THE EFFECT OF MEDICAID ON CHRONIC CONDITIONS CARE AND PHYSICAL HEALTH OUTCOMES: EVIDENCE FROM THE OREGON HEALTH INSURANCE EXPERIMENT

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Analysis Plan
April 4, 2019

Introduction

The goal of the analysis described here is to use the Oregon Health Insurance Experiment (OHIE) and the data we collected through in-person interviews, physical exams, and administrative data to estimate the effects of expanding Medicaid availability to a population of low-income adults. The lottery and subsequent data collection are described in substantial detail elsewhere (Allen et al. 2010; Finkelstein et al. 2012; Baicker et al. 2013; Finkelstein et al. 2016).

This analysis extends our previous assessment of the effects of Medicaid by assessing new physical health outcomes and the management of chronic conditions. First, we examine new biomarkers, including C-reactive protein, waist circumference, 30-second pulse, and Body Mass Index (BMI) for our entire study population. Second, we assess care and outcomes for asthma – a prevalent condition which we have not yet analyzed in these data. Third, we delve more deeply into the management of diabetes, building on prior analyses of diagnosis of diabetes and blood sugar control (Baicker et al. 2013). Fourth, we gauge the effect of Medicaid on health care utilization for individuals with vs. without pre-existing diagnoses of chronic conditions, examining the heterogeneity of the effect of Medicaid on overall utilization found in our prior analyses (Finkelstein et al. 2012; Baicker et al. 2013; Taubman et al. 2014; Finkelstein et al. 2016).

Several of these analyses focus on a subset of the lottery population with chronic conditions. For these analyses, we focus on the population in which those chronic conditions had been diagnosed before the lottery, or "pre-lottery diagnosis," because the lottery itself may have affected access to care and thus, potentially, post-lottery diagnoses. Evaluating the effect of the lottery and subsequent Medicaid coverage on the subset of those with pre-lottery diagnoses, which we verify are balanced between treatment and control groups, can thus produce valid causal estimates, while any analysis based on the potentially endogenously-selected subset receiving a diagnosis post-lottery would risk introducing bias.

As with prior work, this document pre-specifies our planned analysis before we implement any comparison of outcomes for treatment and control groups. Creating this record of our ex ante planned analysis helps to minimize issues of data mining and specification searching. We do, however, examine the distribution of the outcomes in the control group to inform our specification decisions, and perform treatment-control comparisons of baseline sample characteristics, pre-lottery diagnoses, and insurance coverage to validate our empirical strategy. This plan was also constructed after completion of several other published analyses using the lottery to estimate different effects of insurance (such as (Finkelstein et al. 2012), (Baicker et al. 2013), (Taubman et al. 2014) (Finkelstein, et al. 2016), and (Baicker et al. 2014)). The methods proposed here utilize several of the same datasets and follow our prior analyses very closely, and many of the specification choices were informed by the results of those prior analyses.

Methods

Randomization and Intervention

In 2008, Oregon selected roughly 30,000 individuals by lottery from a waiting list of over 80,000 for an opportunity to apply for an otherwise closed Medicaid program. The state conducted eight lottery drawings from March through September 2008. Selected individuals won the opportunity – for themselves and any household member – to apply for health insurance benefits through Oregon Health Plan Standard (OHP Standard). OHP Standard provided benefits to low-income adults who were not categorically eligible for Oregon's traditional Medicaid program (OHP Plus). To be eligible, individuals must have been adults ages 19 – 64, not otherwise eligible for Medicaid or other public insurance, Oregon residents, U.S. citizens or legal immigrants, had been without health insurance for six months, had income below the federal poverty level, and had assets below $2,000. Among the randomly selected individuals, those who completed the application process and met the eligibility criteria were enrolled in OHP Standard. OHP Standard offered relatively comprehensive medical benefits with no consumer cost sharing and low monthly premiums (between $0 and $20, based on income), provided mostly through managed care organizations. The lottery process and OHP Standard have been described in more detail elsewhere (Finkelstein et al. 2012).

Data Sources

The data sources used are only described briefly here; see (Finkelstein et al. 2012), (Baicker et al. 2013), and (Taubman et al. 2014) for additional detail on data, and www.nber.org/oregon for additional detail on fielding and survey instruments. Protection of human subjects was overseen by multiple IRBs.

In-Person Surveys and Clinical Assessments

Between September 2009 and December 2010, we conducted a large in-person data collection effort to assess a wide variety of outcomes. The 20,745-person sample for the in-person data collection included almost all of the individuals selected in the lottery living in the Portland area and a roughly equal number of unselected controls. This data set includes answers to a detailed questionnaire, a catalog of medication in participants' possession, and collection of dried blood spots. We use these data to assess the effect of the lottery on health care and outcomes.

Of particular importance to this study, respondents were asked whether they had ever been diagnosed with diabetes, hypertension, high cholesterol, asthma, congestive heart failure, acute myocardial infarction, emphysema, kidney failure, or cancer; those who reported that they had received such a diagnosis were then asked when they were first diagnosed, ascertaining whether they were diagnosed before or after the lottery. Detail on the distribution of these conditions and assessment of the balance between treatment and control groups is described in the Study Population section below.

Hospital Discharge Records

We obtained hospital discharge data for the entire state of Oregon from January 2008 through September 2010. Working with the Office of Oregon Health Policy and Research, we probabilistically matched these data to the lottery list, thereby identifying hospital admissions for our sample. These data are similar to the Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) dataset. We use these data to assess the effect of the lottery on inpatient resource utilization, focusing on both all-cause and diagnosis-specific admissions for people with pre-lottery diagnoses.

Emergency Department Records

We obtained standard individual-level emergency department visit data for twelve hospitals in the Portland-metro area from January 2007 through September 2010. We probabilistically matched these data to the Oregon Health Insurance Experiment Study population based on information provided at the time of lottery sign-up. We use these data to assess the effect of the lottery on ED utilization, including all-cause, diagnosis-specific, and other categories of visits (e.g., non-emergent, preventable, primary care-treatable) for people with pre-lottery diagnoses. We use the 10,156 respondents from in-person survey who resided in zip codes covered by the ED visit data ("overlap sample") to assess the joint probability of having a primary care visit and an emergency department visit for people with pre-lottery diagnoses, compared to those without. Sample characteristics for each of the data sources is described in Appendix Table 1.

Lottery and Medicaid Enrollment

In addition to the in-person interview data we collected, the state provided us with detailed data on Medicaid enrollment for every individual on the list (starting prior to the lottery). We use this to construct our primary measure of insurance coverage during study period.

Statistical Analysis

Intent-to-Treat Effect of the Lottery (ITT)

Our analytic approach begins with an intent-to-treat (ITT) model comparing outcomes for all those who were selected in the lottery (the study treatment group) to all those who were on the list but not selected (the study control group), or the effect of winning the lottery. We estimate the ITT by fitting the following OLS equation:

$$y_{ih} = b_0 + b_1 LOTTERY_h + X_{ih} b_2 + V_{ih} b_3 + e_{ih} \quad (1)$$

where *i* denotes an individual and h denotes a household.

LOTTERY is an indicator variable for whether or not household h was selected by the lottery. The coefficient on *LOTTERY* (β_1) is the main coefficient of interest and gives the average difference in (adjusted) means between the treatment group (the lottery winners) and the control

group (those not selected by the lottery); it is interpreted as the impact of being able to apply for OHP Standard through the Oregon lottery.

We denote by X_{ih} the set of covariates that are correlated with treatment probability (and potentially with the outcome) and therefore must be controlled for so that estimates of β_1 give an unbiased estimate of the relationship between winning the lottery and the outcome. In all of our analyses, X_{ih} includes indicator variables for the number of individuals in the household listed on the lottery sign-up form (hereafter "household size"); although the state randomly sampled from individuals on the list, the entire household of any selected individual was considered selected and eligible to apply for insurance. We denote by V_{ih} a second set of covariates that can be included to potentially improve power by accounting for chance differences between treatment and control groups in variables that may be important determinants of outcomes. These covariates are not needed for β_1 to give an unbiased estimate of the relationship between winning the lottery and the outcome, however, as they are not related to treatment status. Following our previous work, our primary specification includes the pre-randomization version of the outcome for data from administrative data sets (hospitalizations, ED visits, and credit outcomes). In all of our ITT estimates and in our subsequent instrumental variable estimates (see below), we estimate linear models even though a number of our outcomes are binary. We explore the sensitivity of our results to an alternate specification using logistic regression and calculating average marginal effects for all binary outcomes. In all of our analyses we cluster the standard errors on the household identifier since the treatment is at the household level. All analyses of outcomes from the survey data are weighted using survey weights to account for fielding design (described in more detail in the Appendix to (Baicker et al. 2013)).

For the new physical health outcomes and post-lottery diagnoses examined, these analyses will be performed on the entire lottery sample. For analyses examining the care for the subset of the population with a given set of chronic conditions, we will break the sample into those with and without pre-lottery diagnoses (an exogenous classification). We will estimate effects separately based on this classification and will test for heterogeneity based on that status using a fully-interacted model (interacting that classification indicator with the lottery indicator and with covariates).

Local Average Treatment Effect of Medicaid (LATE)

The intent-to-treat estimates from equation (1) provide an estimate of the causal effect of winning the lottery (i.e. winning the opportunity to apply for OHP Standard). This provides an estimate of the net impact of expanding access to public health insurance. We are also interested in the impact of insurance coverage itself. We model this as follows:

$$y_{ih} = \rho_0 + \rho_1 MEDICAID_{ih} + X_{ih}\rho_2 + V_{ih}\rho_3 + \eta_{ih} \qquad (2)$$

where *MEDICAID* is a measure of insurance coverage and all other variables are as defined in equation (1). We estimate equation (2) by two stage least squares (2SLS), using the following first stage equation:

$$MEDICAID_{ih} = \delta_0 + \delta_1 LOTTERY_h + X_{ih}\delta_2 + V_{ih}\delta_3 + \mu_{ih} \quad (3)$$

in which the excluded instrument is the variable *LOTTERY*.

We interpret the coefficient on insurance from instrumental variable estimation of equation (2) as the local average treatment effect of insurance, or LATE (Imbens and Angrist 1994). In other words, our estimate of π_1 identifies the causal impact of insurance among the subset of individuals who obtain insurance upon winning the lottery but who would not obtain insurance without winning the lottery (i.e. the compliers). The LATE interpretation requires the additional identifying assumption that the only mechanism through which winning the lottery affects the outcomes studied is the lottery's impact on insurance coverage. We believe this is a reasonable approximation; in earlier work we discussed potential violations; where we could explore them we did not find cause for concern (Finkelstein et al. 2012).

As with the ITT analyses, for the new physical health outcomes and post-lottery diagnoses examined, these analyses will be performed on the entire lottery sample. For analyses examining the care for the subset of the population with a given set of chronic conditions, we will break the sample into those with and without pre-lottery diagnoses. We will estimate effects separately based on this classification and will test for heterogeneity based on that status using a fully-interacted model (drawing inferences based on the estimated coefficient on the interaction between Medicaid and that indicator from the two-stage model).

Examining the Joint Probability of Outpatient Care and Emergency Department Utilization

In prior work, we demonstrated that, if anything, Medicaid made the ED and the doctor's office more complementary, rather than more substitutable (Finkelstein et al. 2016). We repeat that analysis here, examining those with and without pre-lottery diagnoses of chronic conditions. Following those methods, we estimate the impacts of Medicaid on three different health care utilization outcomes in a pooled set of IV equations (2): if the individual had an office visit in the last 12 months (*OFFICE*), if an individual had an ED visit in the last 12 months (*ED*), and if the person had both an ED and an in-person office visit in the last 12 months (*BOTH*). These three questions come from the overlap sample of in-person respondents who resided in a zip code covered by the Emergency Department data (n = 10,156). We compare the estimated impact of Medicaid on the probability of having both types of visits ($\widehat{\pi^{BOTH}}$) to the impact of Medicaid on the probability of having both types of visits that would be implied if the impact of Medicaid on the probability of having an ED visit and the impact of Medicaid on the probability of having an office visit were independent, which we denote by π_{IND}^{BOTH}. If the impacts of Medicaid on ED and office visits were independent, the increase in BOTH would be given by Bayes' rule:

$$\pi_{IND}^{BOTH} = \mu_c^{ED}\widehat{\pi^{OFFICE}} + \mu_c^{OFFICE}\widehat{\pi^{ED}} + \widehat{\pi^{OFFICE}}\widehat{\pi^{ED}} \quad (4)$$

where μ_c^y is the control complier mean for outcome *y*; these are calculated according to the standard formulas.(Abadie 2002, Abadie 2003, Angrist and Pischke 2009) We then conduct an

F-test of the equality of the estimate of $\widehat{\pi^{BOTH}}$ from equation (2) and the calculated value π_{IND}^{BOTH}, where π_{IND}^{BOTH} is computed by the non-linear combination of parameters in equation (4).

Results

Sample Description and Initial Analyses

The Study Population

Of the 89,824 individuals who submitted names to the lottery, a total of 10,405 individuals selected in the lottery and 10,340 individuals not selected were sampled for inclusion in the in-person data collection effort. Of those sampled for inclusion, a total of 12,229 individuals responded to the survey by October 13, 2010 for an effective response rate of 73%.

The pre-lottery demographic characteristics of the study sample are shown in Table 1. Just over half the study participants are women, about a quarter are ages 50-64 (the oldest eligible age group), and about 70 percent are white. We did not see any significant differences between treatment and control groups on these characteristics overall or in any of the subsets examined. The treatment and control groups are balanced across a wide variety of baseline and interview characteristics. A global test of balance across these characteristics shows no significant difference, nor is there a significant difference in survey response rates between treatment and control groups (see (Finkelstein et al. 2012) for details).

During that interview, respondents were asked whether they had ever been diagnosed with diabetes, hypertension, high cholesterol, asthma, congestive heart failure, heart attack, emphysema, kidney failure, or cancer, and if so, when that diagnosis was first received. Table 1 also reports the fraction of the control group reporting a pre-lottery diagnosis of any of the chronic conditions, as well as the difference between treatment and control groups. Among the in-person survey respondent sample, 42.8% reported having been diagnosed with at least one of these conditions in advance of the lottery. We focus on those having received a diagnosis in advance of the lottery because such pre-existing diagnosis should be independent of lottery selection status, allowing us to use the lottery to gauge the causal effect of insurance on treatment of these chronically ill patients in a way that is not subject to the confounding effect of insurance coverage on current health status. Because having received the diagnosis "pre-lottery" is actually assessed after the lottery took place, it is in theory potentially subject to recall bias affected by treatment status, but we see no imbalance. None of the differences in individual diagnoses between treatment and control groups is statistically significant, and the F-test in the bottom row shows that there are no significant differences between the treatment and control groups across the group of diagnoses overall.

Insurance Coverage

Appendix Table 2 reports the effect of the lottery on Medicaid coverage for those in the in-person study overall and for the subgroups of those with and without pre-lottery diagnoses. Our primary measure of insurance coverage is whether the individual was ever on Medicaid (which

includes both OHP Standard and OHP Plus) during our study period, as measured by the state's Medicaid enrollment files. Panel A was previously reported in (Baicker et al. 2013) and shows an increase of 24.1 points in the probability of having Medicaid coverage for the entire in-person sample. Estimates for those with pre-lottery diagnoses and without are quite similar, with the lottery increasing the probability of being on Medicaid at any point during the study period by 24.8 percentage points for the subset of the in-person sample with a pre-lottery diagnosis, and 23.7 percentage points for those without.

Outcomes Analysis Tables

Unlike the descriptive tables above, the analysis of differences between treatment and control groups for all of the tables described below has yet to be performed – we report only summary statistics for the control group, with the rest of the table blank. These analyses will be completed only after this analysis plan is archived.

Health Outcomes

Table 2 examines physical health outcomes for the overall in-person survey population. Specifically, we consider the effect on physiological measurements not analyzed elsewhere, including: C-reactive protein, waist circumference, 30-second resting pulse, and body mass index (BMI). For the first two, we include both continuous measures and indicators for being at elevated health risk. Elevated C-reactive protein, associated with inflammation and elevated risk of adverse cardiovascular events, is defined as greater than 3.0 mg per liter of blood (Ridker 2003). Waist measurement associated with elevated risk for obesity is defined as a waist circumference greater than 102 cm for men and greater than 88 cm for women (National, Heart, Lung, and Blood Institute (NHLBI)).

Chronic Disease Care and Management

Table 3 focuses on the care for diabetes (Panel A) and asthma (Panel B). For each condition, we include an examination of specific treatments and symptoms among the subset of our in-person respondents who report having been diagnosed with that condition before lottery.

Diabetes: The first rows of Panel A include the full in-person sample and examine the incidence of new diagnoses of diabetes post-lottery and the prevalence of medication for diabetes. We examine whether individuals had any medication for a diabetes-related medication in their possession (using the medication catalog described above; see Appendix to (Baicker et al. 2013) for specific medications included); and whether they had insulin (a subset of the first category), in their possession. Use of insulin captures both the severity of the disease (in that not all diabetics progress to the point of needing insulin, and insurance may slow disease progression) and care received (in that conditional on needing insulin, insurance may increase the likelihood of it being prescribed or having it). As such, it is not clear what sign the net effect of insurance is likely to have.

The next rows examine the subset of the in-person sample diagnosed with diabetes before the lottery. We first examine three measures considered components of "best practices" and rarely contraindicated: eye exams, foot exams, and advice on diet modification. We also include a combination of the three, examining the share of diabetic patients receiving all three that we label "best practice" care. We next examine whether individuals were advised to check their blood sugar, if they are currently checking their sugar regularly (categorizing those who were not advised to do so as not doing so) and whether they have all the supplies needed to do so (categorizing those who do not check as having all the supplies they need). Finally, we examine whether these patients reported having diabetes-related medications recommended or renewed within the last year, as well as whether they have such medications in their possession.

Asthma: The first rows of Panel B examine post-lottery asthma diagnosis and medication use for the overall sample. The next rows focus on the subset of the study sample who reported a pre-lottery diagnosis of asthma. We examine the self-reported frequency of various asthma symptoms, including coughing, wheezing, shortness of breath, chest pain, asthma attacks, awakening due to asthma, etc. These measures are indicative of degree of control and success of management; we hypothesize that insurance may improve these outcomes. We analyze indicators for whether individuals experienced such symptoms on some days, most days or every day (vs. few days or never). Among this group with pre-lottery asthma diagnoses, those who reported no longer having asthma nor using an inhaler were coded as not suffering from these asthma symptoms. Additional information on the distribution of answers to these questions is included in Appendix Table 3. Similar to the diabetes panel, we also report the current possession of asthma medications (using the medication catalog), both overall and by maintenance versus rescue medications.

Utilization

Table 4 compares the effect of the lottery and Medicaid coverage on hospital and emergency department utilization for those with and without pre-lottery diagnoses, drawing on both survey and administrative data sources. We consider the total utilization of prescription drugs, measured as those currently taken (collected as a detailed catalog of actual medications); outpatient office visits, self-reported for the last 12 months; emergency department visits to Portland-area EDs for our in-person sample from 2008-2010; and hospital visits for our in-person sample from the state-wide hospital discharge data from 2008-2010. For both ED visits and hospitalizations, we assess utilization overall as well for diagnoses associated with the conditions that define our pre-lottery diagnoses. Additionally, we evaluate the number of ED visits that may have been avoided (emergent but preventable, primary care treatable, or non-emergent) according to the algorithm developed by (Billings, Parikh and Mijanovich 2000). The final column assesses whether the estimated coefficients for the sample with vs. without pre-lottery diagnoses are significantly different from each other.

Table 5 compares those with and without pre-lottery diagnosed chronic conditions on (A) the probability of an outpatient visit in the prior 12 months; (B) the probability of having an ED visit in the past 12 months; and (C) the joint probability of having an outpatient visit and ED visit in the past 12 months. As described above, we then compare the estimated joint probability to what would be implied by the estimates from the individual components if those components were

independent in order to assess whether Medicaid makes these two types of care more complementary or more substitutable. The final column assesses whether the estimated coefficients for the sample with vs. without pre-lottery diagnoses are significantly different from each other.

Additional Analyses

As our primary specification we use linear probability models, even for rates of binary outcomes. As an alternate specification, we report marginal effects from logistic models for all binary outcomes in Appendix Table 4.

Figures and tables

Table 1: Sample Characteristics

	Control Mean	T-C Difference
	(1)	(2)
Female	0.567	-0.007
	.	(0.009)
Age 19-34	0.360	-0.009
	.	(0.010)
Age 35-49	0.364	0.002
	.	(0.010)
Age 50-64	0.276	0.007
	.	(0.009)
White†	0.688	0.004
	.	(0.010)
Black†	0.105	0.001
	.	(0.006)
Other race†	0.148	0.000
	.	(0.008)
Hispanic	0.144	-0.003
	.	(0.008)
Interview Conducted in English	0.882	0.003
	.	(0.008)
Global test of balance	.	0.000
	.	(0.004)
	.	[0.972]
In-Person Survey Response rate	0.730	0.003
		(0.016)
Fraction with Pre-Lottery Diagnosis of		
Diabetes	0.072	-0.002
	.	(0.005)
High BP	0.181	0.002

	.	(0.008)
High Cholesterol	0.127	-0.001
	.	(0.007)
Any of Above (Cardiovascular Disease)	0.267	-0.003
	.	(0.009)
Asthma	0.199	-0.007
		(0.008)
Congestive Heart Failure	0.010	0.002
	.	(0.002)
Heart Attack	0.020	-0.001
	.	(0.003)
Emphysema/COPD	0.023	0.000
	.	(0.003)
Kidney	0.018	0.000
	.	(0.002)
Cancer	0.043	0.001
	.	(0.004)
Any of Above	0.428	-0.005
	.	(0.010)
Two or more of Any of Above (excludes cancer)	0.151	0.004
	.	(0.007)
Number of Conditions (excluding depression)	0.692	-0.006
	.	(0.020)
F test for group		0.270
p-value for F test		0.980
N		12,229

Notes: For each sample, the first column reports the average response rate of all individuals in the control group. The second column reports the difference between the average response rate for all individuals selected in the lottery to the average response rate for all respondents in the control group, as calculated by ordinary least squares regression. All regressions include indicators for each household size and all standard errors are clustered on household. We report the coefficient and standard error (in parentheses) and per comparison p-value [in brackets]. All analysis is weighted using survey weights.

Table 2: Additional Health Outcomes (In-Person Overall)

	Control Mean	ITT	LATE	p-value
	(1)	(2)	(3)	(4)
CRP				
Numerical value	5.45			
	(0.12)			
Healthy range indicator †	0.53			
	(0.01)			
Waist circumference				
Numerical value	99.45			
	(0.26)			
Healthy range indicator †	0.43			
	(0.01)			
30-second pulse				
Numerical value	35.81			
	(0.09)			
BMI				
Numerical value	29.82			
	(0.11)			

Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all respondents selected in the lottery to the average outcome for all control respondents, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All regressions also included controls for age (with dummies for age decile), sex, and interactions of age decile dummies and sex. All analysis is weighted using survey weights. (Standard errors in parentheses) † Note that healthy range for CRP is defined as <3mg/L, for waist circumference it is defined as <88cm for women and <102cm for men. Sample sizes: 11,886 (CRP); N=11,987 (waist circumference); N=12,198 (30-second pulse); N=12,175 (BMI)

Table 3: Care for Chronic Conditions

	Control Mean	ITT	LATE	p-value
	(1)	(2)	(3)	(4)
Panel A: Diabetes				
Overall in-person sample (N=12,229)				
Diabetes diagnosis post-lottery†	0.011			
	(0.001)			
Current use of diabetes medications				
Any diabetes medication†	0.065			
	(0.004)			
Insulin	0.038			
	(0.003)			
Sample with pre-lottery diagnosis of diabetes (N=872)				
Eye Exam	0.424			
	(0.03)			
Foot Exam	0.673			
	(0.03)			
Special Diet	0.563			
	(0.03)			
Receipt of 'Best Practice' Care (Eye+Foot+Diet)	0.219			
	(0.02)			
Home blood sugar check advised	0.851			
	(0.02)			
Doing home check now	0.685			
	(0.03)			
Have all check supplies needed	0.668			
	(0.03)			
Diabetes medications recommended or renewed	0.833			
	(0.02)			
Insulin recommended or renewed	0.450			
	(0.03)			
Diabetes pills recommended or renewed	0.641			
	(0.03)			
Current use of diabetes medications				
Any diabetes medication	0.744			
	(0.02)			
Insulin	0.364			
	(0.03)			
Panel B: Asthma				
B.1 Overall in-person sample (N=12,229)				
Asthma diagnosis post-lottery	0.011			

	(0.001)
Current use of asthma medications	
Any asthma medication*	0.140
	(0.01)
Maintenance	0.067
	(0.00)
Rescue	0.119
	(0.01)
B.2 Pre-lottery diagnosis of asthma (N=2,361)	
Still have asthma now?	0.629
	(0.02)
Cough - some days, most days, everyday	0.395
	(0.02)
Wheezing - some days, most days, everyday	0.377
	(0.02)
Shortness of breath - some days, most days, everyday	0.371
	(0.02)
Chest pain - some days, most days, or everyday	0.169
	(0.01)
Any asthma attack	0.318
	(0.02)
Woken by asthma - some days, most days, everyday	0.170
	(0.01)
Asthma symptom - moderate, severe, or very severe	0.305
	(0.01)
Current use of asthma medications	
Any asthma medication	0.385
	(0.02)
Maintenance	0.191
	(0.01)
Rescue	0.339
	(0.02)

Diabetes Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all individuals selected in the lottery to the average outcome for all control individuals, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All analysis is weighted using survey weights. (Standard errors in parentheses).

Asthma Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all individuals selected in the lottery to the average outcome for all control individuals, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All analysis is weighted using survey weights. (Standard errors in parentheses).

†Results previously reported in Baicker et al (2013).

*Results previously reported in Baicker et al (2017).

Table 4: Utilization

	Any Pre-Lottery Dx				No Pre-Lottery Dx				p-value of diff
	Control Mean	ITT	LATE	p-value	Control Mean	ITT	LATE	p-value	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of prescription medications (current possession)	3.04				0.94				
	(0.08)				(0.03)				
Number of outpatient visits	6.98				4.48				
	(0.28)				(0.18)				
Number of ED visits	1.23				0.82				
	(0.05)				(0.03)				
Number of non-emergent, preventable, or PC treatable ED visits	0.87				0.53				
	(0.08)				(0.03)				
Number of ED visits due to pre-lottery dx conditions	0.08				0.03				
	(0.01)				(0.01)				
Number of hospitalizations	0.25				0.14				
	(0.02)				(0.01)				
Number of hospitalizations due to pre-lottery dx conditions	0.03				0.01				
	(0.004)				(0.002)				

Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all respondents selected in the lottery to the average outcome for all control respondents, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All analysis is weighted using survey weights. (Standard errors in parentheses). Sample sizes: Medication: N=5,170 (pre-lottery dx), N=7,056 (no pre-lottery dx); Outpatient: N=5,163 (pre-lottery dx), N=7,042 (no pre-lottery dx); ED: N=5,163 (pre-lottery dx), N=7,041 (no pre-lottery dx); Hospitalization: N=5,164 (pre-lottery dx), N=7,041 (no pre-lottery dx).

Table 5: Joint Probability

	Any Pre-Lottery Dx				No Pre-Lottery Dx				p-value of diff
	Control Mean	ITT	LATE	p-value	Control Mean	ITT	LATE	p-value	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Had an office visit in last 12 months	0.727				0.588				
Had an ED visit in last 12 months	0.319				0.239				
Had both an ED and an office visit in last 12 months ("joint probability")	0.237				0.157				
Predicted change in "joint probabilty" if changes in office visits and ED visits were									
F-statistic for independence of increases in office visits and ED visits									
p-value									
N		4282				5874			

* Calculated by applying Bayes' rule to the estimated increase in the probability of an office visit (row 1), the estimated increase in the probability of an ED visit (row 2), and the control complier means for each of those outcomes.

Notes: The effect of Medicaid was estimated with the use of two-stage least-squares instrumental-variable regression. All regressions include indicators for the number of household members on the lottery list, and all standard errors (shown in parentheses) were "clustered", or adjusted to allow for arbitrary correlation of error terms within household. Analysis is limited to the overlap sample and all analyses are weighted using weights described in the text. The penultimate rows report the F-statistic and p-value of the test of the hypothesis that the estimated increase in the joint probabilty of having an ED and an office visit in the last 12 months (row 3) is equal to the predicted increase in this joint probability if the increases were independent (row 4).

Appendix Table 1: Characteristics of Different Samples

	In-Person Overall		Any Pre-Lottery Dx		ED – In-Person overlap	
	Control Mean	T-C Difference	Control Mean	T-C Difference	Control Mean	T-C Difference
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.567	-0.007	0.591	-0.008	0.568	-0.009
	.	(0.009)	.	(0.014)	.	(0.010)
Age 19-34	0.360	-0.009	0.255	-0.011	0.356	-0.007
	.	(0.010)	.	(0.015)	.	(0.011)
Age 35-49	0.364	0.002	0.347	0.005	0.364	0.004
	.	(0.010)	.	(0.015)	.	(0.011)
Age 50-64	0.276	0.007	0.397	0.005	0.280	0.004
	.	(0.009)	.	(0.016)	.	(0.010)
White†	0.688	0.004	0.739	-0.009	0.664	0.010
	.	(0.010)	.	(0.014)	.	(0.011)
Black†	0.105	0.001	0.113	-0.002	0.120	0.001
	.	(0.006)	.	(0.010)	.	(0.007)
Other race†	0.148	0.000	0.142	0.017	0.153	0.005
	.	(0.008)	.	(0.011)	.	(0.009)
Hispanic	0.144	-0.003	0.105	0.000	0.147	-0.012
	.	(0.008)	.	(0.009)	.	(0.008)
Interview Conducted in English	0.882	0.003	0.928	-0.005	0.882	0.005
	.	(0.008)	.	(0.008)	.	(0.008)
Global test of balance	.	0.000	.	-0.001	.	0.000
	.	(0.004)	.	(0.005)	.	(0.004)
	.	[0.972]	.	[0.794]	.	[0.927]
Response rate	0.73	0.003	0.312	-0.002	0.606	0.006
		(0.016)		(0.010)		(0.014)
N		12229	.	5171	.	10156

Notes: For each sample, the first column reports the average response rate of all indivuals in the control group. The second column reports the difference between the average response rate for all individuals selected in the lottery to the average response rate for all respondents in the control group, as calculated by ordinary least squares regression. All regressions include indicators for each household size and all standard errors are clustered on household. We report the coefficient, standard error (in parentheses), and per comparison p-value [in brackets]. All analysis is weighted using survey weights.

Appendix Table 2: Insurance Coverage (First Stage Estimates)

	In-Person Overall		Any Pre-Lottery Dx	
	Control Mean	Estimated FS	Control Mean	Estimated FS
	(1)	(2)	(3)	(4)
Ever on Medicaid during inperson survey period†	0.185	0.241	0.198	0.248
	.	(0.009)	.	(0.014)
	.	[0.000]	.	[0.000]
Ever on OHP Standard during inperson survey period†	0.033	0.265	0.036	0.284
	.	(0.007)	.	(0.011)
	.	[0.000]	.	[0.000]
# of months on Medicaid during study period	2.56	4.16	2.86	4.44
	.	(0.164)	.	(0.249)
	.	[0.000]	.	[0.000]
N	12229	.	5171	.

Notes: For each sample, the first column reports the fraction with insurance coverage of all indivuals in the control group. The se
difference between the fraction with insurance coverage for all individuals selected in the lottery to the fraction with insurance c
control group, as calculated by ordinary least squares regression. All regressions include indicators for each household size and a
household. We report the coefficient, standard error (in parentheses), and per comparison p-value [in brackets]. All analysis is w

† by the end of the in-person survey study period.

Appendix Table 3. Distribution of Frequency of Asthma Symptoms (Control Group)

	(1)	(2)	(3)	(4)	(5)	(6)
	Cured	Never	A few days	Some days	Most days	Everyday
Coughing	0.377	0.107	0.135	0.124	0.094	0.164
Wheezing	0.377	0.134	0.130	0.144	0.095	0.122
Shortness of breath	0.377	0.104	0.150	0.161	0.096	0.112
Chest pain	0.377	0.331	0.124	0.106	0.036	0.027
Asthma attack	0.377	0.402	0.121	0.065	0.017	0.017
Awaken due to asthma	0.377	0.307	0.146	0.077	0.047	0.046
	Cured	Very mild	Mild	Moderate	Severe	Very severe
Severity of asthma symptoms	0.377	0.137	0.179	0.210	0.075	0.022

Appendix 4: Care for Chronic Conditions - Logistic Regression

	Control Mean	ITT	p-value
	(1)	(2)	(3)
Panel A: Diabetes			
Overall in-person sample (N=12,229)			
Diabetes diagnosis post-lottery	0.011		
	(0.00)		
Current use of diabetes medications			
Any diabetes medication	0.065		
	(0.00)		
Insulin	0.038		
	(0.00)		
Pre-lottery diagnosis of diabetes (N=872)			
Eye Exam	0.424		
	(0.03)		
Foot Exam	0.673		
	(0.03)		
Special Diet	0.563		
	(0.03)		
Receipt of 'Best Practice' Care (Eye+Feet+Diet)	0.219		
	(0.02)		
Home blood sugar check advised?	0.851		
	(0.02)		
Doing home check now? (coded as 0 if not advised to check	0.685		
	(0.03)		
Have all check supplies needed? (coded as 1 if none needed)	0.668		
	(0.03)		
Diabetes or insulin pills recommended or renewed	0.833		
	(0.02)		
Insulin recommended or renewed	0.450		
	(0.03)		
Diabetes pills recommended or renewed	0.641		
	(0.03)		
Current use of diabetes medications			
Any diabetes medications	0.744		
	(0.02)		
Insulin	0.364		
	(0.03)		
Panel B: Asthma			
B.1 Overall in-person sample (N=12,229)			
Asthma diagnosis post-lottery	0.011		
	(0.00)		
Current use of asthma medications			
Any asthma medication	0.140		
	(0.01)		
Maintenance	0.067		
	(0.00)		
Rescue	0.119		
	(0.01)		
B.2 Pre-lottery diagnosis of asthma (N=2,361)			
Still have asthma now?	0.629		
	(0.02)		
Cough - some days, most days, everyday	0.395		
	(0.02)		
Wheezing - some days, most days, everyday	0.377		
	(0.02)		
Shortness of breath - some days, most days, everyday	0.371		
	(0.02)		
Chest pain - some days, most days, or everyday	0.169		
	(0.01)		
Any asthma attack	0.318		
	(0.02)		
Woken by asthma - some days, most days, everyday	0.170		
	(0.01)		
Asthma symptom - moderate, severe, or very severe	0.305		
	(0.01)		
Current use of asthma medications			
Any asthma medications	0.385		
	(0.02)		
Maintenance	0.191		
	(0.01)		
Rescue	0.339		
	(0.02)		

Diabetes Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all individuals selected in the lottery to the average outcome for all control individuals, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All analysis is weighted using survey weights. (Standard errors in parentheses).

Asthma Notes: For each sample, Column 1 reports the weighted mean of the dependent variable in the control sample of survey respondents and standard deviation for continuous outcomes. Column 2 reports intent-to-treat estimates, which compare the average outcome for all individuals selected in the lottery to the average outcome for all control individuals, as calculated by ordinary least squares regression. Column 3 reports the local-average-treatment-effect for insurance coverage as estimated by instrumental variable regression. Column 4 reports the per-comparison p value. All regressions include indicators for each household size, and all standard errors are clustered on the household. All analysis is weighted using survey weights. (Standard errors in parentheses).

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