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ORIGINAL ARTICLE

Out-of-pocket expenditures on traditional and Western medicine in Taiwan

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Abstract
Objectives Coexistence of traditional and modern medicine is common in Asian countries. This paper investigates out-of-pocket expenditures on traditional medicine, traditional medical service, and Western medicine by households in Taiwan.
Methods Using a national sample of 13,765 households, the three expenditure equations are estimated with a censored system procedure. Effects of socio-demographic variables are explored by calculating marginal effects on probabilities and levels of medical expenses.
Results Different types of medical expenditures are correlated. Households with higher income and more aging members use more traditional medicine than others, as do households in agricultural sector and in urban areas. In addition, households living in rural areas relative to those in the cities are more likely to use and also spend more on traditional service. Regional disparity of health care utilization is found.
Conclusions Higher income households spend more on traditional medicine, likely due to the fact that patients usually pay out-of-pocket for herbal materials needed in preparation of traditional medicine. To ensure equity in health care utilization, establishment of hospitals and clinics in rural areas should be considered.

Keywords Censored equation system · Traditional medicine · Western medicine · Taiwan

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Introduction

Since inception of the National Health Insurance program (NHI) in 1995, Taiwan has been recognized by the international public health community for its success in providing a universal medical care insurance and improving health of its citizens. The insurance benefits are comprehensive including in-patient and out-patient cares, dental service, traditional (Chinese) medical therapies, child delivery service, physical rehabilitation, home nursing care, preventive service, and chronic mental illness [Bureau of National Health Insurance Program (BNHI) 2010]. Currently, administrative costs are as low as 1.6 % of total medical expenses; and about 93 % of all health care facilities (18,000 health care providers) are contracted with the BNHI. In a pay-as-you-go system, the NHI is financed mainly by payroll-related premiums, 39 % of which is paid by the insured, 35 % by employers, and 26 % by the government.

Although the NHI has successfully alleviated financial barriers to medical service under a modest cost-sharing mechanism (Cheng 2003), medical service still comes with significant costs. A budget deficit occurred 3 years after implementation of the program, reaching NT$12.6 billion and accounting for 6.1 % of the gross domestic product by 2006. Balancing the NHI budget has therefore become a priority policy issue of the Health Department in Taiwan.

In response to mounting financial burden, the premium rate was adjusted from 4.25 to 5.17 % in April 2010. Other policy measures such as payment reforms and adjustment in copayments were also implemented. In addition to cost containment, reducing health inequality is an important objective of NHI (Chu et al. 2005). Inequality in health status and health service utilizations has been reported recently (Lee and Jones 2007; Lu et al. 2007).

In Taiwan, both modern (Western) and traditional medicines are available. Traditional medicine includes inpatient and out-patient clinical services and other supplemental services such as acupunctures. Differences in utilization between these two types of medical service have been found across socioeconomic groups. For instance, elderly people and people living in the southern area are more likely to rely on traditional medicine than other age groups and people living in other areas (Liao et al. 2008). The current NHI system does not cover many types of traditional service. Some have suggested to expand the NHI system to include a larger variety of the traditional services and medicine. However, whether to extend coverage of traditional medicine and service has remained a great debate. On one hand, accommodating more traditional service into the NHI can increase equity of healthcare service among socioeconomic groups. On the other hand, these additional services will also increase the financial burdens of the insured person who use primarily Western medicine.

Traditional medicine has expanded and gained popularity globally. It is used not only for primary health care in developing countries but also in developed countries where Western medicine is predominant. One important feature of the health care system in Taiwan is the coexistence of Western medicine and traditional medicine. Traditional medicine and services are the most popular forms of complementary or alternative medicine in Hong Kong and Singapore (Chan et al. 2003; Lim et al. 2005). In 2001, approximately 63 % of all qualified NHI beneficiaries in Taiwan used traditional medicine (Chen et al. 2007). In light of the high prevalence of traditional care usage in Taiwan, an investigation of the utilization of traditional medicine, traditional service, and Western medicine is both timely and important.

A growing number of studies have addressed topics on traditional medicine (Chan et al. 2003; Chi 1994; Chi et al. 1996; Ma 1999; Miltiades and Wu 2008; Shih et al. 2008; Yen et al. 2001). Most previous research featured descriptive analysis of the prevalence of traditional medicine utilization using small samples or selected groups such as the elderly or immigrants. In-depth, analyses of traditional medicine uses are rare with the exception of Yen et al. (2001), who employed hurdle count models to examine factors associated with the probability and level of traditional medicine utilization in Taiwan. Despite a growing body of literature on traditional medical uses, little is known about the association among uses of Western medicine, traditional medicine, and traditional service. To fill this knowledge gap, this paper investigates out-of-pocket expenses on these different types of medicine in Taiwan.

This paper contributes to the empirical literature of health care utilization in three ways. First, we study determinants of out-of-pocket expenditures on three types of health service—traditional medicine, traditional service, and Western medicine. Second, we investigate how socioeconomic characteristics and other factors affect both the probability of seeking medical service and the level of medical expenditures using a censored equation system estimation procedure. In contrast to existing studies, which focus on either Western or traditional health service (e.g., Chi et al. 1996; Yen et al. 2001), our estimates are statistically more efficient in that unobserved heterogeneity between different types of health service is accounted for. Third, this study addresses the extent to which utilizations of traditional medicine, traditional service, and Western medicine may differ by region, employment status, and income level.

Using a sample of 13,765 households drawn from the 2006 Survey of Family Income and Expenditures (SFIE) in Taiwan, human capital of the household head, household characteristics, and geographical factors are found to be significant determinants of medical expenditures. Households with higher income and larger, older households spend more on traditional medicine than other households. Education of the household head is negatively associated with the probability and expenditure level of traditional medicine. Households with a member employed in the agricultural sector are more likely to use traditional medicine and traditional service, and they also spend more on such cares. Households in rural areas are more likely to use and also spend more on traditional service; they are less likely to use and also spend less on Western medicine than households in urban areas.

Methods

Data

Data used in this study are drawn from the 2006 SFIE, the most recent wave available, conducted by the Directorate-General of Budget, Accounting and Statistics in Taiwan (DGBAS 2006). The SFIE is a nationally representative sample, and detailed sampling design can be found in the survey documentation (DGBAS 2006). Data collected in SFIE include income earned by family members from salaries and household expenses on different types of

medical service. In the 2006 SFIE, 13,776 households were interviewed. After excluding a few observations with missing values or otherwise incomplete data, a final sample of 13,765 households remained for analysis.

The dependent variables are household out-of-pocket expenditures on three different types of medical service: traditional medicine, traditional service, and Western medicine. The out-of-pocket expenditures of Western medicine include expenses on antiphlogistic medicine for colds and coughs, external use medicine ointment, antibiotics, and other patent medicine. Traditional service primarily includes out-of-pocket expenses on acupuncture and moxibustion service, and therapies for physical pain reduction. Traditional out-of-pocket medicine expenses cover primary expenses on Chinese angelica, ginseng, four things, four spirits, ten tonic soups, or other Chinese herbal compositions, while expenses on traditional service includes payments for Chinese-style prescriptions for physical therapy, bruises, and panic recovery. The sample means for these three types of expenses are NT$2,340 (about USD$72 as of December 2006), NT$310, and NT$1,670 per year, respectively. Among the "consuming" households, which constituted 88, 17 and 92 % of the sample respectively, the sample means are NT$2,670, NT$1,810 and NT$1,820 (Table 1).

Three categories of explanatory variables are used: characteristics of the household head, family characteristics, and regional or geographic factors. Characteristics of the household head include age and dummy variables indicating education level [no education, junior high school, and senior high school (reference = college degree or higher)], and primary occupation of the household head [agricultural, manufacturing, and service sector (reference = other)]. Several variables on household income, wealth, and family structure are also included. Household income and wealth are reflected by the per capita disposable income, numbers of cars owned (reflecting both mobility and assets), size of the house, and a dummy variable indicating home ownership. Finally, dummy variables indicating regions [south, east, and central (reference = north)] and urbanization [town and village (reference = city)] are included. The definitions and sample statistics of all variables are presented in Table 1.

Statistical analysis

Our sample includes households who do not spend on one or more of the three types of medicine (Table 1). Two approaches are commonly used in modeling the demand of medical service or healthcare utilization with such limited dependent variables. The first is the Tobit (or censored regression) model. The second approach falls into the category of sample selection (Heckman 1979) or double-hurdle (Jones 2000) model, in which one stochastic mechanism governs the selection process and a second process determines the level of the dependent variable. The sample selection approach is empirically appealing but model identification requires use of exclusion variables which do not exist in the cross-sectional data we use. Therefore, we follow the first approach while extending the conventional Tobit procedure in two important ways. First, since the Tobit estimates are inconsistent when the assumption of normally distributed or homoscedastic errors is violated (Arabmazar and Schmidt 1981, 1982), we apply the inverse hyperbolic sine (IHS) transformation (Burbidge et al. 1988) in the dependent variables and also parameterize the error standard deviations as functions of explanatory variables. We further improve on statistical efficiency of the Tobit model by estimating a trivariate equation system which captures interactions among medical expenditures.

For household t, we use a vector x_t to represent explanatory variables, a linear function to approximate each of the deterministic medical demand functions, and a random error u_{it} to capture the unobservables. Then, a system of equations for censored medical expenditures (y_{it}) can be specified as

$$\begin{aligned} T(y_{it}) &= x_t'\beta_i + u_{it} \quad \text{if} \quad x_t'\beta_i + u_{it} > 0 \\ &= 0 \qquad\quad \text{if} \quad x_t'\beta_i + u_{it} \le 0, \quad i = 1,2,3;\ t = 1,\ldots,T, \end{aligned} \tag{1}$$

where β_i are vectors of parameters and the error terms (u_{1t}, u_{2t}, u_{3t}) are distributed as trivariate normal with zero means, standard deviations $(\sigma_1, \sigma_2, \sigma_3)$, and correlations $(\rho_{21}, \rho_{31}, \rho_{32})$, and the dependent variables y_{it} are transformed by the IHS transformation (Burbidge et al. 1988):

$$\begin{aligned} T(y_{it}) &= \sinh^{-1}(\theta_i y_{it})/\theta_i \\ &= \log[\theta_i y_{it} + (\theta_i^2 y_{it}^2 + 1)^{1/2}]/\theta_i, \quad i = 1,2,3. \end{aligned} \tag{2}$$

The transformation is linear when the parameter θ_i approaches zero and behaves logarithmically for large values of the dependent variables y_{it} over a wide range of θ_i and, as such, is suitable for modeling variables with extreme values (Burbidge et al. 1988). Figure 1 shows the transformation for the values of y_{it} in the range of the skewness parameter θ_i uncovered in the current study. The figure shows that the transformed variable can vary notably depending on the value of θ_i, providing the flexibility needed for empirical application.

As in other transformations such as the Box-Cox transformation (Lankford and Wyckoff 1991), the IHS transformation is a variance-stabilizing transformation. But to further accommodate heteroscedasticity of error terms, each of the error standard deviations is parameterized as a

Table 1 Variable definitions and sample statistics ($n = 13{,}765$), Survey of Family Income and Expenditure (SFIE), Taiwan, 2006

Variable	Definition	Mean	SD
Dependent variables: household expenditures per year (NT$1,000)			
Traditional medicine	On traditional (Chinese) medicine	2.34	4.66
	Among consuming households (87.8 % of sample)	(2.67)	(4.88)
Traditional service	On traditional (Chinese) medical service	0.31	1.66
	Among consuming households (17.4 % of sample)	(1.81)	(3.63)
Western medicine	On Western (modern) medicine	1.67	3.55
	Among consuming households (91.9 % of sample)	(1.82)	(3.66)
Continuous explanatory variables			
Age	Age of household head (years)	49.0	14.2
House size	House size (ping; 1 ping = 3.305 m^2)	4.31	2.25
Income	Per capita household disposable income (NT$100,000)	2.90	1.94
Age ≤5	Number of household members age <6	0.17	0.48
Age 6–17	Number of household members age 6–17	0.57	0.90
Age 18–44	Number of household members age 18–44	1.28	1.02
Age 45–64	Number of household members age 45–64	0.90	0.84
Age ≥65	Number of household members age ≥65	0.46	0.71
Cars	Number of cars owned	0.70	0.68
Binary explanatory variables (yes = 1, no = 0)			
No educ.	Household head has no education	0.05	
Jr. high	Household head finished Jr. high school	0.35	
Sr. high	Household head finished Sr. high school	0.44	
College	Household head has college degree or higher (reference)	0.17	
Ag work	Household head does agricultural work (as primary job)	0.06	
Manufacture	Household head works in manufacturing	0.30	
Service	Household head works in service sector	0.22	
Others	Household head works in other sectors (reference)	0.42	
Home owner	Owns a house	0.87	
Town	Resides in a town area	0.15	
Village	Resides in a village area	0.03	
City	Resides in a city area (reference)	0.82	
Central	Resides in central Taiwan	0.21	
South	Resides in the southern part of Taiwan	0.32	
East	Resides in the eastern part of Taiwan	0.05	
North	Resides in the northern part of Taiwan (reference)	0.42	

Exchange rate was approximately NT$32.46 for 1 USD during December 2006

function of explanatory variables (vector w_t) with parameter γ_i :

$$\sigma_{it} = \exp(w_t'\gamma_i),\ i = 1, 2, 3. \tag{3}$$

The unknown parameters to estimate include the regression parameter vectors $(\beta_1, \beta_2, \beta_3)$, heteroscedasticity parameter vectors $(\gamma_1, \gamma_2, \gamma_3)$, the IHS (skewness) parameters $(\theta_1, \theta_2, \theta_3)$, and error correlation parameters $(\rho_{21}, \rho_{31}, \rho_{32})$. Apart from the heteroscedastic error specification (3), the censored system (1) amounts to the simultaneous-equation model of Amemiya (1974) which, when prices are constant as in the single cross section used in the current application, is identical to the utility-theoretic Kuhn-Tucker model of Wales and Woodland (1983) and Ransom (1987, p. 357). Amemiya (1974) provides a general methodology on estimation of a censored equation system. For a small (trivariate) system, the estimation procedure is much simplified, although the IHS transformation introduces an additional term, Jacobian of the transformation $(1 + \theta_i^2 y_{it}^2)^{-1/2}$ for each equation i, in the sample likelihood function. Details on the likelihood function are available upon request.

The trivariate Tobit model reduces to three single-equation Tobit models upon imposing parametric restrictions $\rho_{21} = \rho_{31} = \rho_{32} = 0$, and each of the Tobit equations approaches the untransformed Tobit when the IHS

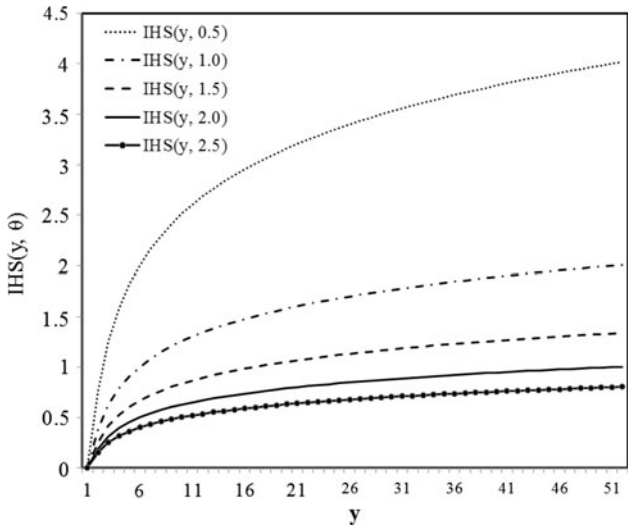

Fig. 1 The inverse hyperbolic sine transformation of expenditure (y) with parameter (θ)

parameter $\theta_i \to 0$. These nested hypotheses can be tested by conventional means such as likelihood-ratio test and Wald test.

Measuring the effects of the explanatory variables

The effects of continuous (binary) explanatory variables on each y_{it} can be explored by examining marginal (discrete) effects, obtained by differentiating (differencing) the probability of a positive observation

$$\Pr(y_{it} > 0) = \Phi(x_t'\beta_i/\sigma_i), \tag{4}$$

the unconditional mean

$$E(y_{it}) = \int_0^\infty y_{it}(1 + \theta_i^2 y_{it}^2)^{-1/2}\sigma_i^{-1}\phi\{[T(y_{it}) - x_t'\beta_i]/\sigma_{it}\}\, dy_{it}, \tag{5}$$

and the conditional mean.

$$E(y_{it}|y_{it} > 0) = E(y_{it})/\Pr(y_{it}|y_{it} > 0), \tag{6}$$

using (4) and (5), where $\phi(\cdot)$ is the probability density function and $\Phi(\cdot)$ is the cumulative distribution function of the unit normal. For statistical inference, standard errors of marginal effects are calculated by the δ-method (Rao 1973, p. 388).

Results

Besides the IHS transformation presented above, during preliminary analysis we also estimated the trivariate Tobit system using an alternative transformation on the dependent variables: the Box-Cox transformation [see Lankford and Wyckoff (1991) for an application of the Box-Cox transformation to single-equation Tobit]. Result of a nonnested specification test (Vuong 1989) suggests that the IHS Tobit system performs better than the Box-Cox alternative in fitting the data. Therefore, our empirical analysis is based on the former. Results of the Box-Cox model are available upon request from the authors.

Parameter estimates

Maximum-likelihood estimates of the IHS Tobit system are presented in Table 2. Estimates for all three IHS parameters (θ_i) are significantly different from zero at the 1 % level of significance, less than unity for traditional service and greater than unity for the other two expenditures. Over half of the variables are significant in the heteroscedasticity equations for traditional medicine and Western medicine, while significance is more scant for traditional service (four variables significant). Joint significance of these variables in the heteroscedasticity equations is further indicated by results of the Wald tests, with a p value <0.001 in all the three equations. Thus, homoscedasticity of the error terms is strongly rejected, suggesting that conventional, homoscedastic Tobit specification can lead to misleading (inconsistent) empirical estimates.

One unique feature of this study is to consider the interrelationship of the out-of-pocket expenditures of all three types of services. Such consideration is supported by significance (at the 1 % level) of the error correlations: 0.234 between traditional medicine and traditional service, 0.304 between traditional medicine and Western medicine, and 0.108 between traditional service and Western medicine. Wald test result further suggests that these error correlations are jointly significant at the 1 % level of significance, justifying estimation of the expenditure equations in a system, versus separate estimation, to improve statistical efficiency. These positive error correlations also suggest that unobservable factors affect the three expenditures in the same direction.

The empirical specification is justified by the significance of the explanatory variables. As shown in Table 2, all but two of the explanatory variables are significant at the 10 % level of significance or lower in the traditional medicine equation, and all but three variables significant in the Western medicine equation. Statistical significance is only slightly more scant in the traditional service equation, with over 70 % (or 16) of the explanatory variables significant. Household age composition variables are all positive and significant at the 1 % level of significance in all the equations (one exception). Income and its squared terms are significant at the 1 % level in all the equations, suggesting an increasing effect of age on each of the expenditures at a decreasing rate.

Table 2 Maximum-likelihood estimates of medical expenditure system: IHS transformed trivariate Tobit system with heteroscedastic errors, Taiwan, 2006

Variable	Traditional medicine		Traditional service		Western medicine	
	Expend. eq.	Het. eq.	Expend. eq.	Het. eq.	Expend. eq.	Het. eq.
Constant	0.000 (0.047)	–0.474*** (0.038)	–2.692*** (0.296)	0.323*** (0.093)	0.299*** (0.028)	–1.120*** (0.037)
Age/10	0.015** (0.006)	0.007 (0.005)	–0.112*** (0.041)	0.024* (0.014)	–0.002 (0.004)	0.022*** (0.005)
House size/10	0.009*** (0.003)	–0.007*** (0.002)	0.050*** (0.017)	–0.009 (0.006)	–0.005*** (0.002)	0.006** (0.003)
Income	0.106*** (0.011)	0.057*** (0.004)	0.070 (0.067)	0.105*** (0.012)	0.053*** (0.005)	0.028*** (0.003)
Age ≤5	0.137*** (0.014)	0.032** (0.014)	0.700*** (0.059)	–0.100*** (0.022)	0.064*** (0.008)	0.004 (0.012)
Age 6–17	0.089*** (0.008)	–0.006 (0.007)	0.158*** (0.045)	–0.004 (0.016)	0.045*** (0.005)	0.015** (0.006)
Age 18–44	0.111*** (0.008)	–0.023*** (0.007)	0.150*** (0.048)	–0.003 (0.016)	0.057*** (0.005)	–0.020*** (0.006)
Age 45–64	0.167*** (0.009)	–0.039*** (0.008)	–0.029 (0.057)	0.100*** (0.020)	0.070*** (0.005)	0.016** (0.008)
Age ≥65	0.184*** (0.011)	0.016* (0.010)	0.289*** (0.060)	0.013 (0.026)	0.098*** (0.007)	0.067*** (0.010)
Cars	0.018* (0.011)	–0.004 (0.010)	0.015 (0.068)	–0.003 (0.025)	–0.012* (0.007)	0.014 (0.009)
Income^2/1000	–0.077*** (0.010)		–0.518*** (0.108)		–0.026*** (0.004)	
No educ.	0.121*** (0.038)		0.195 (0.172)		0.007 (0.023)	
Jr. high	0.088*** (0.022)		0.368*** (0.099)		0.027** (0.013)	
Sr. high	0.054*** (0.019)		0.165* (0.086)		0.019* (0.011)	
Ag. work	0.061** (0.028)		0.303*** (0.111)		0.075*** (0.018)	
Manufacture	0.032** (0.016)		0.045 (0.066)		0.014 (0.009)	
Service	–0.002 (0.017)		0.032 (0.072)		0.022** (0.010)	
Home owner	0.161*** (0.019)		0.349*** (0.085)		0.036*** (0.011)	
Town	0.031* (0.019)		0.258*** (0.073)		–0.032*** (0.011)	
Village	–0.010 (0.039)		0.593*** (0.143)		–0.046** (0.023)	
Central	–0.061*** (0.018)		0.051 (0.074)		0.086*** (0.011)	
South	–0.181*** (0.015)		0.175*** (0.062)		–0.084*** (0.009)	
East	–0.564*** (0.031)		–0.882*** (0.160)		–0.107*** (0.018)	
θ_i (IHS parameter)	1.462*** (0.036)		0.572*** (0.035)		2.350*** (0.057)	
Error correlations (ρ_{ij})						
Traditional service	0.234*** (0.012)					
Western medicine	0.304*** (0.007)		0.108*** (0.013)			
Wald tests						
Het. ($df = 9$)		341.78		200.94		271.26
$\rho_{ij} = 0$ ($df = 3$)		2387.37				
$\theta_i = 0$ ($df = 3$)		4194.30				
Log likelihood	–57270.859					

Asymptotic standard errors are in parentheses

*** $p < 0.01$

** $p < 0.05$

* $p < 0.10$

Effects of explanatory variables

To further explore the roles of explanatory variables, we present marginal effects on the probabilities, conditional levels, and unconditional levels of expenditures [see Eqs. (4), (5), and (6)]. Results are exhibited in Table 3. Corroborating findings by Chan et al. (2007) and Yen et al. (2001), education of the household head is negatively associated with the probability and expenditure level of traditional medicine. For instance, compared to their college-educated counterparts, households headed by an individual who finished only junior high school are 1.99 and 4.34 % more likely to use traditional medicine and traditional service and, conditional on use, spend NT$282 and NT$160 more per year, respectively. Overall, the corresponding marginal effects on the unconditional levels are NT$305 and NT$99 more per year. A negative association between the education level of the household

head and Western medicine is found. Compared to households with a college-educated head, households headed by an individual with junior (senior) high school are 0.75 % (0.53 %) more likely to use Western medicine, and they also spend NT$98 (NT$68) more per year conditional on use.

Occupation of the household head also plays a significant role in medical expenses of the households. Compared to households the headed by an individual with one of the "other" job categories, households with a head working in the agricultural sector are 1.35, 3.70, and 1.89 % more likely to use traditional medicine, traditional service, and Western medicine, respectively. They also spend, on average NT$201, NT$137, and NT$296 more per year conditional on use, and NT$217, NT$87, and NT$314 more per year overall (unconditionally).

Household characteristics also affect medical expenditures. Households with higher income are generally more likely to use traditional medicine and Western medicine and also spend more than households with lower income. As household income increases by NT$100,000 per year, all else equal, the probabilities of using traditional and Western medicine increase by 0.18 and 0.56 %, respectively, and the amounts spent increase by NT$369 and NT$193 a year conditional on use, and by NT$340 and NT$190 overall. The positive and larger effects of income on traditional medicine than Western medicine may reflect the fact that some materials, such as herbal materials, needed in preparation of traditional medicine are not reimbursable under current health care system, which usually have to be paid for out-of-pocket (Liao et al. 2008). The positive association between income and traditional medicine expenses can be reinforced by the effects of household wealth. Compared with renters or those who otherwise do not own a house, households owning a house are 4.18 and 3.78 % more likely to use traditional medicine and traditional service; they also spend NT$462 and NT$140 more conditional on use and NT$504 and NT$80 more overall. Household composition variables have uniformly positive effects on all three types of service, which suggest the probabilities of uses and levels of expenditures increase as household size increases, regardless of age categories. For traditional medicine, the largest effects are seen in the numbers of children and the elderly. For instance, an additional household member age $\geq$65 leads to an increase of NT$665 on traditional medicine; this additional elderly member also spends on average NT$481 more per year on Western medicine.

On the effects of urbanization and regions, compared to households in urban areas, households residing in small towns and villages are 3.09 and 7.66 % more likely, respectively, to use traditional service, spend NT$114 and NT$286 more per year conditional on use, and NT$71 and NT$192 more per year overall. These results may reflect the disparity in the health care system in which major medical facilities are typically located in urban areas and not in small towns or villages. This finding may also reflect travel cost differences in accessing hospitals or clinics in urban and rural areas. Finally on regions, households residing in the central, south, and east regions are less likely to use traditional medicine and also spend less than those in the northern region. It is worth noting that the differences among urban, town, and villages and across regions may also reflect the effects of prices, which are not available in the current survey.

Discussion

This paper sheds light on the empirical literature of health care utilization by examining out-of-pocket expenditures by Taiwanese households on three types of medical expenditures—traditional medicine, traditional service, and Western medicine. Using data from the 2006 SFIE in Taiwan, we estimate an IHS transformed and heteroscedasticity corrected Tobit equation system by the method of maximum likelihood, which can ameliorate statistical inconsistency in the empirical estimates when the dependent variables are skews and error terms heteroscedastic. Several interesting results are found. First, expenditures on modern medicine, traditional medicine, and traditional service are correlated. In addition, human capital of the household head, household characteristics, geographical factors, household income, and wealth all play significant roles in determining out-of-pocket medical expenditures. These results are consistent with previous findings on the topic. Households with higher income and those with more elderly members spend more on traditional medicine.

Education level of the household head has negative effects on the probability and level of expenditure on traditional medicine. Occupation matters, with households from the agricultural sector using more traditional medicine than other households. Rural–urban differences also exist, with households in rural areas being more likely to use traditional service but less likely to use Western medicine than other households. This reflects either the geographical disparity of modern health care in Taiwan or the fact that hospitals in rural areas offer less upgraded service and have less modern technologies. This result may also reflect the possibility that residents in rural areas are of poorer health than those in urban areas. Lastly, households living in the eastern part of the island are less likely to seek, and also spend less on, all the three types of care. This may suggest unequal distribution of medical resources across regions.

Table 3 Marginal effects of explanatory variables on probabilities, conditional level, and unconditional level of medical expenditures, Taiwan, 2006

Variable	Traditional medicine			Traditional service			Western medicine		
	Probability	Cond. level	Uncond. level	Probability	Cond. level	Uncond. level	Probability	Cond.level	Uncond. level
Continuous explanatory variables									
Age/10	0.180 (0.193)	0.068*** (0.025)	0.066*** (0.024)	–0.710** (0.330)	0.039 (0.040)	–0.005 (0.010)	–0.445*** (0.152)	0.036** (0.016)	0.027* (0.016)
House size/10	0.350*** (0.089)	0.008 (0.011)	0.015 (0.011)	0.363*** (0.139)	–0.011 (0.018)	0.004 (0.004)	–0.260*** (0.079)	–0.007 (0.008)	–0.011 (0.008)
Income	0.183 (0.165)	0.369*** (0.024)	0.340*** (0.024)	–0.125 (0.331)	0.282*** (0.039)	0.045*** (0.009)	0.564*** (0.106)	0.193*** (0.014)	0.190*** (0.015)
Age ≤5	2.495*** (0.460)	0.530*** (0.060)	0.541*** (0.056)	5.643*** (0.564)	–0.066 (0.070)	0.080*** (0.018)	1.722*** (0.340)	0.238*** (0.034)	0.252*** (0.034)
Age 6–17	2.198*** (0.242)	0.261*** (0.030)	0.289*** (0.029)	1.712*** (0.353)	0.051 (0.048)	0.036*** (0.011)	1.010*** (0.191)	0.194*** (0.020)	0.199*** (0.020)
Age 18–44	3.080*** (0.246)	0.275*** (0.029)	0.323*** (0.028)	1.658*** (0.364)	0.053 (0.043)	0.035*** (0.010)	1.970*** (0.183)	0.167*** (0.020)	0.190*** (0.020)
Age 445–6	4.731*** (0.289)	0.405*** (0.034)	0.480*** (0.033)	2.079*** (0.426)	0.349*** (0.059)	0.092*** (0.014)	1.677*** (0.217)	0.284*** (0.023)	0.294*** (0.023)
Age ≥65	3.912*** (0.351)	0.629*** (0.045)	0.665*** (0.043)	3.647*** (0.510)	0.170** (0.078)	0.087*** (0.019)	1.541*** (0.285)	0.485*** (0.032)	0.481*** (0.031)
Cars	0.502 (0.357)	0.046 (0.043)	0.054 (0.041)	0.094 (0.537)	–0.005 (0.073)	0.001 (0.017)	–0.584** (0.269)	–0.015 (0.029)	–0.024 (0.028)
Binary explanatory variables									
No educ.	2.534*** (0.696)	0.416*** (0.140)	0.448*** (0.149)	2.332 (2.137)	0.086 (0.079)	0.054 (0.051)	0.184 (0.625)	0.024 (0.083)	0.026 (0.088)
Jr. high	1.989***(0.475)	0.282*** (0.071)	0.305*** (0.077)	4.341*** (1.195)	0.160*** (0.044)	0.099*** (0.028)	0.750** (0.360)	0.098** (0.049)	0.105** (0.052)
Sr. high	1.246*** (0.426)	0.171*** (0.059)	0.185*** (0.064)	1.906* (0.997)	0.070* (0.037)	0.043* (0.022)	0.527* (0.312)	0.068* (0.040)	0.072* (0.043)
Ag. work	1.353** (0.586)	0.201** (0.096)	0.217** (0.103)	3.695*** (1.423)	0.137** (0.053)	0.087** (0.035)	1.888*** (0.396)	0.296*** (0.077)	0.314*** (0.081)
Manufacture	0.733** (0.356)	0.101** (0.050)	0.110** (0.055)	0.522 (0.770)	0.019 (0.028)	0.012 (0.017)	0.385 (0.262)	0.050 (0.035)	0.053 (0.037)
Service	–0.051 (0.387)	–0.007 (0.052)	–0.007 (0.057)	0.372 (0.832)	0.014 (0.031)	0.008 (0.019)	0.614** (0.271)	0.082** (0.037)	0.087** (0.040)
Home owner	4.182*** (0.551)	0.462*** (0.050)	0.504*** (0.055)	3.781*** (0.859)	0.140*** (0.033)	0.080*** (0.018)	1.071*** (0.344)	0.126*** (0.037)	0.135*** (0.040)
Town	0.706* (0.415)	0.099 (0.061)	0.107 (0.066)	3.088*** (0.899)	0.114*** (0.034)	0.071*** (0.022)	–0.932*** (0.347)	–0.111*** (0.039)	–0.119*** (0.041)
Village	–0.231 (0.922)	–0.031 (0.121)	–0.033 (0.131)	7.659*** (2.025)	0.286*** (0.078)	0.192*** (0.057)	–1.408* (0.775)	–0.158** (0.076)	–0.169** (0.082)
Central	–1.460*** (0.455)	–0.186*** (0.054)	–0.202*** (0.059)	0.591 (0.859)	0.022 (0.032)	0.013 (0.019)	2.212*** (0.252)	0.330*** (0.043)	0.351*** (0.045)
South	–4.471*** (0.387)	–0.542*** (0.042)	–0.590*** (0.046)	2.039*** (0.734)	0.075*** (0.027)	0.046*** (0.017)	–2.515*** (0.280)	–0.293*** (0.030)	–0.314*** (0.032)
East	–19.999*** (1.401)	–1.232*** (0.046)	–1.371*** (0.052)	–8.370*** (1.200)	–0.319*** (0.050)	–0.164*** (0.021)	–3.610*** (0.718)	–0.344*** (0.052)	–0.371*** (0.057)

Standard errors are in parentheses

*** $p < 0.01$

** $p < 0.05$

* $p < 0.10$

Policy implications

Some policy implications can be drawn from these results that are relevant to the mission of the NHI system in Taiwan. As indicated earlier, the main objective of the NHI is to provide universal health insurance benefits to Taiwan's citizens and alleviate people's financial barriers to health care. To better control the increasing medical costs, the BNHI has raised the premium rate and implemented various payment schemes such as a global budget payment system and a performance-based payment system. The financial burden comes mainly from Western medicine. For instance, in the case of out-patient care reimbursement, less than 6 % was claimed by the use of traditional medicine and nearly 80 % by the use of Western medicine in recent years. Other than cost control, reducing inequality in health status and medical care utilizations is very important. To further achieve the equality of healthcare uses, information on the utilization differences between Western and traditional medicine and service is of crucial importance.

According to our findings, households with higher income and wealth are more likely to use and also pay more on traditional medicine. This may reflect the fact that some expenses on herbal materials used in traditional medicine are not covered by the current NHI system and have to be paid out-of-pocket. Therefore, households with high income are more likely to use traditional medicine than lower-income households. The inequality in utilization rates between traditional and Western medicine among different groups of people may also lead to greater inequality in health. As a result, to alleviate financial barriers to traditional medicine among low-income households, it is necessary to re-evaluate prescription coverage in the current health care system. In addition, regional differences of medical expenditures are evident which may reflect disparity in local health care resources. To ensure equity in health care utilization, establishment of healthcare facilities in rural areas should be considered.

We also suggest that the BNHI re-evaluate the prescription coverage in NHI to promote usage of traditional medicine among low-income households. However, from the viewpoint of cost containment, extended insurance coverage may increase utilization rates, thereby causing financial burden to the society. The trade-off between equity and cost control remains an important policy issue and the issue is worthy of further investigation.

Limitations

Two caveats pertain in this study. For example, the expenditures on Western and traditional medicine and service are self-reported. Therefore, our results may suffer from the self-report bias. In addition, this paper focuses on aggregate health care expenditures only. Data permitting, one might also investigate the extent to which individuals with different socio-demographic characteristics may have different out-patient and in-patient visits.

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Conflict of interest None.

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