

ONLINE SUPPLEMENTARY DATA

Supplementary Data 1. Medical Expenditure Panel Survey (MEPS) Brief Description.

MEPS Household Component (MEPS-HC) comprises of three components: The Household Component (HC), the Medical Provider Component (MPC) and the Insurance Component (IC). The HC provides information about demographic, socio-economic factors, medical conditions, healthcare use and costs, sources of payment and health insurance status. The HC information is self-reported while the MPC obtains data on medical and financial resources from hospitals, physicians, home health providers, and pharmacies so as to validate and/or supplement information in the HC (AHRQ MEPS HC). Below are the links and resources for the MEPS methodologies:

Agency for Healthcare Research and Quality. Methodology Report # 27, Sample design of the 2011 Medical Expenditure Panel Survey Insurance Component 2013a. Available at https://meps.ahrq.gov/data_files/publications/mr27/mr27.pdf Accessed June 20, 2017.

Agency for Healthcare Research and Quality. Household Component-Insurance Component Linked Data 1999, Research File 2003. Available at https://meps.ahrq.gov/mepsweb/data_stats/download_data_files_detail.jsp?cboPufNumber=LINK_99HC/IC Accessed June 20, 2017.

Agency for Healthcare Research and Quality. Medical Expenditure Panel Survey, 2013 Medical Conditions 2013b. Available at https://meps.ahrq.gov/data_stats/download_data/pufs/h162/h162doc.pdf Accessed June 20, 2017.

Agency for Healthcare Research and Quality. MEPS-HC Response Rates by Panel. Available at https://meps.ahrq.gov/mepsweb/survey_comp/hc_response_rate.jsp Accessed June 20, 2017.

Supplementary Data 2. Description of Anderson Behavior Model.

The expanded Andersen Behavioral Model of Health Services Use, widely known as the Andersen Healthcare Utilization and Behavioral Model (ABM) was used to identify independent variables for our study¹. This model has been extensively used in health services research to evaluate the factors associated with healthcare use and costs.

As per the ABM model, the use of healthcare services depends on several individual and contextual constructs. These constructs are: 1) *Predisposing factors*: These factors identify if individuals tend to represent more or less use healthcare services. We included age, gender, and race/ethnicity as predisposing factors. 2) *Enabling factors*: These factors enable or impede an individual's use of healthcare services. We included marital status, income status, health insurance, and employment status as enabling factors. 3) *Need-related factors*: These factors determine the need of use of healthcare services at an individual level. We included perceived physical and mental health status, co-occurring chronic conditions categorized into total number of physical and mental health conditions as need factors. We determined the list of conditions based on the guidance document from the Department of Health and Human Services Office of the Assistant Secretary of Health (OASH) which defines and measures the chronic conditions for research purpose as well as other common chronic conditions identified among individuals with arthritis using clinical classification codes². Based on these criteria, we included all the MEPS priority conditions such as heart disease, hypertension, stroke, emphysema or chronic bronchitis, high cholesterol, cancer, diabetes, asthma, in addition to gastrointestinal disorders, endocrinology or metabolic disorders, kidney diseases, and eyes disorders. Moreover, we defined the number of mental conditions by adding the presence of anxiety, depression,

¹ Andersen R. Revisiting the Behavioral Model and Access to Medical Care: Does it matter? *J Health Soc Behav* 1995;36:1-10.

² Goodman RA, Posner SF, Huang ES, Parekh AK, Koh HK. Defining and measuring chronic conditions: imperatives for research, policy, program, and practice. *Prev Chronic Dis*. 2013 Apr 25;10:E66. doi: 10.5888/pcd10.120239.

schizophrenia, or substance abuse. Furthermore, we also identified and included common acute conditions such as infections or acute injury. 4) *Personal health practice*: These factors related to an individual’s personal health behaviors impact an individual’s healthcare use. We included body mass index, current smoking status and exercise as personal health practice factors. 4) *External environment*: These factors facilitate the use of healthcare services based on the structure of services in the geographical areas an individual resides. We included census defined regions as external environmental factor. Details on each type of independent variables for each study aims are provided in **Appendix 3**.

Supplementary Table 1. Independent variables identification/definitions in Medical Expenditure Panel Survey, 2008-2014.

Variable(s)	Definition(s)/Clinical Classification Codes
Predisposing Factors	
Age	Every survey respondent was asked for his/her date of birth and if necessary verified during each MEPS interview.
Sex	Every survey respondent was asked for his/her sex and if necessary, verified during each MEPS interview.
Race	Every survey respondent was asked about his/her race and ethnic background and if necessary, verified during each MEPS interview.
Marital Status	Every survey respondent was asked about his/her current marital status was collected and/or updated during every round of the MEPS interview
Enabling Factors	
Poverty level	Survey respondents were asked about their total family income. Four income groups were defined based on the percentage of the poverty line for total family income, adjusted for family size and composition. It has following categories: poor (less than 100%), near poor (100% to less than 125%), low income (125% to less than 200%), middle income (200% to less than 400%), and high income (greater than or equal to 400%). For analyses we combine near poor/low income as a single category.
Education level	Survey respondents were asked about their current education. MEPS data administration converted self-reported education into a broader classification of education in a range of 0 to 16 years of education, where 0 represent “Less than 1st Grade” and 16 represents “Master, Doctorate, or Other Professional Degree.”
Need Factors	
Perceived Physical Health	“In general, compared to other people of {your/his/her} age, would you say that {your/his/her} health is excellent, very good, good, fair, or poor?”

Variable(s)	Definition(s)/Clinical Classification Codes
Perceived Mental Health	"In general, would you say that {your/{PERSON}'s} mental health is excellent, very good, good, fair, or poor?"
Priority Chronic Conditions Questionnaires	
High blood pressure	if the person had ever been diagnosed as having high blood pressure (other than during pregnancy)"
Heart disease*	if the person had ever been diagnosed as having coronary heart disease if the person had ever been diagnosed as having angina, or angina pectoris if the person had ever been diagnosed as having a heart attack, or myocardial infarction if the person had ever been diagnosed with any other kind of heart disease or condition
Stroke	if the person (aged 18 or older) had ever been diagnosed as having had a stroke or transient ischemic attack (TIA or ministroke)
Emphysema	if the person (aged 18 or older) had ever been diagnosed with emphysema
Chronic Bronchitis	if the person (aged 18 or older) has had chronic bronchitis in the last 12 months
High cholesterol	if the person had ever been diagnosed as having high cholesterol
Cancer	if person had ever been diagnosed as having cancer or a malignancy of any kind.
Diabetes	if person (aged 18 or older) had ever been diagnosed with diabetes (excluding gestational diabetes).
Joint pain	if the person (aged 18 or older) had experienced pain, swelling, or stiffness around a joint in the last 12 months
Arthritis	if the person (aged 18 or older) had ever been diagnosed with arthritis
Asthma	if a person had ever been diagnosed with asthma
External Environment Characteristics	
Region	Census defined region of survey respondents
Other Conditions of Interest	
Gastrointestinal disorders	
Esophageal disorders	138
IBD	144,140
Gastric Ulcer	139
Liver disorders	149,150,151
Diverticulosis	146
Endocrine/Metabolic disorders	
Thyroid disorders	048
Endocrine	051
Nutrition/Endocrine deficiency-anemia	058,059
Osteoporosis	206
Neurological disorders	
Paralysis or other neurodegenerative disease	79, 80, 81, 82,83
Headache-including migraine	84

Variable(s)	Definition(s)/Clinical Classification Codes
Peripheral Vascular disease	114,248
Kidney Diseases	
Kidney failure	158,157
Fluid and electrolyte	55
Eye-disorders	
Glaucoma/Cataract	086,088
Blindness	089
Gall bladder	149
Mental-Health Conditions	
Anxiety	651
Depression/Mood	657
Schizophrenia	659
Substance Abuse	660,661
Delirium, dementia, and amnestic and other cognitive disorders	653
Other Conditions	
AIDS	005
Hepatitis	006
Acute conditions	
Infection	001, 002, 003, 004, 007, 008, 009
Fracture	226,228, 229, 230, 231

Supplementary Table 2. Chronic Conditions among individuals with and without Arthritis using Medical Expenditure Panel Survey, 2008-2014.

	Arthritis (Weighted %)							No-Arthritis (Weighted %)						
	2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Cardiovascular														
Hypertension	58.0	59.2	59.3	60.1	60.4	60.6	59.3	23.1	23.3	23.6	23.4	23.8	24.5	23.9
Heart disease	28.5	29.0	29.3	29.7	28.4	30.7	31.0	9.5	9.0	8.6	8.5	8.8	9.3	9.0
Coronary Heart Disease	14.4	13.7	12.6	12.9	12.8	13.0	13.2	3.3	3.2	3.4	2.9	3.0	2.9	2.6
Myocardial Infarction	9.0	9.0	8.6	8.5	7.8	8.0	8.7	2.1	2.1	2.1	2.1	2.2	2.2	2.0
Angina	8.0	7.1	7.0	6.7	6.0	5.7	6.0	1.5	1.3	1.3	1.1	1.1	1.3	1.1
Other Heart Disease	21.6	22.5	22.2	22.4	21.7	23.9	24.0	7.4	7.0	6.7	6.6	6.7	7.1	7.1
Peripheral vascular disease	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Metabolic/Endocrine														
Diabetes	19.7	17.2	18.6	18.8	18.1	19.3	20.2	6.3	5.5	5.6	6.3	6.1	5.9	6.2
Hyperlipidemia	55.1	54.0	54.5	54.0	53.1	55.6	54.8	23.3	23.4	22.5	22.5	22.8	22.9	22.7
Thyroid disorder	14.1	14.3	14.7	13.6	13.6	14.3	15.4	4.4	4.6	5.3	4.9	5.0	5.1	4.7
Osteoporosis	4.9	4.2	3.7	3.3	2.7	2.5	2.1	1.1	1.0	1.0	0.6	0.5	0.6	0.6
Other endocrine disorders	1.9	2.0	1.9	2.3	2.3	2.4	2.6	0.7	0.9	1.0	1.1	1.1	1.2	1.4
Cancer***	20.9	20.7	20.0	21.1	20.9	21.2	21.8	6.5	6.5	6.6	6.9	7.0	6.6	6.7
Mental Health														
Depression	16.8	17.4	18.9	19.0	19.3	20.8	20.5	7.3	7.8	7.8	7.9	7.9	8.3	8.8
Anxiety	12.7	13.2	12.9	15.1	16.6	18.2	18.3	7.1	7.3	7.3	7.6	8.7	9.0	9.4
Substance Abuse	0.5	0.5	0.8	1.0	0.7	0.7	1.0	0.5	0.6	0.5	0.5	0.5	0.5	0.6
Schizophrenia	0.3	0.5	0.6	0.5	0.5	0.5	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Respiratory Condition(s)														
Asthma	13.4	13.6	14.8	14.0	13.9	14.1	14.4	7.5	7.5	7.6	7.5	7.9	8.4	8.1
COPD	11.4	12.1	12.8	12.2	10.5	10.7	11.2	3.2	2.7	2.3	2.4	2.3	2.2	2.1
Emphysema	6.2	6.1	6.2	6.0	5.1	5.9	5.7	1.2	1.0	1.0	1.0	0.9	0.8	0.9
Chronic Bronchitis	6.3	5.8	6.5	6.3	5.3	5.1	5.6	1.6	1.4	1.2	1.1	1.1	1.1	1.0
Eye-Disorders														
Glaucoma/cataract	9.2	9.1	8.0	8.3	8.5	9.3	10.5	1.9	1.8	1.7	2.1	1.9	1.9	2.1
Blindness	2.9	3.3	3.3	3.3	3.5	3.7	4.6	2.2	1.9	1.9	2.0	1.8	2.3	2.9
Neurological disorder														

(Continued....)

	Arthritis (Weighted %)							No-Arthritis (Weighted %)						
	2008	2009	2010	2011	2012	2013	2014	2008	2009	2010	2011	2012	2013	2014
Paralysis and Neurological	4.4	4.7	4.7	4.3	4.4	4.7	4.8	1.5	1.6	1.5	1.5	1.4	1.3	1.6
Dementia	2.0	1.9	2.2	2.2	2.1	2.0	1.7	0.4	0.4	0.4	0.3	0.3	0.4	0.5
Stroke	9.2	9.1	9.3	9.3	8.3	9.3	9.1	1.9	1.7	1.6	1.6	1.7	1.9	1.9
Headache	5.9	6.7	6.4	7.2	6.6	6.8	6.9	5.2	5.2	5.2	5.5	5.6	5.4	4.0
Gastrointestinal disorders														
Esophageal disorder	15.1	14.6	15.3	16.9	16.2	16.5	17.7	4.4	4.0	4.0	4.3	4.0	3.7	3.9
Diverticulosis	1.3	1.0	1.1	0.9	0.9	1.4	0.9	0.2	0.3	0.2	0.2	0.3	0.3	0.2
IBD	1.2	1.2	1.4	1.8	1.8	2.0	1.5	0.6	0.7	0.7	0.6	0.6	0.6	0.6
Liver disease	0.8	0.8	0.8	0.7	0.9	1.2	1.3	0.3	0.4	0.2	0.3	0.4	0.4	0.4
Gastric Ulcer	0.7	0.6	0.7	0.6	0.5	0.5	0.6	0.2	0.1	0.3	0.2	0.2	0.2	0.2
Other diseases														
Kidney Failure	0.6	0.8	0.8	0.9	1.1	0.6	0.6	0.1	0.1	0.2	0.2	0.2	0.2	0.1
Fluid and Electrolytes	4.4	4.4	4.5	4.5	5.1	5.4	4.8	0.9	0.9	1.0	1.0	1.0	1.1	1.0
Fracture	5.0	5.1	5.2	3.9	4.7	4.9	5.2	2.3	2.3	2.0	2.1	2.2	2.2	2.1
Nutrient deficiency including	4.2	4.0	4.1	5.2	4.6	5.7	5.5	1.7	2.0	2.0	1.8	2.0	1.9	2.1
Serious conditions														
Hepatitis	0.3	0.6	0.5	0.6	0.4	0.4	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.3
AIDS/HIV	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.0	0.2

Abbreviations: COPD: Chronic Obstructive Pulmonary Disease; IBD: Irritable Bowel Syndrome; AIDS: Acquired Immuno-Deficiency Syndrome; HIV: Human Immunodeficiency Virus.

Supplementary Table 3. Types of Out of Pocket (OOP) Healthcare Expenditures among Individuals with and without Arthritis, Medical Expenditure Panel Survey 2008-2014.

	Arthritis		No Arthritis		Sig.
	Mean	95% CI	Mean	95% CI	
Inpatient					
2008	\$50	[40, 59]	\$36	[30, 42]	
2009	\$117	[54, 179]	\$41	[32, 49]	***
2010	\$58	[41, 75]	\$38	[30, 46]	
2011	\$75	[39, 112]	\$37	[30, 44]	
2012	\$126	[47, 206]	\$38	[28, 48]	
2013	\$98	[49, 147]	\$32	[24, 39]	**
2014	\$55	[35, 75]	\$30	[21, 38]	***
Emergency Room					
2008	\$19	[15, 23]	\$24	[18, 30]	
2009	\$23	[18, 28]	\$24	[21, 28]	
2010	\$21	[15, 27]	\$20	[15, 25]	
2011	\$19	[15, 22]	\$20	[17, 24]	
2012	\$36	[22, 50]	\$24	[20, 28]	
2013	\$27	[16, 37]	\$22	[19, 26]	
2014	\$21	[15, 26]	\$19	[15, 23]	
Outpatient					
2008	\$357	[319, 396]	\$208	[192, 224]	***
2009	\$360	[328, 392]	\$190	[179, 201]	***
2010	\$312	[284, 339]	\$201	[184, 218]	***
2011	\$334	[298, 370]	\$193	[178, 207]	***
2012	\$305	[276, 333]	\$176	[160, 191]	***
2013	\$351	[313, 390]	\$191	[169, 212]	***
2014	\$337	[299, 375]	\$187	[171, 203]	***
Prescription Drugs					
2008	\$648	[596, 700]	\$219	[203, 235]	***
2009	\$553	[514, 591]	\$177	[165, 189]	***
2010	\$547	[516, 578]	\$181	[169, 194]	***
2011	\$519	[486, 553]	\$174	[164, 184]	***
2012	\$463	[431, 495]	\$158	[145, 171]	***

2013	\$423	[375, 471]	\$130	[119, 140]	***
2014	\$378	[343, 413]	\$124	[113, 136]	***
Other (including home health, vision, dental and miscellaneous)					
2008	\$418	[363, 474]	\$218	[194,241]	***
2009	\$334	[298, 370]	\$202	[181, 223]	***
2010	\$330	[296, 364]	\$168	[153, 184]	***
2011	\$349	[291, 408]	\$175	[160, 191]	***
2012	\$351	[293, 408]	\$172	[140, 204]	***
2013	\$360	[302, 419]	\$179	[162, 197]	***
2014	\$308	[274, 343]	\$170	[155, 186]	***

CI: Confidence Interval

Supplementary Table 4A. Aggregated costs in 2014 constant dollars using PCEH index.

	Total	Out of Pocket		Inpatient		Outpatient		Pharmacy	
		Aggregated	% of Total	Aggregated	% of Total	Aggregated	% of Total	Aggregated	% of Total
Based on Unadjusted Average Costs estimates									
2008	\$552.0	\$79.1	14%	\$160.0	29%	\$180.0	33%	\$136.5	25%
2009	\$577.7	\$75.8	13%	\$160.8	28%	\$199.9	35%	\$140.4	24%
2010	\$568.5	\$71.0	13%	\$177.4	31%	\$173.0	30%	\$142.5	25%
2011	\$590.8	\$72.0	12%	\$184.3	31%	\$178.8	30%	\$150.8	26%
2012	\$617.9	\$75.7	12%	\$193.5	31%	\$196.4	32%	\$147.3	24%
2013	\$625.8	\$77.5	12%	\$168.8	27%	\$210.1	34%	\$166.1	27%
2014	\$645.1	\$71.5	11%	\$169.3	26%	\$217.9	34%	\$172.6	27%
Based on Estimates from Fully Adjusted Model									
2008	\$105.9	\$6.6	6%	\$40.7	38%	\$40.4	38%	\$24.8	23%
2009	\$105.0	\$9.6	9%	\$22.0	21%	\$42.1	40%	\$25.0	24%
2010	\$82.4	\$7.4	9%	\$18.1	22%	\$24.7	30%	\$20.9	25%
2011	\$114.5	\$8.9	8%	\$33.2	29%	\$27.3	24%	\$39.2	34%
2012	\$156.9	\$11.8	8%	\$54.0	34%	\$55.3	35%	\$33.4	21%
2013	\$140.6	\$11.1	8%	\$31.0	22%	\$60.3	43%	\$33.4	24%
2014	\$107.7	\$10.9	10%	\$30.5	28%	\$36.3	34%	\$34.4	32%

Note: We converted the 2014 consumer price indexed constant dollar to Personal Consumption Expenditure Health (PCEH) Index adjusted healthcare costs. Below is the cross-walk of factors used to convert 2014 constant dollar using CPI-M and PCEH available on:

https://meps.ahrq.gov/about_meps/Price_Index.shtml.

Supplementary Table 4B. Cross-walk between CPI-M and PHEH adjusted total direct and Out of Pocket costs					
Year	CPI-M	Adjustment Factor for 2014 constant dollar using CPI-M	PHCE	Adjustment Factor for 2014 constant dollar using PCEH	Converting 2014 CPI-M to 2014 PHC

2008	364.1	1.1956	97.3	1.1285	0.9439
2009	375.6	1.1589	100	1.0980	0.9474
2010	388.4	1.1208	102.6	1.0702	0.9549
2011	400.3	1.0874	104.7	1.0487	0.9644
2012	414.9	1.0492	106.9	1.0271	0.9790
2013	425.1	1.0240	108.2	1.0148	0.9910
2014	435.3	1.0000	109.8	1.0000	1.0000

CPI: Consumer Price Index; PCEH: Personal Consumption Expenditure Health Index

Supplementary Figure 1. Trends in Inpatient ad ER Hospitalizations among individuals with arthritis from 2008 to 2014.

