

Estimation of the multinomial logit model is straightforward. Newton's method will normally find a solution very readily unless the data is badly conditioned. The log-likelihood can be derived by defining for each individual, $d_{ij} = 1$ if alternative j is chosen by individual i, and 0 if not, for the J+1 possible outcomes. Then for each I one and only one of the d_{ij}'s is 1. The log-likelihood is a generalization of that for the binomial probity or logit model:

$$\text{LnL} = \sum_{i=1}^{n} \sum_{j=1}^{j} d_{ij} \text{Ln prob}(y_i = j)$$

The derivatives have the characteristically simple form

$$\forall_j = 1,2,\ldots,j \quad \frac{\sigma \text{LnL}}{\sigma \beta_J} = \sum_{i=1}^{n} [d_{ij} - P_{ij}] x_i$$

So we can form J equations which could be solved to get β's. The marginal effects of the characteristics on the probabilities are

$$\sigma_j = \frac{\sigma P_i}{\sigma x_i} = P_j[\beta_j - \sum_{k=0}^{j} P_k \beta_k] = P_j[\beta_i - \beta]$$

Therefore, every sub vector of β enters every marginal effect, both through the probabilities and through the weighted average that appears in .... J. These values can be computed from the parameter estimates.

4- The Data

The data used in this study are drawn from a household survey which was conducted for the purpose of this particular project. The survey was conducted with the help of organization and a door-to-door method was used to complete questionnaires in 12 different cities all over the country. To get the sample in each city the following method was adopted: Provinces were first clustered in four different groups based on some socio-economic attributes. The cities related to each group of provinces were listed and based on the health related attributes were divided into three sub-groups. With 12 different clusters of cities a random sampling was used to pick a city from each group. The variable used for clustering provinces and cities include: income, health expenditures, number of physicians, education level and the number of hospitalized patients.

As mentioned earlier the population covered in this study relates to members of two of the National Health Insurance Organizations (NHIO) namely Government Employee Fund and Especial Group Fund. The share of the sample for each group of provinces was calculated using the following formula:

$N_{ij} = (P_{ij}/S_i)*n_i$

Where:

N_{ij}= Share of sample in the i_{th} group from the j_{th} Fund.

P_{ij}= Total population of j_{th} group provinces with respect to each Fund.

S_i= Total number of members in the i_{th} Fund in the country.

N_i= Total number of the sample in each group of provinces.

Table 1 shows the share of the sample in each of the four groups of provinces. Once the four groups were identified, the cities within each group were also classified into three distinct groups based on family size and population in each city. Thus, all cities in the country were classified in 12 different clusters (4 groups and three clusters within each group) and one city from each cluster was chosen randomly for the purpose of surveying. Following the procedure mentioned earlier, the share of the sample for each city and for each Fund was also calculated. Table 2 shows the name and share of each city selected for the purpose of sampling.

The survey collected information on family background, financial, economic, health, nutrition and other resources available to households. It contains information on gender, age, education, job status, number of children, home ownership, number of bedrooms and square meters of their living spaces, car ownership, health indicators such as clean water and sewage, bath and basic health requirements. Other information in the survey includes medical care expenditure, type of providers used for the services, expenditures on medicine prescriptions, radiology and other lab works, waiting time for receiving medical services and access time, etc.

Detailed information on quantity, type and expenditures for health care used was also obtained from all household members who reported an illness or injury during the four weeks prior to the interview for office and clinic visits, and 12 months prior to interview for in-patient services at hospitals or clinics. The arguments of the demand functions are health attributes, the cost of obtaining medical care, and individual and family characteristics that may affect the type of medical care they choose. Other variables that may influence the consumption of medical care include age, the number of sick days or hospital days, working status, car and home ownership, air conditioning, clean water, washing machine, complementary insurance, etc.

In general, the estimation of a discrete choice model requires information about provider characteristics, such as price, travel time, and waiting time for each individual and treatment option, regardless of the choice actually made. The definition and measurement of price in the health care market pose difficult theoretical and empirical problems. Problems arise because health care services vary in quality and thus their individual prices are not comparable.

Two main schools of thoughts regarding the appropriate price can be found in the empirical literature on health care demand. Researchers such as Akin et al. (1985) conducted health facility surveys and used the provider-reported price of a visit for each type of health service. Such a price is fixed datum which is independent from patient characteristics.

Table (1): The Share of the Sample in Each Group

	Total Coverage by NHIO		Share of sample in each group	
	Gov. Empl. Fund	Especial Grp. Fund	Gov. Empl. Fund	Especial Grp. Fund
Group 1	2,582.832	339,114	1497	197
Group 2	873,770	221,395	506	128
Group 3	1,774,850	283,334	1011	164
Group 4	2,173,136	410,695	1259	238
Total	**7,374,588**	**1,254,538**	**4273**	**737**

Table (2): Total Sample in Different Cities

#	City	Gov. Empl. Sample	Especial Group Sample
1	Khoramshahr	315	41
2	Khalkhal	142	24
3	Esfahan	1040	137
4	Zanjan	161	41
5	Khoy	171	44
6	Kermanshah	173	48
7	Eghlid	190	31
8	Tehran	594	96
9	Shiraz	227	37
10	Bushehr	318	60
11	Gonbad-e-kavoos	347	66
12	Ghom	595	112
13	**Total**	**4275**	**728**

On the other hand, other researchers such as Gertler et al. (1987) and Gertler and Van der Gaag (1990) use self-reported prices from the household survey. Gertler et al. (1987) use the price as predicted price from an estimated hedonic price equation with individual and provider characteristics as independent variables. Gertler and Van der Gaag (1990) replace the missing prices with median expenditures based on the experience of other users. In this study the total cost of obtaining medical care is calculated as the sum of the monetary prices and opportunity costs. The monetary price is the sum of office visits and out-of-pocket expenses, cost of medicines, and traveling cost. The opportunity cost of time is the monetary value of the sum of round trip travel time and waiting time.

5- Empirical Results

This section is devoted to the results of the logistic regressions. As the literature indicates, the dependent variable in the demand for medical care can be formed in two different ways, either using medical expenditures for households and individuals or a 0-1 variable in the logistic regressions. In this study the second approach is used and a multinomial Logit model is estimated to get parameters of the demand model. Independent variables are divided into three different groups: demographic, economic and health related factors. Besides usual variables being used in the demand argument, some like car and home ownership are also used as the proxies for wealth in the demand function. Price variable was constructed based on the explanation given in the previous section.

Using the information in the survey collected, household demand for medical care was broken down into in-patient and out-patient care. Individuals are faced with four different options for office and out-patient visits. The choices are: seeing GPs and specialists having a contract with NHIO, seeing GPs and specialists with no contract with NHIO, hospitals and clinics with a contract with NHIO and hospitals and clinics with no contract. In-patient and hospitalization choices for the individuals are two fold: hospitals with and without contract with NHIO. The results of the coefficients and elasticities for different models are reported in Tables3 and 4 .

The estimated coefficients obtained for price and income with the application of maximum likelihood method were highly significant statistically (P <0.00001). Those for age, sex, wealth proxies, and health related variables were significant at 0.05 levels or better. The blank cells in the tables show insignificant variables and thus the coefficients and elasticities were not reported in the tables.

The findings emanating from an analysis of elasticities obtained in Table 3 and 4 are as follows:

Age: A person's age has a positive effect on the decision to seek care. In particular the elderly are much more likely to seek care in the presence of a health problem than are other age categories. The age variable was broken down into five groups known as: AGE1= 5-18, AGE2= 19-46, AGE3= 47-65, AGE4= 67 and up. Age variables in the model showed different elasticities and significance within each age group. In model, one AGE4 was more significant than other groups with the elasticity of 0.0268. AGE5 and AGE2 had higher elasticities compared with the other two age groups in model 2 with a magnitude of 0.0482 and 0.0328 respectively. AGE2 in model 3 showed a higher significance with 0.033 in elasticity and finally for the first age group a negative elasticity of –0.0397 was reported for model 4.

Education: The level of formal education of the person has a significant positive effect on the probability to seek care, suggesting that the more educated place a higher value on treatment. Education variable in the sample was classified into four groups: less than High-school Diploma, High-School Diploma, Bachelors Degree, and Post-Graduate studies. This variable showed an expected sign and significance in three of the models. The highest elasticity belongs to the groups Bachelor's degree with a magnitude of 0.0611 in the first model followed by 0.042 and 0.0339 in the second and third model.

Gender: Females appear to be more likely to seek care than males. This observation is confirmed in two of our models. The probability of seeking care for the first and third model is significant and the elasticities reported are 0.0909 and 0.424 respectively. It basically shows that female tendencies for seeking care with contract-based entities are more than males; therefore most of the treatment is provided through such care providers.

Table (3): Demand for Medical Care in Iran: Out-Patient Case

	Model 1	**Model 2**	**Model 3**	**Model 4**
	(elastcity)	(elastcity)	(elastcity)	(elastcity)
AGE	0.0268 AGE2	0.0328 AGE2,0.0482AGE5	0.0334 AGE2	0.0397 AGE1
BATH	-0.134	-0.2789	-0.0046	
BED	0.0104			(0.0661)
WASH.MACHINE	-0.179	-0.3191		
EDUC.	0.0611	0.0442	0.0324	
AIR CON.	-0.0122		-0.0324	-0.528
CENT. HEAT	-0.0669	-0.0913		
HOME	0.149			0.0296
JOB	-0.0997		-0.0037	
CAR	0.0993			
PRICE	-0.9684	-1.10	-1.12	-1.78
SEX	0.0909		0.0424	
TELEPHONE	0.0862		0.0177	0.0268
INCOME	0.6123	0.7285	0.5218	0.8426
COMP. INSUR			-0.0046	
DURATION OF STAY	0.0572	0.0439	0.0306	0.0417

Table (4): Demand for Medical Care in Iran: In-Patient Case

	Model 1
PRICE	-1.08
SEX	0.0575
INCOME	0.7231
EDUCATION	0.136
AIR CONDITIONING	-0.1088
BEDROOMS	0.0336
WASHING MACHINE	-0.0859
COMPL. INSURANCE	0.0538

Health Related Variables: Access to warm water, washing machine, central heating and air conditioning all have a negative impact on demand for medical care. These variables have also shown an expected sign in our study, though their significance level was 0.05 percent or less in some case. Variable Bath was significant in the first three models. Washing machine was significant in two of the models, Central Heating in two and air conditioning in three models. Clean water did not appear to be significant in any of the models. The elasticities reported were very low in most of the variables and they all had negative signs.

Work Status: People working in the informal sector are more likely to choose self-care and less likely to go to providers having a contract with NHIO. The results confirm the fact and show that those loosing their job and changing the job status will have a negative probability of using either of the services available to them. The negative elasticities are reported only for model 1 and 3 with a magnitude of –0.0997 and –0.0037 respectively.

Price: price is the variable with a significant importance from the policy-makers' points of view. There should exist a negative relationship between the probability of seeking medical care and the price. As explained earlier the price in this research is constructed as the sum of the out-of-pocket expenses, drug cost, opportunity cost of time and transportation cost to providers. Price elasticities in all models showed an expected sign and were in the range of (-0.968) to (-1.78). This finding has important implications for the cost recovery action of the organization. We can notice the price is in the inelastic range of the demand curve only for model 1. The rest are either close to unity or in the elastic range.

Income: The theoretical sign of income variable in health care demand function is positive, showing a higher probability of seeking care with increase in income. Our income elasticities are all positive and in the range of 0.6123–0.8426 in different models. The results show that seeking care among households is considered to be a necessary good.

Duration of illness: As expected, the duration of illness and health problems are positively related to the probability of seeking care. Generally in the presence of an illness, people tend to wait a few days before seeking care hoping that the problem will correct itself. The variable shows expected

sign and significance in all of our models with elasticities ranging from 0.0306 in model 3 to 0.0572 in model 1.

Other variables: Other variables such as home ownership, number of bedrooms, TV and telephone ownership did not turn out to be significant in any of our models so were dropped from the equations.

Demand for hospitalization and its results are presented in Table 4. Two options are available for households: either using those hospitals having a contract with NHIO or else private hospitals. The variables structure are very similar to our previous models except that the observations are only limited to those related to hospitalized patients in the survey. In terms of elasticities, the elasticity of AGE1 and the probability of using hospitals having a contract with NHIO is higher than other age groups. It is basically three percent higher than our base scenario. Those who carry complementary insurance in the survey have also shown a higher probability of hospitalization in the case of illness. Income elasticity is less than one showing it as a necessary good. Education, air conditioning and washing machine were all significant with very low elasticity. The price elasticity of demand is also reported to be around –1.08.

6- Conclusion

Models of choice of medical care were estimated using data from urban areas of Iran. The alternative providers included GPs and specialists having a contract with NHIO, those who do not, clinics and hospitals having a contract with NHIO and those who do not. The demand function is modeled based on a multinomial Logit function and was formulated for both out-patient and hospitalization demand. The models were estimated separately with different choices of treatment by individuals. The data set consisted of 5000 households which were surveyed during the year 2000 for the purpose of this research.

After a brief review of the literature and theoretical base of the demand for medical care, data and variables are introduced and models were estimated using a maximum likelihood approach.

Price had a negative effect and was significant in all models, though with different elasticities. Low and high age groups are much more likely to seek care in the presence of a health problem, perhaps because they are more

vulnerable to illness and have a weaker immune system compared to other age groups. The level of formal education has a positive effect on the probability to seek out-patient medical care, but for the hospitalization care shows no significance. Among adult and child out-patient demand, females appear to be more likely to seek care than males.

Income has a substantial effect on the demand for medical care. Patients from wealthy families seek more formal care and prefer private facilities. Work status has also some effect on the choices of medical facilities. If people get unemployed or change their job status, the probability of seeking self-care will increase.

The primary purpose in estimating the models of medical care for NHIO was to evaluate the effect of changing price and user fees for government medical care. The general impression is that the price elasticities are very close to unitary elasticity in two cases. For the out-patient case and in model 1 the price is inelastic; for model 2 and 3 close to unity and in model 4 it is elastic. The elasticities show that any increase in price would have negative consequences for the household and will create serious equity and access problems. It seems that out-of-pocket and user fees are good candidates for cost recovery and for preventing losses, but NHIO should also clearly think about the access and equity problems associated with any price increase.

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