

Complementary and Alternative Medicine and Conventional Health Care: Substitutes or Complements?

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Abstract

This study used Grossman's model of demand for health to examine Complementary and Alternative Medicine (CAM) use by consumers in the U.S. Main objectives of this study were to identify the predictors of demand for CAM and to examine whether CAM and conventional care are economic substitutes or complements. Data used for this study were from the 2002 and the 2004 Medical Expenditure Panel Survey. Health insurance coverage for conventional care, presence of children under age 18 in household, hours of employment, wages, age, chronic conditions, age, gender, race/ethnicity, and risk tolerance predicted probability and level of CAM use. The positive cross-price elasticity of physician visits in chiropractic and acupuncture and/or massage model suggests substitution of CAM for conventional care. Implications for consumer well-being and health care policy are delineated.

Keywords: Health care, Complementary and Alternative Medicine, Price elasticity

1. Introduction

Escalating health care costs are straining the financial well-being as well as health of consumers in the U.S. Nearly 46 million families are uninsured and face the challenges of paying medical bills and even those with insurance coverage experience dramatic increases in the premiums and deductibles (Collins, Kriss, Doty, & Rustgi, 2008). Amid a variety of problems facing the U.S. health care system, Complementary and Alternative Medicine (CAM) has gained unprecedented popularity among consumers. Nearly 38% of the respondents used CAM during 2007 (Nahin, Barnes, Stussman, & Bloom, 2009).

Widespread use of CAM is an emerging phenomenon that may have significant implications for consumers and health care system. Integration of CAM and conventional care is becoming increasingly common and a growing number of insurers are offering plans that cover CAM, thus reducing the price of CAM for consumers (Lafferty et al., 2006). This trend has stimulated health care researchers to investigate how consumers integrate CAM and conventional care in managing their health. Based on analysis of utilization patterns, most studies have concluded that CAM and conventional care are used simultaneously (Astin, 1998; Druss & Rosenheck, 1999; Li, Quinn, McCulloch, Jacobs & Chan, 2004; Ritchie, Gohmann, & McKinney 2005; Grzywacz et al., 2005). Bonafede, Dick, Noyes, Klein, and Brown (2008) examined the effect of acupuncture utilization on conventional health care utilization and concluded that acupuncture is an economic substitute for some medical services.

From the consumers' perspective, simultaneous use of CAM and conventional care is likely to increase the demand on resources and therefore influence financial well-being of consumers. From the cost perspective, it is important to examine the effect of the price of CAM on CAM use, especially if insurers extend coverage for CAM. In order to assess the economic consequences of integration of CAM and conventional care for consumers and the health care system, it is also important to examine how the price of CAM affects use of conventional or mainstream health care. According to Herman, Craig, and Caspi (2005), there has been less incentive to perform such analyses as consumers pay for the majority of CAM costs out-of-pocket and there is insignificant involvement of third-party payers in financing CAM.

The main goals of this study are to examine 1) predictors of demand for CAM and, 2) whether CAM and conventional care are economic substitutes or complements. In this study, the choice of variables and hypotheses are based on Grossman's (1972) model of demand for health care. This model has been widely used to explain the demand for conventional health care (e.g. Grossman, 1972; Jacobson, 2000). Three CAM modalities including chiropractic, acupuncture and massage are examined. In this study, conventional care refers to outpatient physician visits. This study will enhance the understanding of consumer decision-making for CAM use and refine the understanding of relationships between CAM use and conventional care use by consumers.

2. Theoretical Model

According to Grossman (1972), individuals produce health by investments of market purchased good and services, and time. CAM (A) and conventional health care (C) are used by individuals to improve health status. In order to improve health, individuals also spend time on activities such as utilizing CAM (T_A) or conventional health care (T_C). Individual characteristics (E) such as age, education, and present health status, affect the individual's efficiency in producing health. The production function for health can be expressed as $H(A, C, T_A, T_C; E)$. Similarly, other commodities, Z, are produced with the input of goods X, and time T_X . The production function for Z is expressed as $Z(X, T_X; E)$.

Drawing on the household production model and Grossman's model of demand for health, an individual's utility depends on own health (H) and other commodities (Z) consumed by the individual, and preferences (P) of the individual. The utility function can be expressed as $U = u(H, Z; P)$. The health production function and the production function for other commodities can be substituted into the utility function to express the individual's utility as $U(H(A, C, T_A, T_C; E), Z(X, T_X; E); P)$. Individuals maximize utility subject to time and budget constraints. The full budget constraint is specified as $(p_A + wT_A)A + (p_C + wT_C)C + (p_X + wT_X)X = wT_w + v = I$ where w is the wage rate, I denotes the total resources available for expenditure, p_A is the price of CAM, A is the quantity of CAM, p_C is the price of conventional health care, C is the quantity of conventional health care, p_X is the price of other market goods and services, X is the quantity of all other market goods and services, wT_w is the earned income, and v is the unearned income. Comparative statics of the model described above indicates that demand for CAM is a function of price of CAM (p_A), the price of conventional care (p_C), price of other market goods (p_X), the time spent on CAM use (T_A), time spent on conventional care use (T_C), time on all other activities (T_X), wages (w), unearned income (v), the individual's efficiency in producing good health (E), and the individual's preferences (P). Therefore, these variables are hypothesized to have a significant effect on demand for CAM.

3. Methods

3.1 Data and Sample

Data are drawn from the 2002 and the 2004 Medical Expenditure Panel Survey (MEPS).

The sample is comprised of 48,467 individuals who belonged to the U.S. civilian, noninstitutionalized population during the year of data collection, had a person-level weight and were 18 years or older. Nearly 5% of the respondents reported using chiropractic. About 2% used acupuncture and/or massage during the survey years. Due to low use rates of acupuncture and massage, it is not possible to evaluate these modalities separately. Therefore, the analysis for level of use among the users was performed on 2,142 chiropractic users and 690 acupuncture and /or massage users. The MEPS is a panel study that utilizes a complex, overlapping panel design (Cohen, 1997). In this study, to account for the sampling design, design-based analysis is performed using Stata v9™.

3.2 Data Analysis

Demand for CAM is modeled using a two-part model. Since CAM is an optional mode of health care for the majority of consumers, modeling the probability and quantity of use decisions separately is conceptually appropriate. The decision to use any CAM is modeled in the first stage using a logit regression, and the level of use among the users is modeled in the second stage using OLS regression. In OLS regression model, if both the dependent and independent variable(s) are log-transformed, the parameter estimates are interpreted as elasticities. For all models, marginal effects are calculated at the mean values for continuous variables and the modal values for categorical variables. In a two-part model, the overall price elasticity is computed by summing the price elasticity of any use of health care services from the logit model and the price elasticity of quantity of health care services used from the OLS regression (Ross & Chaloupka, 2001).

3.3 Dependent and Independent Variables

In the first stage of the two-part model, the dependent variables are dichotomous indicators of whether chiropractic and acupuncture and/or massage were used. In the second part of the model, quantity of health care, as measured by number of visits to health care providers, is used to measure utilization of CAM. In order to make CAM and conventional care visits comparable, office-based, outpatient CAM provider and physician visits for diagnosis or treatment and follow-up or post-operative visits were used.

Independent variables include price of CAM and conventional care, health insurance coverage status and type of coverage, time inputs, wages, unearned income, production and preference factors. Household surveys rarely collect data on market prices of health care services. In this study, the out-of-pocket payments for the services made by the respondents at the point of access are used as the measure of price of CAM and conventional care. In previous research, a similar measure of price of health care has been used to estimate the own-price and cross-price elasticities of different types of health care services (Helms, Newhouse, and Phelps, 1978; Manning, Newhouse, Duan, Keeler, & Leibowitz, 1987). The issue of inaccurate measures of price in survey data is further complicated by missing out-of-pocket payments or price information for the non-users. Several studies have used a deterministic, regression-based approach to predict the prices for the non-users (Deb and Holmes 1998; Hunt-McCool, Kiker, & Ng, 1994). In this study, a Hot Deck method is used to impute the prices for the non-users of chiropractic, acupuncture and/or massage, physical therapy, and physician visits. Imputation is done using region, MSA status, and type of health insurance as the classification variables. The mean imputed out-of-pocket payment is approximately \$24 for chiropractic, \$40 for acupuncture and / or massage visits, and \$27 for physician visits.

Information on wages is observed only for those who are working. Therefore, Mincer (1974)'s human capitals earnings function estimated using ordinary least squares (OLS) is used for predicting wages. Unearned family income is a continuous variable and includes unemployment compensation income, worker's compensation income, interest income, dividend income, pension income, social security income, person's veteran income, trust/rent income, IRA income, alimony, child support, public assistance, and other income. In the data, there is no information on amount of time spent on utilization of CAM and other health care services. Therefore, measures that effect time available to use CAM and other health care services, referred to as time constraints, are included as proxies for time input. These factors include hours of employment and presence of children under age 18 in the household. Measures of conventional health insurance coverage status as well as type of health insurance plan are included. Production factors including age, education, and health status affect an individual's efficiency in producing health and therefore affect demand for health care. Preference factors include gender, race/ethnicity, marital status, risk attitude, and health behaviors. Geographic region of residence, MSA status, acculturation, access to conventional health care are included as control variables.

4. Results

4.1 Descriptive Statistics

Table 1 reports the characteristics of the users and non-users of CAM. Among the users, the average number of chiropractic visits per year was about eight and the average number of acupuncture and/or massage visits per year was about six. For the users of chiropractic, and acupuncture and/or massage the per-visit out-of-pocket costs were nearly \$24, and \$45 respectively. Bridevaux (2004) reported per visit out-of-pocket payment of \$44 for acupuncture and \$33 for massage. A comparison of the profiles of users and non-users of CAM revealed several differences between the two groups. For example, users of chiropractic were more likely than non-users to use other types of health care services. A higher percent of non-users than users (72% vs. 63%) had employer-provided private health insurance. More non-users than users had public health insurance including Medicare and Medicaid. A higher percent of non-users than users were uninsured.

Table 1. Descriptive Characteristics of Users and Non-users of CAM

Variables	Chiropractic		Acupuncture / Massage	
	Users (n = 2,142)	Non-users (n = 46,325)	Users (n = 690)	Non-users (n = 47,777)
Decision to Use				
Chiropractic			29.46%	4.86%
Acupuncture/Massage	10.45%	1.41%		
Level of use (Annual number of visits)				
Chiropractic visits	8.39 (0.28) ^a	-	2.74 (0.30) ^a	0.40 (0.02)
Acupuncture and/or massage	0.71 (0.08)	0.07 (0.01)	5.61 (0.31)	-
Price				
Out-of-pocket payments / visit (2004 \$)				
Chiropractic	24.20 (0.84)	24.58 (0.21)	27.21 (1.42)	24.51 (0.21)
Acupuncture/Massage	43.08 (0.76)	41.30 (0.18)	45.43 (1.45)	41.31(0.18)
Physical therapy	18.48 (1.11)	20.57 (0.30)	19.06 (1.88)	20.48 (0.30)
Physician visits	28.13 (4.26)	27.55 (0.74)	41.30 (11.42)	27.31 (0.72)
Health insurance				
HMO coverage	29.63%	31.66%	33.91%	31.51%
Medicare	18.58%	18.09%	12.23%	18.22%
Medicaid	4.43%	9.38%	3.56%	9.23%
Other Public	3.49%	3.86%	2.80%	3.86%
Employer provided private	71.94%	63.12%	70.86%	63.45%
Other private	9.41%	6.98%	9.46%	7.07%
Uninsured	8.09%	13.82%	10.54%	13.57%
Time factors				
Children under age 18 not present in household	64.25%	57.60%	70.39%	57.71%
Hours of employment				
Full-time	53.06%	51.60%	57.27%	51.57%
Part-Time	31.28%	26.06%	28.12%	26.30%
Not working	15.66%	22.34%	14.61%	22.12%
Time to get to usual place of health care				
No usual place of health care	16.16%	23.32%	16.35%	23.24%
Less than 15 minutes	44.27%	38.11%	43.32%	38.34%
15 minutes to 30 minutes	30.72%	29.79%	32.82%	29.79%
More than 30 minutes	8.85%	8.60%	7.51%	8.63%
Hourly wages (2004 \$)	18.59 (0.22)	16.86 (0.07)	20.38 (0.34)	16.90 (0.07)
	5263.60 (275.56)	4011.23 (97.55)	5089.99 (502.64)	4058.39 (95.63)
Unearned Income (2004 \$)				
Production factors				
Age	48.14 (0.46)	45.29 (0.17)	45.88 (0.70)	45.43 (0.16)
Number of years of education	13.34 (0.09)	12.68 (0.07)	14.44 (0.12)	12.69 (0.04)
Health status				
Self perceived physical health status				
Excellent	20.66%	25.50%	25.90%	25.23%
Very good	35.81%	33.33%	33.80%	33.45%
Good	28.81%	28.02%	26.99%	28.08%
Fair / Poor	14.73%	13.16%	13.31%	13.24%

Self perceived mental health status				
Excellent	33.57%	36.48%	37.24%	36.30%
Very good	32.71%	31.00%	31.03%	31.09%
Good	26.67%	25.42%	24.71%	25.50%
Fair / Poor	7.06%	7.11%	7.03%	7.11%
Chronic conditions				
Cancer	5.54%	4.06%	6.09%	4.10%
Diabetes	6.16%	7.10%	5.35%	7.09%
Hypertension	19.42%	19.06%	15.56%	19.14%
Heart disease	10.02%	8.59%	6.02%	8.72%
Arthritis	30.81%	20.05%	26.12	20.52%
Asthma	6.46%	4.14%	4.97%	4.25%
Back problems	52.89%	9.87%	34.61%	11.73%
Musculoskeletal Problems	27.61%	14.62%	25.83%	15.11%
Preference Factors				
Gender				
Female	58.05%	51.56%	70.93%	51.53%
Male	41.95%	48.44%	29.07%	48.47%
Marital Status				
Married	63.26%	55.26%	51.25%	55.78%
Divorced/Separated	13.35%	12.97%	20.29%	12.85%
Widowed	7.25%	6.84%	5.47%	6.89%
Never married	16.14%	24.92%	22.98%	24.48%
Race/ethnicity				
Non-Hispanic White	87.82%	69.14%	83.72%	69.87%
Non-Hispanic Black	2.89%	11.61%	2.12%	11.32%
Non-Hispanic others	4.40%	6.42%	8.64%	6.27%
Hispanic	4.89%	12.83%	5.52%	12.54%
Smoking	14.39%	20.06%	11.75%	19.91%
High Risk tolerance	22.04%	20.25%	22.49%	20.31%
Control Variables				
Experienced difficulty in accessing care	4.37%	3.21%	4.71%	3.24%
Region				
Northeast	18.19%	19.18%	16.17%	19.19%
Midwest	33.59%	21.93%	20.75%	22.59%
West	22.45%	36.48%	19.42%	36.05%
South	25.77%	22.40%	43.67%	22.18%
MSA	75.00%	82.23%	83.25%	81.82%

^aFor continuous variables, numbers in parenthesis are standard errors of mean.

4.2 Results of Multivariate analysis

4.2.1 Chiropractic care

Table 2 reports the significant multivariate analysis results for chiropractic care. Price of chiropractic has a significant negative effect on level of use of chiropractic. At the mean, 1% increase in price of chiropractic results in a decrease of about 0.08% in number of chiropractic visits. Health insurance coverage for conventional care has significant negative effect on probability of chiropractic use. For instance, HMO coverage decreases the probability of use of chiropractic services by 3.5%. The average number of chiropractic visits are 25% less for those who have Medicaid coverage than those who do not have Medicaid coverage.

Hypertension reduces the probability of chiropractic use by nearly 4%. Individuals with asthma, back problems, and/or musculoskeletal problems are more likely to use chiropractic. Compared to those who do not have any back problems, those who have back problems are about 24% more likely to use chiropractic. Musculoskeletal problems increase the probability of use by 13%.

Males are about 4% less likely to use chiropractic than females and number of chiropractic visits is about 20% less among males than females. Compared to the Hispanics, non-Hispanic Whites are almost 10% more likely to use chiropractic while non-Hispanic Blacks are 7% less likely to use chiropractic. Smoking decreases the probability of chiropractic use by 8%. Among the control variables, region of residence, MSA status, and preferred language for communication affect probability of chiropractic use.

Table 2. Results of Two-Part Model for Chiropractic Use

Variables	First Part: Logit		Second part: OLS	
	Coeff.	Marginal effect	Coeff.	Marginal effect
Intercept	-4.435^a		1.858	
Price				
Out-of-pocket payments				
Chiropractic	-0.002	0.000	-0.082	-0.033
Health insurance				
HMO	-0.183	-0.035	-0.011	-0.104
Medicare	-0.324	-0.061	0.032	0.317
Medicaid	-0.550	-0.097	-0.281	-2.408
Time factors				
Hours of employment (Not working ^b)				
Full-time	0.276	0.052	-0.023	-0.234
Part-time	0.330	0.063	0.021	0.210
Health status				
Self perceived physical health status (Fair or poor)				
Excellent	-0.072	-0.014	-0.063	-0.642
Very good	0.074	0.015	-0.034	-0.350
Good	-0.013	-0.002	0.153	1.729
Chronic Conditions				
Hypertension	-0.202	-0.039	0.051	0.517
Asthma	0.309	0.066	-0.124	-1.144
Back problem	2.275	0.242	0.078	0.742
Musculoskeletal problems	0.586	0.131	0.017	0.165
Preference Factors				
Gender (Female)				
Male	-0.219	-0.042	-0.217	-1.917
Married	0.310	0.058	-0.074	-0.759
Divorced / separated	0.235	0.046	0.058	0.584
Widowed	0.110	0.020	-0.084	-0.796
Race/ethnicity (Hispanic)				
Non-Hispanic White	0.560	0.098	-0.001	-0.008
Non-Hispanic Black	-0.565	-0.070	0.119	1.248
Non-Hispanic others	0.205	0.035	0.160	1.704
Smoking	-0.440	-0.080	-0.009	-0.088
High risk tolerance	0.233	0.049	-0.038	-0.369
Control variables				
Region (West)				
Northeast	-0.271	-0.063	0.185	1.792
Midwest	0.087	0.022	0.053	0.480
South	-0.661	-0.150	0.106	0.992
MSA	-0.344	-0.074	0.088	0.830
English preferred language	0.667	0.114	-0.432	-5.317
R-squared			.080	

^a: Coefficients and Marginal effects in bold are significant at alpha level of .05 or less

^b: Categories in parentheses are reference groups.

4.2.2 Acupuncture and/or Massage

Out-of-pocket payments for chiropractic have a positive effect on likelihood of use of acupuncture and/or massage (Table 3). Those with Medicare and/or Medicaid coverage are less likely to use acupuncture and/or massage. Time constraint has a significant effect on likelihood as well as the level of use.

Compared to those who have children under age 18 in household, the average number of acupuncture and/or massage visits is about 21% more among those who do not have children younger than age 18 in household. The full-time employed individuals have about 31% fewer visits than those who do not work. Part-time employed individuals have 22% fewer visits than the reference group. One percent increase in hourly wages increases the number of visits by 0.5%. Unearned income has a positive effect on likelihood of use of acupuncture and/or massage. On average, number of visits increase by 1.5% with one year increase in age.

Higher self-perceived physical health status is associated with a reduction in number of visits. Interestingly, mental health status has positive effect on use of acupuncture and/or massage. Those in excellent or very good mental health status have nearly 30% more visits than those perceiving their health status as fair or poor health. Back problems and musculoskeletal problems increase the probability of use of acupuncture and/or massage. Gender has a significant effect on acupuncture and/or massage use. Males are 2.2% less likely to use acupuncture and/or massage than are females. Compared to Hispanics, non-Hispanic Whites and non-Hispanic others are more likely to use while non-Hispanic Blacks are less likely to use acupuncture and/or massage. In comparison to the Hispanics, non-Hispanic Whites are 1.5% and non-Hispanic others are 1.6% more likely to use acupuncture and/or massage. On the other hand, compared to Hispanics, non-Hispanic Blacks are 1.2% less likely to use acupuncture and/or massage. Current smokers are less likely to use acupuncture and/or massage. None of the preference factors is significant in the second stage level of use equation. This implies that preferences come into play when consumers decide whether to use acupuncture and/or massage. However, these factors are not significant predictors of quantity of use.

Region of residence has a significant effect on likelihood of acupuncture and/or massage use. Individuals living in the West are more likely to use than those living in other regions of the U.S. Living in the Northeast or Midwest, decreases the probability of use by about 6% each and living in South decreases the probability of use by nearly 7%.

Table 3. Two-part Model for Acupuncture and/or Massage Use

Variables	First Part: Logit		Second part: OLS	
	Coef.	Marginal effects	Coef.	Marginal effects
Intercept	-7.135^a		0.443	
Price				
Out-of-pocket payments				
Chiropractic	0.090	1.2E-04	-0.014	-0.003
Health insurance				
Medicare	-0.574	-0.016	-0.237	-1.234
Medicaid	-0.595	-0.016	0.074	0.446
Time factors				
Children under age 18 not present in household	0.293	0.009	0.192	1.018
Hours of employment (Not working ^b)				
Full-time	0.234	0.008	-0.362	-2.550
Part-Time	0.221	0.007	-0.246	-1.826
Log Wages (Predicted, 2004 \$)	0.323	0.004	0.504	0.144
Log unearned family income (2004 \$)	0.051	4.3E-04	-0.023	0.000
Production factors				
Age	-0.008	-2.9E-04	0.015	0.090
Education	0.179	0.006	-0.017	-0.101
Health status				
Self perceived physical health status (Fair or poor)				
Excellent	-0.213	-0.009	-0.464	-3.470
Very good	-0.294	-0.012	-0.470	-3.500
Good	-0.188	-0.008	-0.299	-2.417
Self perceived mental health status (Fair or poor)				
Excellent	-0.138	-0.005	0.275	1.405
Very good	-0.118	-0.005	0.275	1.401

Good	-0.046	-0.002	0.156	0.747
Chronic Conditions				
Back problem	1.265	0.027	-0.013	-0.079
Musculoskeletal problems	0.586	0.028	-0.060	-0.339
Preference Factors				
Gender (Female)				
Male	-0.902	-0.022	-0.153	-0.827
Marital Status (Never Married)				
Married	-0.181	-0.007	-0.090	-0.548
Divorced / Separated	0.389	0.020	-0.077	-0.476
Widowed	-0.078	-0.003	0.088	0.585
Race/ethnicity (Hispanic)				
Non-Hispanic White	0.542	0.015	-0.028	-0.168
Non-Hispanic Black	-0.784	-0.012	0.138	0.891
Non-Hispanic others	0.567	0.016	-0.076	-0.439
Smoking	-0.430	-0.013	-0.065	-0.366
Control variables				
Region (West)				
Northeast	-0.840	-0.059	0.048	0.335
Midwest	-0.805	-0.057	-0.046	-0.309
South	-1.151	-0.072	-0.165	-1.045
R-squared			0.171	

^a: Coefficients and Marginal effects in bold are significant at alpha level of .05 or less

^b: Categories in parentheses are reference groups.

4.3 Price Elasticities

The magnitudes of own- and cross-price elasticities for chiropractic as well as acupuncture and/or massage are small (Table 5). Nevertheless, the sign of total own-price elasticities for chiropractic is negative suggesting that increase in own-price results in a reduction in demand for chiropractic. The positive cross-price elasticity of physician visits in chiropractic and acupuncture and/or massage model suggests substitution of CAM for conventional care.

Table 4. Price Elasticities

	Chiropractic			Acupuncture and/or Massage		
	First-part	Second-part	Total	First-part	Second- part	Total
Out-of-pocket payments						
Chiropractic	-0.001	-0.082	-0.083	0.087	-0.014	0.073
Acupuncture/Massage	-0.019	-0.009	-0.028	0.041	-0.041	0.001
Physical therapy	-0.006	0.006	0.000	-0.041	0.029	-0.012
Physician visits	-0.005	0.009	0.005	0.062	0.013	0.075

5. Discussion

The first objective of this study was to identify the predictors of CAM use. The findings suggest that demand for chiropractic may respond positively to a reduction in out-of-pocket price paid by consumers. However, by definition of demand elasticity, the magnitude of the effect implies that demand for chiropractic is own-price inelastic. Therefore, the results of this study also suggest that any additions to the costs attributable to increase in demand would be minimal. In acupuncture and/or massage model, a positive association between out-of-pocket payments for chiropractic and likelihood of acupuncture and/or massage use implies that consumers may substitute acupuncture and/or massage for chiropractic if the price of chiropractic increases. Proponents of CAM argue that CAM is more effective and less expensive than conventional care for many health conditions and therefore can substitute for conventional care (White & Ernst, 2000). The total cross-price elasticity of physician visits in chiropractic and acupuncture and/or massage model suggests that CAM and conventional care are substitutes.

Therefore, consequences of increase in demand for CAM due to reduced price, particularly for chiropractic, may be offset by reduced demand for physician care.

Health insurance coverage for conventional care has a negative effect on likelihood of use of chiropractic as well as acupuncture and/or massage. This result suggests that potential access to conventional health care may reduce likelihood of CAM use. This result may also be attributed to the coverage policies for CAM. Employment time reduces time available for use of chiropractic and other activities and therefore should reduce the likelihood of chiropractic use. On the contrary, in chiropractic model, results indicate that individuals who are full-time or part-time employed, compared to those who are not working, are significantly more likely to use chiropractic. This study strongly suggests that time-constrained individuals are less likely to use acupuncture and/or massage. The relationship between time constraint and CAM use should be further examined with more appropriate measures of time constraint. Grossman's model suggests that individuals with higher wages are more likely to invest in health (income effect) because they perceive higher benefits associated with improved health (Grossman, 1972). Thus, high wage earners in this study have a higher demand for acupuncture and/or massage.

The positive effect of unearned income on decision to use acupuncture and /or massage is consistent with prediction of Grossman's model of demand for health. In 2000, only about 17% of the health insurance companies nationwide provided some coverage for acupuncture and about 12% covered massage therapy (White House Commission on Complementary and Alternative Medicine Policy, 2002). Therefore, use of acupuncture and/or massage is likely to be influenced by the consumers' ability to pay for these services.

In general, presence of several chronic conditions increases the CAM use. Individuals in poorer health status use more health care services in general. Higher use of acupuncture and/or massage among individuals in excellent or very good mental health status is suggestive of use of these modalities for health maintenance and health promotion. Massage therapy decreases stress and anxiety (Field et al., 1992). Literature on CAM use also suggests that CAM use is prevalent among individuals with mental conditions (Druss & Rosenheck, 2000; Simon et al., 2004).

CAM use is higher among females than males. This result supports the higher use of CAM reported among females in previous research (Burke, Upchurch, Dye, & Chyu, 2006; Lafferty et al., 2006). Consistent with previous research (e.g. Bausell, Lee, & Berman, 2001; Ni, Simile, & Hardy 2002; Conboy et al., 2005; Coulter & Shekelle, 2005; Graham et al., 2005), CAM use is higher among non-Hispanic Whites compared to other racial and ethnic subpopulations.

Smokers in this study are less likely to use CAM. According to Fuchs (1982), smoking is a proxy for discount rates or time preference. Smokers have a higher rate of time preference and are less likely to make investments in health through use of CAM. Geographic variations in likelihood of CAM use may reflect difference in preferences for health care services among individuals residing in different regions or differences in supply of CAM providers across regions (Shekelle, 1994).

6. Implications

This study has several implications for the consumers, healthcare practitioners, and policy makers. With disputed scientific evidence on efficacy and effectiveness of CAM modalities, health policy decisions can be challenging. Results generated in this study are of use to insurers and policy makers to quantify the impact of reimbursement for CAM modalities on total cost for the consumers and the health care system. The findings suggest that reduction in out-of-pocket payments for chiropractic may induce demand for chiropractic but any additions to the costs would be minimal. If reduction in price increases chiropractic utilization, from a cost-containment perspective, the important policy question is whether chiropractic substitutes for conventional care or simply enhances range of treatments and the costs. Proponents of CAM argue that CAM is more effective and less expensive than conventional care for many health conditions and therefore can substitute for conventional care (White & Ernst, 2000). The positive effect, although statistically non-significant, of out-of-pocket payments for physician care on demand for chiropractic found in this study suggests that consumers may substitute chiropractic care for physician care. A positive association between out-of-pocket payments for chiropractic and likelihood of acupuncture and/or massage use implies that consumers may substitute acupuncture and/or massage for chiropractic if the price of chiropractic increases.

Therefore, chiropractors may face competition from acupuncturists and/or massage therapists especially when there is an overlap in scope of practice of these providers (Lafferty et al., 2006). Lafferty et al. (2006) posit that such competition would protect the insurers from unprecedented increases in expenditures on CAM services if they add coverage for acupuncture and/or massage to the plan benefits. Apart from investigating the relationship between demand for CAM and conventional care, researchers should also investigate relative costs and benefits of different CAM modalities.

Managed care relies on tools such as treatment protocols, management controls, and coordination of services to reduce use of unnecessary health care and level of moral hazard (Stano, 1997). However, such controls on utilization of chiropractic may not necessarily be beneficial to the consumer and the health care plan. Legorreta et al. (2004) found that managed chiropractic care might reduce the health care costs via several mechanisms including substitution of chiropractic for conventional health care, and positive risk selection. This study found some evidence of substitution of chiropractic care for physician visits and thus supports the cost-savings potential of CAM modalities. Therefore, if chiropractic care has positive health effects for consumers and is more cost-effective than conventional care, fewer utilization restrictions on chiropractic use may lead to cost-savings for the consumers and the health care plans.

Factors such as policies concerning coverage for health care services, distribution and availability of providers, and regulation of providers influence access to and delivery of health care services (WHCCAMP, 2002). Negative effect of Medicare and Medicaid coverage on demand for CAM may imply that health insurance for conventional health care lowers the price of conventional care and thus increases the relative price of CAM, resulting in reduced demand for CAM. Therefore, consumers who have access to conventional care via health insurance coverage may have a lower demand for CAM. If CAM modalities are better or equally beneficial as conventional care, the negative effect of Medicare and Medicaid coverage on demand for CAM may indicate barriers to access to CAM due to coverage restrictions. However, unless CAM modalities are proven less expensive than conventional care in producing similar or better health outcomes, public insurance plans may be reluctant to cover CAM modalities.

This study strongly suggests that time constraints have negative effects on demand for acupuncture and/or massage. Such barriers to access to health care and policies should be aimed at improving access to health care for these individuals. For example, provision of childcare services at the location of provision of health care service may enable individuals who have to take care of young children to access health care. Consumers' preferences influence their propensity of demand for CAM modalities. Women have a higher preference for CAM than men do. Although the majority of previous studies on CAM use have found a higher use of CAM among women than men, little information is available on reasons for this gender difference in use. A higher demand for CAM among females calls for research on efficacy and effectiveness of modalities for health conditions that are specific to women or are more prevalent among women than men. There is also a pressing need to examine if women are substituting CAM for conventional care or using these as complements. Since women have greater longevity, patterns of use of CAM and conventional care may have significant financial and health implications for women as well as health care costs.

Racial and ethnic differences in demand for CAM can be attributed to preferences of consumers and characteristics of the CAM delivery system. Other than differences in preferences, racial and ethnic differences in CAM use found in this study may be attributable to factors related to delivery of CAM. According to Cherkin et al. (2002), race/ethnicity of patients of CAM practitioners resembles that of the practitioners themselves. Cohen, Gabriel, and Terrell (2002) emphasize the importance of a culturally diverse health care workforce in order to provide optimal health care to individuals from diverse cultural and ethnic backgrounds. If reduced demand for CAM modalities examined in this study among the racial and ethnic minority subpopulations is due to lack of access to culturally diverse providers of these modalities, greater racial and ethnic diversity in providers may reduce the gap in access to these modalities.

This research may be viewed as an exploration of economics of CAM use while differentiating between the determinants of decision to use and level of CAM use. More accurate measures of price of CAM paid by consumers and health insurance coverage of CAM can significantly improve the reliability of estimates produced in this study. A logical question is whether, or to what extent, demand for CAM as a complement or substitute to conventional care at a given level of out-of-pocket payments, contributes to the health status.

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