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Heterogeneity of Emergency Department Use and Cost: Evidence From the Oregon Health Insurance Experiment

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HETEROGENEITY OF EMERGENCY DEPARTMENT USE AND COST: EVIDENCE FROM THE OREGON HEALTH INSURANCE EXPERIMENT

by

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Table of Contents:

Introduction:

In 2008, Oregon was given permission by the Centers for Medicare and Medicaid Services (CMS) to expand the State's Medicaid program (Oregon Health Plan Standard) by lottery (Allen, et al. 2010). This allowed for a randomized control study focused on the effect of Medicaid coverage on various factors. The Oregon Health Insurance Experiment (OHIE) was conducted to capitalize on this rare event (Allen, et al. 2010, Finkelstein, et al. 2012, Taubman, et al. 2014).

Previous studies using OHIE have focused on the many changes Medicaid coverage had on health, hospital use, financial outcomes, and wellbeing (Finkelstein, et al. 2012, Taubman, et al. 2014, Baicker, et al. 2013). This paper studies the effect of Medicaid coverage on emergency department (ED) use and costs. It focuses on the heterogeneity between individuals without Medicaid and those with Medicaid. Specifically, the research is centered on six subgroups generated from survey responses. By focusing on these subgroups it allows for a better understand of what factors are associated with changes in ED use and costs. The subgroups are: (1) usual place for medical care – clinic, (2) received care at a primary care clinic, (3) currently taking any prescription medications, (4) currently owe money for medical expenses, (5) borrowed money/skipped bills to pay health care costs, (6) been refused care because owe money for past treatment. For each subgroup some individuals received Medicaid and some individuals did not. Analysis focused on how those individuals with Medicaid utilized ED differently than individuals who did not receive Medicaid.

By sorting by survey response and due to the randomized control set up, the research provides an opportunity to establish the causal effect of Medicaid coverage within each subgroup. Most notably there was an increased number of ED visits by individuals with Medicaid in all subgroups. The largest of which was 193 percent increase in ED visits by

individuals with Medicaid and reported being refused care because they owed money for past treatment. Focusing just on ED visits that were primary care preventable, a similar increase in use occurred due to Medicaid coverage. Interestingly, individuals who reported receiving care at a primary care clinic used the ED for primary care preventable needs 109 percent more than similar individuals without Medicaid. Non-emergent ED visits also increased with Medicaid coverage. Overall ED costs were higher for individuals with Medicaid coverage, but analysis of cost per ED visit did not show a statistical significance in increasing or decreasing ED costs per visits with Medicaid coverage.

A greater understanding of the causal effect of Medicaid is vital with the unprecedented expansion of Medicaid under the auspice of the Patient Protection and Affordable Care Act. Previous research utilizing survey data and quasi-experimental design was limited to only establishing correlation (Smulowitz, et al. 2011, Kasper, Giovannini and Hoffman 2000, Ginde, Lowe and Wiler 2012, Capp, et al. 2013). Proponents of the Affordable Care Act often claim that an expansion of Medicaid to uninsured low-income individuals will relieve the strain on emergency departments and costs. This relies heavily on primary care services serving as substitutes for more costly ED services. However, Medicaid also reduces the personal cost of ED visits and could increase ED use if ED use is a normal good. A normal good is one in which an increase in wealth (effective wealth increases with Medicaid coverage) causes an increase demand for the good.

Literature Review:

The most significant research regarding the effect of Medicaid coverage on ED use was conducted by Taubman and others (2014). Their research analyzed the same data set used in this study and found that Medicaid increases ED use. The marginal effect of Medicaid coverage for

the entire sample was 41% and the mean value in the control group was 1.022 ED visits. An instrumental variable approach was utilized to estimate Medicaid coverage for their study. This study utilized the same instrumental variables (winning the lottery and household size).

However, Taubman and others (2014) research is different in many aspects. It looked at three major subgroups created by the number of ED visits in the pre-randomization period, hospital admission type and timing, and type of ED visit. Their research also compared self-reported (survey response) ED data to hospital administrative data. In the supplemental materials they also looked at the heterogeneity of ED use on the following sub-populations: gender, age, smoking habits, pre-lottery diagnosis, race, education, prior financial status, and timing of lottery sign up.

In most cases Medicaid coverage increase ED use (Taubman, et al. 2014). However, for gender and age they suggested that there was also heterogeneity within individuals with Medicaid coverage. They reported that "the increase in emergency-department use is larger for men than for women; there is some evidence of larger increases for younger individuals than for older individuals". For each subpopulation they estimated the effect of Medicaid coverage twice; one model for men (or older individuals) and another model for women (or younger individuals). The marginal effect of Medicaid coverage on ED visits for men was 0.484 and the marginal effects of Medicaid coverage on ED visits for women was 0.331. Also the marginal effect of Medicaid coverage on ED visits for younger individuals (49 and younger) was 0.502 and the marginal effects of Medicaid coverage on ED visits for older individuals (50 and older) was 0.175. This study challenges their claim that with Medicaid coverage men used the ED more than women with Medicaid coverage and younger individuals more than older individuals by utilizing a different linear model approach.

Taubman and others (2014) research is the most recent randomized control study that analyzed the effect insurance coverage had on ED use. The RAND Health Insurance Experiment conducted in the 1970s utilized a randomized assignment of copay levels and measured the heterogeneity between copay levels (Newhouse 1993, Aron-Dine, Einav and Finkelstein 2013). The RAND study found that the more comprehensive the insurance (i.e., lower copay levels) the greater use of the ED. One limitation of the RAND study is the difference between the private insurance provided by the study and Medicaid insurance provided today by states. The importance of analyzing the effect of Medicaid coverage on ED use is the current expansion of Medicaid coverage by the Affordable Care Act.

In 2011, research conducted by Smulowitz and others (2011) focused on the expansion of health insurance as a result of the Massachusetts Health Reform. They analyzed ED visits from 11 hospitals before and after the Massachusetts Health Reform took effect in 2006. They found a slight drop in the rate of "low-severity" ED visits. However, this was not a randomized control study and was not able to establish the causal effect that health insurance expansion has on ED use.

Research by Kasper and others (2000) utilized longitudinal data to analyze how health care use changed for individuals that either gained insurance or lost insurance during the study. A more recent study by Ginde and others (2012) employed a longitudinal study and focused specifically on how ED visits differed for individuals who had continuous health insurance from individuals who gained health insurance during the study. Their research found that individuals who gained insurance were associated with increased ED use. They predicted that with the changing health care landscape there would be a surge in ED use.

Lastly, Capp and others (2013) used a cross-sectional study of ED use from the 2011 National Health Interview Survey to analyze how self-perceived severity of a health care need was associated with health insurance type. Their research found that it was not self-perceived severity of a health care need that increased ED use but rather lacking access to non-ED care that increased ED use. They suggested that Medicaid insurance should address this lack of access to non-ED care in order to reduce ED use.

Data:

In 2008, there were approximately 90,000 individuals who enrolled in the lottery (Finkelstein, et al. 2012). However, the OHIE focused on only 74,922 individuals (Finkelstein, et al. 2012) (Taubman, et al. 2014). Those left out were excluded to due to: multiple entry, not eligible for OHP Standard (out of state address, not 18-64, died before the lottery), eligible for Medicare before the end of the experiment, and/or had an institutional address. There were 29,834 individuals who were chosen in the lottery and were able to apply for OHP Standard. This resulted in 45,088 individuals who were not allowed to apply (see Table 1). Table 1 also reports for the entire OHIE how many individuals received Medicaid coverage (18,013) and how many individuals did not (56,909). In addition to the entire OHIE, Table 1 also reports the number of individuals by Medicaid coverage and lottery for each of the eight additional subgroups (discussed later in paper).

Two mail surveys were sent to 58,405 individuals at the start of the lottery and 12 months after (denoted as 0M and 12M respectively) (Finkelstein, et al. 2012). Of the 58,405, there were 29,589 who were selected in the lottery and 28,816 who were not selected in the lottery. An additional survey was sent out at six months (6M) but it just included individuals (11,756) who responded early to the 0M survey. The surveys had varying response rates (see Table 2 for

response rates and the supplementary materials accompanying the NBER dataset[1] for a full description of the survey methods). These three mail surveys were used to generate the six subgroups used for the heterogeneity study. Table 3 shows the survey questions used and how the responses were used to create the subgroups.

In addition to the mail surveys, the OHIE research focused on 12 hospitals in the Portland area. ED visits information was collected and matched with 29,646 individuals in the broader lottery study (Taubman, et al. 2014). Of the 29,646, there were 9,624 individuals chosen from the lottery and 15,020 who were not (see Table 1). However, due to privacy concerns some information was censored from the publicly available dataset (see the supplementary materials accompanying the NBER dataset). This study used five variables as dependent variables in the analysis. They are: (1) number of ED visits, (2) number of primary care preventable ED visits, (3) number of non-emergent ED visits, (4) total ED costs, (5) costs per ED visit (see Table 4 for summary statistics of dependent variables).

Research Methods:

This research focuses on the heterogeneity between having Medicaid (OHP Standard) or not. However, the randomized control study did not assign Medicaid to individuals. The lottery allowed individuals to sign up, but individuals who did not win the lottery could also have obtained Medicaid during the study. For example, some women who became pregnant and some individuals who became disabled also obtained Medicaid. For the purpose of thoroughness it was important to use an instrumental variable approach to estimate the causal relationship

[1] Finkelstein, Amy. Oregon Health Insurance Experiment Public Use Data, 2013. Available at http://www.nber.org/oregon/data.html.

Medicaid coverage had on ED use and costs. Lottery and household size were the instruments used to estimate Medicaid coverage. Household size was included as all individuals from the same household were allowed to apply for Medicaid even if just one individual was selected during the lottery (Taubman, et al. 2014). This created an unequal chance of obtaining Medicaid for larger households than smaller households. The following equation demonstrate how Medicaid coverage was instrumented for:

$$Medicaid\ Coverage = \alpha 0 + \alpha 1 * Lottery + \alpha 2 * Household\ Size + \varepsilon \quad (1)$$

The analysis of Medicaid coverage on ED use and costs included six different subgroups based on survey responses. There were 10,454 individuals from the 29,646 individuals in the Portland ED sample that also responded to at least one of the surveys. However, the response rate varied across the six different subgroups. Thus a unique Medicaid coverage estimate was created for each subgroup (see Table 5).

The research focused on studying the effects of Medicaid coverage within six subgroups. Taubman and others (2014) included analysis of the heterogeneity of physical and social subgroups. These included gender, age, smoking habits, pre-lottery diagnosis, race, education, prior financial status, and timing of lottery sign up (Taubman, et al. 2014). This study focuses on surveyed responses to create subgroups in an attempt to get at the reason for the increase in ED use with Medicaid. Six survey questions included were: (1) usual place for medical care-clinic, (2) received care at a primary care clinic, (3) currently taking medication, (4) currently owe for past treatment, (5) borrowed/skipped bills to pay for health care bills, and (6) had been refused care because they owed for prior treatment. Each of these subgroups was created by aggregating the survey responses from 0M, 6M, and 12M surveys. Thus individuals in the 'yes' category reported at least one time across the three surveys that they had this occur to them. Individuals

in the 'no' category responded at least once no but never yes. This approach was taken to fully utilize the survey data despite low response rates (see Table 2). The survey questions are reported in Table 3. It is important to note that for (2) received care at a primary care clinic, (5) borrowed/skipped bills to pay for health care bills and (6) been refused care because owe for prior treatment the question only asked for events within the last six months.

A linear model was created to estimate how those individuals with Medicaid coverage use the ED differently than those without Medicaid coverage (control) for each of the six subgroups. Each subgroup in turn had two categories composed of those individuals that responded yes and those individuals that responded no. Thus each regression model included four estimated values; control-yes, control-no, coverage-yes, and coverage-no. There were also five different dependent variables used: (A) number of ED visits, (B) number of primary care preventable ED visits, (C) number of non-emergent ED visits, (D) total ED costs, (E) costs per ED visit. Both (B) number of primary care preventable ED visits and (C) number of non-emergent ED visits were classified as such by Finkelstein and others (2012) using an algorithm developed by Billings and others (2000). In total there were 30 different linear models that were estimated for the heterogeneity study following the equation:

$$\textit{Dependent Variable} = \beta_0 + \beta_1 * \textit{No} + \beta_2 * \textit{Medicaid Coverage} + \beta_3 * \textit{Medicaid Coverage-No} + \mu \quad (3)$$

Interpreting the model values is not straightforward as β_1, β_2, and β_3 each estimate a marginal effect. However, it was important to estimate the effect of Medicaid coverage this way in order to insure that statistical significance would be reported. For example using (A) number of ED visits as the dependent variable and (2) usual place of medical care-clinic as the subgroup each of the four estimated values (β's) are interpreted as the following:

β_0 estimates the number of ED visits by individuals without Medicaid coverage and reported that their usual place of care was a clinic.

β_1 estimates the marginal effect that not reporting a clinic as their usual place of care and without Medicaid coverage had on the number of ED visits. Thus $\beta_0 + \beta_1$ estimates the number of ED visits by individuals without Medicaid coverage and did not report that their usual place of care was a clinic.

β_2 estimates the marginal effect of having Medicaid coverage and reporting a clinic as their usual place of care had on ED visits. Thus $\beta_0 + \beta_2$ estimates the number of ED visits by individuals with Medicaid coverage and reported that their usual place of care was a clinic.

$\beta_2 + \beta_3$ estimates the marginal effects of having Medicaid coverage and not reporting a clinic as their usual place of care had on ED visits. Thus $\beta_0 + \beta_1 + \beta_2 + \beta_3$ estimates the number of ED visits by individuals with Medicaid coverage and did not report that their usual place of care was a clinic.

In addition to studying the effect of Medicaid on ED use and cost, it was also crucial to model the causal effect of winning the lottery; an intent-to-treat analysis (Gupta 2011, Taubman, et al. 2014). This approach avoids over optimistic results or implications of the lottery (Gupta 2011). This means that the intent-to-treat included all individuals who were given the opportunity to sign up for Medicaid as the control variable. In contrast with the effect of Medicaid coverage in which only individuals who won the lottery and signed up for Medicaid or obtained Medicaid another way were considered the control. The intent-to-treat analysis was

conducted using the same model as the Medicaid coverage analysis and is interpreted in the same manner.

$$Dependent\ Variable = \beta_0 + \beta_1 * No + \beta_2 * Lottery + \beta_2 * Lottery\text{-}No + \mu \quad (4)$$

The last aspect of the study centers on a lapse by Taubman and others (2014) in reporting the heterogeneity between the following subpopulations: gender and age. As there is no underlining statistical test to demonstrate that the values are significantly different. This study used the same linear model as before for the entire subpopulation in order to test if there was a statistical significance between men and women with Medicaid coverage and older and younger individuals with Medicaid coverage. Thus the linear model estimates are:

$$Number\ of\ ED\ Visits = \beta_0 + \beta_1 * Female + \beta_2 * Medicaid\ Coverage + \beta_3 * Medicaid\ Coverage * Female + \mu \quad (5)$$

$$Dependent\ Variable = \beta_0 + \beta_1 * Younger + \beta_2 * Medicaid\ Coverage + \beta_3 * Medicaid\ Coverage * Younger + \mu \quad (6)$$

Results:

The base part of the study was the intent-to-treat analysis that measured the effect the lottery had on ED use and outcomes. For the first three dependent variables (number of ED visits, number of primary care preventable ED visits, and the number of non-emergent ED visits) the marginal effect of the lottery was statistically significant but much smaller than the marginal effect estimated with Medicaid coverage (see Tables 6, 7, and 8). However for the cost dependent variables (total ED costs and cost per ED visit) the marginal effect of the lottery was more often than not statistically insignificant (see Tables 9 and 10).

The main part of the study focused on using an instrumental variable approach to generate a Medicaid coverage variable (the 1st stage least squares regression). The various effects of the lottery and household size on Medicaid coverage for the different dependent variables are reported in Table 5. Three dependent variables, the number of ED visits individuals who won the lottery, variables number of primary care preventable ED visits, and the number of non-emergent ED visits all estimated that individuals who were selected in the lottery and the same household size as those who were not selected were 29 percent more likely to have had Medicaid coverage. The dependent variables regarding costs (total ED costs and cost per ED visit) showed a similar trend with 32% and 33% increase respectively. The final two dependent variables, gender and age, had the same estimated increase of 25%, due to the fact that both were not based on the restricted survey data ED sample. In all cases the estimated coefficient on household size was negative, suggesting that for the survey response ED subsample a larger household size decrease by 4-7% an individual's likelihood of receiving Medicaid coverage (see Table 5). This may be due to the income restrictions or other factors dependent on household size. Individual who did not win the lottery did still have a 19-29% chance of receiving Medicaid coverage due to previous factors mentioned such as pregnancy and/or disability (see Table 5).

Table 6 shows the relationship between the number of ED visits and Medicaid coverage. Consistent with the research done by Taubman and others (2014) there was heterogeneity within the censored ED visits sample as the dependent variable. However, the ED/survey sample estimate for the effect of Medicaid coverage was larger (0.650 as opposed to 0.401) (Taubman, et al. 2014). This estimate means that for the censored sample the effect of Medicaid coverage increased ED visits by 0.650 above the estimated average for the control group of 0.734 (a 90%

increase). Expanding to the intent-to-treat study the marginal effect of the lottery was much smaller than the marginal effect of Medicaid coverage (0.098 than 0.650 and 11% than 90%, see Table 4).

Further analysis of ED visits in the six subgroups had the following results (see Table 6). All marginal effects of Medicaid coverage were positive and ranged from a 0.767 to 2.228 increase in ED visits. Both groups of clinical use (usual place for medical care and received care at a primary care clinic) showed an increase in ED visits with Medicaid coverage (0.0695 and 0 83 respectively). However, having Medicaid coverage and not having a clinic as a usual place of care was not statistically different from those who had Medicaid coverage and have a clinic as a usual place of care. Yet, from the same data set, individuals who had Medicaid coverage and did not report receiving care at a primary care clinic visited the ED 0.585 times less than individuals who had Medicaid coverage and received care at a primary care clinic. This is interesting as primary care users are typically associated with using the ED less rather than more.

The most prominent result from the ED visits focused study came from individuals who reported having been refused care because they owed money for past treatment. Such individuals who received Medicaid coverage visited the ED 193% more than similar individuals who did not have Medicaid coverage (an on average increase of 2.228 ED visits). Individuals who did not report being refused care and had Medicaid coverage used the ED much less (1.7200 than their counterparts with Medicaid coverage. It is important to note that the same size was very small for individuals who reported being refused care because they owed money for past treatment (840 total or 8.3% with 595 having Medicaid coverage and 245 not having Medicaid coverage, see Table 1). However, despite the small sample size both estimates were statistically significant at the 1% level.

Table 7 shows the next dependent variable included in the study; the number of ED visits that were emergent but primary care preventable. The censored ED sample estimate for the effect of Medicaid coverage was 0.255 above the control of 0.248 (103%). Like before, every estimate of the effect of Medicaid coverage within the six subgroups was positive and statistically significant. The most important subgroups to consider are those that reported receiving care at a primary care clinic and those who had a clinic as their usual place of care. Primary care medicine could have a negligible effect on the other dependent variables (number of ED visits, non-emergent ED visits, ED costs and costs per ED visits), but it most likely could affect primary care preventable ED visits. However, Medicaid coverage increased primary care preventable ED visits for both groups associated with primary care, place of care clinic and received care at a primary care clinic, 0.266 and 0.314 respectively. Focusing on just individuals with Medicaid coverage, those that reported receiving care at a primary care clinic used the ED for primary care preventable needs 0.242 more times.

Results of ED visits that were classified as non-emergent are found in Table 8. Similar to the prior two ED use types there was a positive estimated effect of Medicaid coverage in all six subgroups. The effect of Medicaid coverage for the censored ED sample was 0.181 more than non-emergent ED visits. The subgroup with the largest effect of Medicaid coverage was individuals who had been refused care with an estimate of 0.534 more non-emergent ED visit (206%). The subgroup of individuals taking prescription medication also has interesting results. Individuals who did not have Medicaid coverage but were taking prescription medication used the ED 69% (0.140) more than individuals without Medicaid coverage and not taking prescription medication.

Lastly, while understanding the effect of Medicaid coverage on the number of ED visits is important, it is also crucial to understand how Medicaid coverage affects cost. Table 9 shows how ED costs changed with Medicaid coverage for the censored ED sample and the six subgroups. For the censored ED sample, the average total ED costs for the control group was $3,469.04. The effect of Medicaid coverage was statistically significant at the 10% level and estimated a $1,055.06 increase in ED costs. The marginal effects of Medicaid coverage in all of six subgroups were statistically significant and ranged from $1,459.72 to $4,594.16. The largest of which came again from individuals who reported being refused care because they could not pay, a 122% increase. This is very interesting and could demonstrate how delayed care (because of financial constraints) could further increase medical costs due to costly ED care.

Further analysis of ED costs looks at how cost per ED visits differed with Medicaid coverage (see Table 10). The increase number of visits was clearly shown thus it is important to remove such effects and look at the cost savings Medicaid coverage may have. However, none of the subgroups or even the entire censored ED sample had a statistically significant estimated effect of Medicaid coverage. Moreover, all estimates for the control group were statistically significant at the 1% level. This solidifies that Medicaid coverage did not increase or decrease ED costs per visit.

The final part of the study looked at the claim by Taubman and others (2014) that men and younger individuals utilized the ED more when they received Medicaid. However, there was not a statistically significant difference between males and females with Medicaid coverage in ED visits (see Table 11). The same is true for younger and older individuals with Medicaid coverage. There was a statistically significant increase (0.133) for younger individuals without Medicaid coverage than older individuals without Medicaid coverage. This suggests just

comparing the estimated marginal effects of Medicaid coverage for the two variables is not enough to infer that they are statistically different. However, estimating the marginal effects within a subgroup may provide statistically significant estimates.

Discussion:

The purpose of this study was to estimate the causal effect of Medicaid coverage. It was shown that Medicaid coverage increased ED use for all ED visit types as well as those that were primary care preventable and non-emergent. Six subgroups were studied based on survey responses. In all cases for the three groups of ED visit types Medicaid coverage increased use. The largest increase in ED use came from individuals who reported being refused care because they owed money for previous treatment and received Medicaid coverage. Further study is needed in order to fully understand why Medicaid coverage had such an impact. One possibility may be that delaying care due to financial constraints encouraged such individuals to seek care at the ED. Medicaid coverage further increases this behavior (presenting at the ED) by 122% to 262% depending on the ED visit type.

Focusing on how individuals with Medicaid coverage differed within subgroups also provides interesting results. For example in the case of individuals with Medicaid coverage that responded to the survey question about whether they received care at a primary care clinic in the past six months a marginal effect was observed. Individuals who reported receiving care at a primary care clinic used the ED for primary care preventable ED visits 0.242 more times than individuals who did not report receiving care at a primary care clinic.

Interestingly, Medicaid coverage did not decrease costs per ED visits. However, it is important to recognize the limits of this study. Most notably, the Oregon study is not readily

generalizable to the entire US. Specifically the Affordable Care Act mandates participation and in the Oregon lottery participation was voluntary. Thus the Affordable Care Act may more closely resemble the intent-to-treat analysis included in this study. In this regard, the effect of the lottery was occasionally statistically significant. Furthermore, the duration of this study was very short (a mere 18 months) and the long term effect of Medicaid coverage on ED use and cost cannot be explained.

Table 1: Summary Statistics of Groups by Medicaid Coverage and Lottery

		N	Medicaid Coverage	No Coverage	Lottery	No Lottery
Oregon Health Insurance Experiment		74922	18013 (24%)	56909 (76.0%)	29834 (39.8 %)	45088 (60.2 %)
Emergency Department Sample		24646	5929 (24.1%)	18717 (75.9%)	9626 (39.1 %)	15020 (60.9 %)
Usual place for medical care-Clinic	Yes	10058	1791 (17.8%)	3338 (33.2%)	2727 (27.1%)	2402 (23.9%)
	No		1028 (10.2%)	3901 (38.8%)	2343 (23.3%)	2586 (25.7%)
Received care at a primary care clinic	Yes	10413	2236 (21.5%)	4639 (44.6%)	3540 (34.0%)	3335 (32.0%)
	No		699 (6.7%)	2839 (27.3%)	1706 (16.4%)	1832 (17.6%)
Currently taking any prescription medications	Yes	9604	1759 (18.3%)	3542 (36.9%)	2688 (28.0%)	2613 (27.2%)
	No		976 (10.2%)	3327 (34.6%)	2179 (22.7%)	2124 (22.1%)
Currently owe money for medical expenses	Yes	10397	1908 (18.4%)	4747 (45.7%)	3258 (31.3%)	3397 (32.7%)
	No		1029 (9.9%)	2713 (26.1%)	1979 (19.0%)	1763 (17.0%)
Borrowed money/skipped bills to pay health care costs	Yes	10373	1236 (11.9%)	3386 (32.6%)	2268 (21.9%)	2354 (22.7%)
	No		1688 (16.3%)	4063 (39.2%)	2957 (28.5%)	2794 (26.9%)
Been refused care because owe money for past treatment	Yes	10137	245 (2.4%)	595 (5.9%)	403 (4.0%)	437 (4.3)
	No		2624 (25.9%)	6673 (65.8%)	4733 (46.7%)	4564 (45.0%)
Gender	Male	24622	2167 (8.8%)	8993 (36.5%)	4461 (18.1%)	6699 (27.2%)
	Female		3749 (15.2%)	9713 (39.4%)	5151 (20.9%)	8311 (33.8%)
Age	Old*	24622	1428 (5.8%)	4773 (19.4%)	2380 (9.7%)	3821 (15.5%)
	Young*		4488 (18.2%)	13933 (56.6%)	7232 (29.4%)	11189 (45.4%)

Note: The percentages are calculated by dividing the number of observations by the number in the entire group.
* For the group age, old represents individuals 50 and older at the start of the study while young represents individuals 49 and younger at the start of the study.

Table 2: Survey Response Rates

		0M	6M	12M
Returned Survey	Yes	26,423 (45.2%)	6,359 (54.1%)	23,777 (40.7%)
	No	31,982 (54.8%)	5,397 (45.9%)	34,628 (59.3%)
Total Number of Surveys Sent		58,405	11,756	58,405

Note: The same 58,405 individuals sent the 0M survey were also sent the 12M survey. This included 29,589 treatment individuals and 28, 816 control individuals. For the 6M survey a subsample (11,756) which focused on early respondents to the OM survey. The supplementary materials provided with the Oregon Health Insurance Experiment Public Use Data report that the 6M returned surveys (6,359) had a weighted or effective response rate of 42 percent.

Table 3: Survey Questions

Term used in paper and tables	Question per surveys	Notes
Usual place for medical care- Clinic	Where do you usually go to receive medical care? *Mark only one.* -A private doctor's office or clinic -A public health clinic, community health center, or tribal clinic -A hospital-based clinic -A hospital emergency room -An urgent care clinic -Some other place not listed here; Where? -I don't have a usual place	Yes if response a private doctor's office or clinic, a public health clinic, community health center, or tribal clinic or a hospital-based clinic. No if response all others.
Received care at a primary care clinic	In the last 6 months, how many times did you go to a doctor's office, clinic, or other health care provider to get care for yourself? Don't include emergency room or hospital visits. Your best estimate is fine. -None -1 time -2times 3 or more times (how many?:_____)	Yes if response a number greater than 0. No if response 0.
Currently taking any prescription medications	How many different prescription medications are you currently taking?	Yes if response a number greater than 0. No if response 0.
Currently owe money for medical expenses	Do you currently owe money to a health care provider, credit card company, or anyone else for medical expenses? -Yes -No	
Borrowed money/skipped bills to pay health care costs	In the last 6 months, have you had to borrow money, skip paying other bills, or pay other bills late in order to pay health care bills? -Yes -No	
Been refused care because owe money for past treatment	In the last 6 months, has a doctor, clinic, or medial service refused to treat you because you owed money to them for past treatment? -Yes -No	

Table 4: Summary Statistics of Dependent Variables

	N	Mean	Standard Deviation	Minimum	Maximum
Number of ED Visits	24622	0.907	2.204	0	22
Number of Primary Care Preventable ED Visits	24626	0.320	0.921	0	16.429
Number of Non-Emergent ED Visits	24634	0.193	0.681	0	13.639
Total ED Costs	8449	3874.57	5644.60	2.00	67984.55
Costs per ED Visit	8437	1455.48	1326.12	0.00	18917.80

Note: As the number of PC preventable and non-emergent ED visits were calculated using an algorithm by Billings and others (2000), non-integer values were possible (i.e., the maximum values were not integer values due to the algorithm used).
The number of ED visits was truncated to 22 ED visits in order insure that there were at least 10 observation per number of ED visit by Finkelstein (2013). In addition to the truncation of the number of ED visits, 24 observations were censored to insure de-identification.

Table 5: Instrumental Variables

	N	Intercept	Lottery	Household Size
Number of ED Visits	10449	0.21658 (0.013)	0.28756 (0.008)	-0.06253 (0.009)
Number of Primary Care Preventable ED Visits	10451	0.21678 (0.013)	0.28731 (0.008)	-0.06281 (0.009)
Number of Non-Emergent ED Visits	10454	0.21678 (0.013)	0.28748 (0.008)	-0.06286 (0.009)
Total ED Costs	3482	0.29352 (0.025)	0.31652 (0.016)	-0.06772 (0.020)
Costs per ED Visit	3479	0.29377 (0.025)	0.32645 (0.016)	-0.06782 (0.020)
Censored ED (Gender/Age)	24622	0.19116 (0.008)	0.24703 (0.005)	-0.03927 (0.007)

Note: All values significant at the 1% level. These values represent the 1st stage least square regression of lottery and household size on Medicaid coverage.

Table 6: Heterogeneity of Number of ED Visits

	Number of ED Visits				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	0.724	0.650	90%	0.858	0.098
	(0.047)***	(0.149)***		(0.031)***	(0.043)**
Usual place for medical care – Clinic	0.770	0.695		0.909	0.118
	(0.067)***	(0.206)***	90%	(0.043)***	(0.059)**
Marginal Effect – No	-0.086	-0.149		-0.103	-0.059
	(0.095)	(0.301)		(0.061)*	(0.086)
Received care at a primary care clinic	0.843	0.783	93%	0.998	0.135
	(0.059)***	(0.183)***		(0.038)***	(0.053)**
Marginal Effect – No	-0.305	-0.585		-0.397	-0.153
	(0.099)***	(0.316)*		(0.064)***	(0.091)*
Currently taking any prescription medications	0.987	0.767	78%	1.139	0.134
	(0.062)***	(0.193)***		(0.039)***	(0.055)**
Marginal Effect – No	-0.614	-0.386		-0.687	-0.078
	(0.095)***	(0.300)		(0.061)***	(0.086)
Currently owe money for medical expenses	0.950	0.953	100%	1.128	0.183
	(0.058)***	(0.184)***		(0.037)***	(0.053)***
Marginal Effect – No	-0.671	-0.703		-0.794	-0.151
	(0.098)***	(0.306)**		(0.063)***	(0.088)*
Borrowed money/skipped bills to pay health care bills	0.944	0.828	88%	1.102	0.151
	(0.070)***	(0.222)***		(0.045)***	(0.064)**
Marginal Effect – No	-0.412	-0.284		-0.453	-0.077
	(0.095)***	(0.299)		(0.061)***	(0.086)
Been refused care because owe money for past treatment	1.152	2.228	193%	1.513	0.532
	(0.137)***	(0.446)***		(0.088)***	(0.129)***
Marginal Effect – No	-0.495	-1.720		-0.744	-0.469
	(0.146)***	(0.473)***		(0.093)***	(0.136)***

Note: The percentages indicated in the table under the Effect of Medicaid Coverage represents the percent increase in ED visits by individuals with Medicaid coverage above the control. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level.
N = 10449

Table 7: Heterogeneity of Number of Primary Care Preventable ED Visits

	Number of PC Preventable ED Visits				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	0.248	0.255	103%	0.299	0.042
	(0.020)***	(0.062)***		(0.013)***	(0.018)**
Usual place for medical care – Clinic	0.259	0.266	103%	0.310	0.049
	(0.028)***	(0.086)***		(0.018)***	(0.025)**
Marginal Effect – No	-0.019	-0.035		-0.021	-0.019
	(0.040)	(0.126)		(0.026)	(0.036)
Received care at a primary care clinic	0.288	0.314	109%	0.348	0.058
	(0.025)***	(0.077)***		(0.016)***	(0.022)***
Marginal Effect – No	-0.100	-0.242		-0.138	-0.063
	(0.041)**	(0.132)*		(0.027)***	(0.038)*
Currently taking any prescription medications	0.326	0.311	95%	0.386	0.057
	(0.026)***	(0.081)***		(0.017)***	(0.023)**
Marginal Effect – No	-0.181	-0.166		-0.211	-0.036
	(0.040)***	(0.126)		(0.026)***	(0.036)
Currently owe money for medical expenses	0.323	0.384	119%	0.392	0.077
	(0.024)***	(0.077)***		(0.016)***	(0.022)***
Marginal Effect – No	-0.221	-0.306		-0.273	-0.069
	(0.041)***	(0.129)**		(0.027)***	(0.037)*
Borrowed money/skipped bills to pay health care bills	0.319	0.338	106%	0.382	0.066
	(0.029)***	(0.093)***		(0.019)***	(0.027)**
Marginal Effect – No	-0.133	-0.135		-0.153	-0.037
	(0.040)***	(0.125)		(0.026)***	(0.036)
Been refused care because owe money for past treatment	0.380	0.997	262%	0.538	0.245
	(0.058)***	(0.186)***		(0.037)***	(0.054)***
Marginal Effect – No	-0.153	-0.812		-0.271	-0.223
	(0.061)**	(0.198)***		(0.039)***	(0.057)***

Note: The percentages indicated in the table under the Effect of Medicaid Coverage represents the percent increase in PC preventable ED visits by individuals with Medicaid coverage above the control. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level
N = 10451

Table 8: Heterogeneity of Number of Non-Emergent ED Visits

	Number of Non-Emergent ED Visits				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	0.142	0.181	127%	0.176	0.033
	(0.015)***	(0.046)***		(0.009)***	(0.013)**
Usual place for medical care – Clinic	0.149	0.192	129%	0.184	0.039
	(0.021)***	(0.064)***		(0.013)***	(0.018)**
Marginal Effect – No	-0.013	-0.033		-0.016	-0.014
	(0.029)	(0.093)		(0.019)	(0.027)
Received care at a primary care clinic	0.167	0.198	119%	0.203	0.040
	(0.018)***	(0.057)***		(0.012)***	(0.016)**
Marginal Effect – No	-0.063	-0.087		-0.075	-0.027
	(0.031)**	(0.098)		(0.020)***	(0.028)
Currently taking any prescription medications	0.202	0.193	96%	0.238	0.037
	(0.019)***	(0.060)***		(0.012)***	(0.017)**
Marginal Effect – No	-0.140	-0.053		-0.151	-0.008
	(0.030)***	(0.093)		(0.019)***	(0.027)
Currently owe money for medical expenses	0.195	0.250	128%	0.239	0.053
	(0.018)***	(0.057)***		(0.012)***	(0.016)***
Marginal Effect – No	-0.155	-0.162		-0.184	-0.035
	(0.030)***	(0.095)*		(0.020)***	(0.028)
Borrowed money/skipped bills to pay health care bills	0.202	0.189	94%	0.237	0.036
	(0.022)***	(0.069)***		(0.014)***	(0.020)*
Marginal Effect – No	-0.112	-0.005		-0.114	-0.000
	(0.029)***	(0.093)		(0.019)***	(0.026)
Been refused care because owe money for past treatment	0.259	0.534	206%	0.345	0.128
	(0.043)***	(0.138)***		(0.027)***	(0.040)***
Marginal Effect – No	-0.135	-0.383		-0.191	-0.101
	(0.045)***	(0.147)***		(0.029)***	(0.042)**

Note: The percentages indicated in the table under the Effect of Medicaid Coverage represents the percent increase in Non-Emergent ED visits by individuals with Medicaid coverage above the control. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level
N = 10454

Table 9: Heterogeneity of ED Costs

	Total ED Costs				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	3469.04	1055.06	30%	3752.19	230.18
	(242.24)***	(587.31)*		(136.24)***	(191.25)
Usual place for medical care – Clinic	3554.43	1511.75	43%	3917.39	382.33
	(332.85)***	(808.75)*		(185.61)***	(255.52)
Marginal Effect – No	-138.16	-1119.56		-357.26	-403.59
	(494.32)	(1222.84)		(272.96)	(385.29)
Received care at a primary care clinic	3648.42	1299.56	36%	3989.42	294.71
	(286.36)***	(700.00) *		(158.82)***	(220.666)
Marginal Effect – No	-599.16	-1241.46		-871.36	-388.55
	(556.41)	(1393.01)		(306.33)***	(439.09)
Currently taking any prescription medications	3745.92	1628.90	43%	4156.69	392.59
	(286.39)***	(707.18)**		(157.72)***	(222.61)*
Marginal Effect – No	-1102.44	-1746.68		-1508.05	-487.38
	(545.95)**	(1340.53)		(304.54)***	(423.81)
Currently owe money for medical expenses	3527.31	1637.26	46%	3936.62	399.66
	(269.40)***	(668.69)**		(148.20)***	(210.62)*
Marginal Effect – No	-658.15	-2098.67		-1129.64	-607.45
	(648.74)	(1559.80)		(366.77)***	(494.44)
Borrowed money/skipped bills to pay health care bills	3683.31	1459.72	40%	4057.76	333.72
	(329.30)***	(821.26)*		(181.71)***	(259.26)
Marginal Effect – No	-563.12	-588.90		-694.09	-166.47
	(494.73)	(1216.25)		(273.87)**	(383.32)
Been refused care because owe money for past treatment	3781.15	4594.16	122%	4897.33	1163.56
	(597.67)***	(1513.25)***		(327.61)***	(477.35)**
Marginal Effect – No	-438.77	-3983.77		-1380.11	-1057.00
	(654.87)	(1649.42)**		(359.66)***	(520.28)**

Note: The percentages indicated in the table under the Effect of Medicaid Coverage represents the percent increase in ED costs by individuals with Medicaid coverage above the control. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level
N = 3482

Table 10: Heterogeneity of Costs per ED Visit

	Costs per ED Visit				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	1491.74	-95.64	-	1472.32	-33.19
	(57.11)***	(138.45)		(32.03)***	(44.97)
Usual place for medical care - Clinic	1601.33	-217.82	-	1552.73	-67.04
	(77.16)***	(184.44)		(43.62)***	(60.07)
Marginal Effect – No	-231.52	235.71		-174.02	62.34
	(114.58)**	(278.92)		(64.17)***	(90.60)
Received care at a primary care clinic	1531.74	-123.21	-	1503.89	-37.29
	(66.59)***	(160.15)		(37.45)***	(52.04)
Marginal Effect – No	-139.48	61.49		-117.39	1.65
	(129.31)	(318.56)		(72.21)	(103.51)
Currently taking any prescription medications	1520.53	-36.47	-	1510.58	-7.67
	(66.94)***	(162.65)		(37.39)***	(52.78)
Marginal Effect – No	-110.64	-195.53		-142.58	-81.71
	(127.61)	(308.24)		(72.17)**	(100.43)
Currently owe money for medical expenses	1507.34	-86.09	-	1490.16	-30.65
	(62.76)***	(153.31)		(35.02)***	(49.77)
Marginal Effect – No	-106.91	6.12		-109.19	9.27
	(151.21)	(357.54)		(86.63)	(116.79)
Borrowed money/skipped bills to pay health care bills	1498.83	-70.34	-	1481.59	-18.41
	(76.53)***	(187.76)		(42.83)***	(61.10)
Marginal Effect – No	-18.43	-46.67		-21.04	-29.61
	(114.97)	(278.12)		(64.54)	(90.35)
Been refused care because owe money for past treatment	1704.38	-379.69	-	1634.61	-147.73
	(39.78)***	(348.37)		(77.70)***	(113.23)
Marginal Effect – No	-257.55	348.43		-195.48	139.51
	(153.13)*	(379.61)		(85.28)**	(123.38)

Note: The percent increase in costs per ED visit was not calculated as there was no statistical significance. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level
N = 3479

Table 9: Heterogeneity of ED Visits by Gender and Age

	Number of ED Visits				
				Intent-to-Treat	
	Control	Effect of Medicaid Coverage		Control	Effect of Lottery
Censored ED Sample	0.944	0.224	24%	1.002	-0.011
	(0.035)***	(0.129)*		(0.020)***	(0.031)
Gender	0.887	0.348	39%	0.989	0.007
	(0.52)***	(0.192)*		(0.30)***	(0.047)
Marginal Effect – Female	0.102	-0.224		0.060	-0.032
	(0.070)	(0.260)		(0.040)	(0.063)
Age (50 and older)	0.844	0.241	-	0.896	0.014
	(0.070)***	(0.258)		(0.039)***	(0.063)
Marginal Effect – Younger	0.133	-0.025		0.141	-0.035
(49 and younger)	(0.080)*	(0.298)		(0.045)***	(0.073)

Note: The percentages indicated in the table under the Effect of Medicaid Coverage represents the percent increase in ED visits by individuals with Medicaid coverage above the control. The dash indicates that there was not statistical significance and the percent increase was not calculated. *** Significant at the 1 Percent Level, ** Significant at the 5 percent level, * Significant at the 10 percent level
N = 24622

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