

## Appendix

### Method, Data Sources and Detailed Tables

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## Method and Data Sources

### *Study Design*

A cross-sectional analysis of data from the combined 1997 and 1998 National Health Interview Surveys (NHIS) was used to explore the interrelationship of rural residence and race on health care access, measured by health insurance, and health care utilization, measured as reported health care encounters. The population of interest was older adults, defined as persons greater than age 64.

### *Data Source*

The NHIS is an annual survey conducted for the National Center for Health Statistics by the U.S. Bureau of the Census and is the principal source of information on the health of the civilian, noninstitutionalized household population of the United States. It uses a complex sample design involving stratification, clustering, and multistage sampling. In both 1997 and 1998, the Hispanic and African American populations were oversampled. NHIS files include weights for each person that reflect design, ratio, nonresponse, and post-stratification adjustments.

The 1997 NHIS consisted of 39,832 households with 103,447 people in 40,623 families; the 1998 NHIS had 38,209 households with 98,785 people in 38,773 families. The combined sample size for the Person-Level Files is 202,262. The total response rate for the NHIS in 1997 was 91.8%; in 1998 it was 90.0%.

The data used to analyze older adults came from the 1997 and 1998 NHIS Person-Level Files. These files were concatenated and the survey sampling weights adjusted to half their original size to convert two years of data to the equivalent of data for a single year. Slight differences in the surveys from 1997 and 1998 required some manipulation of the 1997 data to get comparable values for person-level health insurance status (insured/not insured/missing).

There are six sections in the Family Core, which is the source for the Person-level variables. These six sections are the Health Status and Limitation of Activity Section; the Injury Section; the Health Care Access and Utilization Section; the Health Insurance Section; the Socio-demographic Section; and the Income and Assets Section.

The *Health Status and Limitation of Activity Section* contains respondent-assessed disabilities, disability-associated conditions, and overall health status for all family members. For activity limitations, respondents were asked questions about work limitations, the need for personal assistance with personal care needs such as eating, bathing, dressing, getting around inside the home, and the need for personal assistance with routine needs such as everyday household chores, and doing necessary business, shopping or running errands. Only if any such limitations were identified were respondents asked to specify the health condition(s) causing the limitation(s) and how long they had each condition. For adults, the fixed response categories for conditions or health problems were broad: vision/problem seeing; hearing problem; arthritis/rheumatism; back or neck problem; fractures, bone/joint injury; other injury; heart problem; stroke problem; hypertension/high blood pressure; diabetes; lung/breathing problem;

cancer; birth defect; mental retardation; other developmental problem; senility; depression/anxiety/emotional problem; weight problem; and other impairment. Each condition was classified as chronic, not chronic, or unknown if chronic. Conditions that cannot be cured once acquired, such as heart disease, diabetes, birth defects, amputations, and senility, were considered chronic. Conditions related to pregnancy were always considered not chronic. Additionally, conditions must have been present at least three months to be considered chronic.

The *Injury Section*, not used for this report, contains information about medically attended injuries and poisonings that occurred to any member of the family within a three-month period. Both injuries and poisonings were episode-based, with each episode consisting of at least one injury or poisoning. Injuries were classified according to the nature of-injury codes 800-959 or 990-999 of the Ninth Revision of the International Classification of Diseases (ICD-9-CM).

The *Health Care Access and Utilization Sections* from the 1997 and 1998 NHIS are identical and contain information-addressing access to health care and utilization of services. This section has three parts: Access to Care; Hospitalization; and Health Care Contacts. Home care and office visits were distinguished beginning in 1997 and there were separate questions for both. Also beginning in 1997, respondents were asked about care from all types of medical doctors such as dermatologists, psychiatrists, ophthalmologists, general practitioners, nurses, physical therapists, and chiropractors. Respondents were also asked about 10 or more visits to doctors or other health care professionals in the last 12 months.

The *Health Insurance Section* covers type of health care coverage (Medicare, Medicaid, military/VA, CHAMPUS/TRICARE/CHAPM-VA, state-sponsored health plan, other government program, Indian Health Service, or private insurance), private insurance characteristics, periods of time without health insurance and reasons for no health insurance, and out-of-pocket costs in the last year.

The *Socio-demographic Section* collected information on place of birth, citizenship status, and years of education for all family members regardless of age. Adults were also asked if they were working in the week before the interview, and if not, their main reason for not working. For those who were working, additional questions inquired about the number of hours worked, how many months they worked in the previous year, how much they earned in the last year, and whether their employer provided health insurance.

The *Income and Assets Section* contains information regarding income sources and total combined family income and home tenure status. Specifically, respondents were asked if their income came from wages and salary, Social Security or Railroad Retirement, other pensions, Supplemental Security Income, Welfare/Temporary Assistance to Needy Families, interest from saving or other bank accounts, dividends from stocks or mutual funds, rental income, royalties, estates, or trusts, child support payments, alimony, Worker's Compensation, and Unemployment Compensation. A detailed poverty indicator used information from the U.S. Bureau of the Census on 1997 poverty thresholds. The poverty indicator was a ratio of the 1997 income value to the poverty threshold, given the family's overall size as well as the number of children aged 17 and under in the family. The resulting ratio, ordered into 14 gradients, applies to each family

in the survey. However, the poverty variable was blank for 7,407 of 23, 331 records (31%) among elderly respondents and therefore was not used in this analysis.

The principal variable of interest was rural residence. The NHIS measure of rurality was used. The NHIS defines any place of residence outside of a Metropolitan Statistical Area (MSA) as “rural.”

Non-informative responses were not used in the analysis. Non-informative responses include those coded to reflect “Don’t Know,” “Not in universe”, “Not ascertained”, “Refused”, and all missing responses. Exclusion of non-informative answers changes the base for calculating the percentages in each cross-classification cell, so sample sizes are the maximum possible number of responses that could be used and not necessarily the actual number used.

Analysis began with series of descriptive tables including the important demographic variables and covariates. The principal outcome explored as a measure of access was physician visits in the last twelve months, expressed as a binary variable (yes/no).

The weighted and unweighted populations included in the analyses are shown in Table A-1. All population estimates and estimates of the proportions with accompanying standard errors and all logistic regressions were done with SAS-callable SUDAAN 8 and SAS 8.1. Use of this technique guarantees both unbiased point estimates and valid variance estimation. Because the NHIS sample survey design does not oversample persons who live in rural areas, some sample sizes are small for rural minorities. The NHIS documentation does not specify a minimum numeric value for valid point estimates, but some of the rural minority sample sizes are small enough for concern (fewer than 30 observations per year, or less than 60 observations in the combined data).

Table A-1. Weighted and unweighted sample sizes of all elderly adults, by gender, race/ethnicity and residence, 1997 & 1998 NHIS Data

<b>Elderly Adults** (65+)</b>	<b>White</b>	<b>African American</b>	<b>Hispanic</b>	<b>Other</b>	<b>Total</b>
<b>Metropolitan</b>					
<b>Male</b>	5,675 8,524,556	793 849,995	809 639,359	208 283,952	7485 10,297,862
<b>Female</b>	7,870 11,708,980	1,313 1,308,494	1,127 890,156	297 401,223	10,607 14,308,852
<b>Total</b>	13,545 20,233,536	2,106 2,158,489	1,936 1,529,515	505 685,175	18,092 24,606,714
<b>Non-metro</b>					
<b>Male</b>	1,937 2,952,492	154 170,325	106 70,013	29 43,835	2,226 3,236,664
<b>Female</b>	2,573 3,873,745	251 260,020	126 78,707	43 57,168	2,993 4,269,639
<b>Total</b>	4,510 6,826,236	405 430,345	232 148,719	72 101,003	5,219 7,506,302

\*\*Figures from the combined 1997 & 1998 NHIS Person-Level Files calculated in SAS-Callable SUDAAN 8.

Table A-2. Summary characteristics for adults 65 years old or over by race/ethnicity and metropolitan and rural locations, 1997 & 1998 NHIS Data

Metropolitan	Total	White	African American	Hispanic	Other
Unweighted observations	18,092	13,545	2,106	1,936	505
Weighted National Estimate	24,606,714	20,233,536	2,158,489	1,529,515	685,175
Age (% in category):					
65-69	30.1	28.9	35.5	36.4	37.2
70-74	26.3	26.1	25.6	28.2	28.2
75-79	21.1	21.5	18.8	18.7	19.3
80-84	13.6	14.3	12.4	9.1	7.6
85+	9.0	9.3	7.7	7.7	7.7
Education (years)	11.8	12.3	10.4	8.3	11.0
Family Size (persons)	2.0	1.9	2.1	2.5	3.0
Number of Physician Visits	9.6	9.6	9.7	9.4	9.1
Number of Conditions (mean)	0.66	0.63	0.87	0.79	0.52
Insurance					
Any private insurance	66.9	73	43.7	30.5	40.5
Any Medicaid but not private	6.8	3.9	15.9	24.7	24.2
Medicare, military, or govt.	25.1	22.4	38.8	40.0	29.6
Uninsured (%)	1.1	0.65	1.6	4.9	5.6*
Non-metro					
Unweighted observations	5,219	5,219	5,219	5,219	5,219
Weighted National Estimate	7,506,302	7,506,302	7,506,302	7,506,302	7,506,302
Age (% in category):					
65-69	29.8	29.6	27.6	37.8	35.0
70-74	25.8	25.5	26.1	31	38.5
75-79	20.8	21.1	19.1	15.8	13.8*
80-84	13.4	13.5	14.9	8.7	8.3*
85+	10.2	10.3	12.2	6.6	4.4*
Education (years)	11.1	11.3	8.6	6.7	11.2
Family Size (persons)	1.8	1.8	2.1	2.2	2.2
Number of Physician Visits	9.1	9.1	10.4	6.6	5.6
Number of conditions	0.81	0.79	1.1	0.89	0.66
Insurance					
Any private insurance	72.0	75.5	33.9	33.4	57.0
Any Medicaid but not private	7.7	6.0	26.0	32.5	7.5*
Medicare, military, or govt. alone	19.6	18.1	38.8	29.0	28.3
Uninsured (%)	0.66*	0.43*	1.3*	5.1*	7.2*

\* Based on < 30 observations

Unweighted and weighted sample sizes calculated using the 1997 & 1998, NHIS Person-Level Data in SAS-Callable SUDAAN 7.5.6. Means and percentages calculated using the 1997 & 1998 NHIS Person-Level Data in SAS 8.1

Table A-3. Summary characteristics for elderly adults 65 years old or over by race/ethnicity and limited/not limited status, in metropolitan and rural locations, 1997 & 1998 NHIS data

	Limited				Not Limited			
Urban	White	African American	Hispanic	Other	White	African American	Hispanic	Other
Unweighted observations	4,977	996	791	139	8,895	1,179	1,214	372
<i>Weighted National Estimate</i>	<i>7,434,340</i>	<i>1,011,256</i>	<i>607,802</i>	<i>189,498</i>	<i>13,321,035</i>	<i>1,219,684</i>	<i>975,622</i>	<i>504,380</i>
Age (mean in years)	76.1	74.8	74.9	74.5	73.0	71.9	71.6	72.0
Education (mean in years)	13.9	12.0	7.3	11.2	14.5	13.6	11.5	13.5
Family Size (mean number of persons)	1.8	2.0	2.5	2.7	1.9	2.2	2.6	3.1
Number of Physician Visits	13.9	13.1	14.8	17.1	7.2	6.9	6.0	5.9
Number of Conditions (mean per respondent)	1.7	1.9	2.0	1.8	0	0	0	0
Percent Uninsured	0.3	0.4	3.1	3.0	0.5	2.5	5.8	5.5
<b>Rural</b>								
Unweighted observations	1,972	234	110	22	2,647	184	127	52
<i>Weighted National Estimate</i>	<i>3,024,237</i>	<i>241,389</i>	<i>68,011</i>	<i>31,381</i>	<i>3,979,337</i>	<i>203,987</i>	<i>85,631</i>	<i>72,978</i>
Age (mean in years)	76.0	76.3	72.9	72.8	72.7	72.5	72.0	71.6
Education (mean in years)	13.6	10.5	5.5	10.5	13.9	12.9	8.1	13.9
Family Size (mean number of persons)	1.7	2.1	2.3	2.1	1.8	2.2	2.2	2.2
Number of Physician Visits	12.2	11.4	10.4	5.0	6.7	9.2	3.4	6.0
Number of Conditions (mean per respondent)	1.8	2.1	2.0	2.0	0	0	0	0
Percent Uninsured	0.2	1.1	3.6	0.0	0.5	2.1	6.2	4.7

Unweighted and weighted sample sizes calculated using the 1997 & 1998 NHIS Person-Level Data in SAS-Callable SUDAAN 7.5.6

All means and percentages calculated using the 1997 & 1998 NHIS Person-Level Data in SAS V8

\* Unweighted sample size is less than 6

Table A-4. Weighted and unweighted sample sizes of all elderly adults by number of visits to a physician in the last year by Race/Ethnicity and Non-Rural and Rural Residence, 1997 & 1998 Data

	<b>Total</b>	<b>White</b>	<b>Afr Amer</b>	<b>Hispanic</b>	<b>Other</b>
<b>Total, all US</b>	23,110 <i>31,829,725</i>	17,906 <i>26,830,581</i>	2,486 <i>2,564,828</i>	2,156 <i>1,669,592</i>	562 <i>764,725</i>
At least one visit	5,712 <i>7,931,794</i>	4,468 <i>6,726,715</i>	628 <i>646,999</i>	490 <i>389,093</i>	126 <i>168,987</i>
No visit	17,398 <i>23,897,931</i>	13,438 <i>20,103,866</i>	1,858 <i>1,917,829</i>	1,666 <i>1,280,499</i>	436 <i>595,738</i>
<b>Metropolitan</b>					
<b>Total</b>	17,918 <i>24,361,373</i>	13,414 <i>20,032,071</i>	2,086 <i>2,140,363</i>	1,926 <i>1,522,308</i>	492 <i>666,631</i>
At least one visit	4,478 <i>6,150,478</i>	3,397 <i>5,103,219</i>	524 <i>534,752</i>	441 <i>356,950</i>	116 <i>155,558</i>
No visit	13,440 <i>18,210,895</i>	10,017 <i>14,928,853</i>	1,562 <i>1,605,611</i>	1,485 <i>1,165,358</i>	376 <i>511,074</i>
<b>Non-metro</b>					
<b>Total</b>	5,192 <i>7,468,352</i>	4,492 <i>6,798,510</i>	400 <i>424,465</i>	230 <i>147,284</i>	70 <i>98,094</i>
At least one visit	1,234 <i>1,781,316</i>	1,071 <i>1,623,497</i>	104 <i>112,247</i>	49 <i>32,143</i>	10 <i>13,430</i>
No visit	3,958 <i>5,687,036</i>	3,421 <i>5,175,013</i>	296 <i>312,218</i>	181 <i>115,141</i>	60 <i>84,664</i>

Table A-5 Percentage of all elderly adults with at least one physician visit in past two weeks.

Characteristic	Visits	No Visits
Total	24.8	75.2
<b>Sex</b>		
Male	24.1	75.9
Female	25.4	74.6
<b>Region</b>		
Northeast	23.8	76.2
Midwest	24.9	75.1
South	24.8	75.2
West	26.1	73.9
<b>Race</b>		
Caucasian	25.0	75.0
African-American	25.2	74.8
Hispanic	23.3	76.7
Other	22.0	78.0
<b>Household income &lt; \$20,000</b>		
Yes	25.9	74.2
No	25.1	75.0
<b>Residence</b>		
Non-Rural	25.2	74.9
Rural	23.8	76.2
<b>HS Grad?</b>		
Yes	25.2	74.8
No	25.3	74.7
<b>Insurance</b>		
Any private	25.8	75.1
Any Medicaid but not private	28.3	71.7
Medicare, military, or other government only	22.0	78.0
Uninsured	8.7	91.3
<b>Limited?</b>		
Yes	32.8	67.3
No	19.9	80.1
<b>Condition</b>		
Yes	32.8	67.2
No	20.0	80.0
<b>Health (Self-Reported)</b>		
Good-to-Excellent	21.7	78.3
Poor/Fair	33.5	66.5

## Multivariate Analysis

### *Analytic approach*

Covariates used in the analysis for elderly adults were sex (male or female), race (non-Hispanic white; non-Hispanic black; Hispanic; and other), limitation of normal activities (such as walking, climbing, standing, sitting, stooping, grasping, carrying, pushing, going out to shop, attend movies or sporting events, visit friends, attend clubs and meetings, go to parties, or to relax at home reading, watching TV, sewing, or listening to music), region (Northeast, Midwest, South, and West), level of education (high school graduate or non-high school graduate), rurality (rural or non-rural, where rural is defined as “non-MSA” and non-rural locations range in population from 5,000,000 or more to under 250,000), insurance (four categories: private insurance, which included all elders reporting private insurance, generally as a supplement to Medicare; Medicaid, which included both Medicaid alone and Medicaid supplementing Medicare, but excluded any persons with private insurance; Medicare or other government insurance (military, veterans) alone; and uninsured), income (below \$20,000 versus \$20,000 and above), family size (number of persons), self-reported health status (good-to-excellent or poor/fair), and age in years.

The algorithm used to build each separate model was to start with a model that included all covariates of interest, including specific pre-identified two- and three-way interactions. Then, starting with the highest order interactions, statistically insignificant interactions were deleted one at a time ( $\alpha = 0.01$ ), then main effects ( $\alpha = 0.05$ ). The final model in each case has only statistically significant main effects and main effects associated with an interaction term, with the exceptions described already.

The model-building process for older adults using visits to a physician in the last two weeks as the outcome started with the following list of covariates and interactions. Each was selected based on its possible or suspected association with the outcome.

#### Variables:

- Sex (male or female)
- Race/ethnicity (white, black, Hispanic, other)
- Rurality (metropolitan / non-metro)
- Income (below \$20,000/higher)
- Family size
- Insurance (four categories, including uninsured)
- Education (high school graduate versus less)
- Region
- Health (good-to-excellent or poor/fair)
- Limitation in activities (yes / no)
- Age

#### Two way interactions:

- Rurality and sex
- Rurality and race/ethnicity
- Rurality and income

- Rurality and high school graduate
- Rurality and region
- Rurality and limited activity
- Rurality and health
- Rurality and age
- Rurality and insurance
- Sex and age
- Income and insurance
- Education and income status
- Race and income
- Race and education
- Education and insurance

Three way interactions:

- Rurality, education, and income
- Rurality, income, and insurance
- Rurality, sex, and age
- Rurality, race, and income
- Rurality, race, and education
- Rurality, high school graduate, and insurance

The final model, after iteratively deleting non-statistically significant covariates from the model, contained the following covariates, including two significant interactions:

- Race/ethnicity
- Income
- Family size
- Insurance
- Rurality
- Education
- Condition status (A/C/W)
- Health status
- Limitation
- Rurality
- Rurality and health
- Race/ethnicity and income

The logistic regression was set up to predict the probability of a visit to a physician in the last 2 weeks, so a negative beta coefficient reflects a decreased probability of such a visit (See Table A-6). Odds ratios derived from the beta coefficients are shown in Table A-7. A significant beta coefficient for an interaction means that the effects of the main covariates are not additive on a log scale; that is, the sum of the effects of the covariates in the interaction is adjusted by the value of the interaction beta coefficient.

Table A-6. Logistic Regression predicting a physician visit in the previous two weeks, person 65 and older, beta coefficients

Covariates	Beta coefficient	SE Beta	p-value
Intercept	-1.2654	0.05223	<0.0001
<b>Combined race/ethnicity recode</b>			
Hispanic	-0.0937	0.0895	0.2955
White	0	0	0
African American	0.0966	0.0818	0.2383
Other	-0.1269	0.2054	0.5371
<b>Family income</b>			
\$20,000 or more	0.1160	0.0478	0.0158
Below \$20,000	0	0	0
<b>Family size</b>			
Each additional family member	-0.0686	0.0196	0.0005
<b>Insurance coverage</b>			
Any private insurance	0	0	0
Any Medicaid but not private	-0.0333	0.0706	0.0000
Medicare, military, or other government only	-0.1744	0.0461	0.6377
Uninsured	-0.9071	0.2610	0.0016
<b>Residence</b>			
Non-rural	0	0	0
Rural	-0.0572	0.0529	0.2800
<b>Limitations</b>			
Yes	0.5484	0.0393	0.0000
No	0	0	0
<b>Health</b>			
Good to excellent	0	0	0
Poor/fair	0.4920	0.0493	0.0000
<b>Education</b>			
Not a HS graduate	-0.1024	0.0411	0.0133
HS graduate	0	0	0
<b>Health and rurality</b>			
Good to excellent, non-rural	0	0	0
Good to excellent, rural	0	0	0
Poor to fair, non-rural	0	0	0
Poor to fair, rural	-0.2651	0.0904	0.0035
<b>Race/ethnicity and household income</b>			
Hispanic and \$20,000 or more	0.1375	0.1437	0.3392
Hispanic and less than \$20,000	0	0	0
White and \$20,000 or more	0	0	0
White and less than \$20,000	0	0	0
Black and \$20,000 or more	-0.3747	0.1133	0.0010
Black and less than \$20,000	0	0	0
Other and \$20,000 or more	0.2975	0.2397	0.2154
Other and less than \$20,000	0	0	0

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