The Effect of the Oregon Health Plan Cutbacks on the Presentation of Chronic Illnesses to Oregon Emergency Departments

by

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CERTIFICATE OF APPROVAL

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Abstract

Background and Objective: An economic downturn and state budget cuts led to Medicaid program changes across the country in the early part of this decade. In Oregon, state budget constraints led to a restructuring of their Medicaid program, the Oregon Health Plan (OHP). In March 2003, extensive cutbacks were made to the OHP leading to disenrollment of nearly 80% of the enrollees who were non-categorical (part of the OHP expansion group). This study focused on whether there was a change in use of Oregon emergency departments (EDs) for chronic illnesses after versus before the OHP policy changes and, if so, if the pattern of change varied among payer groups. A subset of visits by patients with behavioral health diagnoses was also studied to determine if having a behavioral health problem altered the potential relationship between ED utilization for chronic illnesses and the OHP policy changes among different payer groups.

Methods: ED claims data ranging from March 1, 2001 through February 28, 2005 were examined for 22 Oregon hospitals. Using multivariate regression, we compared the proportion of chronic illness visits (measured as chronic ambulatory sensitive conditions) after versus before the OHP policy changes by payer group for all visits and for the subset of behavioral health visits.

Results: Uninsured visits were significantly more likely to be for a chronic ACS condition after versus before the OHP policy changes (OR = 1.10, CI 1.05, 1.16). These increased odds were not seen in the commercial or the OHP groups (OR = 0.97, CI 0.93, 1.00 and OR = 1.00, CI 0.96, 1.04). This change seen in uninsured visits differed

significantly from the lack of change seen in the commercial and OHP groups (Wald p =<0.01). In the behavioral health subgroup of visits, the association between chronic ACS visits and time period for the uninsured payer status was also appreciated (OR = 1.16, CI 1.04, 1.28). However, the change seen in the uninsured group was not shown to be statistically significant (Wald p = 0.09), thought to be due to lack of power.

Conclusion: The policy changes in the OHP led to cutbacks in March of 2003. These cutbacks were followed by a significant increase in the proportion of preventable uninsured visits to Oregon emergency departments for chronic illnesses. The association seen between visits for chronic illnesses in the uninsured, and the OHP policy change, raises the need for further debate about the most cost-effective way to deal with rising health care costs.

Introduction

The purpose of this study was to examine the effect of the cutbacks in the Oregon Health Plan (OHP) on emergency department utilization. In general, this study focused on whether there was a change in use of Oregon emergency departments (EDs) for chronic illnesses after the OHP policy changes and, if so, if the pattern of change varied among payer groups. In addition, a subset of emergency department visits by patients with behavioral health diagnoses was studied to determine if having a behavioral health problem altered the potential relationship between ED utilization for chronic illnesses after versus before the OHP policy changes among different payer groups.

Background

In 2001, an economic downturn resulted in a significant decline in state revenue; all 50 states, in an attempt to deal with the decline in their budgets, instituted several cost-saving measures in their Medicaid programs, making Medicaid cuts a national issue.[1] The experience in Oregon was no different. Oregon's unemployment rate in 2001-03 was the highest in the country.[2] For Oregon, Medicaid cutbacks were to become a particularly challenging issue. During the 1990s, Oregon had received a Section 1115 waiver to restructure and expand the eligibility of their Medicaid program; this was known as the Oregon Health Plan (OHP). The environment in Oregon, with the recession and the state budget constraints, provided a background for the study of Medicaid enrollees in the setting of program cutbacks.

In this section, we will address several issues, including the history of the OHP, the impact of the OHP changes, and the significance of this study. We will discuss

emergency department (ED) utilization and the issue of access to care in association with Medicaid cutbacks. We will do this by looking briefly at ED utilization in Oregon in general, and then focusing on particular subsets of enrollees potentially affected by Medicaid cuts, including those with chronic illnesses and behavioral health diagnoses.

OHP Historical Overview

In February of 1994, the Oregon Health Plan began its operation five years after being approved by the Oregon legislature.[3] The OHP was a novel attempt at expanding the state's Medicaid coverage to all persons with incomes up to 100% of the federal poverty level.[4] The health plan included a basic benefit package that was determined by a prioritized list of medical conditions and treatments ranked by several criteria, including cost effectiveness and "net benefit."[2] The expansion of the Medicaid plan via a Section 1115 waiver in 1994 led to approximately 100,000 additional Medicaid enrollees.[4] State statistics collected during that time showed a 7% decline in the percentage of the state's uninsured from 1992 to 1999, with a nearly 10% decline in ED utilization rates in Oregon from OHP's inception in 1994 to 1999.[5]

During the 1990s, the OHP garnered a lot of attention for its novel approach. Several studies looked at the potential success of the OHP and found that, despite the controversy surrounding the issue of the prioritized list, the OHP led to increased Medicaid coverage for some of Oregon's uninsured. [2-4, 6] Further, the OHP was shown not only to provide a means for insurance, but also led to satisfied enrollees with increased access to medical care and decreased unmet need. One additional finding from

a study that examined the characteristics of the expansion group was that those persons were on average “in fairly poor health” by self-report.[4]

The Impact of the Changes in the OHP

In the early years of the twenty-first century, a recession led to cutbacks in Medicaid programs across the country.[1] In Oregon, the OHP underwent a restructuring in order to deal with budget constraints. In March of 2003, through another waiver, the OHP was split into two separate programs: OHP Plus and OHP Standard. The Plus population was the categorically eligible Medicaid enrollees, such as poverty-level children, pregnant women, and persons receiving disability. The benefits for these enrollees were largely untouched by the cutbacks. However, the new Standard population, which included those OHP enrollees in the expansion group, experienced several changes in their OHP coverage. Cost-saving measures were instituted such as co-payments (which were eliminated by court order in June 2004), and increased premiums, which could no longer be waived due to income. Services were also cut from the benefit roster of the approximate 100,000 Standard enrollees, including dental, vision, and behavioral health (from 3/03 to 8/04), durable medical equipment, physical and occupational therapy, speech therapy, chiropractic, as well as home health and medical transportation. Lastly, lockout periods were instituted for any enrollee who defaulted on their monthly premiums.

Enrollment of the expansion population declined by over 80% following the changes in the OHP.[7] Further, enrollees who lost coverage reported greater barriers to medical care and medications, leading to increased unmet need and the accumulation of

medical debt.[8] The cost-saving measures instituted as part of the waiver disproportionately affected the poorest enrollees. The majority (82%) of previous enrollees who left due to cost-sharing measures were still uninsured at six months after the cutbacks and reported barriers to accessing outpatient care and increased utilization of hospital emergency departments for their medical needs, as compared to those who left the OHP due to reasons not related to cost-sharing.[9, 10]

In looking at what happened to patterns of ED utilization after the OHP cuts, a study by Lowe et al. showed that in one Oregon ED, there was a 17% increase in visits by the uninsured and a decrease in OHP beneficiary visits by 20%.[11] These results imply that the decrease in access to outpatient care due to the cutbacks led to the newly uninsured to seek care in the ED. This study was further supported by a follow-up study by Lowe et al. that showed a similar trend in a sample of 26 EDs state-wide.[12] In this study, looking at ED visits before versus after the OHP cutbacks, there was found to be an adjusted increase of approximately 20% in uninsured visits per year to the sample EDs, with a documented decrease in visits for OHP and commercial payer groups in the same time period.[12] However, one limitation as discussed by Lowe et al. was that the increase seen in the ED visits by the uninsured could be due to either an increase in the visit rate or an increase in the number of uninsured Oregonians coming to the ED.[12] Although this question cannot be answered with the data presented in the study, regardless of the actual cause for this increase, either explanation has costly implications for the OHP policy change.

An issue that is raised by Lowe et al. in their discussion from the multi-hospital study is to begin to question what types of diagnoses account for this increase in the ED

visits pre versus post OHP cutbacks. Lowe et al. showed that particular sub-groups, such as patients with behavioral health complaints, exhibited altered utilization of ED services after the OHP cutbacks. This was implied by the substantial shifts in the numbers of OHP and uninsured behavioral health visits.[12] The percentage of behavioral health visits by OHP beneficiaries during the study period were shown to decrease while the percentage of behavioral health visits by the uninsured rose.[12] Specifically, Lowe et al. demonstrated a 173% in drug-related , a 106% increase in psychiatric, and a 82% increase in alcohol-related visits by the uninsured payer class.[12] These results supported what had been reported by the aforementioned studies: that the OHP cutbacks were affecting access to care in the community and leading to an altered pattern of ED utilization and, thus, an altered pattern of diagnostic presentations among the OHP and uninsured populations.

ED Utilization and Medicaid Cuts: Defining the Role of this Study

The findings cited above have been supported by several studies that highlighted ED utilization as a measure of the dysfunction of the healthcare system. ED use is associated with decreased access to outpatient care, as measured by follow-up availability [13] and self-reported access[14]. Because of the laws concerning ED treatment and evaluation as provisioned by EMTALA, EDs are the only part of our healthcare system where all Americans are legally guaranteed access to health care.[15] The ED functions as a health care safety net or a "provider of last resort for millions of Americans."[16]

The next logical step to augment the research on the OHP cutbacks was to examine what happened to ED utilization patterns in Oregon after the OHP policy

changed, using an ED dataset that contains a larger percentage of ED visits in Oregon, and to begin to answer the question posed by Lowe et al. in their multi-hospital study: what types of diagnoses are showing up in the ED in the uninsured group after the OHP cutbacks? In the prospective study by Solotaroff et al., the chronically ill as compared to non-chronically ill previous enrollees, had a self-reported increase in their ED use.[17] Further, 68% of those with chronic illnesses in the study continued to lack replacement insurance.[17] As such, one hypothesis that became the focus for this study was that there would be an increase in the frequency of chronic illnesses presenting to the ED by the uninsured after versus before the OHP cuts, related to strained outpatient access to care. On a small scale, this was shown in a qualitative study looking at the effects of the OHP cutbacks on enrollees/previous enrollees. Over half of the 13 patients interviewed were presenting to the ED for acute exacerbations of their chronic disease.[18] Patients in that study presented with such diagnoses as hyperglycemia in a diabetic, an acute seizure in an epileptic, a migraine headache in a patient with chronic migraines, a Chron's flare, and an episode of hypertensive urgency in a chronic hypertensive patient.

We hypothesized for this study, based on the previous data cited, that those previous OHP enrollees with chronic illnesses who lost their OHP coverage and became uninsured will be forced to seek care in the ED for acute exacerbations of their chronic illnesses. Therefore, some of the increase in ED utilization by uninsured patients will be due to an increase in presentations of acute exacerbations of uncontrolled chronic illnesses. Our hypothesis was the proportion of ED visits for chronic illnesses would increase among the uninsured after the OHP policy changes.

Chronic Illness as Defined by Ambulatory Care Sensitive Conditions

For this study, we were interested in measuring chronic illness visits to Oregon EDs around the time of the OHP policy changes in February/March of 2003. There are many types of chronic illnesses but, as mentioned, we were specifically interested in chronic illnesses that would be sensitive to changes in outpatient access. Therefore, Ambulatory Care Sensitive conditions (ACS) were used to measure ED visits for chronic disease in this study. ACS conditions are "conditions for which good outpatient care can potentially prevent the need for hospitalization."[19] ACS conditions are part of several research initiatives supported by the Agency for Health Care Quality and Research. They are a validated research tool that has been used in the literature to measure the quality of outpatient access.[13] [20] Research on ACS conditions has traditionally been used with hospital admission data, but has more recently been cited in ED literature.[13] Discussion about using ED data instead of or in addition to hospitalization data proposes that this approach could reduce selection bias encountered when using hospitalization data alone.[19]

One of the AHRQ research initiatives, the Safety Net Monitoring (SNM) project, lists several ACS conditions or diagnoses. For our study, we were interested in looking specifically at chronic illnesses and therefore chose a subset of the PQI list, the "chronic" ACS conditions. These illnesses are defined as being "controllable with outpatient intervention."[13] [19] From the AHRQ SNM work, we also looked at the ED presentation of another set of diagnoses, the marker conditions. Marker conditions are often used in conjunction with ACS diagnoses as comparison outcomes. The theory behind using marker conditions for comparison is that the presentation of these

conditions should remain constant despite the OHP policy changes and vary only by population size and prevalence of illness.[10]

The Behavioral Health Patient

As a final part of this study, we examined patients with behavioral health diagnoses as a separate group. Our hypothesis was that patients with a diagnosis of a behavioral health illness would also have a difficult time with the change in their outpatient access due to the OHP cutbacks. Oregonians with a behavioral health diagnosis who lost coverage lost both of their physical and behavioral health coverage, potentially leading to an exacerbation of their behavioral health issues and making management of their medical issues more difficult. Our interest in this group comes from research that shows that persons with behavioral health issues are underserved.[21] These patients have a higher rate of morbidity/mortality than the general population, often from non-communicable diseases such as diabetes.[22] Moreover, these patients have a difficult time obtaining access to care despite often having a regular provider.[21]

Frequent ED users have both chronic behavioral and medical issues that contribute to their utilization patterns.[23-27] [28] One study of Oregon's state Medicaid population showed that 97% of the frequent users with >75 visits over 4 years have made a Medicaid claim for a behavioral health complaint.[23] These patients, as discussed in this research, have a difficult time managing their complex medical issues, which leads to increased ED utilization patterns. In this line of thinking, this group represents a "sick," underserved population that has difficulty accessing outpatient care even when provided with stable, accessible medical care. Therefore, in the setting of the OHP policy changes,

we hypothesized that there would be an increase in the proportion of visits for chronic illnesses among uninsured behavioral health patients.

Methods

Study Design

This study used previously collected ED claims data from a representative sample of Oregon emergency departments. The OHP policy changes of interest occurred in February and March 2003. We utilized claims data collected for the study by Lowe et al [12] for all ED visits over 24 months before and 24 months after the cutbacks, i.e. from March 1, 2001 through February 28, 2005. For this study, we compared the presentation of chronic illnesses in different payer groups during two time periods – before versus after the OHP cutbacks.

Study Population

The publication by Lowe et al. describes the study population:

"In selecting EDs, we considered patient volume, urban versus rural location, designation as a Critical Access Hospital, a rural hospital subgroup as defined by the Oregon Office of Rural Health [29], and the region of Oregon where the hospitals were located. According to these criteria, we identified 16 EDs that represented the range of Oregon EDs. Twelve of the 16 had informatics systems that could provide the necessary data and agreed to participate. The 4 EDs that did not participate were all small, rural EDs. However, we were able to recruit an additional 6 rural EDs. Finally, an opportunity arose to include an additional 8 urban EDs in the Portland region. Including these EDs

allowed us to study 12 of the 13 EDs in the 3-county Portland region, representing 94% of ED visits in the region... The 58 Oregon EDs reported 1,047,780 visits between July 1, 2002 and June 30, 2003. EDs included in the study reported 654,404 (62%) of these visits… Of the study EDs, 20 provided data for all 48 months and 22 could provide data for at least 43 months (August 1, 2001 through February 28, 2005)."[12] These 22 hospitals were chosen for our final study sample to maximize the representation of Oregon ED visits that occurred around the OHP cutbacks.

For this study, we examined data from complete records from all emergency department visits that presented to the subset of 22 Oregon EDs (Table 1). Visits without complete data on the key predictor and outcome variables were excluded from the study. The analysis was done at the visit level and not the patient level for two main reasons. Firstly, patients were assigned unique identifiers within a hospital system but not between systems; thus, the same patient could be represented by several different patient IDs in our dataset without a reliable means to link these visits to one patient. Secondly, the dataset represents a subset of ED visits in Oregon during the time period, not a complete sample, leaving the potential for missing ED visits by a particular patient because the visit occurred at an ED not in the dataset. Therefore, following patients over time such as in a retrospective cohort study was not possible. Given these dataset limitations, analysis was conducted at the visit level.

The visits included in the dataset were limited to those of adults aged 18-65. The reason for this was that the OHP cutbacks did not apply to children or adults over 65, who would be eligible for Medicare. We also only included those visits by patients with OHP, commercial, or no insurance. These payer groups were chosen because OHP and

uninsured groups' utilization patterns of the ED could have changed in relation to the OHP cutbacks. Visits by patients with commercial insurance should not have changed in relation to the cutbacks, but were included for comparison.

There were several visits by other payer types that were excluded, such as auto insurance and workman's compensation. These coverage types were excluded because they should not have been affected by the OHP cutbacks and appeared in very small numbers in the dataset. Visits by Medicare patients were also excluded because the patients that compose these visits are predominantly >65 years old, making commercial visits, which would represent patients with a more diverse age range, a better set of comparison visits. Lastly, patients with non-Oregon Medicaid were excluded in order to concentrate on the utilization habits of Oregon residents.

In order to investigate patients with a behavioral health diagnosis for the study, we identified patients, who had made visits to the study EDs for a behavioral health complaint (psychiatric, drug, or alcohol) at any time in the study period from August, 2001 to February, 2005. Once these patients were identified, the visits for these patients (all visits for each patient) were used for the sub-analysis.

Key Variables

Predictors

- Before/After Period: Time period designation is for after versus before the cutbacks in OHP. This predictor variable was used to determine whether there were changes in the proportion of chronic illnesses that presented after versus before the OHP cuts. Two different sets of before/after time periods were utilized

for this study. The primary analysis compared a "before cutback" period from August, 2001 to February, 2003 versus an "after cutback" period from March, 2003 to February, 2005, including all months with complete data from all of the hospitals within the dataset. A sensitivity analysis compared September, 2002 to August, 2003 versus September, 2003 to August, 2004. By limiting the analysis to 12-month periods before and after the cutbacks, this approach controlled for seasonal variation. Also, eliminating six months before and six months after the cutbacks reduced the potential "noise" around the 3/03 cutbacks date. We assumed that there could be confusion about eligibility and coverage around the time of the cutbacks. The sensitivity analysis before/after time periods removed this time of potential enrollee confusion.

- Payer Category: The payer category variable was used to delineate type of payer class for each visit; the categories for this variable were OHP, uninsured, and commercially insured.

Outcome Variables

- Chronic ACS Conditions (chronic ACS): This variable was used to identify patient visits for chronic ACS conditions, which includes congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), asthma, hypertension (HTN), and diabetes mellitus (DM). This was the dependent variable for this study and was coded as a dichotomous variable. All ICD9 codes were previously designated for each diagnosis as defined by the Safety Net Monitoring project on the AHRQ website. [30] The ICD9 codes that were used to define these chronic ACS conditions were cross-referenced with several ACS lists, including that used

in Bindman and Oster's paper [13], the AHRQ's Patient Quality Indicators list [31], and the frequently cited Weissman list [32]. After reviewing these lists, we considered creating a novel ICD9 list from our cross-referencing work, but opted to investigate the five diagnoses found in the ED study done by Bindman and Oster (CHF, COPD, asthma, HTN, and DM) using the ICD9 definitions found in the Safety Net Monitoring ACS list, as it has been previously validated. We considered utilizing the Billings algorithm for ED visits [33], as it has been used to examine ED visits that are susceptible to ambulatory treatment, but decided against this classification scheme as it did not allow us to examine the utilization of the ED specifically for chronic illness. Furthermore, a recent evaluation of this algorithm showed that it was difficult to reproduce and interpret the results.[34] All ICD9 codes listed below for DM, HTN, Asthma, COPD, and CHF were used for this variable.

- Diabetes: This variable represented ICD9 codes for visits where the discharge diagnosis was diabetes or diabetes-related diagnoses, and included ICD9 codes: 250.0–250.33, 250.8–250.93
- Hypertension: This variable represented ICD9 codes for visits where the discharge diagnosis was hypertension or hypertension-related diagnoses, and included ICD9 codes: 401.0, 401.9, 402.00, 402.10, 402.90
- Asthma: This variable represented ICD9 codes for visits where the discharge diagnosis was asthma or asthma-related diagnoses, and included ICD9 codes: 493–493.92

- COPD: This variable represented ICD9 codes for visits where the discharge diagnosis was COPD or COPD-related diagnoses, and included ICD9 codes: 491–492.8, 494–494.1, 496
- CHF: This variable represented ICD9 codes for visits where the discharge diagnosis was CHF or CHF-related diagnoses, and included ICD9 codes: 402.01, 402.11, 402.91, 428–428.9, 518.4

- Chronic ACS Conditions Plus Additional (Chronic ACS Plus): This variable was used to identify patient visits for the chronic ACS conditions (CHF, COPD, asthma, HTN, and DM) plus additional chronic illness diagnoses that were included on the AHRQ list (convulsions and angina). Moreover, convulsions were found on initial analysis as having high frequency in our dataset. ICD9 codes were used to identify this variable and included all codes listed for DM, HTN, Asthma, COPD, and CHF as well as the ICD9 codes listed for the additional diagnoses.
  - Convulsions: This variable represented ICD9 codes for visits where the discharge diagnosis was convulsions. This group was defined using the Safety Net Monitoring list from the AHRQ, and included ICD9 codes: 345, 780.3–780.9
  - Angina: This variable represented ICD9 codes for visits where the discharge diagnosis was angina. This group was defined using the Safety Net Monitoring list from the AHRQ, and included ICD9 codes: 411.1, 411.8–411.89, 413–413.9

- Marker Conditions: This variable represented the conditions that were used as "markers" for the time period chosen. Marker diagnoses include appendicitis, acute myocardial infarction, gastrointestinal obstruction, and hip/femoral fracture in patients >45 years of age. The marker outcome was included in this study to be used as a means for comparison with the models for chronic ACS conditions and chronic ACS Plus (chronic illnesses). These diagnoses have been shown in previous studies to remain constant and vary primarily with the population size and prevalence of illness. [35] [20] These marker conditions were derived from the Safety Net Monitoring list.[30] This variable represented all of the markers pooled together and all ICD9 codes listed for each marker condition below.
    - Appendicitis: This variable represented ICD9 codes for visits where the discharge diagnosis was appendicitis, both ruptured and unruptured. The AHRQ list was constructed to use hospital discharge data, and therefore excludes ruptured appendicitis. However, in our adaptation of this list, we determined that the prevalence of appendicitis, both ruptured and unruptured, should not change because of the OHP cuts, and should therefore still be useful as a marker condition. This group was defined using the Safety Net Monitoring list from the AHRQ and contained ICD9 codes: 540–542
    - AMI: This variable represented ICD9 codes for visits where the discharge diagnosis was AMI. This group was defined using the Safety Net Monitoring list from the AHRQ and contained ICD9 codes: 410–410.92

- Gastrointestinal Obstruction: This variable represented ICD9 codes for visits where the discharge diagnosis was GI Obstruction. This group was defined using the Safety Net Monitoring list from the AHRQ and contained ICD9 codes: 560–560.9
- Hip/Femur Fracture (age >45): This variable represented ICD9 codes for visits where the discharge diagnosis was hip/femur fracture. This group was defined using the Safety Net Monitoring list from the AHRQ and contained ICD9 codes: 820–820.9

Confounders

- Age: This variable represented the age of the patient during the visit and was categorized into clinically meaningful age groups.
- Gender: Gender of the patient was designated by this variable.
- Race: Ideally, this variable would have been examined to look for the effects of race on ED utilization for ACS conditions; however, over 800,000 records lacked this information and the variable was therefore not used in order to avoid a selection bias.
- Month: Month was included in the model to control for seasonal variation.
- Zip Code converted into a measure of socioeconomic status (SES): Zip code information was included to control for socioeconomic status. Research has been conducted on this topic by Dr. Nancy Krieger and the Public Health Disparities Geocoding Project through Harvard University; it is used widely throughout the literature to provide meaningful measures of socioeconomic inequalities in public health work.[36] [37] [38] Krieger's group has examined several potential

variables that can be obtained from the US Census to account for area-based SES [39, 40]. Her work has validated the variable "percentage of persons living below the US poverty line" as discerning socioeconomic gradients.[39, 40] Other means of measuring SES have been used in the literature, including the use of median household income,[41, 42] racial and ethnic composition,[41] years of schooling,[41, 43] recent occupation,[43] and total income.[43] Krieger's measure was chosen for this project because of the consistent results her team has produced, showing it to be a useful means of approximating SES. The other measures have not been subjected to the same rigorous assessment.

In order to convert to census-compatible information, the zip code from our dataset was matched to Zip Code Tabulation Areas (ZCTAs) that were created by the US Census Bureau. We chose this method to tabulate data in order to circumvent the need for geocoding, given the lack of complete addresses in the database.[44] Krieger et al. and the US Census Bureau caution users of this technique because, in some instances, ZCTAs will differ from zip code designation, especially in rural areas where some zip codes covering areas with a low density population will not have an assigned ZCTA.[44] [45] However, despite these limitations, there is evidence both from Krieger's work and others' research that zip code-based SES measures can detect SES gradients.[40] [42]

With the census-based ZCTAs, we were able to match "percentage of persons living below the US poverty line" information into each visit. Meaningful categories of this variable were sought and found in a discussion by Kreiger et al. Her work looks at "poverty areas," defined by the federal

government as an area where >20% of the population is below the SES.[40] However, in our dataset, patient visits that link to an area meeting this description represent the 90th percentile in the distribution. Given this, making a dichotomous variable comparing visits at <90th percentile versus those at >90th percentile was decided against in order to avoid masking potential variability at lower SES percentiles. Quartiles were therefore calculated using the distribution for the entire study population, and used for both the full study and the behavioral health analysis.

- Urban/Rural Designation of Hospital: This variable was used to control for the location of patient visits between urban and rural populations. Some literature has suggested that ACS diagnoses are not as predictive of outpatient access in rural settings as compared to urban settings,[46] while others suggest that there is an association, [47] making this an important variable to include in the model. This variable was coded as the string variable "Urban" and "Rural," and was recoded into a categorical variable.
- Admission for Visit: This variable was used to control for any difference in the admission status of the various insurance groups. We had theorized that this variable could be used as a proxy for severity of illness on presentation, assuming that those visits that resulted in an admission were for more severe presentations. This was a categorical variable.

Statistical Analysis

Descriptive Statistics

Descriptive statistics, including means, standard deviations, proportions, and frequencies were used to describe the characteristics of the sample hospitals as well as the remaining hospitals in Oregon not used in the study. They were also used to illustrate the characteristics of the patients whose visits were examined in this study.

Model Considerations

First, relationships between all categorical variables (gender, insurance type, period, month, urban/rural status, admission status) and the three outcome variables (chronic ACS, chronic ACS plus, and marker) were assessed via contingency tables. Using this method, no cells smaller than 5 were identified; therefore, none of the categorical variables required collapsing.

The continuous variables age and percent below federal poverty level (SES) were categorized for this study. For age, three clinically relevant categories were used: 18-30, 31-50, and 51-65, based on an *a priori* decision. For SES, as discussed, we considered a dichotomous categorization based on the federal definition of "poverty areas."[40] However, we decided against this in order to avoid masking potential variability at lower SES percentiles. The relationships between this variable and the outcomes were examined and were not linear on the logit scale. Given this and with no other clinically meaningful definitions available, SES was categorized into quartiles as previously described.

Outcomes were binary; therefore, logistic regression modeling was used. Moreover, our dataset contained clustering at the hospital and the patient level. A generalized estimating equation (GEE) approach was used to control clustering at the

patient level, and the hospital system variable was included in all models as a fixed effect to control for difference among hospitals. An attempt was made to control for clustering at both the hospital and patient levels, using multi-level mixed-effects logistic regression; this was unsuccessful due to the substantial size of data set.

Univariate Regression

We examined the association between each independent variable and the outcome variable using univariate logistic regression analyses. A cutoff p value of ≤ 0.25 was used for inclusion in the multivariate analysis for candidate independent variables.[48] However, we had reason to keep the majority of the variables being examined for multivariable analysis, despite the univariate analysis results. Our reasons for keeping several of the variables for multivariate analysis included: 1) the variables insurance status and period were required for the hypothesis under study; 2) age and gender potentially had important clinical relationships to the outcome variables; 3) month was used to control for monthly variation in ED visit types; 4) percent below FPL was kept because research looking at the ACS diagnoses as a predictor of outpatient access suggests SES as a potential confounder; 5) urban/rural status was kept because research suggests a relationship between urban/rural status and ACS hospitalizations.[46] [47]

Multiple Regression

GEE logistic regression models were constructed for each of the chronic ACS, chronic ACS plus, and marker condition outcomes. We included the primary independent variables, the month variable, and the clinically important or potential

confounding variables and any other independent variables significant at 0.25 in univariate analysis in the model. The interaction term between the before/after variable and insurance types was included and always kept in the model, since this was the primary hypothesis of this study. Month was also kept in each model to control for seasonal variation, while the hospital variable was included to control for differences among hospital systems. All of the variables turned out to be significant at the 0.05 level. The only variable excluded form the model was admission to the hospital, which was strongly correlated with marker conditions and not a confounding variable for the chronic ACS and chronic ACS plus conditions.

Several additional interactions were tested for, including age*gender, age*SES, and gender*SES, based on clinical plausibility. The results for this analysis showed that the interactions achieved significance; however, including these interaction terms led to little change in the point estimates for the main interaction (period *insurance type), and these interactions were removed from the model since they were not of inferential interest of this study and added unnecessary complexity to the model.

Final models included the before/after period variable, insurance status, before/after period*insurance type, age, gender, month, percent below FPL, and urban/rural status for each outcome (chronic ACS, chronic ACS plus, and marker). All steps in the analysis were carried out using chronic ACS, chronic ACS plus, and marker conditions as outcomes. The results of this project were reported as odds ratios (ORs) and a 95% confidence interval (CI). Because the occurrence of the outcomes (chronic ACS, chronic ACS plus, marker) was rare (<4%), the odds ratios can be used to approximate relative risk. The models utilized the full study population and were

repeated using the subset of visits by behavioral health patients. Further, a sensitivity analysis was carried out for the main population and the behavioral health group using the alternate before/after period, which removed the confusion around the OHP cutbacks by excluding six months before and six months after the cutbacks, as well as controlling for seasonal variation.

The study was approved by the institutional review board at Oregon Health & Science University.

Results

Descriptive Analyses

There were 1,642,518 visits to Oregon EDs during the study period. The characteristics of the hospitals used in the data set can be seen in Table 2. The majority (68%) of hospitals included in the study were urban, which would explain why there were fewer Critical Access hospitals in our data set compared to those not included (9% vs. 39%), as well as more inpatient beds (mean 224 vs. 70), and a higher mean ED census than those hospitals not included (26,425 vs. 12,956).

Descriptive summaries of the ED visits used in both the total study sample and the subset of behavioral health patients can be seen in Tables 3 and 4. The tables are categorized into before and after the cutbacks and subcategorized by insurance type, consistent with the structure of our study hypothesis.

In the full study sample, the uninsured group included 49.3% patients aged 18-30, 42.5% aged 31-50, 8.2% aged 51-65, and 53.7% male patients before the OHP cutbacks. The majority of visits in each payer group came from urban hospitals both before and

after the cutbacks. Comparing patterns after versus before the cutbacks, there were minimal changes in the distributions of age, gender, payer status, and urban/rural status; there were no substantial changes in the proportion of visits coming from zip codes of different average income levels (Table 3).

The percentage of visits for chronic ACS or marker diagnoses in the full study population was less than 4% for all payer categories (Table 3). The proportion of visits for chronic ACS diagnoses in the uninsured group was 2.34% before the cutbacks and 2.78% after. In the OHP group, marker visits changed from 0.49% to 0.40%, and in the uninsured group they changed from 0.43% to 0.55% after the OHP cutbacks.

Looking at the subgroup of patients with behavioral health diagnoses, the uninsured group contained 41.6% of patients aged 18-30, 49.8% aged 31-50, 8.6% aged 51-65 and 54.7% male patients before the OHP cutbacks. Comparing patterns after versus before the cutbacks, there were minimal changes in the distributions of age, gender, payer status, and urban/rural status; there were no substantial changes in the proportion of visits coming from zip codes of different average income levels (Table 4). The majority of visits in each payer group in this subset of behavioral health patients came from an urban hospital in both time periods.

The proportion of visits for chronic ACS diagnoses in the uninsured group was 2.42% before and 3.21% after the cutbacks (Table 4). The corresponding numbers were 3.79% and 4.24% in the OHP group. Proportions of marker visits for the uninsured group were 0.37% before and 0.30% after the OHP cutbacks.

Results for Full Study Population

Chronic ACS Visits - After *versus* Before Time Periods

Uninsured visits were significantly more likely to be for a chronic ACS condition after the cutbacks than before (OR = 1.10, CI 1.05, 1.16, Table 5). These increased odds were not seen in the commercial or the OHP groups (OR = 0.97, CI 0.93, 1.00 and OR = 1.00, CI 0.96, 1.04). A test of the interaction term before/after period*payer category revealed that the rise in chronic ACS visits for the uninsured differed significantly from the lack of change seen in the commercial and OHP groups (Wald p =<0.01; Table 5).

Chronic ACS Visits – Before *and* After Time Periods

Compared to the commercially insured visits before the OHP cutbacks in March, 2003, there was a significantly greater proportion of chronic ACS visits by an OHP enrollee (OR = 1.47, CI 1.41, 1.54) and by an uninsured patient (OR = 1.21, CI 1.15, 1.28, Table 5). In looking at results for the after time period, the odds of an OHP and an uninsured chronic ACS visit were 1.53 (CI 1.46, 1.60) and 1.38 (CI 1.33, 1.44), respectively, when compared to commercial visits. Further, after the cutbacks, the odds of an uninsured visit being for a chronic ACS condition were significantly less than the odds in the OHP group (OR = 0.91, CI 0.87, 0.95), which was the same as the pattern seen before the cutbacks (OR = 0.82, CI 0.78, 0.87).

Marker Results

Looking at the after *versus* before time periods, the proportion of marker visits by an OHP payer decreased significantly after the cutbacks (OR = 0.81, CI 0.73, 0.89), while

the proportion of visits for an uninsured patient increased significantly (OR = 1.22, CI 1.09, 1.36) when compared to commercial visits (Table 5). A test of the interaction term before/after period*payer category revealed that the changes in chronic ACS visits for the uninsured and OHP groups after versus before the cutbacks were significantly different from the change seen in the commercial group (Wald $p < 0.01$; Table 5).

In looking at both the before *and* after time periods, the odds of a marker visit by an OHP or an uninsured patient were significantly less than the odds of a marker visit by a commercial patient (Table 5).

Covariate Results

The odds of a chronic ACS visit were greater in older patients aged 51-65, compared to those aged 18-30 (OR = 2.78, CI 2.67, 2.89, Table 6). Furthermore, the odds of a visit for a chronic ACS diagnosis was less in females, but greater in patients residing in ZIP codes with a higher percentage of residents below the federal poverty level, and those residing in rural locations (Table 6).

Sensitivity Analysis Results

As stated in the "Methods," a sensitivity analysis was performed using a second before/after time period (September, 2001 to August, 2002 versus September, 2003 to August, 2004). This new period removed six months pre and six months post OHP cuts, to eliminate a time of expected confusion around the OHP cutbacks. The results of these models were consistent with our main study results and our hypothesis, an increase in the

odds that an uninsured ED visit would be for a chronic ACS diagnosis after the cutbacks (OR = 1.19, CI 1.11, 1.28, Table 7).

Another sensitivity analysis looked at the outcome of chronic ACS conditions with an expanded list of diagnoses. Again, the results were similar to the primary analysis and, therefore, are not presented here.

Results for Patients with Behavioral Health Diagnoses

Chronic ACS Results

An additional analysis was carried out using visits in our dataset by patients who had presented with a behavioral health visit. These patients carry the extra burden of either a psychiatric, drug, or alcohol diagnosis. In this group, because of their additional disease burden, we had expected to see the association between chronic ACS visits and time period preserved for the uninsured payer status, and this was confirmed (OR = 1.16, CI 1.04, 1.28, Table 8). However, the test for the interaction term before/after period*payer status was not statistically significant (Wald p = 0.09, Table 8), and therefore the increase in odds seen in the uninsured group was not statistically different from the change in odds in the OHP or commercial groups. The remainder of the numbers was calculated for the purpose of completeness and for comparison to the sensitivity analysis models.

Marker Results

As was seen with the chronic ACS results, the interaction term for before/after period*insurance type was not statistically significant (Wald p = 0.13, Table 8), and

therefore, the change in odds for a marker visit seen in the uninsured group was not significantly different from the lack of change seen in the commercial and OHP groups.

Covariate Results

In this sub-analysis, patients aged 51-65 were more likely to present to the ED with a chronic ACS diagnosis compared to the 18-30 group (OR = 3.59, CI 3.28, 3.93). Chronic ACS visits were also more likely to be made by males and patients whose zip code came from an area with the highest percentage of people below the federal poverty level. There was no difference seen for chronic ACS visits in this population between rural and urban areas (Table 9).

Sensitivity Analysis Results

The sensitivity analysis was repeated using an additional before/after time period, which removed six months pre and six months post OHP cuts, eliminating some of the variability around the policy changes. These results agree with our hypothesis, and show an association between chronic ACS visits and time period for the uninsured group (OR = 1.41, CI 1.22, 1.62, Table 10). The test for the interaction term before/after period*payer group was statistically significant, and therefore the increase in odds for a chronic ACS visit in the uninsured group was significantly different than the lack of change seen in the OHP and commercial groups (Wald $p < 0.01$, Table 10).

Results were very similar between chronic ACS and chronic ACS plus analyses. Therefore, only the results for the chronic ACS and marker analyses were presented and discussed in the paper.

Discussion

Full Study Population

In this study, when looking at all ED visits, there was a 10% (CI 5% to 16%) increase in adjusted odds that an uninsured visit was for a chronic ACS diagnosis after versus before the OHP cutbacks (Table 5). There was no significant change in odds for either the OHP or the commercial group. Further, this increase in ACS conditions among the uninsured group was not observed in the commercial and OHP groups (Table 5). These findings are consistent with our study hypothesis that the OHP cutbacks were associated with an increase in uninsured visits for chronic illnesses to Oregon emergency departments.

A recent study by Lowe et al. showed an increase in drug, alcohol, and psychiatric visits (173%, 82%, and 106%, respectively) in uninsured patients after versus before the OHP cutbacks.[12] Lowe et al.'s findings suggest that the increase in these diagnostic presentations is related to a "deteriorating access to outpatient care."[12] This argument is central to the findings and conclusions for this study as well. Our study postulated that the OHP cutbacks led to an increase in the number of uninsured Oregonians with unmet health care needs, which was shown in the survey study by Wright and Carlson.[8] This difficulty with meeting health care needs could become a problem for those with chronic illnesses, leading to an acute exacerbation of their chronic illnesses and an eventual emergency department visit. The study by Solotaroff et al. demonstrated that previous OHP enrollees with chronic illnesses, as compared to those without chronic illnesses, had self-reported increases in their ED use.[17] Further, as was seen in the OHP qualitative study, previous enrollees with chronic illnesses were coming to the ED with a potentially

preventable exacerbation of their chronic illnesses.[18] One patient interviewed in that study reported that he had difficulty obtaining insulin for his diabetes. He stated that, "Well, the deal there is, again, with no insurance, I can't afford it. I take insulin, and my mom she goes across the border. It's only ten miles and she'll get me insulin once in a while and sends it up… she sent me some antibiotics. There's about four or five different things I'm supposed to be taking for my high blood pressure stuff, but I can't afford them. I've gone months without insulin."[18] The results of our study, demonstrating an association between uninsured payer status and the increase in the number of presentations for chronic illnesses on a statewide scale, suggests that the OHP cutbacks led to an increase in preventable emergency department presentations for chronic illnesses.

Several health system factors have been shown to be associated with ACS hospitalizations. Having access to a primary care physician,[47] a regular source of care, [49] and continuity of care [13] were associated with fewer ACS hospitalizations. Given that patients who lost their OHP benefits were shown to have increased difficulty in terms of access to care, the findings seen with ACS hospitalizations are consistent with our study results on ACS ED visits.

ACS hospitalizations have also been used to assess the effects of large-scale policy changes. A study by Saha et al. examined the effects of the OHP expansion in 1994 on ACS hospitalizations.[10] The researchers examined ACS hospitalization rates after versus before implementation of the OHP in 1994. Their research demonstrated an unexpected increase in hospitalization rates for the combined group of Medicaid and uninsured patients. After some discussion, the authors suggested that the increase in the

ACS hospitalization rates was due to the Medicaid expansion group.[10] Some of the reasons proposed for this increase in hospitalizations for ACS conditions were a "pent up demand for health," or that the post-expansion Medicaid group may have gained access to a physician who decided that their disease state required inpatient care, in effect "paved the way to the hospital for previously uninsured patients."[10]

The results of the Saha et al study demonstrates that accurately describing the effects of health policy changes is a complex issue. In terms of how these results mesh with our results, the increase in hospitalization rates seen in the Medicaid expansion group implies that the expansion groups suffered from ACS illnesses and were subsequently hospitalized due to the severity of their illnesses. On average, the OHP expansion group described themselves as in "fairly poor health."[4] When the cutbacks occurred, a large portion of the OHP expansion group lost their insurance coverage. Although the expansion group did not necessarily contain the same members at the time of the cutbacks, it is plausible that this group that demonstrated an increased rate of ACS hospitalizations in the Saha study, suffered from the loss of their OHP coverage demonstrating unmet health care needs that led them to seek care in the emergency department.

Two other studies have examined the effect of health policy change and ACS hospitalizations. These studies used different data sources and examined the effects of health system expansion in California, finding a decrease in ACS hospitalizations.[50] [51] Although these studies looked at a pediatric population, the analogy is useful and consistent with our results.

Marker results for the full study population show an increase in odds for a marker diagnosis in the uninsured group (1.22, CI 1.09, 1.36) and a drop in odds for an OHP marker visit (0.81, CI 0.73, 0.89) after versus before the OHP cutbacks (Table 5). The marker conditions were included to act as a comparison group of diagnoses. These conditions have been shown in previous studies to remain constant and vary primarily with the population size and prevalence of illness.[35] [20] This may demonstrate a "stress effect" experienced by those who lost their OHP benefits, resulting in increased presentation for acute MIs, for example. However, the marker results may in fact reflect the very low prevalence of marker conditions in our dataset (<1%), which would cause a large change in odds calculations for a small change in proportion. Another reason that the marker results for this study may not be informative is related to the actual coding of this variable for use in the multivariate models. Some of the marker diagnoses required additional information that would only have been available from a hospital record and not during an ED visit. These adaptations to the marker coding may have further contributed to the difficulty of interpreting the results.

Behavioral Health Patients

The second part of the study looked at a subset of patients who made a behavioral health visit during the study period. We hypothesized that the relationship between the OHP cutbacks and presentations for a chronic illness by the uninsured group would also be observed in this group. There was no association between uninsured visits and the presentation of chronic ACS illnesses after versus before the OHP cutbacks in the subset of behavioral health patients. Although we did report increased odds of 16% (OR 1.16,

CI 1.04 to 1.28, Table 8) for an uninsured visit for an ACS diagnosis after versus before the cutbacks in this group, this change was not statistically significant when compared to the changes in the other payer groups (Wald p = .09, Table 8).

The sensitivity analysis that we ran using a subset of the time period in the main analysis, removing the "noise" around the OHP cutbacks, did demonstrate increased odds for presenting with an ACS diagnosis for the uninsured group (OR = 1.41, CI 1.22, 1.62, Table 8); this was significantly different from the changes in the other payer groups (Wald < 0.01, Table 10). These findings support our hypothesis, but the overall result for this group is less robust.

One explanation for the difference in the two sets of results is that this group was dealing with changes in both their medical and behavioral health coverage. Therefore, this group may have been more affected by the confusion around the OHP cutbacks compared to the entire study population. However, another possibility for the difference in result between the main and the sensitivity analysis is lack of power to detect a difference using the main time periods. The magnitude of the OR for the uninsured visits from the behavioral health analysis was similar to what was seen with the visits for the full study population (full population OR = 1.10, behavioral health subset OR = 1.16, tables 5 and 8 respectively). Further, the crude measures seen in Table 4 demonstrate a change from 2.42% chronic ACS visits in the uninsured to 3.21% - a difference of 25% compared to after the cutbacks. Although the overall percentages are small and this is a crude measure, this is a substantial change, supporting this argument that lack of power contributed to the lack of statistically significant findings seen in the main study time period discussed above (Table 8).

Limitations

There were several limitations in this study. As seen in the "Results" section, the proportion for an ACS or a marker diagnosis is quite low (2.40% - 3.51% for chronic ACS and 0.4% - 1.55% for Marker); therefore, it is possible that the changes seen in the proportions for each insurance group is related to a change in another diagnostic category (the denominator) rather than the ACS or marker categories. In considering this issue, we examined the raw counts for chronic ACS visits in the uninsured group. The overall trend in the counts demonstrated an increase in chronic ACS visits in the uninsured after the OHP cutbacks, consistent with the results for the proportion of uninsured visits. Therefore, the consistent trend in the counts supports the results seen in the proportions.

Using a subset of Oregon ED data introduces another possible limitation. As mentioned previously, we examined a sample (62%) of the total ED visits in the state during the time period versus all of the visits to Oregon EDs. Overall, in our sample of 26 EDs, rural EDs were underrepresented. The under-representation of rural hospitals in our dataset may mean that our data more accurately represent the association between payer types and presentation for chronic ACS illnesses after versus before the OHP cutbacks in an urban population, and are less generalizable to what is occurring in rural Oregon.

Several confounders were controlled for in this study, including age, gender, month, urban/rural status, and SES. Race could not be accounted for given the large number of records with missing race data; this could have led to potential bias in this study, as race has been shown to be a predictor of ACS hospitalizations.[46] For instance, if the uninsured group were to include a larger number of African Americans than the

commercial group, one potential effect could be to bias the results away from the null. However, some literature has commented on the idea that race is a proxy measure for outpatient access.[19]

Another confounder that has been mentioned in ACS research is the severity of illness [20], which has been shown to vary among insurance groups.[32] Lowe et al. in a recent publication argued that there may be more reliable methods for measuring severity of illness such as admission rate.[7] Our study did not utilize a disease severity measurement to adjust for the differences between insurance groups. However, looking at the descriptive results for the total study population (Table 3 and 4), there is no notable difference in the characteristics of the payer groups in the two time periods. Therefore, we could postulate that the disease severities within each group may also have remained constant. It is plausible, however, that the newly uninsured OHP expansion group, who as we discussed demonstrated higher initial ACS hospitalization rates in the Saha study, were on average sicker, then the increase in proportion of the ACS visits may in fact be explained by the overall poor health of this group. One potential future direction for this project would be to include admission status in the model to control for disease severity.

As mentioned, prevalence of ACS conditions is another confounder that could not be controlled for in this study. As discussed with severity, if the newly uninsured group had a higher prevalence of ACS conditions than the other groups, it is possible that this explains the increase in proportion of ACS visits in the uninsured seen in our study results.

For the sub-analysis of patients with behavioral health visits, we chose to identify them as any patient who presented to the study EDs during the full time period with a

behavioral health diagnosis. Choosing to identify patients this way answered a specific question in this part of the study: was there an association between the OHP cutbacks and a chronic ACS visit among payer groups in patients with behavioral health diagnoses? How or when the patient developed the behavioral health problem was not a factor in our hypothesis. It is possible that some of the visits were made by patients who only developed their behavioral health problem after the cutbacks, (for example, due to the stress of insurance coverage loss.)

Conclusion and Public Health Implications

The policy changes in the Oregon Health Plan were associated with an increase in preventable visits to emergency departments in a representative sample of Oregon hospitals. This increase is thought to be related to the loss of access to outpatient medical care. Our study chose to look at visits for chronic illnesses, as the group of patients with these illnesses is especially sensitive to regular medical care for health maintenance. The association seen between visits for chronic illnesses in the uninsured, and the OHP policy change, raises the need for further debate about the most cost-effective way to deal with rising health care costs. Further, not only should we consider the cost-shift from outpatient to ambulatory care, but also, as evidenced in this paper, that the increased unmet medical need leads to an immeasurable and profound personal cost.

From our study, another conclusion to consider is that ED data are a good source of information to evaluate access to care issues. Further, chronic ACS diagnoses appear to be reliable indicators using ED data versus hospitalization data. Given this, as mentioned by Saha et al., [10] using ED data combined with hospitalization data could

lead to a more comprehensive database and surveillance tool to examine the issues of access to care in the community.

Future Research

Future research on this subject should include an urban/rural sub-analysis to determine whether this is an effect modifier, and whether the experiences of patients in these two locations are different.

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Appendix

Table 1. Inclusion and Exclusion Criteria

58 Hospitals in Oregon

↓

22 Hospitals providing data from August, 2001 – February, 2005

Inclusion	Exclusion
All visits with complete data	Visits with incomplete data
Adults aged 18–65	Children, adults >65 years
Insurance groups:	Insurance groups:
Commercial	Auto
OHP	Workman's Compensation
Uninsured	Medicare
	Non-Oregon Medicaid

For the Behavioral Health Sub-Analysis:
After the initial selection of visits, patients who had presented during the study time period (August, 2001 – February, 2005) with drug, alcohol, or psychiatric diagnoses were identified and all visits from these patients were used in the sub-analysis.

Table 2. Comparison of Study and Non-Study Hospitals

Characteristics	Included	Not Included	Total
Location, No. (%)			
Urban	15 (68)	5 (14)	20 (34)
Rural	7 (32)	31(86)	38 (66)
Critical Access Hospital			
Yes	2 (9)	14 (39)	16 (28)
No	20 (91)	22 (71)	42 (72)
Inpatient Beds			
Mean	224	70	129
Median	159	49	49
Range	21 - 554	11 - 406	11 - 554
ED Census July 1, 2002 to June 30, 2003			
Mean	26,425	12,956	17,761
Median	25,657	10,106	12,635
Range	7,714 - 63,721	687 - 57,854	687 - 63,721

Table 3. Total Study Population
Characteristics of Visits by Insurance Group Before and After the OHP Cutbacks

	Before			After		
Predictors	**Commercial**	**OHP**	**Uninsured**	**Commercial**	**OHP**	**Uninsured**
Age Groups						
Ages (18-30)	29.5%	39.9%	49.3%	28.5%	40.3%	45.5%
Ages (31-50)	46.8%	48.8%	42.5%	45.5%	46.6%	45.8%
Ages (51-65)	23.8%	11.4%	8.2%	26.1%	13.1%	8.8%
Gender						
Female	55.3%	60.9%	46.3%	55.2%	68.6%	46.2%
Male	44.7%	39.1%	53.7%	44.8%	31.4%	53.8%
Percentage Below FPL						
1st quartile	33.0%	15.8%	21.7%	33.5%	17.1%	19.7%
2nd quartile	26.3%	22.9%	25.6%	26.7%	23.3%	25.6%
3rd quartile	22.5%	25.5%	25.9%	22.1%	27.0%	26.1%
4th quartile	18.1%	35.8%	26.9%	17.8%	32.6%	28.6%
Hospital Location						
Rural	13.5%	16.0%	13.1%	15.2%	15.5%	15.5%
Urban	86.5%	84.0%	86.9%	84.8%	84.5%	84.5%

	Before			After		
Outcomes	**Commercial**	**OHP**	**Uninsured**	**Commercial**	**OHP**	**Uninsured**
Chronic ACS	2.40%	3.36%	2.34%	2.35%	3.51%	2.78%
Marker	1.42%	0.49%	0.43%	1.55%	0.40%	0.55%

Table 4. Behavioral Health Sub-Analysis
Characteristics of Visits by Insurance Group Before and After the OHP Cutbacks

	Before			After		
Predictors	**Commercial**	**OHP**	**Uninsured**	**Commercial**	**OHP**	**Uninsured**
Age Groups						
Ages (18-30)	25.6%	30.4%	41.6%	25.9%	30.1%	37.1%
Ages (31-50)	51.2%	56.4%	49.8%	48.7%	53.8%	53.4%
Ages (51-65)	23.2%	13.3%	8.6%	25.4%	16.0%	9.6%
Gender						
Female	62.4%	57.9%	45.3%	62.1%	65.3%	45.4%
Male	37.6%	42.1%	54.7%	37.9%	34.7%	54.6%
Percentage Below FPL						
1st quartile	29.1%	13.3%	17.7%	29.1%	14.4%	16.1%
2nd quartile	27.4%	22.6%	25.3%	28.9%	23.0%	26.0%
3rd quartile	22.6%	24.4%	24.3%	22.0%	26.3%	24.2%
4th quartile	20.9%	39.8%	32.6%	20.0%	36.4%	33.6%
Hospital Location						
Rural	15.1%	17.5%	16.1%	16.3%	17.7%	17.6%
Urban	84.9%	82.5%	83.9%	83.7%	82.3%	82.4%

	Before			After		
Outcomes	**Commercial**	**OHP**	**Uninsured**	**Commercial**	**OHP**	**Uninsured**
Chronic ACS	3.14%	3.79%	2.42%	3.16%	4.24%	3.21%
Marker	1.26%	0.40%	0.37%	1.33%	0.37%	0.30%

Table 5. Total Study Population
Multivariate Results

	Chronic ACS					Marker				
	OR	p	95% CI		Wald p	OR	p	95% CI		Wald p
Temporal Change - After vs. Before OHP Cutbacks										
Commercial	0.97	0.07	0.93	1.00		1.05	0.05	1.00	1.10	
OHP	1.00	0.89	0.96	1.04		0.81	<0.01	0.73	0.89	
Uninsured	1.10	<0.01	1.05	1.16		1.22	<0.01	1.09	1.36	
Difference Between Temporal Change by Payer Status - Interaction term results**										
OHP vs. Commercial	1.04	0.18	0.98	1.09		0.77	<0.01	0.69	0.86	
Uninsured vs. Commercial	1.14	<0.01	1.07	1.21		1.16	0.01	1.03	1.31	
Uninsured vs. OHP	1.10	<0.01	1.03	1.17	<0.01*	1.51	<0.01	1.30	1.75	<0.01*
Before OHP Cutbacks										
OHP vs. Commercial	1.47	<0.01	1.41	1.54		0.50	<0.01	0.46	0.54	
Uninsured vs. Commercial	1.21	<0.01	1.15	1.28		0.42	<0.01	0.38	0.46	
Uninsured vs. OHP	0.82	<0.01	0.78	0.87		0.84	<0.01	0.75	0.94	
After OHP Cutbacks										
OHP vs. Commercial	1.53	<0.01	1.46	1.60		0.38	<0.01	0.35	0.42	
Uninsured vs. Commercial	1.38	<0.01	1.33	1.44		0.49	<0.01	0.45	0.52	
Uninsured vs. OHP	0.91	<0.01	0.87	0.95		1.27	<0.01	1.15	1.40	

*For simplicity, Wald p values only shown for interaction term results.
**The ORs for these results are actually ratios of the Temporal Change ORs by the same name (ie. "OHP vs. Commercial" is the ratio of the Temporal Change OR for OHP divided by the Temporal Change OR for Commercial.

Table 6. Total Study Population
Multivariate Results

	Chronic ACS					Marker				
	OR	p	95% CI		Wald p	OR	p	95% CI		Wald p
Covariate Results										
Ages (31-50 vs. 18-30)	1.47	<0.01	1.42	1.52		1.40	<0.01	1.32	1.47	
Ages (51-65 vs. 18-30)	2.78	<0.01	2.67	2.89	<0.01	3.44	<0.01	3.26	3.64	<0.01
Female vs. Male	0.92	<0.01	0.90	0.95		1.76	<0.01	1.69	1.83	
% Below FPL (2nd vs. 1st)	1.06	0.01	1.01	1.11		0.95	0.08	0.89	1.01	
% Below FPL (3rd vs. 1st)	1.06	0.01	1.02	1.11		0.93	0.01	0.87	0.98	
% Below FPL (4th vs. 1st)	1.17	<0.01	1.11	1.22	<0.01	0.80	<0.01	0.75	0.86	<0.01
Rural vs. Urban	1.38	<0.01	1.15	1.66		1.65	<0.01	1.24	2.21	

Table 7. Total Study Population
Multivariate Results Comparing Main and Sensitivity Analysis Before/After Time Periods

Main Analysis Time periods compared: (Aug 2001 - Feb 2003 vs. Mar 2003 - Feb 2005)						Senstivity Analysis Time periods compared: (Sep 2001 - Aug 2002 vs. Sep 2003 - Aug 2004)				
	Chronic ACS					Chronic ACS				
	OR	p	95% CI		Wald p	OR	p	95% CI		Wald p
Temporal Change - After vs. Before OHP Cutbacks										
Commercial	0.97	0.07	0.93	1.00		0.91	<0.01	0.87	0.96	
OHP	1.00	0.89	0.96	1.04		1.01	0.77	0.96	1.06	
Uninsured	1.10	<0.01	1.05	1.16		1.19	<0.01	1.11	1.28	
Difference Between Temporal Change by Payer Status - Interaction term results**										
OHP vs. Commercial	1.04	0.18	0.98	1.09		1.11	0.01	1.03	1.19	
Uninsured vs. Commercial	1.14	<0.01	1.07	1.21		1.31	<0.01	1.20	1.42	
Uninsured vs. OHP	1.10	<0.01	1.03	1.17	<0.01*	1.18	<0.01	1.09	1.29	<0.01*
Before OHP Cutbacks										
OHP vs. Commercial	1.47	<0.01	1.41	1.54		1.48	<0.01	1.40	1.56	
Uninsured vs. Commercial	1.21	<0.01	1.15	1.28		1.12	<0.01	1.05	1.20	
Uninsured vs. OHP	0.82	<0.01	0.78	0.87		0.76	<0.01	0.71	0.81	
After OHP Cutbacks										
OHP vs. Commercial	1.53	<0.01	1.46	1.60		1.63	<0.01	1.54	1.73	
Uninsured vs. Commercial	1.38	<0.01	1.33	1.44		1.47	<0.01	1.38	1.56	
Uninsured vs. OHP	0.91	<0.01	0.87	0.95		0.90	<0.01	0.85	0.95	

*For simplicity, Wald p values only shown for interaction term results.
**The ORs for these results are actually ratios of the Temporal Change ORs by the same name (ie. "OHP vs. Commercial" is the ratio of the Temporal Change OR for OHP divided by the Temporal Change OR for Commercial.

Table 8. Behavioral Health Sub-Analysis
Multivariate Results

	Chronic ACS					Marker				
	OR	p	95% CI		Wald p	OR	p	95% CI		Wald p
Temporal Change - After vs. Before OHP Cutbacks										
Commercial	1.00	1.00	0.92	1.08		1.00	0.99	0.89	1.13	
OHP	1.05	0.08	0.99	1.12		0.88	0.15	0.74	1.05	
Uninsured	1.16	0.01	1.04	1.28		0.75	0.04	0.57	0.99	
Difference Between Temporal Change by Payer Status - Interaction term results**										
OHP vs. Commercial	1.05	0.30	0.95	1.16		0.88	0.24	0.72	1.09	
Uninsured vs. Commercial	1.16	0.03	1.02	1.32		0.75	0.06	0.56	1.01	
Uninsured vs. OHP	1.10	0.12	0.98	1.23	0.09*	0.85	0.33	0.62	1.17	0.13*
Before OHP Cutbacks										
OHP vs. Commercial	1.27	<0.01	1.16	1.38		0.45	<0.01	0.39	0.53	
Uninsured vs. Commercial	1.04	0.49	0.93	1.17		0.45	<0.01	0.35	0.57	
Uninsured vs. OHP	0.82	<0.01	0.74	0.91		0.99	0.92	0.77	1.27	
After OHP Cutbacks										
OHP vs. Commercial	1.34	<0.01	1.23	1.45		0.40	<0.01	0.34	0.47	
Uninsured vs. Commercial	1.20	<0.01	1.10	1.31		0.34	<0.01	0.28	0.41	
Uninsured vs. OHP	0.90	0.01	0.84	0.97		0.84	0.10	0.69	1.03	

*For simplicity, Wald p values only shown for interaction term results.
**The ORs for these results are actually ratios of the Temporal Change ORs by the same name (ie. "OHP vs. Commercial" is the ratio of the Temporal Change OR for OHP divided by the Temporal Change OR for Commercial.

Table 9. Behavioral Health Sub-Analysis
Multivariate Results

	Chronic ACS					Marker				
	OR	p	95% CI		Wald p	OR	p	95% CI		Wald p
Covariate Results										
Ages (31-50 vs. 18-30)	1.59	<0.01	1.47	1.73		2.31	<0.01	1.96	2.73	
Ages (51-65 vs. 18-30)	3.59	<0.01	3.28	3.92	<0.01	6.77	<0.01	5.73	8.01	<0.01
Female vs. Male	0.88	<0.01	0.83	0.94		1.46	<0.01	1.32	1.61	
% Below FPL (2nd vs. 1st)	1.13	0.02	1.02	1.25		0.92	0.32	0.79	1.08	
% Below FPL (3rd vs. 1st)	1.12	0.03	1.01	1.24		0.93	0.35	0.79	1.08	
% Below FPL (4th vs. 1st)	1.15	0.01	1.03	1.27	0.06	0.80	0.01	0.67	0.94	0.05
Rural vs. Urban	1.00	0.99	0.68	1.47		0.87	0.65	0.48	1.58	

Table 10. Behavioral Health Sub-Analysis
Multivariate Results Comparing Main and Sensitivity Analysis Before/After Time Periods

Main Analysis						**Senstivity Analysis**				
Time periods compared:						Time periods compared:				
(Aug 2001 - Feb 2003 vs. Mar 2003 - Feb 2005)						(Sep 2001 - Aug 2002 vs. Sep 2003 - Aug 2004)				
	Chronic ACS					**Chronic ACS**				
	OR	**p**	**95% CI**		**Wald p**	**OR**	**p**	**95% CI**		**Wald p**
Temporal Change - After vs. Before OHP Cutbacks										
Commercial	1.00	1.00	0.92	1.08		0.95	0.39	0.85	1.06	
OHP	1.05	0.08	0.99	1.12		1.06	0.19	0.97	1.14	
Uninsured	1.16	0.01	1.04	1.28		1.41	<0.01	1.22	1.62	
Difference Between Temporal Change by Payer Status - Interaction term results**										
OHP vs. Commercial	1.05	0.30	0.95	1.16		1.11	0.14	0.97	1.27	
Uninsured vs. Commercial	1.16	0.03	1.02	1.32		1.47	<0.01	1.23	1.76	
Uninsured vs. OHP	1.10	0.12	0.98	1.23	0.09*	1.33	<0.01	1.13	1.57	<0.01*
Before OHP Cutbacks										
OHP vs. Commercial	1.27	<0.01	1.16	1.38		1.26	<0.01	1.13	1.40	
Uninsured vs. Commercial	1.04	0.49	0.93	1.17		0.89	0.12	0.76	1.03	
Uninsured vs. OHP	0.82	<0.01	0.74	0.91		0.70	<0.01	0.61	0.81	
After OHP Cutbacks										
OHP vs. Commercial	1.34	<0.01	1.23	1.45		1.40	<0.01	1.25	1.56	
Uninsured vs. Commercial	1.20	<0.01	1.10	1.31		1.31	<0.01	1.16	1.47	
Uninsured vs. OHP	0.90	0.01	0.84	0.97		0.93	0.18	0.85	1.03	

*For simplicity, Wald p values only shown for interaction term results.

**The ORs for these results are actually ratios of the Temporal Change ORs by the same name (ie. “OHP vs. Commercial” is the ratio of the Temporal Change OR for OHP divided by the Temporal Change OR for Commercial.