

Senior Project
Department of Economics



**Minimum Insurance Mandates and Hospital Care
Utilization for Arthritis Patients: Evidence from the
Massachusetts 2006 Health Care Reform**

Lucas Van Cleef
May, 2016

Advisors: Dr. Francesco Renna
Dr. Elizabeth Erickson

Table of Contents

I.	Introduction and Motivation.....	3
II.	Literature Review.....	5
III.	Theory.....	7
IV.	Data and Methodology.....	8
V.	Results.....	11
VI.	Conclusions and Limitations.....	12
VII.	References.....	15
VIII.	Appendix.....	16

Abstract

In this study I test the hypothesis that the 2006 Massachusetts health care reform has had a negative effect on hospital care expenditure for arthritis patients, compared to the rest of New England. To these ends I employ a difference-in-difference model to compare this expenditure across the years prior to and following this reform. Using data from the Panel Study of Income Dynamics (PSID) I include observations from New England, whom also report to be diagnosed with arthritis. I conclude from my study that there is a significant negative impact of the aforementioned health care reform for arthritis patients affected by its enactment.

According to an estimation by Lundkvist et al (2007), anywhere from 0.5 - 1.0% of the world suffers from arthritis. For those over the age of 60, this rate is increased to 2%. (p. S49) Depending on the country, as many as 30-50% of those afflicted with arthritis will be forced to retire early, mainly due to the inhibitory nature of active inflammation. (p. s53) In Australia, the likelihood of early retirement by those in the pre-retirement age group of 45-64 is three times greater for those with arthritis than those without. Consequently, arthritis is the medical condition responsible for the second highest number of early retirement incidents. (Schofield et al, 2013, p.1)

Unlike other conditions, arthritis is unlikely to result in the death of the afflicted patient. When considering the burden associated with any chronic condition, both morbidity and mortality must be considered. While mortality refers to the potential of death by a particular illness, morbidity refers to the loss of disability affected life years (DALY), or years of healthy life lost due to the condition. (Lundkvist et al, 2007, p. S50) Embodied in these lost DALYs are the pain, functional impairment, fatigue, and depression that a patient may be subject to due to arthritis. (Lundkvist et al, 2007, p. s51) Aside from the personal physical and emotional distress borne by these symptoms, their treatment and prevention also induces financial strain due to high direct medical costs, but even more so in terms of indirect costs associated with lost labor participation and with it lost tax revenue. (Lundkvist et al, 2007, p. s56)

Amongst chronic conditions, studies have repeatedly revealed arthritis patients to have lower mean utility than any other patient group. This includes cataracts and multiple sclerosis amongst others. Utility here refers to the overall quality of life, measured from 0 (death) to 1 (full health). (Lundkvist et al, 2007, p. s51) This utility not only embodies the loss of ability to work, but also the physical and mental suffering of the patient.

In 2006 alone the costs of Arthritis to North America and Europe totaled 97 Billion euros, of which 42 billion were derived from direct expenditure on medical treatment. (Lundkvist et al,

2007, p. s58) Of these costs, the lion's share of 32% can be attributed to the indirect costs of foregone labor force participation. (p. S57) Aside from these national costs, the indirect costs of arthritis are also embodied in lost wages, diminished savings, and early liquidation of premature capital assets. (Schofield et al, 2013, p. 8) Compared to their healthy and employed counterparts whose weekly income averages at over 1500AUD per week in Australia, those afflicted with arthritis make only \$260 AUD. An even greater disparity, however, can be seen in the median savings of individuals at age 65, which is \$319 AUD for those who retire early due to arthritis, while it is over 339,000AUD for those of the same age who remained healthy and employed.

On March 23, 2010, President Barack Obama signed into law the Patient Protection and Affordable Care Act, commonly referred to as the ACA or "Obamacare". (HHS.gov) Part of this comprehensive act includes the "Requirement to maintain minimum essential coverage" as described in Title I, Part I, Section 1501. This component, which came into effect during 2014, requires that all Americans be insured lest they be subject to a fine for each month that they fail to do so. While the public version of the data set I employ in this study does not yet include data for the year 2015, an analogous reform was signed into law by Governor Mitt Romney in Massachusetts, in which all citizens would be required to be insured, and for those under 150% of the poverty line, free state sponsored insurance, MassHealth, would be provided. (www.Mass.gov) In order to anticipate the effects of the ACA for arthritis patients, I will be examining the effect of the aforementioned "Romneycare" on hospital care expenditure for arthritis patients.

While US health policy has extended access to healthcare to a number of at risk Americans, previous policy has primarily benefited the old and the poor. The provisions of the largest prevailing public healthcare programs, Medicaid and Medicare, are not designed with extending the productivity of America's labor force in mind. It would seem that health care policy is more focused on reducing individual financial burdens of the most needy, as opposed to

reducing national financial burdens via preventing chronic conditions such as arthritis that induce early retirement. Using data from the Panel Study of Income Dynamics (PSID) from the years 2005 and 2007, I will be attempting to answer the question, how do universal minimum insurance mandates affect utilization of hospital care by arthritis patients?

Literature Review

A large body of literature suggests that reduced healthcare costs due to increased access to insurance resulting from Massachusetts health care affects how much healthcare individuals utilize, as well as the nature of the methods of health care are consumed. Kolstad and Kowalski (2010), using a difference-in-difference model, determine that the 2006 Massachusetts legislation, which achieved near universal health coverage, led to a decrease in the length of stay for inpatient admissions to hospitals, as well as the number of admissions originating from the emergency room, and an increase in the use of preventative care. Along with a general decrease in the utilization of hospital care, Kolstad and Kowalski (2010) note that this reduction is pronounced amongst preventable conditions, of which arthritis falls amongst. Using their difference-in-difference model, Kolstad and Kowalski reference New England as their reference group as Massachusetts lies within this region thus would be characteristically similar to this control group, aside from the enactment of the “Romneycare” health care reform.

Examining the same 2006 reform, Miller (2012) determines that as the uninsured gained coverage, their out-of-pocket medical costs fell, inducing them to consume more primary and preventative medical care. Her study also finds, however, that reliance on hospital emergency room care was reduced in the wake of the reform’s enactment. Long et al, (2012) confirm this conclusion with their own study, which finds a consistent increase in use of preventative and specialist care in the four years following the Massachusetts reform, whilst also reporting a similarly consistent downward trend in the use of hospital and emergency room care.

Grana and Stuart (1996), operating within the framework that health care utilization is a function of enabling, predisposing, and need based characteristics, examine the effect that additional supplemental insurance has on arthritis treatment utilization by the elderly, all of whom have Medicare. (p. 328) Though they do not analyze the effect of insurance on healthcare utilization by the previously uninsured, Grana and Start (1996) conclude that additional amounts of insurance coverage leads to a higher likelihood of physician service use by individuals with arthritis. Similarly, Li and Anis (2013) find evidence to suggest that cost-sharing programs for pharmaceuticals, including health insurance, induces greater healthcare utilization by seniors with arthritis in the form of medication, though reduces doctor visits and hospitalization events.

In general, the conclusions of the literature on the effect of extended health insurance coverage on hospital care utilization is mixed, with the lion's share pointing at a negative relationship, but generally points to an increase in the utilization of preventative care. This outcome is even truer when honed in on the patient group relevant to my study, being those with arthritis. While these aforementioned studies shed light both on the hospital care utilization patterns for insured arthritis patients, as well as the impact of the 2006 Massachusetts health care reform, none have endeavored to isolate these effects for the arthritis patient group, for whom an increase in the use of preventative care might have a profound effect in reducing early retirement, as well as the costs associated with it for this at risk population.

Theory

The main theoretical basis of my study comes from Aday and Andersen's (1974) framework for access to healthcare¹. This framework suggests that a number of health related outcomes, both for patients and health delivery systems, are influenced by a number of mutable

¹ See Table 1 in Appendix

and immutable characteristics of those delivery systems and the population at risk. Additionally, the characteristics of the health delivery system and population at risk impact one another, as well as the outcomes each one endures as the result of healthcare policy. While “immutable” characteristics cannot be affected by human intervention, the more malleable “mutable” characteristics are those which health policy affects in order to achieve desirable health outcomes. For the population at risk these characteristics can be organized into three main groups: “predisposing” characteristics, “enabling” characteristics, and “need” characteristics. These three categories of independent variables influence a number of outcomes regarding “Utilization of Healthcare” by an individual.

“Predisposing” characteristics are defined by Aday and Andersen (1974) as those that exist prior to the onset of illness. (p. 213) These characteristics include demographic properties of the observations such as age, sex, race, and religion. Also included are variables concerning the individual's' occupation and geographical location of residence. These are included as your relative geography (urban or rural) is relevant to your access to health delivery systems, and occupations come with different health risks associated. “Need” characteristics on the other hand refer to characteristics of the individual's illness itself, and are the most “immediate” determinants of health care utilization (p. 213). This includes both self-reported and professional measurements of variables such as general health status, other co-morbid illnesses, and limitations to daily activity. A number of the studies reviewed in this project also include variables concerning substance use, such as whether or not the individual smokes, and how much they drink

The final sub-set of variables labeled “enabling” refer to characteristics relevant to an individual's means of accessing health care. Aday and Andersen (1974) list “health insurance” as being inherently an enabling variable of health care utilization. Since the 2006 Massachusetts health care reform mandates minimum insurance coverage for all Americans it

functions as an extension of insurance coverage to the previously uninsured. Because of this mandate all individuals in 2007 should be insured regardless of their coverage in 2005. For Americans at the retirement age however, coverage should be near universal in both time periods as most or all of the relevant observations qualify for Medicare. In order to compensate for the diminished, or absent impact of the 2006 reform for these observations, I include the dummy variable “Medicare” into my regression.

In terms of utilizing health care for treatment of arthritis, patients are limited to either having surgery, or more commonly using prescription medication to suppress disabling symptoms of their illness. (www.Arthritis.org) Medication does not serve to rectify the illness at its source, but rather to increase comfort and functionality of the individuals’ prescribed, and prolong the inhibiting effects of arthritis. The actual medications employed vary, but typically include analgesics², corticosteroids, and anti-inflammatory medication in the form of “DMARD”³ and “NSAID” pharmaceuticals. In light of the body of literature reviewed, and the prevailing notion that increased insurance coverage induces individuals to substitute preventative care, such as pharmaceuticals, for emergency care, such as hospitals, I hypothesize that arthritis patients affected by the 2006 Massachusetts health care reform will reduce their utilization of hospital care compared to the neighboring unaffected states of New England.

Data and Methodology

In my study I will be using a difference-in-difference model in which I will be investigating the effect of the Massachusetts health care reform on hospital care utilization by arthritis patients in Massachusetts. This model allows for this analysis by comparing the change in

² Opiate-based pain relievers, such as Oxycodone.

³ Disease-modifying antirheumatic drugs

health care utilization for the relevant population between the pre-treatment and post-treatment years, with the change in health care utilization by patients residing in surrounding states within New England. The reason for this choice in control group, is that the treatment and control groups are characteristically similar geographically. Consequently, differences in these groups are likely drawn along the lines of legislative borders, at least in terms of issues, such as health care utilization, in which state-specific legislation plays a crucial determinant role.

The difference-in-difference model achieves this by including dummy variables for the treatment group and post-treatment period, as well as an interaction term (Post Treatment) between these variables. Also included in the model are the characteristic variables for the individuals (X_n) as described by my health care utilization model. The functional form of my model will be run as:

$$\bar{Y}_{gt} = \gamma_0 + \gamma_1(Treat_g * Post_t) + \gamma_2Treat_g + \gamma_3Post_t + \gamma_4\bar{X}_{gt} + \varepsilon_{gt}$$

The X in this case refers to a number of characteristics of the individuals at risk, which shall be further explicated on in my theory section. These characteristics pertain to individual traits that theoretically affect the demand for health services. The dummy variables “Treat” refer to the effect of being in the treatment group, and the “Post” variable signifies that the individual’s data was collected in the latter period survey, or 2007 in the case of this study. Finally, the Interaction term comprised of “Post” and “Treat” captures the effect of being in the treatment group during the post-treatment year. This term will allow for the isolation of the effect that health care reform has following enactment, separate from merely meeting the qualifications for the treatment group, or having been involved in the “Post” year survey. In other words, the coefficient of this interaction term will reveal the effect I am searching for. Additionally, I have included a dummy variable indicating that an observation is enrolled in Medicare, which would heavily diminish or outright mitigate the effects of the 2006 reform on their insurance status.

The source of my data is the Panel Study of Income Dynamics, provided by the University of Michigan. This study reports a number of income, demographic, and health characteristics of the respondents in two year waves. The dataset I employ for my analysis is a merged dataset including household expenditure information, household characteristics, and individual characteristics. In order to merge individuals with the appropriate household data, I reduced the the individual data component to only those who report to be the head of their household in order that there would not be more than one observation per household. This transformation was made to avoid double counting of household expenditure data in the consumption supplementary dataset. This data was then reduced to include only those diagnosed with arthritis, the relevant population, and in particular only the treatment group (Massachusetts residents) and the control group (residents of unaffected New England states). Finally, data for every year other than 2005 and 2007 has been dropped, the year before and after the Massachusetts healthcare reform was put into place.

As my data comes from datasets from two different years, I made extensive transformations to make it suitable for this analysis, starting by filtering out every observation without arthritis. Further, I recoded the variables from the two different time periods in order that they could be appended in SAS. This was necessary as the variable identification codes change yearly. The observations were then coded with dummy variables for “Post”, if their data comes from the 2007 period, and “Treatment” if they come from Massachusetts.

An initial correlation analysis including a myriad of these illnesses and health-related need variables revealed a large amount of correlation between many of them, thus raising the concern for potential multi-collinearity. In order to compensate for this possibility, I reduced my need variables into one dummy variable of “comorbid” indicating the respondent had been diagnosed with one of the several other chronic illnesses identified in the survey. This reduction in the number of need-based variables further assisted the predictive capability of my analysis

by increasing the degrees of freedom for my model, which suffers from a less than desirable number of observations.

As previously mentioned, my treatment group will consist of observations labeled as residents of Massachusetts in the PSID. My control group on the other hand consists of residents of New England states other than Massachusetts. While both groups are similar in that they are in similar geographic positions, and subject to identical federal laws, they differ in regards to state legislation. My final data set, which includes only arthritis-afflicted household heads from the states comprising New England, in the years of 2005 and 2007, has a sample size of 86, of which 53 fall within the treatment group.

Results

My results, displayed in table 3, yield significant values at the 95% level for “Post”, “Male”, and “Married”, while also reporting significant results at the 90% level for “PostTreatment”, my relevant variable. The -1610.23 coefficient for my variable of interest suggests that that hospital care expenditure was reduced by \$1610.23. This is in line with my hypothesis that the disparity in hospital consumption should have increased between Massachusetts and surrounding states, as literature suggests that increased insurance coverage should induce greater substitution of pharmaceutical and preventative care for hospital care.

While the treatment group in my study, comprised of Massachusetts arthritis patients, experienced a reduction in hospital expenditure in the wake of the reform, this is not the case for the entirety of the sample in this same time period. The statistically significant “Post”, whose coefficient is positive, reveals that my sample as an aggregate experienced a \$1,775.82 higher hospital care expenditure in the year following the reform. This reaffirms the effectiveness of the

reform in reducing hospital care expenditure, as this reduction did not coincide with a general reduction in hospital care expenditure in that same time period.

If my theory is correct in explaining the reduction of hospital care expenditure in the post-reform period by Massachusetts' arthritis patients, than future studies regarding pharmaceutical expenditures by this same group during this time period should yield positive results. However, one potential limitation for this interpretation in my results, is that the reduction in hospital care for arthritis patients in Massachusetts may actually come as a result of arthritis patients being crowded out of hospitals. (Kolstad & Kowalski, 2010, p. 20) It is important to note that though my study included only arthritis patients, the 2006 Massachusetts reform affected everyone in the state regardless of the nature of their chronic illness status, or lack thereof. Consequently, demand for health care, including hospital services, may have increased due to a general subsidization of health care costs by the newly insured.

Seeing as hospital output is partially a function of the capacity of the physical facilities themselves, such as the number of beds, quantity supplied for hospital care might not have been able to expand to the same magnitude as demand. Consequently, it is possible that the patients in my study did not substitute hospital care for pharmaceuticals or preventative screenings, but rather faced a new barrier to access to healthcare in the form of being crowded out. In order to determine whether this crowding out phenomena exists, future studies should consider reviewing whether lower income respondents experienced the most dramatic reductions in hospital care utilization.

Conclusion and Limitations

In conclusion, my study reveals evidence to affirm the effectiveness of the 2006 Massachusetts Health care reform in reducing the utilization of hospital care for arthritis patients. Looking forward, I anticipate from my results that the Affordable Care Act will yield

similar results when the appropriate data is released in order to enable similar studies. In terms of the benefit provided to constituent arthritis patients by this reform, further study would be required in order to determine whether this drop in hospital care utilization was accompanied by an increase in the use of preventative screenings or pharmaceuticals. If this is the case, then the theorized substitution of hospital care for preventative care by the newly insured, as reported by a number of studies in my literature review, would seem to be at play here.

One glaring limitation within my study pertains to my sample size, which comprises of 86 observations. Though my variable of interest was found to be significant and in the expected direction, the very nature of this miniscule sample size calls into question the credibility of my findings. This diminutive sample size comes as a consequence of utilizing the dataset employed for this particular study. Due to time constraints, I was unable to substitute a more suitable dataset, though I will detail below a number of possible alternatives that would augment the credibility of this study should I have had more time to perform it.

While the PSID dataset used in this study contained only 86 arthritis patients from the New England region, it may be more applicable to the study of a reform affecting the nation as a whole, such as the Affordable Care Act. When the scope of the study is expanded in this way, the number of usable observations increases to 1374. This will not be a possible alternative until the 2015 PSID data is released however, as the minimum essential insurance mandate did not go into effect until 2014, despite the ACAs passing in 2010. While this figure is an improvement from my current sample size, it might still be objectionable as proportion of the population, in which case a more robust dataset might be desirable.

One such dataset would be the Medical Expenditure Panel Survey. This dataset, known as MEPS provides a far larger assortment of variables related to health care utilization and expenditure than the PSID. Though this dataset would seemingly be advantageous over the PSID for the purposes of my study, much of the necessary data was masked, including the data

regarding the respondents' state. Overcoming this barrier is possible however, as the MEPS website provides resources for applying for additional data outside of what is available through public releases of the survey. Due to time constraints however, I was not able to make use of this dataset, as by the time I was made aware of it I was unable to apply for the necessary additional data in time for the completion of this study.

Also considered for this study was the Health and Retirement Study. This dataset is unique in that it is focused on individuals at the retirement, and preretirement age groups (45-65). These age groups are particularly relevant to this study as the prevalence and burden of arthritis increases with age. Additionally, a dataset focused on these age groups would allow for a comparison of the hospital care effects included in this study between the retirement and preretirement age groups, thus determining whether these effects differ for those who have already retired onto Medicare, and those who run the risk of early retirement. Similar the MEPS, I was unable to use this study due to the masking of variables important to my study.

A final dataset that might be suitable for a study similar to, but not a replication of, mine would be the Behavioral Risk Factor Surveillance System provided by the Center for Disease Control. This study reports a number variables pertaining to health care utilization, health outcomes, and demographic characteristics of respondents. Unfortunately for the sake of my study however, the number of usable variables pertaining to arthritis care utilization were barren compared to other chronic conditions such as hypertension. Also notable, was the lack of true household income information, which was instead recoded into tiers, of which the highest was for households earning \$75,000+ per year, a bracket in which more than half the surveyed fell within.

References

Aday, Lu Ann, and Andersen, Ronald. "A Framework for the Study of Access to Medical Care." *Health Services Research* 9.3 (1974): 208–220. PDF.

The Official Website of the Department of Revenue. Health Care Reform Information for Individuals. (n.d.). Retrieved from <http://www.mass.gov/dor/individuals/taxpayer-help-and-resources/health-care-reform-information/>

Grana, James, and Stuart, Bruce. "The Impact of Insurance on Access to Physician Services for Elderly People with Arthritis." *Inquiry* 33.4 (1996): 326-38. PDF.

Kolstad, Jonathan T., and Amanda E. Kowalski. "The Impact of Health Care Reform On Hospital and Preventive Care: Evidence from Massachusetts." *Journal of Public Economics* 96.11 (2010): 909-29. *National Bureau of Economic Research*. Web.

Li, X., & Anis, A., 2013. Cost sharing of prescription drugs and demand for health-care utilization among seniors with rheumatoid arthritis. *Applied Economics Letters*, 20(1), 23-27. PDF.

Long, S. K., Stockley, K., & Dahlen, H. (2012). Massachusetts Health Reforms: Uninsurance Remains Low, Self-Reported Health Status Improves As State Prepares To Tackle Costs. *Health Affairs*, 31(2), 444-451. PDF.

Lundkvist, J., F. Kastäng, and G. Kobelt. "The Burden of Rheumatoid Arthritis and Access to Treatment: Health Burden and Costs." *The European Journal of Health Economics Eur J Health Econ* 8.S2 (2007): 49-60. Web.

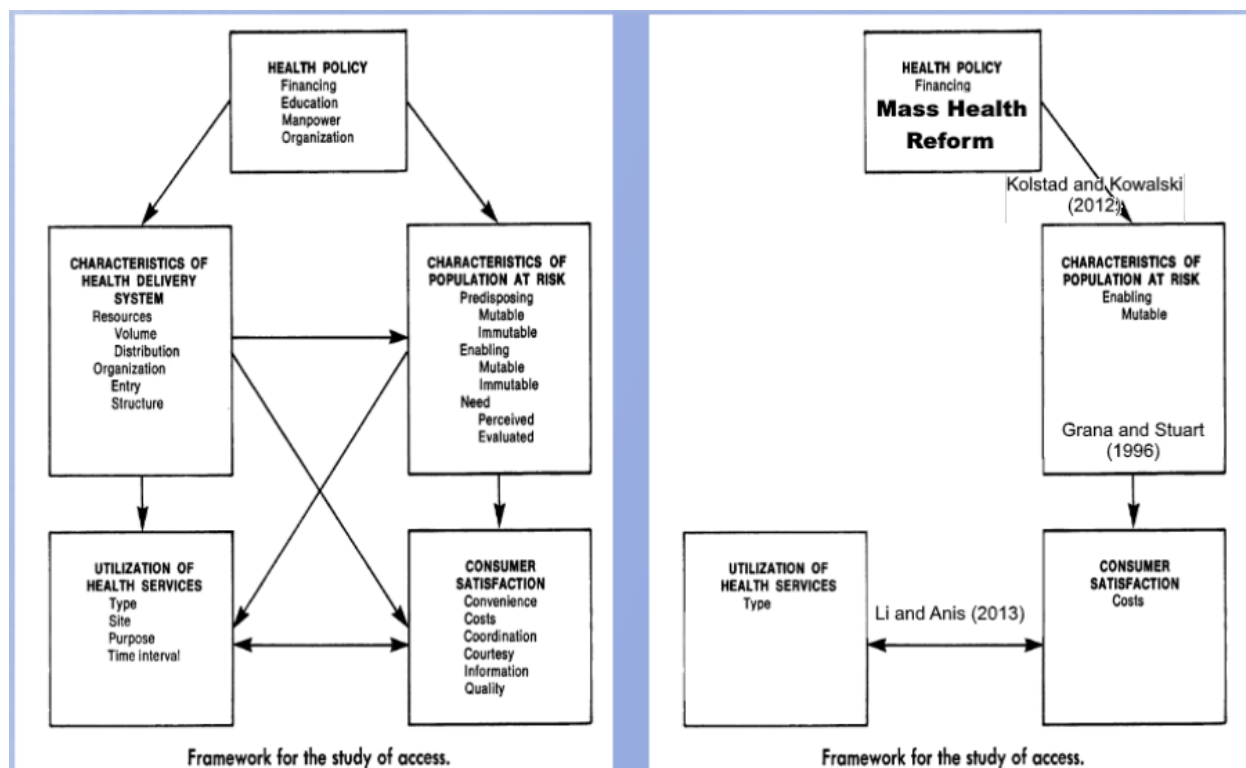
Miller, Sarah. "The Effect of the Massachusetts Reform on Health Care Utilization." *Inquiry* 49.4 (2012): 317-26. Web.

PSID: A National Study of Socioeconomics and Health Over Lifetimes and Across Generations. University of Michigan, n.d. Web. <<https://simba.isr.umich.edu/data/data.aspx>>.

Schofield, Deborah J., Rupendra N. Shrestha, Richard Percival, Megan E. Passey, Emily J. Callander, and Simon J. Kelly. "The Personal and National Costs of Lost Labour Force Participation Due to Arthritis: An Economic Study." *BMC Public Health* 13, no. 188 (2013). PDF.

Appendix

Table 1: Theoretical Model for Access to Health Care



4

Table 2: Descriptive Statistics for Massachusetts Arthritis Patients (PSID)

Variable	Description	N	Mean	Std. Dev.	Min.	Max.
Hospital	Total Household Hospital Expenditure	86	572.74	2217.81	0	18000
Post	Dummy for 2007 Respondent	86	0.52	0.5	0	1
Treatment	Dummy for Massachusetts Resident	86	0.63	0.49	0	1
PostTreatment	Interaction Term: Post*Treatment	86	0.35	0.48	0	1
Age	Age in Years	86	61.8	15.27	27	88
Male	Dummy for Male	86	0.76	0.43	0	1
Married	Dummy for Married Status	86	0.58	0.5	0	1
Education	# of Years of Education	86	14.15	2.68	7	17
Children	# Of Children in Household	86	0.26	0.56	0	2
Employed	Dummy for Currently Employed	86	0.65	0.48	0	1
Comorbid	Dummy for Other Chronic Illness(es)	86	0.79	0.41	0	1
income	Household Income in Previous Year	86	78287.12	61059.45	852	345400
Medicare	Dummy for Medicare Recipient	86	0.15	0.36	0	1

⁴ Left: Aday and Andersen (1974, p. 212)

Table 3: Regression Results

Variable	DF	Parameter Estimate	Std. Error	T-Value	Pr > t
Intercept	1	-423.92	2114.08	-0.2	0.8416
Post	1	1775.82	765.71	2.32	0.0232
Treatment	1	385.11	704.37	0.55	0.5862
PostTreatment	1	-1610.23	968.06	-1.66	0.1005
Age	1	10.99	22.99	0.48	0.6339
Male	1	-1529.71	716.64	-2.13	0.0362
Married	1	1655.74	681.98	2.43	0.0177
Education	1	39.81	99.83	0.4	0.6913
Children	1	83.61	505.73	0.17	0.8691
Employed	1	-31.78	744.58	-0.04	0.9661
Comorbid	1	-355.91	628.23	-0.57	0.5728
Income	1	-0.01	0.01	-1.2	0.2351
Medicare	1	927.75	733.61	1.26	0.21

5

⁵ Green highlighted P-values indicate significance at the 5% level
Red highlighted indicated significance at the 10% level