



THE KAISER COMMISSION ON
Medicaid and the Uninsured

COVERING THE UNINSURED: HOW MUCH WOULD IT COST?

STATISTICAL APPENDIX

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Specification and Estimation of the Two-Part Spending Model*

It is now standard to use a two-part estimation method to determine the effects of various characteristics on medical expenditures.¹ Since a nontrivial proportion of people have no expenditures in a particular year, the first part typically consists of a logistic model to estimate the probability of having any medical expense. Among those who do have expenses, the distribution of expenditures is generally highly skewed to the right, with a small proportion of people having very large expenditures. To correct for skewness, it has been traditional to apply a logarithmic transformation to the data, followed by a smearing correction to retransform predicted spending back into the original scale.² However, recent research suggests that applying a smearing correction can be biased if the smearing correction is not constant across all cases in the sample.³ Given this uncertainty, we used preliminary analysis to explore the sensitivity of the results to alternative assumptions about functional form and retransformation method, and conducted a variety of diagnostic tests.⁴

* This appendix describes the statistical methodology and analyses underlying results presented in J. Hadley and J. Holahan, "Covering the Uninsured: How Much Would It Cost?" *Health Affairs* Web Exclusive (June 4, 2003), available at www.healthaffairs.org.

¹ A. Jones, "Health Econometrics," in *Handbook of Health Economics*, 2000, A. Culyer and J. Newhouse, eds., (Amsterdam: Elsevier).

² N. Duan, "Smearing Estimate: A Nonparametric Retransformation Method," *Journal of the American Statistical Association* 78 (1983): 605-610.

³ J. Mullahy, "Much Ado about Two: Reconsidering Retransformation and the Two-Part Model in health Econometrics," *Journal of Health Economics* 17 (1998): 247-281; W. Manning and J. Mullahy, "Estimating Log Models: To Transform or Not to Transform?" *Journal of Health Economics* 20 (2000): 461-494.

⁴ We are very grateful to W. Manning for providing the programs to estimate alternative functional forms and retransformations. Personal communication from W. Manning, September 15, 2002.

We concluded that a generalized linear model using a gamma function with a log-link performed best for the majority of the models estimated.⁵ The generalized linear model imposes minimal assumptions about the underlying distribution of the data and avoids the problem of having to retransform a logarithmic specification back into natural numbers

Data and Sample

All data for this analysis are from the Medical Expenditure Panel Surveys (MEPS) conducted in 1996, 1997 and 1998. The MEPS is a nationally representative sample of the non-institutionalized population which contains detailed information on annual total charges and payments for health care used, monthly information on insurance coverage, and detailed demographic and health characteristics.⁶ The analysis sample excludes people 65 or older and non-elderly people covered by Medicare, as well as privately-insured families with incomes greater than 400% of the federal poverty level.⁷ People who are in the sample for only a portion of the year (newborns, decedents, and people who become institutionalized) are included for the part of the year they are in the sample. Data from the three surveys were pooled to form a single analysis file.

⁵ D. Blough, C. Madden, and M. Hornbrook, "Modeling Risk Using Generalized Linear Models," *Journal of Health Economics* 18 (1999): 153-171; J. Hardin and J. Hilbe, *Generalized Linear Models and Extensions* (College Station, TX: Stata Corporation 2001).

⁶ See J. W. Cohen, *Design and Methods of the Medical Expenditure Panel Survey Household Component*, MEPS Methodology Report no. 1, Pub. No. 97-0026 (Rockville, MD: Agency for Healthcare Research and Quality 1997).

⁷ About 15% of uninsured adults and 8% of uninsured children have family incomes exceeding 400% of poverty. We retained these cases in the analysis in order to have a representative sample of all uninsured people. We also retained the approximately 2% of full-year publicly insured people with incomes greater than 400% of poverty.

Expenditures were inflated to 2001 dollars using the annual percentage increase in the National Health Accounts.⁸

Model Specification

The key independent variables in the models measure the percentage of the year (based on monthly insurance status) that the person was covered by either public or private insurance. For the people with full-year private or public coverage, the corresponding variable has a value of 1.0. For people with part-year coverage, values ranged from 0.08 (one month of coverage) to 0.92 (eleven months of coverage).

All other independent variables in the models were dichotomous indicators representing census region, gender, age, race and ethnicity, education, income relative to poverty, marital status, and health status. (Mean values by insurance status are reported in Exhibits A.1.a and A.1.b for adults and children) The health status measures include self-reported general health status, self-reported mental health status (fair or poor relative to good or better), and several measures of activity limitations, disabilities, and specific medical conditions.

We used different health measures for children, reflecting differences in the incidence of conditions and diseases. The children's models also included

⁸ <http://cms.hhs.gov/statistics/nhe/historical/t1.asp> (accessed April 21, 2003).

measures of parental marital status and education, in addition to the child's age, gender, race and ethnicity.

Statistical Estimation

Separate models were estimated for adults and children using two different samples of data. One sample combined the full- and part-year uninsured with lower-middle income people with full-year private insurance. The other sample combined the uninsured with the full-year publicly insured. (Sample sizes are shown in Exhibit A.1.)

We explored several alternative approaches to estimating the second part of the two-part model. In each of these approaches, the basic goal is to adjust the distribution of the spending equation so that it more closely reflects a normal distribution. The underlying statistical tests examined how well the expenditure models fit the distribution of actual expenditures.

The specific approaches investigated for specifying and estimating the expenditure equation were

- OLS estimation of a logarithmic transformation with a **homoskedastic** smearing retransformation;
- OLS estimation of a logarithmic transformation with a **heteroskedastic** smearing retransformation based on percentage of time with either private or public insurance coverage;
- Gamma function with a log-link transformation of the explanatory variables; and

- Logarithmic and GLM models with square root transformations.

Results of Preliminary Analysis and Statistical Tests

For the children's samples, which are less prone to a highly skewed distribution of expenditures, both the log OLS and the GLM gamma function with a log-link performed equally well and generated similar estimates of predicted spending. (Results not shown.) For the adult samples, however, the statistical tests were not able to identify any single approach as being unambiguously superior, although they did identify one class of methods as inadequate. In particular, approaches that used a square root transformation were shown to have insufficient curvature to capture the skewness inherent in the data. The other approaches all had similar problems with fitting the behavior represented by the small proportion (upper decile) of people with the largest annual expenses. Given this limitation, the log OLS approach with a homoskedastic smearing correction was found to be incompatible with the existence of a statistically significant relationship between the smearing correction and the percentage of time covered by either public or private insurance. Since the correct smearing retransformation is not obvious when it is related to complex variables, such as the percentages of time covered by private or public insurance, we concluded that the GLM gamma function with a log-link transformation was the most appropriate method to use, even though it still was not fully ideal.

Exhibit A.2 shows the predicted per capita spending estimates for the various samples of adults for each of the estimation methods evaluated. The GLM gamma with log-link is very similar to the log OLS with a heteroskedastic smearing correction for two of the populations (full-year uninsured plus full-year publicly insured, and part-year uninsured plus full-year privately insured) and differs by +14% to -24% for the other two populations. However, when the full-year and part-year uninsured are combined, the differences between the two approaches decrease, to +5% for the uninsured combined with the full-year privately insured, and to -14% for the uninsured combined with the full-year publicly insured.

In the final portion of the sensitivity analysis, we modified the detailed list of variables measuring differences in health characteristics. It has been shown that specifications that are “too rich” can be very inaccurate in predicting extreme expenditures. Essentially, the problem is that they may include several variables that individually have a large impact on spending that cumulates or multiplies for people who have multiple such conditions. To determine how sensitive the predictions are to this possible problem, we re-estimated the GLM gamma function with a log-link transformation under two alternative variable specifications: dropping the list of indicators of specific acute and chronic conditions, and replacing the detailed set of acute and chronic condition variables by a collapsed set of three variables that grouped conditions into major, moderate, and minor categories. (The groupings were based on the magnitudes of the marginal impacts on spending of the individual conditions.)

The results are reported in the last two rows of Exhibit A.2. The effects are fairly small for the samples that involve the privately insured. The per capita spending estimates vary by +2% to –10% when the specific condition variables are omitted, and by 2-4% when they are replaced by the smaller set of categorical condition variables.

The effect of omitting the specific condition variables is much larger on the sample combined with the full-year publicly insured, increasing by 16-31%. Apparently, the much poorer health status of those covered by public insurance “loads onto” the smaller set of variables in such a way that it appears to overstate predicted spending. When the detailed condition list is replaced by the set of three condition categories, predicted spending is virtually the same as when the full list is used.

Based on these results, we concluded that the GLM gamma function with a log-link transformation was the most appropriate statistical approach to estimate the parameters of the expenditure models we used to predict the cost of care that would be used by the uninsured if they had insurance coverage. As can be seen from the range of estimates reported in Exhibit A.2, however, the estimates can vary with the particular assumptions made about functional form, estimation method, and variable specification. While it is not possible to put a precise value on the range of plausible estimates, it may be reasonable to assume that whatever predictions we generate could vary by +/- 20% based on alternative methodological assumptions.

Models Used to Predict Spending

Exhibits A.3 – A.6 report the coefficient estimates of the various two-part models we estimated. Exhibits A.3 and A.5 show the results for the samples of uninsured combined with the full-year privately insured, first for adults and then for children. Exhibits A.4 (adults) and A.6 (children) report the models estimated with the samples of uninsured combined with the full-year publicly insured.

Looking first at the measures of insurance coverage, their coefficients are always positive and always statistically significant. These results are consistent with the substantial body of prior research that shows that the insured are both more likely than the uninsured to have any medical expenditures in a year, and that, conditional on having any expenditures, their spending will be higher. Since we measure insurance by the percentage of the year with coverage, the results also suggest that the amount of time a person has insurance is also relevant.

Two factors are important to keep in mind in interpreting these results. One is that the measure of public insurance coverage in the private insurance sample, and the measure of private insurance coverage in the public insurance sample primarily indicate part-year coverage for people who are uninsured for part of the year. Therefore, it is not appropriate to use the “cross-insurance” variables to make inferences about the relative effects of private and public coverage on spending within each the two samples. Inferences of this type would need to be based on samples that combine all people with public or private coverage, not just the subset who are uninsured for part of the year.

The second important qualification is that these models treat a person's insurance status as exogenous, i.e., independent of any unobserved or underlying factors that might influence both expenditures and choices about insurance coverage. To the extent that the assumption of exogeneity is inappropriate, then the estimated effects of having insurance may be biased. Presumably, if people who are sick or expect to use services are more likely to seek insurance coverage, than our estimates may overstate the effect of having insurance on expenditures.

Unfortunately, the inability to link MEPS data to local area information on the cost of private insurance, public insurance eligibility rules, and state insurance regulations makes it very difficult, if not impossible, to estimate a statistical model that incorporates endogenous insurance choices. Using inadequate instrumental variable estimators for insurance coverage can lead to highly imprecise estimates, which might be less accurate than the potentially biased results obtained under the assumption that insurance choice is exogenous. This is an important issue for future research.

The effects of the socio-demographic and health variables are generally unremarkable and consistent with prior research on the determinants of health spending. Racial and ethnic minorities and people with lower levels of education have lower expenditures than white non-Hispanics and better educated people. Family income relative to poverty does not appear to have a significant effect for adults, presumably because the samples exclude people with incomes greater than four times the federal poverty level. For children, however, it appears that

the probability of having any expenditure is greater for those in families with incomes between two-four times poverty compared to children in families below poverty. It also appears that single adults are less likely to use any services, but the effect on spending, conditional on using any care, is insignificant. Finally, expenditures increase as health status decreases, although there are some variations associated with specific measures of functional and physical limitations.

Exhibit A.1.a (Adults)
Weighted Means of Dependent and Independent Variables,
by Insurance Status

	Full-Year Uninsured	Part-Year Uninsured	Privately Insured	Publicly Insured
N	8,003	5,587	13,398	2,509
any health care expenditures (%)	5820.2%	7981.7%	8521.3%	8676.1%
total health care expenditures (2001\$)	1,157.60	2,240.52	2,970.34	4,850.21
percent of year with private insurance	0.0	46.6	99.8	1.3
percent of year with public insurance	0.0	10.5	0.2	98.7
Census Region (%)	0.0	0.0	0.0	0.0
northeast	16.0	17.6	18.1	26.3
midwest	15.7	20.4	25.7	16.3
south	41.5	37.2	34.9	28.7
west	26.8	24.9	21.3	28.6
Age and Gender (%)				
_19_24	20.7	24.6	11.4	18.4
_25_29	16.3	18.9	11.7	14.0
_30_34	12.6	14.5	13.9	14.3
_35_39	13.2	12.4	16.0	13.2
_40_44	11.6	10.9	15.3	11.3
_45_49	9.0	6.5	10.9	9.0
_50_54	6.9	5.2	8.0	7.5
_55_59	5.0	3.9	6.1	7.2
_60_64	4.6	3.1	6.8	5.3
male	56.8	46.6	46.1	32.2
female	43.2	53.4	53.9	67.8
Race/Ethnicity (%)				
white non-hispanic	54.3	66.4	74.0	46.2
white hispanic	22.1	11.8	9.2	15.7
african american	17.0	15.8	12.4	30.4
asian	5.0	4.4	3.5	5.5
native american	1.6	1.6	0.9	2.4
Education (%)				
less than high school	31.1	18.7	11.7	42.5
high school graduate	37.4	34.5	38.7	38.5
some college	20.1	27.6	28.7	15.2
College graduate	11.4	19.3	21.0	3.8
Income Relative to Poverty (%)				
less than 100% of poverty (FPL)	23.2	17.2	6.4	59.4
100-124% of FPL	7.6	6.7	3.5	9.4
125-199% of FPL	22.3	17.8	17.6	15.7
200-399% of FPL	29.6	33.3	72.4	9.9
400+% of FPL	17.3	25.0	0.0	5.6

Marital Status (%)				
married	41.5	45.2	62.0	30.8
widowed, divorced, separated	20.4	17.9	16.5	27.7
never married	38.0	37.0	21.5	41.5
Self-Reported Health Status (%)				
excellent	28.3	30.6	31.3	14.6
very good	28.6	31.9	34.4	21.6
good	28.9	25.6	25.5	28.8
fair	10.5	9.0	6.9	19.6
poor	3.4	2.9	1.8	14.6
health missing	0.3	0.0	0.2	0.8
mental, fair or poor health	6.7	6.1	3.5	24.0
Functional/Activity limitations (%)				
iadl screener	1.1	1.7	1.1	11.6
adl screener	1.1	1.2	1.1	6.9
difficulty lifting, walking, lifting	3.0	3.6	2.5	14.8
social or cognitive limitations	4.5	4.9	3.4	21.8
any limitations	3.2	3.6	2.3	9.8
unable	2.3	2.5	1.6	17.1
deceased or institutionalized	1.1	0.3	0.5	2.6
Acute and Chronic Conditions (%)				
diabetes	3.1	2.5	3.3	8.7
otitis_media	1.7	2.0	2.5	3.2
hypertension	5.7	6.7	9.4	15.2
asthma	2.5	3.6	3.2	7.8
back_disorder	6.5	6.8	7.4	10.1
infectious diseases	16.5	22.4	22.8	19.2
malignant neoplasm	0.8	0.9	1.6	2.5
endocrine	4.7	6.0	10.3	10.2
blood	0.6	1.1	0.9	2.3
heart and cerebrovascular	2.3	2.2	3.2	7.3
bronchitis	9.0	10.6	12.2	12.1
digestive	10.8	13.9	13.6	20.0
genitourinary	8.0	11.7	13.6	16.1
skin	4.6	7.9	9.2	9.1
musculoskeletal	11.6	13.4	16.2	22.9
fracture	2.0	2.9	2.2	3.2
pregnancy	1.4	7.1	3.8	9.2

Exhibit A.1.b (Children)
Weighted Means of Dependent and Independent Variables,
by Insurance Status

	Full-Year Uninsured	Part-Year Uninsured	Privately Insured	Publicly Insured
n	3,164	3,594	8,390	5,139
any health care expenditures (%)	64.2	79.6	86.0	80.8
total health care expenditures (2001\$)	475.07	943.07	1,492.41	1,034.39
percent of year with private insurance	0.0	33.8	99.4	1.3
percent of year with public insurance	0.0	25.0	0.6	98.7
Census Region (%)	0.0	0.0	0.0	0.0
northeast	12.9	14.3	17.6	20.9
midwest	16.9	20.2	27.6	19.2
south	44.7	40.3	31.8	33.6
west	25.5	25.2	22.9	26.3
Age and Gender (%)				
_0	6.4	5.1	3.7	7.6
_1_4	16.2	23.7	20.2	26.5
_5_9	23.4	28.9	27.5	30.2
_10_12	15.6	15.0	16.3	15.3
_13_18	38.4	27.4	32.3	20.5
male	50.2	51.7	50.8	51.1
female	49.8	48.3	49.2	48.9
Race/Ethnicity (%)				
white non-hispanic	51.2	54.1	73.0	35.6
white hispanic	27.4	19.6	9.8	22.7
african american	16.0	21.0	13.0	35.2
asian	3.4	3.3	3.1	4.7
native american	2.0	2.0	1.1	1.7
Education (%)				
less than high school	33.7	26.3	10.5	43.0
high school graduate	36.6	36.3	37.8	38.4
some college	21.4	26.3	31.2	16.4
college graduate	8.3	11.2	20.4	2.2
Income Relative to Poverty (%)				
less than 100% of FPL	24.4	30.5	8.2	64.6
100-124% of FPL	8.5	9.7	4.2	9.6
125-199% of FPL	28.3	21.7	19.7	16.0
200-399% of FPL	26.9	26.8	68.0	7.7
400+% of FPL	12.0	11.2	0.0	2.1
Parents' Marital Status (%)				
married	65.2	60.0	77.8	37.8
single parent, female	32.2	37.4	18.9	60.1
single parent, male	2.6	2.7	3.2	2.2
Self-Reported Health Status (%)				
excellent	47.5	47.7	53.6	41.2
very good	28.0	29.4	29.4	27.2

good	19.6	19.1	13.8	23.7
fair	2.8	3.2	2.5	5.9
poor	0.9	0.5	0.4	1.2
health missing	1.3	0.1	0.3	0.9
mental, fair or poor health	2.2	2.4	2.0	5.4
Functional Activity Limitations (%)				
adl screener	0.2	0.5	0.5	1.5
deceased or institutionalized	0.2	0.2	0.2	0.5
iadl screener	0.1	0.3	0.3	1.2
limited in any activity (< 5 years)	1.0	2.0	1.6	2.2
in special program (< 5 years)	6.5	9.0	7.6	11.0
Acute and Chronic Conditions (%)				
asthma	4.5	6.3	5.7	9.4
infectious diseases	24.7	29.2	33.8	23.4
bronchitis	11.6	11.7	12.1	9.8
digestive	8.9	8.8	8.6	8.1
genitourinary	3.4	3.5	4.2	2.9
skin	4.2	6.9	8.9	5.5
musculoskeletal	2.8	3.5	3.9	2.3
fracture	2.1	2.7	3.2	2.3

Exhibit A.2
Variations in Projected Spending by Estimation Method
and Variable Specification

Estimation Method ^a and Variable Specification	Sample, by Full/Part-Year Uninsured and Public/Private Full-Year Coverage Group			
	Full-Year Uninsured +		Part-Year Uninsured +	
	Private	Public	Private	Public
All Variables ^b				
Approaches Rejected on Basis of Statistical Tests				
Log OLS with homoskedastic smearing correction	\$2,913	\$2,694	\$3,760	\$3,605
Log OLS with square root transformation	2,320	2,669	2,871	3,249
GLM with square root transformation	2,843	1,839	3,184	2,065
GLM with square root transformation + squared terms	2,276	3,004	2,689	3,608
Preferred Approaches				
Log OLS with heteroskedastic smearing correction	2,689	2,540	3,469	3,398
GLM Gamma with log-link transformation	3,069	2,419	3,331	2,751
Alternative Variable Specifications: GLM Gamma + log-link				
Self-reported health status plus physical limitations; excludes specific acute and chronic conditions	3,133	3,178	3,035	3,193
Adds collapsed set of acute and chronic diseases ^c	2,998	2,469	3,203	2,756

- a. For total expenditures, conditional on having any expenditure; all estimation methods use logistic function to estimate probability of having any expenditure.
- b. See Table 1 for complete list of variables.
- c. Individual acute and chronic conditions collapsed into major, moderate, and minor disease categories based on their marginal impacts on total spending.

Exhibit A.3

**Two-Part Spending Models, Adults, MEPS 1996-1998
(Uninsured plus Full-Year Privately Insured)**

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	26,988		20,133	
percent of year with private insurance	0.97	0.00	0.53	0.00
percent of year with public insurance	1.71	0.00	0.64	0.00
Census Region				
northeast	0.13	0.05	0.00	0.95
midwest	0.24	0.00	-0.08	0.14
south	0.07	0.19	-0.01	0.81
Age and Gender				
_19_24	0.13	0.34	-0.28	0.00
_25_29	0.05	0.68	-0.36	0.00
_30_34	0.03	0.83	-0.27	0.00
_35_39	0.00	0.99	-0.15	0.06
_40_44	-0.05	0.67	-0.08	0.30
_45_49	0.10	0.44	-0.11	0.20
_50_54	0.02	0.89	-0.09	0.27
_55_59	0.00	0.99	-0.11	0.16
male	-0.59	0.00	0.06	0.13
Race/Ethnicity				
white hispanic	-0.46	0.00	-0.20	0.00
african american	-0.58	0.00	-0.21	0.00
asian	-0.49	0.00	-0.32	0.00
native American	-0.28	0.10	-0.08	0.65
Education				
less than highschool education	-0.86	0.00	-0.07	0.22
high school graduate	-0.55	0.00	0.05	0.33
some college	-0.24	0.00	0.00	0.97
Income Relative to Poverty				
100-124% of FPL	-0.04	0.71	-0.11	0.22
125-199% of FPL	0.06	0.40	-0.13	0.10
200-399% of FPL	0.23	0.00	-0.16	0.04
400+% of FPL	0.08	0.39	0.02	0.81
Marital Status				
widowed, divorced, separated	-0.11	0.08	0.14	0.01
never married	-0.18	0.00	0.04	0.41
Self-Reported Health Status				
very good	0.15	0.00	0.12	0.02

good	0.14	0.01	0.27	0.00
fair	0.41	0.00	0.38	0.00
poor	0.64	0.01	0.35	0.00
health missing	-1.16	0.02	1.27	0.01
mental, fair or poor health	0.04	0.75	0.10	0.16
Functional/Activity limitations				
iadl screener	0.60	0.08	0.63	0.00
adl screener	1.30	0.04	0.11	0.49
difficulty lifting or walking	0.21	0.47	0.22	0.05
social or cognitive limitations	0.01	0.97	0.19	0.02
any limitations	0.50	0.04	0.32	0.00
unable	0.83	0.02	0.59	0.00
deceased or institutionalized	0.06	0.83	2.18	0.00
Acute and Chronic Conditions				
diabetes	2.09	0.00	0.26	0.00
otitis_media	1.78	0.00	0.02	0.88
hypertension	2.27	0.00	0.26	0.00
asthma	1.44	0.00	0.18	0.01
back_disorder	0.55	0.00	0.04	0.51
infectious	0.85	0.00	-0.04	0.22
malignant neoplasm	0.93	0.01	1.05	0.00
endocrine	2.36	0.00	0.28	0.00
blood	2.40	0.00	0.22	0.13
heart and cerebrovascular	2.26	0.00	1.02	0.00
bronchitis	0.82	0.00	0.08	0.16
digestive	1.68	0.00	0.46	0.00
genitourinary	1.91	0.00	0.41	0.00
skin	2.14	0.00	0.18	0.01
musculoskeletal	1.07	0.00	0.35	0.00
fracture	2.28	0.00	0.70	0.00
pregnancy	2.21	0.00	1.42	0.00
constant	0.32	0.04	6.69	0.00

Exhibit A.4
Two-Part Spending Models, Adults, MEPS 1996-1998
(Uninsured plus Full-Year Publicly Insured)

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	16099		11075	
percent of year with private insurance	1.10	0.00	0.58	0.00
percent of year with public insurance	1.14	0.00	0.47	0.00
Census Region				
northeast	0.23	0.01	0.07	0.38
midwest	0.24	0.01	-0.02	0.76
south	0.14	0.05	0.08	0.21
Age and Gender				
_19_24	0.28	0.09	-0.26	0.03
_25_29	0.18	0.26	-0.36	0.00
_30_34	0.17	0.29	-0.16	0.19
_35_39	0.19	0.25	-0.07	0.56
_40_44	0.18	0.27	-0.01	0.95
_45_49	0.26	0.13	-0.08	0.53
_50_54	0.26	0.15	0.00	1.00
_55_59	0.24	0.22	-0.02	0.84
male	-0.51	0.00	0.11	0.05
Race/Ethnicity				
white hispanic	-0.52	0.00	-0.13	0.08
african american	-0.53	0.00	-0.25	0.00
asian	-0.32	0.02	-0.50	0.00
native American	-0.27	0.15	-0.10	0.65
Education				
less than highschool education	-0.79	0.00	-0.23	0.00
high school graduate	-0.56	0.00	-0.06	0.43
some college	-0.22	0.03	-0.10	0.16
Income Relative to Poverty				
100-124% of FPL	0.01	0.96	0.07	0.49
125-199% of FPL	0.05	0.50	-0.04	0.60
200-399% of FPL	0.12	0.11	-0.03	0.67
400+% of FPL	-0.01	0.88	0.05	0.58
Marital Status				
widowed, divorced, separated	-0.16	0.04	0.07	0.35
never married	-0.25	0.00	0.04	0.57
Self-Reported Health Status				
very good	0.22	0.00	0.05	0.46

good	0.12	0.09	0.20	0.01
fair	0.40	0.00	0.24	0.01
poor	0.40	0.07	0.22	0.06
health missing	-0.71	0.16	-0.60	0.19
mental, fair or poor health	0.16	0.19	0.21	0.01
Functional/Activity limitations				
iadl screener	0.82	0.03	0.44	0.01
adl screener	0.44	0.48	0.08	0.65
difficulty lifting or walking	0.21	0.44	0.09	0.43
social or cognitive limitations	-0.06	0.78	0.26	0.01
any limitations	0.38	0.09	0.46	0.00
unable	1.09	0.00	0.56	0.00
deceased or institutionalized	0.13	0.64	2.40	0.00
Acute and Chronic Conditions				
diabetes	1.89	0.00	0.33	0.00
otitis_media	1.87	0.00	0.08	0.65
hypertension	2.02	0.00	0.26	0.00
asthma	1.47	0.00	0.10	0.23
back_disorder	0.58	0.00	-0.03	0.64
infectious	0.88	0.00	-0.10	0.07
malignant neoplasm	1.23	0.01	0.75	0.00
endocrine	2.06	0.00	0.31	0.00
blood	2.63	0.00	0.22	0.24
heart and cerebrovascular	1.91	0.00	0.71	0.00
bronchitis	0.83	0.00	0.13	0.10
digestive	1.60	0.00	0.51	0.00
genitourinary	1.73	0.00	0.35	0.00
skin	2.11	0.00	0.09	0.18
musculoskeletal	1.01	0.00	0.22	0.00
fracture	2.16	0.00	0.63	0.00
pregnancy	2.47	0.00	1.30	0.00
constant	0.12	0.54	6.70	0.00

Exhibit A.5
Two-Part Spending Models, Adults, MEPS 1996-1998
(Uninsured plus Full-Year Privately Insured)

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	26,988		20,133	
percent of year with private insurance	0.97	0.00	0.53	0.00
percent of year with public insurance	1.71	0.00	0.64	0.00
Census Region				
northeast	0.13	0.05	0.00	0.95
midwest	0.24	0.00	-0.08	0.14
south	0.07	0.19	-0.01	0.81
Age and Gender				
_19_24	0.13	0.34	-0.28	0.00
_25_29	0.05	0.68	-0.36	0.00
_30_34	0.03	0.83	-0.27	0.00
_35_39	0.00	0.99	-0.15	0.06
_40_44	-0.05	0.67	-0.08	0.30
_45_49	0.10	0.44	-0.11	0.20
_50_54	0.02	0.89	-0.09	0.27
_55_59	0.00	0.99	-0.11	0.16
male	-0.59	0.00	0.06	0.13
Race/Ethnicity				
white hispanic	-0.46	0.00	-0.20	0.00
african american	-0.58	0.00	-0.21	0.00
asian	-0.49	0.00	-0.32	0.00
native American	-0.28	0.10	-0.08	0.65
Education				
less than highschool education	-0.86	0.00	-0.07	0.22
high school graduate	-0.55	0.00	0.05	0.33
some college	-0.24	0.00	0.00	0.97
Income Relative to Poverty				
100-124% of FPL	-0.04	0.71	-0.11	0.22
125-199% of FPL	0.06	0.40	-0.13	0.10
200-399% of FPL	0.23	0.00	-0.16	0.04
400+% of FPL	0.08	0.39	0.02	0.81
Marital Status				
widowed, divorced, separated	-0.11	0.08	0.14	0.01
never married	-0.18	0.00	0.04	0.41
Self-Reported Health Status				
very good	0.15	0.00	0.12	0.02

good	0.14	0.01	0.27	0.00
fair	0.41	0.00	0.38	0.00
poor	0.64	0.01	0.35	0.00
health missing	-1.16	0.02	1.27	0.01
mental, fair or poor health	0.04	0.75	0.10	0.16
Functional/Activity limitations				
iadl screener	0.60	0.08	0.63	0.00
adl screener	1.30	0.04	0.11	0.49
difficulty lifting or walking	0.21	0.47	0.22	0.05
social or cognitive limitations	0.01	0.97	0.19	0.02
any limitations	0.50	0.04	0.32	0.00
unable	0.83	0.02	0.59	0.00
deceased or institutionalized	0.06	0.83	2.18	0.00
Acute and Chronic Conditions				
diabetes	2.09	0.00	0.26	0.00
otitis_media	1.78	0.00	0.02	0.88
hypertension	2.27	0.00	0.26	0.00
asthma	1.44	0.00	0.18	0.01
back_disorder	0.55	0.00	0.04	0.51
infectious	0.85	0.00	-0.04	0.22
malignant neoplasm	0.93	0.01	1.05	0.00
endocrine	2.36	0.00	0.28	0.00
blood	2.40	0.00	0.22	0.13
heart and cerebrovascular	2.26	0.00	1.02	0.00
bronchitis	0.82	0.00	0.08	0.16
digestive	1.68	0.00	0.46	0.00
genitourinary	1.91	0.00	0.41	0.00
skin	2.14	0.00	0.18	0.01
musculoskeletal	1.07	0.00	0.35	0.00
fracture	2.28	0.00	0.70	0.00
pregnancy	2.21	0.00	1.42	0.00
constant	0.32	0.04	6.69	0.00

Exhibit A.6
Two-Part Spending Models, Adults, MEPS 1996-1998
(Uninsured plus Full-Year Publicly Insured)

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	16099		11075	
percent of year with private insurance	1.10	0.00	0.58	0.00
percent of year with public insurance	1.14	0.00	0.47	0.00
Census Region				
northeast	0.23	0.01	0.07	0.38
midwest	0.24	0.01	-0.02	0.76
south	0.14	0.05	0.08	0.21
Age and Gender				
_19_24	0.28	0.09	-0.26	0.03
_25_29	0.18	0.26	-0.36	0.00
_30_34	0.17	0.29	-0.16	0.19
_35_39	0.19	0.25	-0.07	0.56
_40_44	0.18	0.27	-0.01	0.95
_45_49	0.26	0.13	-0.08	0.53
_50_54	0.26	0.15	0.00	1.00
_55_59	0.24	0.22	-0.02	0.84
male	-0.51	0.00	0.11	0.05
Race/Ethnicity				
white hispanic	-0.52	0.00	-0.13	0.08
african american	-0.53	0.00	-0.25	0.00
asian	-0.32	0.02	-0.50	0.00
native American	-0.27	0.15	-0.10	0.65
Education				
less than highschool education	-0.79	0.00	-0.23	0.00
high school graduate	-0.56	0.00	-0.06	0.43
some college	-0.22	0.03	-0.10	0.16
Income Relative to Poverty				
100-124% of FPL	0.01	0.96	0.07	0.49
125-199% of FPL	0.05	0.50	-0.04	0.60
200-399% of FPL	0.12	0.11	-0.03	0.67
400+% of FPL	-0.01	0.88	0.05	0.58
Marital Status				
widowed, divorced, separated	-0.16	0.04	0.07	0.35
never married	-0.25	0.00	0.04	0.57
Self-Reported Health Status				
very good	0.22	0.00	0.05	0.46

good	0.12	0.09	0.20	0.01
fair	0.40	0.00	0.24	0.01
poor	0.40	0.07	0.22	0.06
health missing	-0.71	0.16	-0.60	0.19
mental, fair or poor health	0.16	0.19	0.21	0.01
Functional/Activity limitations				
iadl screener	0.82	0.03	0.44	0.01
adl screener	0.44	0.48	0.08	0.65
difficulty lifting or walking	0.21	0.44	0.09	0.43
social or cognitive limitations	-0.06	0.78	0.26	0.01
any limitations	0.38	0.09	0.46	0.00
unable	1.09	0.00	0.56	0.00
deceased or institutionalized	0.13	0.64	2.40	0.00
Acute and Chronic Conditions				
diabetes	1.89	0.00	0.33	0.00
otitis_media	1.87	0.00	0.08	0.65
hypertension	2.02	0.00	0.26	0.00
asthma	1.47	0.00	0.10	0.23
back_disorder	0.58	0.00	-0.03	0.64
infectious	0.88	0.00	-0.10	0.07
malignant neoplasm	1.23	0.01	0.75	0.00
endocrine	2.06	0.00	0.31	0.00
blood	2.63	0.00	0.22	0.24
heart and cerebrovascular	1.91	0.00	0.71	0.00
bronchitis	0.83	0.00	0.13	0.10
digestive	1.60	0.00	0.51	0.00
genitourinary	1.73	0.00	0.35	0.00
skin	2.11	0.00	0.09	0.18
musculoskeletal	1.01	0.00	0.22	0.00
fracture	2.16	0.00	0.63	0.00
pregnancy	2.47	0.00	1.30	0.00
constant	0.12	0.54	6.70	0.00

Exhibit A.7
Two-Part Spending Models, Children, MEPS 1996-1998
(Uninsured plus Full-Year Privately Insured)

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	15148		11674	
Percent of year with private insurance	0.76	0.00	0.67	0.00
Percent of year with public insurance	1.40	0.00	0.55	0.00
Census Region				
northeast	0.49	0.00	-0.04	0.62
midwest	0.39	0.00	0.08	0.36
south	0.04	0.62	-0.11	0.11
Age and Gender				
_0	0.91	0.00	1.32	0.00
_1_4	0.68	0.00	-0.33	0.00
_5_9	0.29	0.00	-0.62	0.00
_10_12	-0.01	0.95	-0.30	0.00
male	-0.14	0.01	0.00	0.96
Race/Ethnicity				
white hispanic	-0.42	0.00	-0.05	0.52
black	-0.78	0.00	-0.28	0.00
asian	-0.37	0.02	-0.28	0.02
native american	-0.59	0.00	-0.16	0.29
Education				
less than high school	-0.87	0.00	-0.33	0.00
high school graduate	-0.68	0.00	-0.21	0.02
some college	-0.40	0.00	-0.07	0.37
Income Relative to Poverty				
100-124% of FPL	-0.03	0.80	-0.22	0.05
125-199% of FPL	0.18	0.03	-0.18	0.04
200-399% of FPL	0.61	0.00	-0.07	0.40
400+% of FPL	0.73	0.00	0.12	0.36
Marital Status				
single parent, female	0.05	0.51	-0.01	0.86
single parent, male	-0.43	0.01	-0.12	0.38
Self-Reported Health Status				
very good	0.09	0.18	0.21	0.00
good	0.24	0.00	0.58	0.00
fair	0.81	0.00	1.26	0.00
poor	-0.37	0.45	2.35	0.00
healthmissing	-1.54	0.00	0.52	0.35

mental, fair or poor health	0.24	0.24	0.55	0.00
Functional/Activity Limitations				
adl screener	0.37	0.59	1.43	0.00
deceased or institutionalized	-0.70	0.21	2.08	0.00
iadl screener	0.76	0.34	0.24	0.52
limited in any activity (< 5 years)	0.08	0.79	0.51	0.01
in special program (< 5 years)	0.16	0.26	-0.22	0.04
Acute and Chronic Conditions				
asthma	1.53	0.00	0.31	0.00
infectious	0.81	0.00	0.19	0.00
bronchitis	0.92	0.00	0.25	0.00
digestive	0.96	0.00	0.53	0.00
genitourinary	0.99	0.00	0.29	0.01
skin	1.78	0.00	0.10	0.15
musculoskeletal	1.21	0.00	0.45	0.00
fracture	2.20	0.00	0.92	0.00
constant	0.37	0.02	6.27	0.00

Exhibit A.8

**Two-Part Spending Models, Children, MEPS 1996-1998
(Uninsured plus Full-Year Publicly Insured)**

variable	Any Expense		Total Spending	
	Coefficient	p-value	Coefficient	p-value
n	11897		8798	
Percent of year with private insurance	0.94	0.00	0.57	0.00
Percent of year with public insurance	1.03	0.00	0.40	0.00
Census Region				
northeast	0.40	0.00	-0.05	0.61
midwest	0.29	0.01	0.12	0.22
south	0.18	0.02	-0.06	0.42
Age and Gender				
0	1.12	0.00	1.13	0.00
1_4	0.82	0.00	-0.41	0.00
5_9	0.31	0.00	-0.50	0.00
10_12	0.09	0.34	-0.36	0.00
male	-0.15	0.02	0.04	0.50
Race/Ethnicity				
white hispanic	-0.35	0.00	-0.20	0.01
black	-0.66	0.00	-0.16	0.05
asian	-0.28	0.09	-0.16	0.27
native american	-0.47	0.02	-0.12	0.44
Education				
less than high school	-0.44	0.00	-0.36	0.00
high school graduate	-0.47	0.00	-0.43	0.00
some college	-0.05	0.76	-0.15	0.23
Income Relative to Poverty				
100-124% of FPL	0.06	0.54	-0.07	0.54
125-199% of FPL	-0.10	0.22	-0.16	0.06
200-399% of FPL	0.32	0.00	-0.10	0.26
400+% of FPL	0.56	0.00	0.01	0.94
Marital Status				
single parent, female	-0.03	0.69	-0.01	0.93
single parent, male	-0.16	0.40	0.24	0.17
Self-Reported Health Status				
very good	0.07	0.30	0.34	0.00
good	0.23	0.00	0.50	0.00
fair	1.03	0.00	0.94	0.00
poor	0.15	0.77	1.13	0.00
healthmissing	-1.59	0.00	0.96	0.15
mental, fair or poor health	0.38	0.04	0.37	0.00

Functional/Activity Limitations				
adl screener	1.06	0.29	1.09	0.00
deceased or institutionalized	-0.86	0.06	-0.47	0.37
iadl screener	-0.10	0.91	0.59	0.04
limited in any activity (< 5 years)	-0.12	0.65	0.46	0.00
in special program (< 5 years)	0.07	0.62	-0.02	0.82
Acute and Chronic Conditions				
asthma	1.43	0.00	0.25	0.00
infectious	0.93	0.00	0.15	0.01
bronchitis	0.97	0.00	0.26	0.00
digestive	0.95	0.00	0.43	0.00
genitourinary	1.12	0.00	0.44	0.00
skin	1.80	0.00	0.29	0.00
musculoskeletal	1.15	0.00	0.27	0.05
fracture	1.90	0.00	1.41	0.00
constant	0.10	0.60	6.36	0.00

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