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**The Effect of HMOs on Emergency Room Expenditures  
Among Adult Asthma Patients**

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## **Abstract**

### **The Effect of HMOs on Emergency Room Expenditures among Adult Asthma Patients**

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**Eline M. Altenburg-van den Broek**

Chronic diseases, such as asthma, make up the majority of rising health expenditures. Because this type of disease and associated costs respond to preventive care, this study examines whether enrollment in an HMO (associated with preventive care) predicts ER expenditures for asthma patients.

Using data from the 2009-2011 Medical Expenditure Panel Survey (MEPS), we employed a two part model to predict a) the probability of incurring any ER expenditures and b) conditional health expenditures in dollars among adult asthma patients who incurred any ER expenditures. We also looked at differences in predicted ER expenditures for enrollees of public and private insurance. All regressions were adjusted for demographics, public versus private insurance and perceived health status.

We found no significant effect of HMO enrollment on the probability of any ER expenses or conditional ER expenditure, but we did find that private plans had a 56% lower probability of any ER expenditures than public plans. In contrast, once in the ER, patients with private plans had substantial higher predicted expenditures than those in public. However, there was no interaction effect of private insurance and HMO status.

We found that asthma patients with a family income that is slightly above (between 100-125% of) the Federal Poverty Level are more than 4 times more likely to visit the ER. Demographics and perceived health status were also found to be significant predictors of ER usage and expenditures.

This study provides new insights for the discussion about the effect of insurance type on health care expenditures. If we enlarge our sample size, by including more years or by looking at a broader scope of chronic conditions, we may be able to get a more precise estimate of this relation.

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## Table of Contents

<b>1. Introduction</b> .....	1
<b>2. Literature Review</b> .....	2
Asthma, Importance of Preventive Care in Asthma.....	2
Importance of Preventive Care in Asthma Patients.....	3
Effect of Preventive Care on Expenditures.....	4
Effect of HMOs on Health Care Expenditures.....	5
Effect of HMO on Health Care Utilization for Asthma Patients.....	6
Summary of Literature Limitations.....	8
<b>3. Methods</b> .....	9
Conceptual Framework.....	9
Research Questions and Hypothesis.....	11
Data Source.....	11
Study Design and Subjects.....	12
Data Analysis.....	14
<b>4. Results</b> .....	20
Descriptive Analysis.....	20
Regression Analysis.....	23
<b>5. Discussion</b> .....	26
Summary of Findings.....	26
Protocols for Prevention and Benefit Structure: Using Georgia as an Example.....	26
Study Limitations.....	30
Policy Implications.....	32
Future Study.....	34
<b>6. Conclusion</b> .....	36
References.....	37

## **List of Tables**

Table 1. List of Covariates.....	16
Table 2. Summary Statistics of Asthma Patients by HMO status.....	22
Table 3. Regression Results Two-Part Model: asthma-related ER expenditures.....	24
Table 4. Comparison of HMO/non-HMO plans by asthma protocol and benefits.....	28

## **List of Figures**

Figure 1. Conceptual Framework.....	10
Figure 2. Weighted Percentage of any ER expenditures among Insured Asthma Patients aged 18-64 and Inclusion Criteria of Sample for Analysis.....	14

## **List of Abbreviations**

<b>HMO</b>	<b>Health Management Organization</b>
<b>ER</b>	<b>Emergency Room</b>
<b>ED</b>	<b>Emergency Department</b>
<b>COPD</b>	<b>Chronic Obstructive Pulmonary Disease</b>
<b>U.S.</b>	<b>United States</b>
<b>PPACA</b>	<b>Patient Protection and Affordable Care Act</b>
<b>MC</b>	<b>Managed Care</b>
<b>FFS</b>	<b>Fee for Service</b>
<b>MEPS</b>	<b>Medical Expenditure Panel Survey</b>
<b>FDL</b>	<b>Federal Poverty Level</b>
<b>ICD9</b>	<b>International Statistical Classification of Diseases</b>
<b>PPO</b>	<b>Preferred Provider Organization</b>
<b>EPO</b>	<b>Exclusive Provider Organization</b>
<b>POS</b>	<b>Point Of Service plan</b>
<b>OLS</b>	<b>Ordinary Least Squares</b>
<b>GLM</b>	<b>Generalized Linear Model</b>
<b>HEDIS</b>	<b>Health Employer Data and Information Set</b>



## 1. Introduction

In the late 1990s and early 2000s, there was a vivid debate in the United States about the “rise and fall” of managed care plans. One of the major arguments for the fall was that Americans value their choice and autonomy in their healthcare utilizations and they do not appreciate restrictions [1]. Paradoxically, the recent opening of the Health Insurance Exchanges under the Patient Protection and Affordable Care Act (PPACA) offers a plethora of health plan options, and yet one of the first established trends of the exchange data that is being released is that there is a re-emergence of “managed care designs,” for the sake of this study simplified as “HMOs” [2].

Since HMOs differ from other health insurance plans in the way they manage care for their enrollees, and HMOs pay providers for health care differently (though capitation or bundled payments) than other plans, they have a financial interest in promoting prevention, which may be especially important for enrollees with chronic conditions. Some researchers have argued that type of insurance predicts health care utilization [3], but very few studies have been conducted to establish the effect of HMOs versus non-HMOs on health care expenditures, particularly for emergency department usage. This study seeks to answer whether HMOs predict the probability of any ER visit and expenditures among asthma patients, using HMO as a proxy for more preventive services.

## 2. Literature Review

### Asthma

Most of the increase in health care spending in the United States over the past decades is concentrated around the five most expensive conditions: heart disease, mental disorders, pulmonary disorders, cancer and trauma [4]. Asthma and COPD alone accounted for \$64M of the total healthcare expenses and rank fifth on the list of chronic conditions contributing to total expenditures [5]. Even though factors accounting for the rise in asthma and other pulmonary disorders are not well understood, the increasing prevalence and death rates highlight the importance of developing interventions designed to reverse or manage this rise [6].

Akinbami et al. reported recently that asthma prevalence increased from 7.3 percent in 2001 to 8.4 percent in 2010 which reflects 25.7M persons suffering from asthma.[6] In this period, health care visits for asthma patients declined in primary care settings, while asthma emergency department (ED) visit and hospitalization rates increased for certain groups. Asthma health care encounters (per 100 persons with asthma) varied somewhat by demographic characteristics, but were similar for males and females and for black and white persons [6]. In other words, asthma is prevalent across gender and race/ethnicity and is a burden for rising health care expenditures in the United States; therefore, we need to examine factors that promote preventive care behaviors.

### **Importance of Preventive Care in Asthma Patients**

Extant literature stresses the importance of controlling asthma via preventive care and active management of patients' conditions, to prevent acute events. Recent literature shows that patients with partly and uncontrolled asthma report significantly greater use of health care resources and greater limitations in their daily activities compared to patients whose asthma was well controlled [7].

Similarly, Van der Meer et al found that a weekly self-monitoring program and subsequent treatment adjustment lead to improved asthma control in patients with partly and uncontrolled asthma at baseline [8]. In addition to improving the health benefits for asthma patients, lack of short-term symptom control of asthma is associated with excess healthcare utilization and higher expenditures [9].

Yet, the extent to which preventive care saves money is subject to a lot of discussion. According to Steuten et al., disease management for adults with asthma has a high probability of being cost-effective and is associated with a gain in Quality Adjusted Life Years (QALYs) at lower costs [10]. However, Cohen et al. conclude that some preventive measures save money, while others do not [11]. This article focuses on a broader range of preventive measures than just those for asthma patients, but the main conclusion is relevant also in the context of asthma patients: some preventive measures are expensive given the health benefits they confer. Whether a particular preventive measure represents good value or poor value depends on factors such as the population targeted, with measures targeting higher-risk populations typically being the most efficient.

### **Uninsured Patients Have Less Controlled Asthma**

Not surprisingly, extant literature demonstrates that patients who lack health insurance were less likely to have had well-controlled asthma and, consequently, more likely to report ever visiting the emergency department or being hospitalized for asthma compared to those with insurance whose asthma was well controlled [3, 7, 12, 13, 14].

Other than studies in which asthma patients without insurance are compared to those with a plan, or public plans to private plans, we did not find studies that focused on the type of insurance (HMO versus non-HMO) and the effect on asthma control and health care expenditures, other than one focusing on Medicare beneficiaries which established that for Medicare enrollees, patients suffering from COPD increasingly enrolled in managed care plans [15].

### **Effect of Preventive Care on Expenditures**

Some studies focus on the cost-utility [10] or effectiveness [16] of preventive care in asthma patients. In other studies, preventive - defined by disease management programs - did not result in significant differences in utilization [17, 18, 19]. So even though preventive care is sometimes claimed to be cost-effective [10, 16], literature actually suggests that preventive care may not always be cost saving, as some preventive care is actually quite expensive.

With regard to asthma prevention, approaches to primary prevention (to avoid allergen sensitization) and secondary prevention (to avoid disease progression) are still very much in the developmental stage, while tertiary prevention (to avoid asthmatic stimuli) has been more successful particularly in pediatric patients [16]. Primary and

tertiary prevention are said to be progressed by self-management processes which have a reciprocal influence on improved physician-patient communication and disease status tracking [8].

Although the cost savings of many preventive care services is debated, it is well understood that emergency department usage is growing and expensive [20]. A 2011 analysis of the Health Cost Institute on outpatient visit claims (claims for emergency room, outpatient surgery, and observation) showed an increase of 2.1 percent for ER visits and 1.6 percent for services. Prices for outpatient facility visits (5.0%) and services (4.6%) rose faster than utilization. Studies illustrate that in many cases, the reimbursement amounts for patients admitted to the hospital are greater than the anticipated amount for preventive care [21], even though no such study has been performed for asthma patients specifically.

One of the ways the PPACA is intended to make health care more affordable is by reducing unnecessary emergency-room use, including those for well-controlled asthma patients [22, 23, 24]. Therefore, while overall costs may be debatable, it has become important policy and practice to reduce unnecessary ER visits as one component of reducing healthcare costs [22, 23].

### **Effect of HMOs on Health Care Expenditures**

The majority of literature on different types of insurance plans and effects on health care expenditures focuses on the methods of payments to healthcare providers, premium development and healthcare delivery systems rather than insurers' investments in preventive care. Some literature stresses the relation between insurance coverage (versus non-insurance) and expenditure or utilization, regardless of insurance type [25, 26, 27].

Miller and Luft examined how different types of private insurance - indemnity insurance, PPOs, open model HMOs, and closed model HMOs - affect the use of health service and thus expenditure [28, 29]. But this is merely a descriptive study that does not quantify the differences.

Buchmueller et al. published a review of the existing literature about the effect of insurance on health care utilization, concluding that due to data limitations, most studies can do little more than contrast broad categories of insurance, such as the difference in public and private [13]. We found no studies focusing on the effect of HMOs on expenditures, especially not ER expenditures specifically.

There is evidence that HMOs have had an impact on expenditures generally, but this study focused on the rate of growth of system-wide hospital costs, and did thus not focus on utilization but rather the supply of health care [30]. According to Robinson, the average rate of growth in costs per admission between 1982 and 1988 was 9.4% lower in markets with relatively high HMO penetration compared with markets with relatively low HMO penetration [30]. Cost savings for these hospitals were estimated at \$1.04 billion for 1988. This evidence merely says something about the reduction in hospital cost inflation in the event that legislative barriers to selective contracting are removed, but it does not tell us anything about the effect of HMOs on patient-level utilization or expenditures.

### **Effect of HMO on Health Care Utilization for Asthma Patients**

Grasso et al. established that for Medicare enrollees, patients suffering from COPD increasingly enrolled in managed care plans [15], but they did not establish what the effect was on utilization. Generally, we found few studies focusing on asthma patients in this

context. In earlier research, Miller and Luft found that HMO plans had lower hospital utilization rates than indemnity plans among all enrollees [28, 29] These include lower hospital admissions rate and consistently shorter length of stay; greater use of less costly alternatives to expensive procedures or tests; greater use of preventive examinations, procedures or tests; and roughly comparable quality of care. In their articles, Miller and Luft also review studies of the impact of managed care on utilization and outcomes among persons with discrete diseases, in general finding no systematic differences between managed care and FFS with respect to utilization, costs, or outcomes [28].

Yelin et al. did compare kinds and amounts of health care used by adults with asthma, specifically in managed care and fee-for-service settings [31]. They found that those in managed care (MC) and fee-for-service (FFS) did not differ substantively in the proportion with a regular source or principal provider of asthma care; receiving instructions in the use of an inhaler; reporting current use of inhaled beta-agonists, home nebulized beta-agonists, or inhaled steroids; or reporting ER visits or flu shots in the year prior to interview. [31] Persons with asthma in MC reported significantly fewer total physician visits, which according to the authors is due to the fact that those in MC had many fewer visits to allergist-immunologists. Noting that, as Buchmueller et al. concluded, the sample size was indeed relatively small. Yelin et al. found that the MC and FFS groups did not differ significantly in the proportion with asthma-related or non-asthma hospital admissions.

### **Summary of Literature Limitations**

Although there is a small body of literature discussing how insurance plans influence health services usage, there are no data to our knowledge on examining whether the basket of preventive care services (as proxied by HMO enrollment) predicts ER utilization and expenditures for chronically ill patients. Therefore, in this analysis, we provide insight into this relationship among adult asthma patients distinctively, which should help guide recommendations concerning preventive care measures among asthma patients between the ages of 18 and 64. While overall costs for ER visits may be debatable, it has become important policy and practice to reduce unnecessary ER visits as one component of reducing healthcare costs.



### 3. Methods

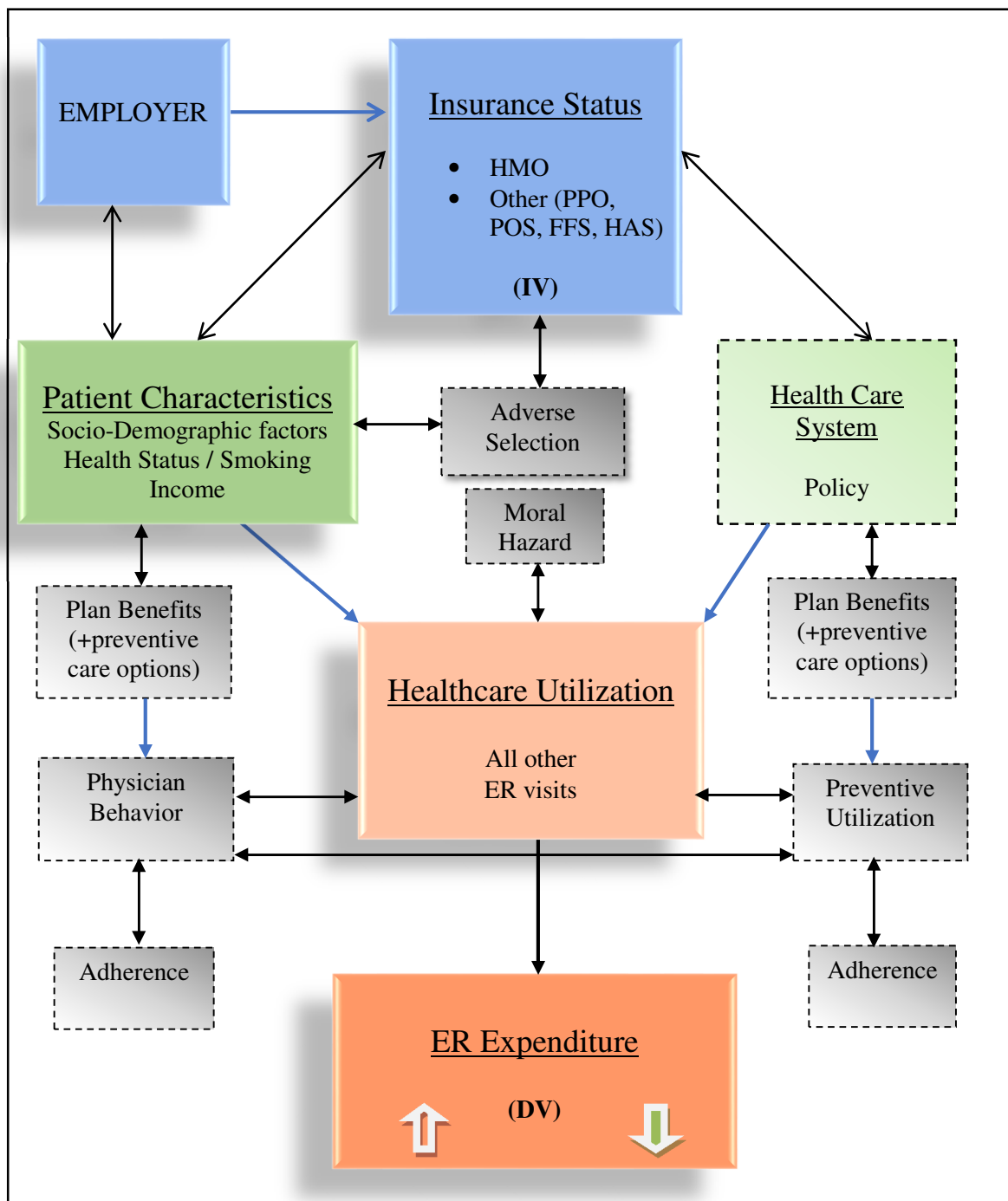
#### Conceptual Framework

Figure 1 illustrates the theoretical model that underlies this study. The blue box represents the main independent variable, Insurance Type: HMO or other plan (non-HMO). The orange box at the bottom of the page depicts the dependent variable in our model, ER expenditures. The lighter orange box, representing health care utilization is related to total ER expenditures; it has either a decreasing or an increasing effect on ER expenditures.

The green boxes represent the covariates in the model. The dotted green box stands for the health care system, which we cannot measure directly. Other variables we could not measure directly are represented by the gray boxes: plan benefits, preventive care options and utilization, physician behavior, adherence to therapy/treatment and effects such as adverse selection (insurance company level) and moral hazard (enrollee level). Some of these variables, like plan benefits, can be measured directly but we did not have access to those specific data in the publicly available Medical Expenditure Panel Survey (MEPS) files that we used.

The blue arrows indicate the course of one-directional change; the black arrows represent variables that may have an effect on another and vice versa. For example, patient characteristics, represented by the variables age, gender, smoking status, marital status, health status, level of education, income as a % of the Federal Poverty Level (FPL) and region are theorized to influence insurance status (two-way) as well as have an effect on healthcare utilization (one-way).

Figure 1: Conceptual Framework



## **Research Question and Hypothesis**

*Q1:* Does HMO enrollment predict ER expenditures among asthma patients?

*H1:* HMO enrollment predicts lower occurrence of any ER visit among asthma patients.

*H1a:* For those asthma patients visiting the ER for asthma-related events, HMO enrollees have lower predicted conditional expenditures.

*Q2:* Does enrollment in a private HMO predict higher expenditures compared to public HMOs?

*H2:* Private HMO enrollment predicts lower occurrence of any ER visit and higher conditional ER expenditures among asthma patients, compared to public HMO plans.

*H2a:* For those asthma patients visiting the ER for asthma-related events, Private HMO enrollees have lower predicted conditional expenditures than Public HMO enrollees.

## **Data Source**

For this research, we used Medical Expenditure Panel Survey (MEPS) data: the Full-Year Consolidated files, Medical Condition files and ER Event files for the years 2009, 2010 and 2011. MEPS is a set of large-scale surveys of families and individuals, their medical providers (doctors, hospitals, pharmacies, etc.), and employers across the United States. MEPS collects data on the specific health services that Americans use, how frequently they use them, the cost of these services, and how they are paid for, as well as data on the cost, scope, and breadth of health insurance held by and available to U.S. workers [31]. The Consolidated files, Condition files and Event files are all part of the Household Component of MEPS which collects data from a sample of families and individuals in selected communities across the United States [32]. MEPS defines health

care expenditures by claims data, or in other words: the amounts charged by providers for health care services.

### **Study Design and Subjects**

To create an adequate sample size, we used three successive years of MEPS files: 2009, 2010 and 2011. First, we identified patients with self-reported asthma on the basis of ICD9-code 493 from the Medical Conditions file. Using data from the Consolidated File, we applied the inclusion and exclusion criteria to the self-reported asthma patients. Since we wanted to look at HMO enrollees versus enrollees of other insurance plans, we deleted all observations without insurance. We also excluded children and elderly from our sample as we did not want to include youth or Medicare eligible patients who may be distinct populations. In 2011, for example, we identified 924 patients with self-reported asthma after applying the inclusion and exclusion criteria.

For these 924 patients we found that 684 patients actually had any health care utilization for their condition during the year of the survey, but we decided to keep all self-reported asthma patients to keep the sample larger. In this case, disease prevalence does not imply people need to use any healthcare during one particular year.

To determine asthma-related ER events, we looked at the three ICD9 diagnosis codes in the ER Event file. If any of the three diagnosis codes were equal to 493, it was considered an asthma-related ER event. The condition codes, clinical classification and procedure codes linked to each ER visit are sequenced in the order in which the conditions were reported by the household respondent, which was in order of input into the database and not in order of importance or severity [33]. We found that of 924 asthma patients, 225

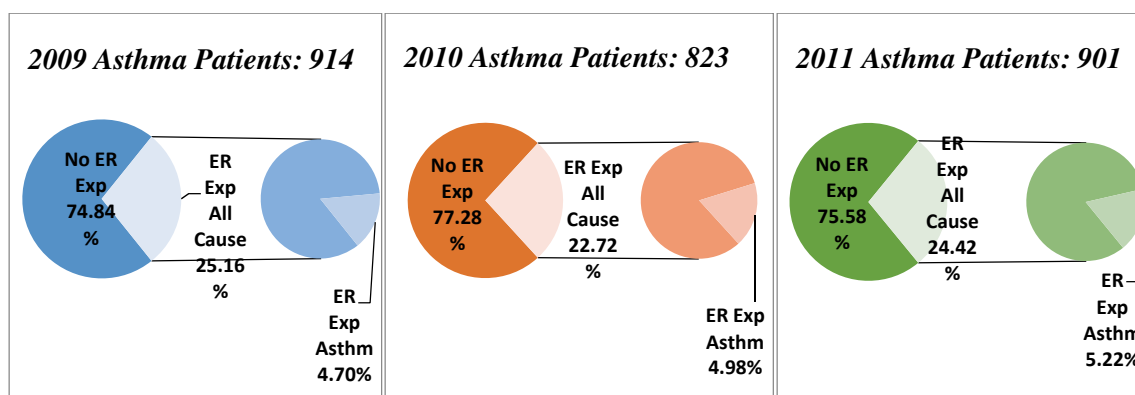
went to the ER for “all cause” and 48 of them went to the ER for asthma-related events. It should be noted that we found many patients with multiple asthma-related ER visits. In other words, for the relatively small percentage of asthma patients visiting the ER for asthma-related events (+/- 5% every year), we found that a majority of this group has multiple ER events in a year.

We appended the three years of data which resulted in 2,638 observations. We then deleted 598 duplicates in the overlapping panels (keeping one randomly chosen observation per person) which left us with a total sample of 2,040. There were 81 observations deleted due to non-positive weights, leaving us with a sample size of 1,959. Survey weights used to correct for the complex survey design of MEPS that includes both stratification and clustering. The sampling weights were adjusted for nonresponse and ranked with respect to population control totals.

We adjusted the conditional expenditures for inflation between the years of 2009, 2010 and 2011 using the GDP deflator [34]. We also adjusted the MEPS weight variable by dividing the variable by 3, creating an average weight over all three years.

Figure 2 is a representation of the three samples (2009, 2010, 2011) and percent of patients with ER expenditures for “all cause” and then for asthma specifically. These samples were appended together creating a sample of 1,959 insured patients with asthma between the ages of 18 and 64.

**Figure 2: Weighted Percentage of any ER expenditures among Insured Asthma Patients aged 18-64**



## Data Analysis

### *Dependent variables: any ER utilization and ER expenditure*

The dependent variables in this study are 1) any ER utilization and 2) conditional predicted ER expenditure, a continuous variable for the total ER facility and doctor expenses. The statistical analysis which will we elaborate on in the next paragraph focused on any ER utilization in the first part of the model, a recoded binary variable yes (1) or no (0). The second part of the model uses total ER expenses.

### *Independent variable: HMO*

The main independent variable is a recoded binary variable for insurance type: HMO (1) and non-HMO (0). Variables in the consolidated files that are used to define these plans include those that define enrollees of public HMOs (Medicaid or SCHIP), private HMOs and all other types of plans defined as “non-HMO”. We used MEPS’ classification of HMOs as a distinct version of managed care, other than Preferred provider organizations (PPOs), Exclusive provider organizations (EPOs), and Point of service plans (POSs). MEPS describes HMOs as: “A health care system that assumes both the financial risks

associated with providing comprehensive medical services (insurance and service risk) and the responsibility for health care delivery in a particular geographic area to HMO members, usually in return for a fixed, prepaid fee. Financial risk may be shared with the providers participating in the HMO.<sup>1</sup> MEPS has clearly defined HMO variables and we defined all other insurance variables as non-HMOs.

### *Covariates*

In addition to the key independent variable, we controlled for several socio-demographic factors (see Table 1) and current smoking status. Drawing from the literature, we believe that smoking has a major impact on the severity of asthma and asthma control, thus we included whether enrollees currently smoke as a measure of their increased risk for emergency department utilization.

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<sup>1</sup> [http://meps.ahrq.gov/survey\\_comp/ic\\_ques\\_glossary.shtml](http://meps.ahrq.gov/survey_comp/ic_ques_glossary.shtml)

**Table 1: List of Covariates**

<b>Variable Name</b>	<b>Variable Type</b>	<b>Description</b>
Age	Continuous	Ranging from 18 to 64
Gender	Binary	Female yes (1), no (0) for male
Smoking Status	Binary	Yes (1) No (0)
Race	Categorical	1 Caucasian 2. African-American 3 Other / multiple (including Asian)
Marital Status	Categorical	1 Married 2 Widowed/Divorced/Separated 3 Never Married
Region	Categorical	1 Northeast 2 Midwest 3 South 4 West
Educational level	Categorical	1 High School or less 2 Any college education 3 Any Postgraduate education
Health Status	Categorical	1 Excellent 2 Very Good 3 Good 4 Fair 5 Poor
Income as % FDL	Categorical	1 Poor / Negative 2 Near Poor 3 Low Income 4 Middle Income 5 High income



### *Statistical Analysis*

We conducted the data analysis with a two-part model. Two-part models are often used when dealing with utilization or expenditure data because due to large numbers of non-users of health services, there are excess zeros in the resource use or cost data and the assumption of normality of the error term is not satisfied [34]. These models usually involve outcomes that have two different statistical meanings, first that the outcome is larger than zero and second the outcome, based on the assumption that it was a positive outcome in the first part. [36].

In the two-part model, a binary choice model is estimated for the probability of observing a zero versus positive outcome. Then, conditional on a positive outcome, an appropriate regression model is estimated for the positive outcome observed [37]. Two-part models are shown to perform better than single-equation models in terms of split sample (in our case: ER expenditure versus none) mean-squared forecast error as they accommodate heterogeneity between users and non-users as well as heterogeneity across users based on level of use [38]. It has also been shown that co-linearity problems and violation of the bivariate normality assumption for the error term, likely in health data sets like MEPS, lead to poor performance of selectivity models and we performed tests to check the model fit in STATA, the modified Hosmer-Lemeshow test and the Pearson correlation, which illustrated that the two-part model is more efficient [39, 40].

First, we used logistic regression to test whether asthma patients in an HMO or non-HMO had any ER expenditures for asthma-related events. The prediction of any ER use is explained by the explanatory variables times the corresponding parameters to be estimated. Then in the second part, we used GLM to predict expenditures for adults who incurred any

asthma-related ER expenditure. “Total ER expense” equals the explanatory variables and corresponding parameters, multiplied by a transformation function. GLM adjusts issues with skewness of the data and related issues via variance weighting. Using the data to find the distributional family and link, we performed a Modified Park test to identify the potential distribution of total ER expenses and the coefficient (2) supported the choice for GLM with gamma family and log link, as the variance exceeded the mean.

After running the two parts and finding a significant relationship between private insurance and ER expenditure (related to our second hypothesis, that private HMO enrollment predicts higher occurrence of ER visits among asthma patients, compared to public HMO plans), we calculated overall annual per patient expenditures for private insurance by multiplying each individual’s probability of any ER expense in the first part by predicted ER expenditure in the second part. Since the two part model does not allow statistical tests of equivalence for overall predicted expenditures [41], we generated standard errors and 95 percent confidence intervals for the regression-adjusted per capita spending estimates using the bootstrap technique with 1,000 replications.

We used SAS version 9.3 of the SAS Institute for the data cleaning, formatting and data manipulation. Subsequently, we conducted our data analysis with STATA 13.0 [42], using the svy command to account for the complex survey design of MEPS and the weighting of observations.

### ***Regression Model***

$$Y_i = \beta_0 + \beta_1 * HMO (0/1) + \beta_2 * Age + \beta_3 * Female (0/1) + \beta_4 * Smoker (0/1) + \beta_5 * Private Insurance (0/1) + \beta_6 * Race + \beta_7 * Marital Status + \beta_8 * Region of the U.S. + \beta_9 * Education level + \beta_{10} * Health Status (self-perceived) + \beta_{11} * Income (%FPL) + \varepsilon$$

In the two-part model,  $Y_i$  first entails any ER expenditures:  $\Pr(y > 0|x) = F(x\delta)$  where  $x$  represents the explanatory variables and  $\delta$  the corresponding parameters to be estimated. In the second part, the model is conditional  $E(y | y > 0, x) = g(x\gamma)$  where  $x$ , again, represents the explanatory variables  $\gamma$  represents the parameters to be estimated and  $g$  stand for the transformation function. [36]

$\beta_0$  is the intercept,  $\beta_1 - \beta_{11}$  represent the coefficients of each explanatory variable, and  $\varepsilon$  is the error term. Perceived health status is a proxy for comorbidities, which are often present in asthma patients. The average person with asthma has 2.3 other chronic conditions. Income as a percentage of FPL corrects for the difference in single person income and family income and is a proxy for socio-economic status.

## 4. Results

### Descriptive Analysis

Table 1 provides the summary statistics of the key variables of interest for the concatenated sample of insured adults with self-reported asthma. After getting rid of duplicate observations for patients in overlapping panels and observations with non-positive weights, we find that 1,235 patients are enrolled in non-HMOs (66.8%) and 724 in HMOs (33.2). Together they make up for a weighted sample size of 1,959 asthma patients between ages 18-64.

We performed Pearson's chi square tests to determine if two categorical variables are statistically independent of each other [43]. We can conclude here that the HMO enrollees' increased amount of smokers (25%) compared to non-HMOs (19.3%) is not due to random variation. We found a larger proportion of privately insured among non-HMO enrollees (74.3%) than among HMO enrollees (66.9%); more Caucasian patients enrolled in non-HMOs (81.8%) compared to HMOs (75.7%) and thus more non-Whites in HMOs (24.3% in total for other races); and similarly, we found more Hispanics enrolled in HMOs than in non-HMOs. All these variables had a highly significant p-value, indicating that some association between the variables and HMO status is present. The same goes for marital status, where we found more married patients in non-HMOs (49.9%) than in non-HMOs (43.6%).

We found that more patients in the Northeast and the West are enrolled in HMOs (resp. 29.3% and 28.9% opposed to 15.9% and 21.0% in non-HMOs). More patients in the Midwest and South are enrolled in a non-HMO (25.1% and 38.0% compared to 21.0% and

20.7% in HMOs in these regions). The chi square test illustrated that HMO status and region are dependent. Similarly, HMO status is not independent of family income (% of FDL). We found that more patients in the “Poor” and “Near poor” categories were enrolled in HMOs (resp. 23.3% and 4.1% compared to non-HMO enrollment 14.2% and 3.0%). This in the “Low income”, “Middle income”, and “High income” categories had more representation in non-HMOs compared to HMOs.

In the case of health status, we find that about three fourths of both groups (HMO and non-HMO) report to be in good, very good or excellent health. There are more patients reporting a fair (17.4%) or poor (8.5%) health status in HMOs than in non-HMOs. In the HMO group more than 60% have any college education or higher, but for non HMOs this percentage is less. About two thirds of our sample is female, both in the HMO group and in the non-HMO group. We found no statistically significant association between health status, education, gender and HMO enrollment.

We performed a pooled two-way t-test for the continuous variable age, and we found that the mean age for enrollees of non-HMOs (43.3 years) is not significantly higher than the mean age of enrollees of HMOs (40.6 years).

**Table 2: Summary Statistics of Asthma patients by Insurance (HMO / non-HMO)**

	<b>Non-HMO</b>	<b>HMO</b>	<b>Total Sample</b>
<b>MEPS Sample Size (n) (% sample)</b>	1235 (66.8)	724 (33.2)	1959
<b>U.S. Weighted Sample Size (n)</b>	13,709,124	6,828,856	20,537,980
<b>Mean age (y) (s.e.)</b>	43.3 (0.48)	40.6 (0.59)	42.4 (0.39)
<b>Female (%)</b>	67.8	65.4	67.0
<b>Smoker (%) *</b>	19.3	25.0	21.2
<b>Insurance (%) **</b>			
Private	74.3	66.9	71.8
Public	25.7	33.1	28.2
<b>Race (%) **</b>			
Caucasian	81.8	75.7	79.8
African-American	11.5	15.9	12.9
Other / multiple	6.7	8.4	7.3
<b>Ethnicity (%) **</b>			
Hispanic	9.4	12.4	10.4
Non-Hispanic	90.6	87.6	89.6
<b>Marital status (%) *</b>			
Married	49.9	43.6	47.9
Widowed/Divorced/Separated	21.2	19.9	20.7
Never Married	28.9	36.5	31.4
<b>Region of country (%) **</b>			
Northeast	15.9	29.3	20.3
Midwest	25.1	21.1	23.8
South	38.0	20.7	32.2
West	21.0	28.9	23.7
<b>Education (%)</b>			
High school or less	39.1	42.8	40.3
College education	44.9	45.7	45.2
Postgraduate education	16.0	11.5	14.5
<b>Health Status (%)</b>			
Excellent	13.8	15.0	14.2
Very good	30.3	31.6	30.7
Good	30.1	32.0	30.8

Fair	17.4	14.9	16.5
Poor	8.5	6.5	7.8
<b>Income as a percent of FPL (%) **</b>			
Poor / Negative	14.2	23.3	17.2
Near Poor 0-100%	3.0	4.1	3.4
Low Income 100-200%	12.8	8.8	11.5
Middle Income 200-400%	28.7	25.5	27.7
High Income Over 400%	41.1	38.3	40.2

\*  $p < 0.05$  \*\*  $p < 0.01$ ; pooled two-sample  $t$ -test was used to test the statistical significance of the continuous variable age;  $\chi^2$  tests were used to determine the differences in the proportion of cat variables among HMO and non-HMO.

### Regression Analysis

As shown in table 3 below, HMO enrollment was not a significant predictor of any ER utilization/expenditure or of conditional expenditures for asthma patients who did have ER visits.

While HMO enrollment was not significant, public/private insurance status does significantly predict ER usage and expenditures. Asthma patients in a private insurance plan have 56% lower odds of having any ER expenditure, but once they do visit the ER (part 2), those with private insurance are actually predicted to have \$1767.27 more expenditures, compared to patients in public plans.

Demographics were also important predictors of ER expenditures. For example, African-Americans have 94% higher odds of having any asthma-related ER expenditure, compared to Caucasian asthma patients, although the amount of conditional expenditure did not vary significantly by race. We also found that with every additional year of age, an asthma patient has 3% lower odds of an ER visit.

Geography also matters, with patients in the Midwest, Southern and West regions all being significantly less likely to demonstrate ER usage and those patients in the South and West to demonstrate significantly lower expenditures when they did visit the ER.

Also worthwhile mentioning is that an asthma patient who is nearly poor is more than 4 times (4.31) more likely to have any ER expenditure than someone who is poor or has a negative income. This may be explained by the fact that this group of people with nearly poor incomes was not eligible for Medicaid in 2009, 2010 and 2011 and, therefore, visited the ER more often than poor patients (who may have had a Medicaid plan) when they had any asthma event, acute or less acute.

**Table 3: Regression Results Two-Part Model: asthma-related ER expenditures**

	<b>Part 1: LOGIT Odds Ratios Any Expenditures</b>	<b>Part 2: GLM Conditional Expenditures (\$)</b>
HMO (yes/no)	0.74 [0.32-1.67]	167.82 [-1554, 1889]
Mean age (years)	<b>0.97**</b> [0.95-0.99]	42.51 [-12, 97]
Female (yes/no)	0.92 [0.48-1.79]	-157.70 [-1055, 739]
Smoker (yes/no)	1.82 [0.87-3.80]	404.83 [-688, 1498]
Private insurance (yes/no)	<b>0.44**</b> [0.20-0.99]	<b>1767.27**</b> [-26, 3561]
Interaction HMO*private	1.13 [0.35-3.62]	-978.73 [-3214, 1257]
<b><i>Race/ethnicity</i></b>		
Caucasian	<i>Reference</i>	<i>Reference</i>
African-American	<b>1.94**</b> [1.08-3.48]	11.58 [-1152, 1175]
Other / Multiple	0.27 [0.05-1.44]	<b>-1502.96***</b> [-2374, -632]
<b><i>Marital status</i></b>		
Married	<i>Reference</i>	<i>Reference</i>



Widowed / Divorced / Separated	1.10 [0.57-2.12]	-426.81 [-1800, 946]
Never married	0.86 [0.40-1.82]	-359.60 [-1869, 1150]
<b><i>Region of country</i></b>		
Northeast	<i>Reference</i>	<i>Reference</i>
Midwest	<b>0.44**</b> [0.21-0.89]	-523.42 [-2511-1464]
South	<b>0.51*</b> [0.25-1.05]	<b>-1736.54*</b> [-3516, 43]
West	<b>0.51*</b> [0.24-1.10]	<b>-1716.25**</b> [-3456, 23]
<b><i>Education</i></b>		
Highschool or less	<i>Reference</i>	<i>Reference</i>
Any college education	1.20 [0.61-2.37]	<b>-1011.16*</b> [-2167, 145]
Any postgraduate education	1.09 [0.61-2.37]	-701.99 [-3844, 2440]
<b><i>Health Status</i></b>		
Excellent	<i>Reference</i>	<i>Reference</i>
Very good	<b>2.71*</b> [0.97-7.53]	-752.57 [-3075, 1569]
Good	<b>2.78*</b> [0.87-8.92]	61.21 [-2097, 2220]
Fair	1.90 [0.57-6.31]	1779.49 [-476, 4035]
Poor	2.26 [0.61-8.30]	1703.88 [-2619, 6026]
<b><i>Income as a percent of FPL</i></b>		
Poor / Neagtive income	<i>Reference</i>	<i>Reference</i>
Nearly poor	<b>4.31**</b> [1.65-11.25]	-202.63 [-1550, 1145]
Low Income	1.29 [0.53-3.16]	-309.45 [-1654, 1035]
Middle Income	2.01 [0.86-4.75]	-122.15 [-1535, 1291]
High Income	1.05 [0.32-3.43]	1390.94 [-538, 3320]
Constant	0.10*** [0.03-0.39]	
<b><i>Observations</i></b>	<b>1959</b>	<b>91</b>

Standard errors in parentheses, 95% CI in brackets, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$

## 5. Discussion

### Summary of Findings

Although HMO enrollment does not appear to predict ER utilization or expenditures for adult asthma patients in our sample, our findings do suggest that private vs. public insurance significantly impacts ER expenditures, as do demographic predictors.

### Protocols for Prevention and Benefit Structures: using Georgia as an Example

To get a general understanding of differences in benefit structure between HMOs and non-HMOs, we first looked at Georgia to see if indeed HMO plans operating in the exchanges differed from other insurance plans offered. We compared HMO plans to all other types of plans, including POS, PPO and health saving accounts. The criteria we looked at were “What preventive services are covered, to what extent are they covered and does the plan have guidelines for controlling asthma.” We found some minor differences between internalized HMOs and HMO-like designs, but more importantly, we found some major differences between HMO plans and non-HMOs.

The state of Georgia has 50 HMOs. In this case HMOs are described as: “An entity that offers prepaid, comprehensive health coverage for both hospital and physician services with specific health care providers using a fixed structure or capitated rates.” This HMO enrollment includes enrollees in both traditional HMOs and HMO point-of-service (POS) plans through: group/commercial plans, Medicare, Medicaid, the Federal Employees Health Benefits Program, direct pay plans and unidentified HMO products [44].

Some of these plans are internalized, such as Kaiser Permanente, others are plans offered by insurance companies that offer a plethora of different plans, including HMO-like benefit designs. It is not within the scope of this research to provide insurance level-specific details on benefit differences. We did compare some insurance plans in Georgia competing in the exchanges to find if there are differences in whether or not they use internal protocols guiding the treatment of asthma patients and which preventive services are (partly) being reimbursed.

We found that the main difference between HMO and non-HMOs is that all HMOs have expanded the package of defined “preventive care” measures beyond the scope of the PPACA. Most non-HMOs cover just those described in the law. Another difference we found was that HMOs (and some POS) start covering those services before the deductible is met, whereas some non-HMOs make patients pay their deductible first. HMOs (and POS) in Georgia have specific guidelines for the diagnosis and treatment of asthma patients, describing in much detail how to manage their care. Other plans (primarily those only offering PPOs) follow more general guidelines, not specifically for different levels of severity of asthma. It should be noted, however, that we don’t know whether HMO physicians follow these guidelines.

**Table 4: Comparison of typical HMO / non-HMO plans by asthma protocol and benefits**

	HMO or non-HMO	Asthma Protocol or Guidelines	Preventive Care and Prescription drugs	Other distinct features
<b>KAISER PERMANENTE</b>	HMO	Yes: Kaiser Adult Asthma Clinical Practice Guideline	No copay (in network) Covered services start BEFORE Deductible is met.	Protocol describes in detail how to manage “special” situations; what home management of asthma should look like in various situations and severity.
<b>BLUE CROSS BLUE SHIELD</b>	HMO	Yes: Clinical Practice Guidelines (CPGs) that form the basis of the BCBS ConditionCare program for asthma patients	No copay (in network) Covered services start BEFORE Deductible is met.	360° Health: an additional (no charge!) program that provides support to help patients with chronic conditions to achieve their health goals. Plan works with patient, doctor and other health care professionals to help asthma patient improve their health. Example: ConditionCare to assist members who are not yet managing a core chronic condition, such as asthma
<b>HUMANA</b>	HMO	Yes, not their own: National Asthma Education and Prevention Program (NAEPP) – Guidelines for the Diagnosis and Management of Asthma	No copay (in network) Covered services start BEFORE Deductible is met.	Prevention includes “Respiratory Therapy” at no charge
	POS	Yes, not their own: Asthma: NAEPP	Out of network: 25% AFTER deductible	No extra prevention as in HMO, such therapy to eliminate or reduce a dependency on tobacco

<b>COVENTRY</b>	POS	Yes, not their own: Borrowed from National Heart, Lung & Blood Institute: National Asthma Education and Prevention Program	No copay (in network) BEFORE Deductible (out of network: 40% after deductible)	Only products and services that are s designated as preventive by the PPACA.
<b>AETNA</b>	POS	Yes: Aetna Better Health: Treating patients with asthma	No copay BEFORE Deductible is met.	Only products and services that are s designated as preventive by the PPACA.
<b>UNITED HEALTHCARE</b>	PPO / HSA	No: UnitedHealthcare Community Plan recommends the use of any of three nationally available (external) non-preventive clinical practice guidelines to help practitioners make decisions about appropriate health care for specific clinical circumstances.	20% copay AFTER Deductible	The freedom to choose any doctor for health care needs
<b>CIGNA</b>	PPO	Not yet asthma: Coverage Policy Unit responsible for development of internal clinical guidelines, and proper use of externally developed guidelines (Milliman Care Guidelines)	No copay (in network) AFTER Deductible	Only products and services that are s designated as preventive by the PPACA. Health First: using a rules-based priority algorithm, identifies participants who may benefit from participation in these programs on a monthly basis based on medical, pharmacy and laboratory claims

*Sources: various insurance companies' websites and georgiahealthbenefits.com*

## Limitations

The major limitation to this study is the sample size. This study measures expenditures for ER visits for the time period of the MEPS survey which is one year. When extracting asthma patients from this group and applying the exclusion criteria, we were left with small samples. It is possible that in a larger sample (or a longitudinal sample in which we collect data over time), some of the insignificant trends seen in our analysis would actually be statistically significant. Also, since this is a population study, we find a low prevalence of acute asthma so we might expect different findings in a more severely ill population, using a data set with detailed information for asthma patients only.

Also related to the cross-sectional nature of the data, we do not have information on how long a respondent has been enrolled in an HMO. If we posit that HMOs are superior at promoting preventive care, a longer tenure in an HMO plan may predict better asthma control. If we had information for a longer period of time, we could include health plan switching, and draw more precise conclusions about the effect of HMO enrollment on ER expenditures. The MEPS insurance files have more detailed information about insurance status and plan characteristics. Due to confidentiality rules, data files for the Insurance Component are not available for public release.

Another limitation is that ER occurrence and total ER expenditures are skewed among asthma patients. We dealt with nonlinearity of some of the covariates in the model. It is possible that those who enroll in HMOs are more receptive to preventive care. For example, some studies have found HMO enrollees to generally be better educated, healthier, and more optimistic about the benefits of preventive care than those in non-HMOs, explaining further the combined effects between these variables and HMO status.

Considering these differences among the insured' characteristics, one could also argue that we should look at "lowered financial barriers and the attraction of receptive beneficiaries".

Some might argue that it is debatable whether HMO is a reliable proxy for prevention; however, this work looks at whether or not HMOs managing enrollees with chronic illness in lower acuity settings lead to lower ER expenditures than non-HMOs. HMOs most often do cover preventive care services fully, but we need more insight what services these include, and how these preventive services relate to patients' chronic conditions (the nature of the preventive services), especially whether these services are much different from benefits offered by non HMOs. So we need to have a clear understanding of what we mean by prevention. In the context of this research, we generally refer to how HMOs manage their patients, having a stronger emphasis on care coordination and electronic patient records guiding patients with chronic conditions. Ideally, we would have data for these patients over a longer period of time but these were not available for this research.

## **Policy Implications**

In the context of increasing costs for healthcare, it is important to identify which factors contribute to the ever increasing costs for health services for the chronically ill. Especially in the context of the Health Insurance Exchanges that have started operation, we would like to know more about whether differences in insurance type and benefits plan structure predict differences in healthcare expenditure.

Consultancy McKinsey recently reported that HMO-type insurance plans seem to re-emerge under the implementation of the Affordable Care Act. According to their report, almost two thirds of the plans offered in the exchanges are “managed-care-like” and 67 percent of new entrants choose these type of plans [45].

The ACA attempts to make preventive care more accessible and affordable for many Americans, while providing insurance companies an incentive to purchase healthcare in a more cost-effective way. Some supporters of the ACA suggest that putting uninsured Americans on Medicaid will reduce costly emergency-room visits by giving them more access to care in other settings [46]. Yet a recent study claims the contrary: that the expansion of Medicaid would in fact increase the amount of ER visits. [47, 48, 49] The reasoning of these Oregon Health Insurance Experiment researchers is that when prices go down, demand goes up, so insurance naturally leads to more health care use overall, including emergency care. The researchers claim that in Oregon, people who gained coverage through Medicaid used the emergency room 40 percent more than those who were uninsured. [48] Our study shows that before (in 2009-2011) those asthma patients who were not eligible for Medicaid but nearly poor were more than 4 times more likely to visit the ER than those who were eligible for Medicaid. This finding questions, at least for



asthma patients, whether expanding the eligibility for Medicaid for these nearly poor patients would indeed even further increase their ER visits.

In those states expanding Medicaid, additional federal funding will be provided to expand their Medicaid programs to cover adults under 65 who make up to 133% of the federal poverty level where this used to be 100%. In our study, this refers to the group of asthma patients who are in the “Nearly Poor” category and future study should establish whether indeed their likeliness of visiting the ER has gone further up or in fact down after the introduction of the Medicaid expansion in some states. Evidence from the Massachusetts model illustrates that improvements in access to care in Massachusetts led to a decline in emergency department (ED) use between 2006 and 2010 [50].

In our study, we did not show that HMO enrollment predicts lower ER expenditure among asthma patients, and more generally, little is known about the impact of HMOs’ disease management programs on medical costs for patients with asthma. This raises the question whether HMO is an appropriate proxy for prevention. Table 5 illustrates that HMOs at least invest more in disease management programs and reimbursement of broader packages of preventive services than do non-HMOs. If we look at the health employer data and information set (HEDIS) criteria for asthma and compare patients who were in a HMO-disease management program to those who were not, we could establish if these led to decreased costs and improved outcomes, like has been done for other chronic conditions [51]. HEDIS is a tool used by more than 90 percent of America's health plans to measure performance on important dimensions of care and service, including the use of appropriate medications for people with asthma and their medication management [52]. If we would ascertain that HMOs are indeed a good proxy for prevention, our study established that this

does not in fact guarantee lower ER expenditure among asthma patients. This conclusion may have implications for the ACA which attempts to make preventive care more accessible for Americans to save costs and improve outcomes. Yet as noted before, we recognize the limitation of our small sample size which may not be allowing us to reach statistical significance to draw such conclusions from.

### **Future Study**

Future study should focus on more data for asthma patients measured over a longer period of time. This way we would be able to establish whether patients have any ER visits over several years and we would have less methods issues dealing with a larger sample. Prevention is typically described by measures that potentially have a long term impact. With time series data, we would be able to draw more detailed conclusions on prevention or insurance plans structure related to prevention.

We could also focus on event level expenditures, rather than patient level. As we found that asthma patients in our sample had multiple ER visits in one year, it would be worthwhile to repeat this research, focusing on these events and type of events to get a better understanding of what caused these patients to require care in an acute setting. We may also use want to qualitative research methods to get more detailed information about these cases.

Future study should also look into the differences of these benefit designs in more detail to define whether preventive measures, as such, predict ER visits and total ER expenditures. These could be various measures to influence patients' behavior such as buying clean air filters for their house change their bedding, vacuuming and cleaning the house more, or taking vacations to destinations known for their clean air. Another

distinguishing factor of the exchanges is that a more diverse set of benefits is emerging. Insurance benefits could be reaching from educating patients about these lifestyle changes and their potential impact on their health, to actually reimbursing some of these measures. It would require some cost benefit analyses to establish whether such measures would have a decreasing impact on healthcare costs. MEPS has insurance files that include more information about plans and benefits. These could be useful to be able to come up with precise policy recommendations how to prevent the expansive expenditures for chronic illnesses, especially in the acute setting.

## 6. Conclusion

This study provides new insights for the discussion about the effect of insurance type on health care expenditures. Even though we did not find a significant effect of HMO status on ER expenditures among asthma patients, we do conclude that it deserves the intention to invest in future research in this field. If we enlarge our sample size, by including more years or by looking at a broader scope of chronic conditions, we may be able to get a more precise estimate of this relation. As the ACA attempts to make preventive care more accessible and affordable for many Americans, while providing insurance companies an incentive to purchase healthcare in a more cost-effective way, it deserves the attention of policymakers to investigate whether HMOs, by investing in prevention, inhibit distinct features that result in lower health care expenditures.

We did find evidence that some of the covariates predict ER expenditures among asthma patients. For example, we found that a nearly poor asthma patient is more than 4 times more likely to visit the ER than a poor patient. This is an interesting finding in the context of the debate about the potential effect of the expansion of Medicaid under the PPACA on ER expenditures. We also found an interaction effect between HMOs and health status that raises new questions about the role of prevention in HMOs as opposed to other plans. Until recently, most studies researching healthcare utilization and expenditures have not looked into the effect of differences in benefit design and insurance policy. This study illustrates that it is important to include these variables in future study.

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