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The Effects of Physician and Hospital Integration on Medicare Beneficiaries' Health Outcomes

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Abstract

We consider whether hospital acquisitions of physicians lead to improved clinical outcomes for Medicare patients aged 65 and older. The analysis combines 2005-2012 Medicare fee-for-service and enrollment data with merger and physician affiliation information from the Levin Reports and SK&A, respectively. The analysis uses propensity score matching and a discrete-time hazard model to determine the effect of acquisitions on several health outcomes: mortality, acute myocardial infarctions, acute circulatory conditions, ischemic heart disease, glaucoma, symptomatic diabetes complications, and asymptomatic diabetes complications. These outcomes represent the progression of hypertension and diabetes into worse health states. Our results indicate that hospital acquisitions of existing physician practices have no wt

I Introduction

Policy makers and industry participants are exploring ways to integrate healthcare services in

This paper uses a difference-in-differences estimation strategy to measure the effects of 28 physician practice acquisitions by hospitals on a variety of health outcomes related to the treatment of hypertension and diabetes among Medicare patients.[5] Our analysis extends the existing empirical literature on the effects of provider integration on healthcare quality in three ways.

First, we identify changes in integration through physician acquisitions by hospital systems, which sharply alter physicians\status" from independent providers to system employees.[6] Direct employment represents an extreme form of integration. Employers can directly manage clinical practices and financial incentives using strategies that may be unavailable through looser forms of integration.[7] Thus, our integration measure facilitates inference regarding the effect of integration in our difference-in-differences econometric framework, which relies on observing providers change status from one form of integration to another.

Second, we measure health using several direct health outcome measures that represent the progression of either diabetes or hypertension into a worse health state: mortality, acute circulatory conditions, acute myocardial infarction (AMI), ischemic heart disease glaucoma, and diabetes complications. We consider diabetes and hypertension since they are prevalent and treatable. Medical science has correlated the outcomes that we consider with the progression of these conditions, and providers track these outcomes to manage a patient's health progression.[8] As such, these outcome measures are direct and prevalent measures of

potential for large efficiencies before the antitrust authorities and the Courts. In the proposed acquisition of the Saltzer medical group by St. Luke's health system, the merging parties claimed that any lost competition attributable to the merger would be offset by efficiencies associated with provider integration. http://www.ag.idaho.gov/consumerProtection/pendingActions/StLukesFTC&IdahoBrief.pdf

[5] Some researchers find that physician-owned practices are more likely to participate in ACOs than physician practices in hospital-based systems (Casalino et al., 2014).

[6] Health services researchers are also interested in the effects of other types of \clinical integration," which is any form of provider coordination that occurs independently of financial integration. Clinical integration may include full financial integration, but also includes other forms of provider coordination that does not necessitate formal mergers and acquisitions. See, e.g., of

disease progression into severe outcomes for important chronic conditions.

The extensive use of mortality by the healthcare quality literature implicitly validates our set of health metrics. While we, too,

confounders or selection bias.

Overall, our analyses find that vertical integration rarely leads to better health outcomes, and sometimes results in worse outcomes. We typically find negligible average effects across acquisitions that do not change much in the several years following an acquisition.[9] These findings are robust, as we do not find evidence of improved health in any of our specifications or with any of our outcome measures. Instead, our results indicate that vertical integration is not associated with improvements in health, despite the fact that the literature has found it to be associated with increased expenditures (Koch et al., 2017, Capps et al., 2015, Baker et al., 2014a).

The rest of the paper is organized as follows: Section II reviews the existing literature on the relationship between acquisitions and health outcomes. Section III describes our data. Section IV presents our empirical strategy for estimating acquisition effects and Section V provides motivating summary and balance statistics. Section VI discusses our findings. We conclude in Section VII.

II Background and literature review

Economic theory suggests that integration effects are ambiguous and may depend upon on a variety of conditions including agency concerns (Cooper et al., 2005), transactions costs (Bresnahan and Levin, 2012), information asymmetries (Wolinsky, 1993, Afendulis and Kessler, 2007), and competitive incentives (Gaynor and Vogt, 2000, Whinston, 2006). Since integration may be welfare increasing or decreasing, determination of its net effects requires empirical assessment. However, empirical assessment depends crucially on the valid measurement of both integration and outcome measurement. Integration takes many forms that vary in degree and scope and may affect a variety of outcomes including quality, costs, prices, and output.

[9] We focus on the average effect of a vertical merger and not the effect of the average merger. As discussed in recent work by Gibbons et al. (2014), these are not necessarily the same.

The empirical literature considers the effects of a variety of integration forms on numerous outcomes. An old literature considers the relationship between firm size, a form of integration, and outcomes such as costs and quality. Some studies find increasing returns, whereas others do not.[10] A related literature considers the effects of provider concentration on economic and clinical outcomes and generally finds that higher concentration leads to higher costs (Cooper et al., 2015) and weakly negative health effects (see, e.g., Gaynor and Town (2012) and Koch et al. (2018)).

A growing literature considers the effects of integration between hospitals and physicians on costs, prices, and utilization (Neprash et al., 2015, Keating et al., 2004, Burns and Muller, 2008, Baker et al., 2014a, 2016, Cuellar and Gertler, 2006, Ciliberto and Dranove, 2006, Capps et al., 2015). A related literature evaluates the performance of ACOs on cost and quality outcomes. Although this literature generally finds that hospital and physician integration result in higher prices or increased costs, Ciliberto and Dranove (2006) finds that integration between hospitals and physicians does not lead to higher charges.

Our analysis is most closely related to the literature that considers the relationship between hospital and physician integration on the quality of care, broadly defined (see Post et al. (2017) for a comprehensive review). However, some of the literature expresses concern that existing evidence has not determined the causal relationship between provider integration and quality since it frequ

betweenvertical integration and health outcomes.

III Data

Our analysis combines ambulatory and hospital claims from Medicare during the period 2005-2012with provider acquisitionsidenti ed using data from SK&A and the Levin Health Care Acquisition Reports (Levin Reports).[12] We describethesedata below.

III.1 Provider acquisitions

The Levin Reports are annual lists of mergers and acquisitions in the healthcare sector compiled by Irving Levin Associates, a private

a liation

III.2 Medicare claims

We combine acquisition information with Medicare healthcare claims from a 5% sample of Medicare bene ciaries during the period 2005 to 2012.[18] The 5% sample of Medicare bene ciaries representsa censusof bene ciary claims from inpatient admissions,hospital outpatient visits, and o ce-based visits for approximately 2.5 million personsper year.

The claims data contain detailed patient, provider, and serviceinformation. Patient information includes5-digit International Classi cation

We associate patients with the

chronic conditions into more severe outcomes related to that condition.

We believe our most credible measures relate to diabetes. Table A-3 provides the descriptions for the ICD-9 codes that we use as diabetes outcome metrics, 250.00-250.93. In our analysis, and in Table A-3, we categorize the ICD-9 codes as either "symptomatic" or "asymptomatic."[24] These codes explicitly identify conditions that are related to the progression of diabetes. For example, the description for 250.10-250.13 is not simply "ketoacidosis," but rather "diabetes with ketoacidosis." In addition to providing a relationship between the outcome and the underlying chronic condition, we note that the existence of the code suggests that providers monitor this complication in order to assess the progression of diabetes. Indeed, the Agency for Healthcare Research

with unobserved determinants of firm size or profitability, then these metrics may bias our analysis. For example, some of our metrics rely on physician diagnoses. If an acquisition results in increased monitoring and thus more diagnoses, our health outcome measure might suggest that acquisitions result in worse health when, in fact, the acquisition resulted in better monitoring and more diagnoses.

To address these potential issues, we consider a set of conditions with different strengths and weaknesses. In particular, mortality and acute myocardial infarction (AMI) represent severe outcomes with obvious symptoms that are unlikely to be coded inconsistently across claims processors. Moreover, these outcomes are unlikely to be disproportionately observed as a result of increased physician am (T)Tj/T1_0 1 Tf 2.409 0 Td (outcomes)Tj74T1_1 1 Tf (( )Tj /T1_0 1 Tf

physicians in our data.[27] To address concerns related to these di erences, our principal econometric speci cation employs propensity score matching techniques to identify a set of relevant control-group patients. We then use these matched pairs in a xed-e ects discrete time hazard model to consider the relationship between health outcomes and physician acquisitions.

IV.1 Propensity score matching

Matching methods are useful for measuring average \treatment" e ects, such as the acquisition e ect in our application, if covariate distributions di er substantially by \treatment" status (i.e., \acquisition" status).[28] As is evident in Table 1, the Medicare data is a good candidate for a matching procedure. We have a large set of potential control-group patients, and the samples of patients treated by acquired and non-acquired physicians di er substantially along rm size. We use propensity score matching to ensure that we have a good control group for the set of patients treated by acquired physicians.

We match patients that visit acquired physicians to patients that visit non-acquired physicians using a single nearest neighbor propensity score match without replacement within an exact match. We de ne the exact match categories using the combination of patient sex-patient birth cohort-physician specialty.[29] For example, one of our \exact-match" categories includes a female that is born in 1935 and visits a family practice physician. We select potential matches for each female bene ciary born in 1935 that visits an /T1_1 1 Tf ( )Tj /T1_0 1 Tf 2.8

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Tw29)T7er 1 Tf ( )Tj /T1_0 1 Tf 4.716 0 Td 0 Td visits b1 Tf ic is an that

conditions are measuredusing indicators for 18 chronic conditions, de ned as any chronic

acquired at some point during the sample period, which we represent as $A = 1$. We assume a logistic functional form

of patients choosing acquired physicians across all age-sex-specialty groups. The resulting sample is the set of patients that visit an acquired physician and each of the matched patients of non-acquired physicians. Our analysis sample is a quarterly dataset that follows each of the treated patients and their matched pair over time.

IV.2 Health outcome "acquisition" effects

We begin implementation of our analysis of "acquisition" effects using a simple difference-in-differences among the sample constructed from our propensity score analysis. Our primary specification estimates health outcome acquisition effects using a discrete-time hazard model from the matched estimation sample. The logit regression controls for a rich set of patient demographic characteristics, provider characteristics, and quarter dummies during the period 2006-2012. Our preferred specification also includes controls for the patient's health. We represent this specification with the following equation:

$$\begin{aligned} Pr(h_{it} = 1 | X_{it};) = (& _{PM} PM_{it} + _{fPM} (fem_i \ PM_{it}) + _{M} M_i + _{fM} (fem_i \ M_i) \\ & + _{i} X_{it} + _{y} yr_{it} + _{M\,y} (M_i \ yr_{it}) + _{ZIP} + _{t} + u_{it}): \end{aligned} \quad (5)$$

The discrete time hazard model considers the probability that we observe a positive realization of our health outcome variable in the contemporaneous period, $h_{it} = 1$. Since our health outcomes represent adverse health conditions, we interpret negative coefficients as improving health and positive coefficient estimates as worsening health. The discrete choice hazard model specifies a logit probability (i.e., $( ) = \exp( )/(1 + \exp( ))$) for patient i in quarter t, conditional on characteristics X and estimable paramaters . Each health outcome that we consider (i.e., acute cardiac conditions, AMI, death, diabetes complications, glaucoma, and ischemic heart disease) is a discrete indicator that specifies whether the patient is observed with the outcome during the quarter, or not. We model each outcome, separately. As is standard for discrete time hazard models, health outcomes are defined as absorbing

states. Patients are assigned a condition for the duration of the sample period following its first observance for all conditions.[3] See

bene ciary visited another specialist not included in the list of the most frequently observed specialties in our data.[42] Our preferred speci cation allows for an acquisition-speci c time trend to di er from the jointly estimated quarter-year xed e ects.[43]

We do not control for matched-pairs in equation (5), and thus do not take full advantage of the propensity score matching procedure. Rather, we limit the full sample to a \trimmed" sample that is more balanced in the covariates than the original full sample, but which may have some remaining bias. However, estimating this relatively parsimonious speci cation allows us to recover marginal e ect estimates since estimation of equation (5) does not require controlling for or recovering xed e ect estimates. In the next speci cation we do account for the matched sample procedure by replacing controls for ZIP code with xed-e ects for matched pairs:

$$Pr(h_{it} = 1 | X_{it};) = (_{PM} PM_{it} + _{fPM} (fem_i \ PM_{it}) + _{M} M_i + _{fM} (fem_i \ M_i) + _{i} X_{it} + _{y} yr_{it} + _{M\ y} (M_i \ yr_{it}) + _{match} + _{t} + u_{it}): \quad (6)$$

Equation (6) (i.e., our \matching estimator") takes full advantage of the nearest-neighbor matching procedure through the inclusion of matched pair xed-e ects, $_{match}$. These xed-e ects represent separate indicators for whether each of the bene aries is a member of a speci c matched-pair identi ed using the nearest neighbor matching procedure. There are, conceptually, N_A 1 of these $_{match}$ indicators, one for each matched acquisition and control bene ciary pair. We use the procedure outlined in Chamberlain (1980) to account for the xed-e ects in the estimation of the post-merger e ects. Implementation of the Chamberlain (1980) procedure e ectively takes di erences of h and X within each matched pair to identify the relevant coe cients, similar to a simple

Equation (7) allows the post-acquisition effect to vary by each of the G acquired groups. However, we pool some smaller acquisitions together and estimate a single effect for them. We also do not single out not estimate them. groups estimate them not pos

recommended by Hirano et al. (2003) to achieve efficient coefficient estimates.[48] We also cluster the standard errors by the matched group (i.e., the treated patient and her matched pair) to allow for correlations over time and across birth cohort-sex-specialty-propensity score matches.

V Descriptive and motivating statistics

In Table 1, we provide summary statistics characterizing a select set of important characteristics for our Medicare sample. Each observation represents a patient-quarter combination. Table 1 provides all information separately for patients of acquired physicians, patients of potential control group physicians, and the sample of matched patients using our propensity score methodology.[49] The sample of non-matched potential controls contains over 40 million patient-quarters, and both the matched and the acquisition samples have more than a million observations. For each sub-sample, Table 1 provides the average propensity score, average demographic characteristics such as age, sex, race, urbanicity, and health condition of the beneficiaries. Table 1 also provides characteristics of the providers seen by the beneficiaries, including the specialties of the providers and whether the patient visited providers of various sizes. We also provide the estimates for every beneficiary in the full sample.[50] Beneficiaries in the sample of potential controls are, on average, 76.2 years old, 86.1% white, 38.3% male, and live predominantly in metro areas with more than 500 thousand people. Beneficiaries often visit multiple providers during a quarter. 74.4% of potential control beneficiaries visited a provider in a group that had fewer than 5 physicians and 70.3% visited physicians employed by groups with between 5-24

e ciaries have some

providers visited. The acquisition sample is far more likely to visit a physician than the sample of potential controls. Moreover, patients of acquired physicians visit physicians employed by larger firms than potential control group beneficiaries. Thus, the samples are not well-balanced along these dimensions.

The matching

physiciansafter the acquisition, and the matched patients that we useas a control-group for the patients of acquired physicians.

A comparisonof outcomesamong patients of acquired physiciansin the pre-acquisition period against outcomesof matched bene ciaries nds that averageoutcomesare somewhat better among the matched bene ciaries. For example, among male patients with hypertension, 5.2% of patients in the \matched" sample develop acute cardiac conditions, whereas 5.6% of patients in the pre-acquisition period develop acute cardiac conditions. These patterns appearfor most of the outcomesthat we consider.However,the comparisonof averages doesnot control for other factors that may explain the di erencessuchaspatient demographics, provider characteristics,industry trends, or length of the sample.[53]

Among patients of acquired physicians, the comparisonof averagehealth outcomesbefore and after acquisitions provides someevidencethat health outcomesimprove following acquisitions. For example, among patients with hypertension, 5.6% of patients develop an acute cardiac condition in the pre-acquisition period, but only 5.1% of those patients develop an acute cardiac condition in the post-acquisition period. In the post-acquisition period, patients of acquired physicians also have weakly better outcomesthan matched bene ciaries. We observethis pattern for most all of our health conditions for both men and women, except for mortality. Mortality outcomesare weakly better prior to acquisitions and among the matched patients than among patients of acquired physiciansfollowing acquisitions, except among men with diabetes. Diabetic male patients of acquired physicians di er from the other samplesin that they have higher mortality in the post-acquisition period than in the pre-acquisition period, but are similar to the other samplesin that they have higher mortality than their matched counterparts.

The goal of our analysis in the following sections is to determine whether the mean di erences observedin Table 2 Dj mortality Tj /T1_0 1 Tf 3..827 0 Td [(m)1 (ean)]TJ /T1_1 1 Tf ( )

confounding factors, such as age and general trends in health and healthcare.[54]

VI Empirical results

In this section, we present the results from our specifications that derive from our propensity score estimation sample. We begin with the results from our difference-in-differences estimation, which we present in Table 3. This table presents coefficients, marginal effects, and their

women. For example, Table 3 presents the marginal e ect estimate from our\full set of controls" speci cation for women from the full propensity score sample in the top panel on the right. We interpret the 0:012 estimate to mean that the mergers we consider reduce the probability that women from this sample will die by 1.2%.[56] However, both the marginal e ect estimate and the corresponding post-merger coe cient estimate, 0:049, are statistically insigni cant at the 5% con dence level, which is consistent with no bene cial merger e ect.

Overall, we nd that acquisitions do not improve health outcomes in any of our speci cations for men or for women. Indeed, simply controlling for age and time removes most of the before and after di erential observed in the sample means and reported in Table 2. Within mortality, most of the coe cients and marginal e ects are not statistically signi cant from zero. Although the acquisition coe cient estimates in our mortality equation are positive and statistically signi cant for both men and women among diabetics, the predicted marginal e ects are not statistically signi cant at the 5% con dence level. However, as we suspected, the marginal e ect estimates for mortality are imprecise. For example, the 95% con dence interval in one speci cation ranges from reducing men's mortality by approximately 50% to increasing men's mortality by more than 25%. Similarly for women, the 95% con dence interval ranges from reducing mortality by nearly 40% to increasing mortality by nearly the same amount in our preferred speci cation using the full sample.

All of our other health measures are much more precisely estimated than are our estimates for mortality. However, despite the greater precision in the estimates from these other health outcomes, none of the marginal e ect estimates provide evidence that acquisitions improve health. Indeed, the marginal e ect estimates across nearly all of our outcomes are statistically insigni cant and none of the estimates imply marginal e ect bene ts, as we

acquisition coe cient estimates reduce the probability that women have heart attacks, we do not nd the same result for men. In addition, the resulting marginal e ect estimates for heart attacks among women are not statistically signi cant. Thus, even where we nd statistically signi cant coe cient estimates consistent with health improvements, we do not nd corresponding statistically signi cant marginal e ects.

None of the estimates in Table 3 fully take advantage of the information from our nearest neighbor matching procedure that we use to create our control sample. In Table 4, we report the coe cient estimates from from our nearest neighbor matching estimator against the corresponding coe cient estimates from these two relatively parsimonious speci cations.[57] We present this comparison since the Chamberlain (1980) procedure that we use to estimate consistent estimates for the coe cients of interest in our most exible speci cation does not allow for the calculation of marginal e ects.

Table 4 shows (Chamberlain (1980) from allow (73 0 Td (o05ost_0 1 4h/T1_1 1 Tf ( )Tj /T1_0 1 Tf 1.642 tef ( )Tj EMC /Lin

signi cant better outcomes,relative to the parsimoniousspeci cations.

We interpret our matching estimator resultsto be similar and often attenuated relative to the preferreddi erence-in-di erence speci cation, despitesome ndings of larger magnitude coe cient estimatesfor mortality and ischemicheart disease.Consequently,we feel con - dent that we can focus on the results from our more parsimoniousdi erence-in-di erence speci cations in the sectionsthat follow. Thesesectionsconsiderwhether

related to diabetes. The top two charts, (a) and (b), correspond with the estimates for asymptomatic and symptomatic diabetes complications, respectively. Chart (c) considers glaucoma, an eye condition that results from the progression of diabetes.[60] The estimates are far more precise than they were for mortality, especially for our

the acquired physicians.[61] That we do not observe beneficial acquisition effects for any of our transactions involving hypertensive patients suggests that our overall findings are unlikely due to choosing irrelevant health conditions for

of the nature of the outcome that we consider. We interpret our results as implying that acquisitions of this type have small clinical bene ts related to the treatment of hypertension and diabetes.

One possible limitation of our study is that some of the \vertical" acquisitions that we consider may also increase physician concentration in the a ected areas. If so, prior research has demonstrated that increased horizontal concentration may lessen competition for quality (Koch et al., 2017) and thus o set e ciencies associated with \vertical" integration. This e ect may also be responsible for the nding .725 0 Tte(a)Tj/T1_0 acquisitions) m 7.84 0.529 0 Td[(o 1]TJ(s)-1 (e

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Table 1: Summary and balance statistics for the Medicare sample 2006-2012

	Potential Controls		Matched		Treated		Normalized Differences	
Variable	Mean	SD	Mean	SD	Mean	SD	Match	P.C.
Propensity Score	0.018	0.039	0.137	0.118	0.144	0.128	0.054	1.329
				Patient demographics				
Age	76.21	8.10	77.34	7.60	77.39	7.60	0.007	0.150
Male	0.383	0.486	0.390	0.488	0.391	0.488	0.002	0.017
White	0.861	0.346	0.917	0.276	0.917	0.276	0.000	0.179
Metro >1 million	0.438	0.494	0.457	0.494	0.461	0.495	0.007	0.045
Metro 500k - 1 million	0.216	0.405	0.244	0.421	0.233	0.414	-0.026	0.041
Metro < 500k	0.116	0.310	0.096	0.283	0.096	0.278	-0.001	-0.068
Non-Metro area	0.229	0.413	0.203	0.394	0.210	0.395	0.019	-0.045
				Patient health				
Hypertension	0.649	0.477	0.711	0.453	0.704	0.456	-0.015	0.118
Diabetes	0.252	0.434	0.276	0.447	0.275	0.447	-0.002	0.052
Circulatory	0.717	0.450	0.790	0.407	0.790	0.407	-0.001	0.170
Musculoskeletal	0.492	0.500	0.556	0.497	0.556	0.497	0.000	0.128
Endocrine	0.388	0.487	0.421	0.494	0.420	0.494	-0.002	0.064
Sense organ diseases	0.314	0.464	0.344	0.475	0.344	0.475	0.000	0.064
Gastrointestinal	0.275	0.446	0.327	0.469	0.327	0.469	-0.001	0.113
Respiratory	0.215	0.411	0.262	0.440	0.258	0.438	-0.008	0.102
Signs/symptoms	0.200	0.400	0.248	0.432	0.249	0.432	0.001	0.117
Genito-urinary	0.224	0.417	0.251	0.433	0.248	0.432	-0.007	0.057
Blood disease	0.176	0.381	0.199	0.399	0.197	0.398	-0.005	0.055
Skin conditions	0.162	0.369	0.184	0.387	0.184	0.388	0.002	0.059
Neoplasms (cancer)	0.122	0.327	0.139	0.346	0.141	0.348	0.005	0.057
				Provider practice characeristics				
Any visit	0.657	0.475	0.841	0.365	0.837	0.369	-0.010	0.423
Family Practice	0.436	0.496	0.545	0.498	0.540	0.498	-0.010	0.210
Diagnostic radiology	0.166	0.372	0.224	0.417	0.224	0.417	0.000	0.145
Cardiology	0.124	0.329	0.179	0.383	0.189	0.392	0.026	0.181
Opthalmology	0.101	0.302	0.122	0.327	0.122	0.328	0.001	0.067
Podiatry	0.080	0.272	0.105	0.307	0.101	0.302	-0.012	0.073
Other	0.339	0.473	0.419	0.493	0.414	0.493	-0.009	0.156
Firm size <5	0.744	0.437	0.823	0.382	0.821	0.384	-0.005	0.187
Firm size 5 -24	0.703	0.457	0.819	0.385	0.819	0.385	0.001	0.274
Firm size 25 - 49	0.495	0.500	0.694	0.461	0.695	0.460	0.003	0.417
Firm size 50 - 99	0.409	0.492	0.633	0.482	0.632	0.482	-0.002	0.458
Firm size 100 - 200	0.306	0.461	0.564	0.496	0.553	0.497	-0.021	0.517
Firm size > 200	0.342	0.474	0.520	0.500	0.525	0.499	0.009	0.374
Obs	40,549,345		1,011,170		1,010,795			

Table 2: Summary of new condition diagnosis during quarter by sample 2006-2012

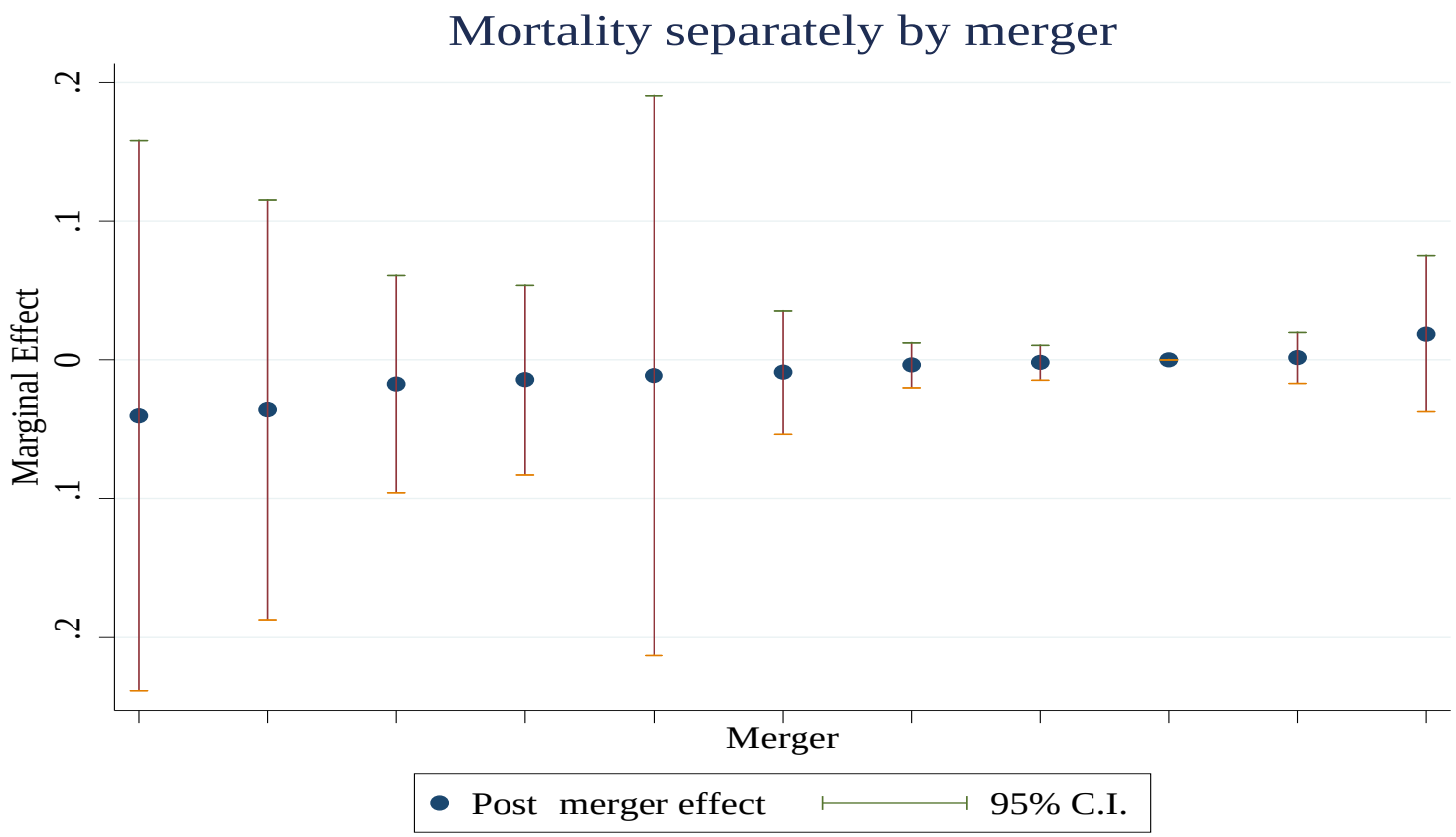
	Matched			Pre-Acquisition			Post-Acquisition		
Variable	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev
MEN					Full Sample				
Mortality	395,128	1.11E-04	1.06E-02	175,970	1.02E-04	1.01E-02	222,966	1.35E-04	1.16E-02
					Hypertension				
Mortality	292,641	1.50E-04	1.23E-02	127,573	1.41E-04	1.19E-02	163,306	1.72E-04	1.31E-02
Acute cardiac	147,317	0.052	0.222	74,406	0.056	0.230	69,283	0.051	0.220
AMI	277,023	0.004	0.066	122,351	0.005	0.071	151,643	0.004	0.066
Ischemic HD	103,512	0.037	0.189	46,931	0.048	0.214	51,346	0.033	0.178
					Diabetes				
Mortality	137,059	1.75E-04	1.32E-02	55,787	1.97E-04	1.40E-02	79,020	1.90E-04	1.38E-02
Asymptomatic	127,683	0.005	0.070	52,687	0.006	0.078	72,942	0.005	0.068
Symptomatic	87,588	0.029	0.168	37,294	0.038	0.191	46,724	0.027	0.161
Glaucoma	111,294	0.006	0.076	47,049	0.008	0.089	63,300	0.004	0.064
WOMEN					Full Sample				
Mortality	617,953	1.15E-04	1.07E-02	273,734	7.67E-05	8.76E-03	346,524	1.91E-04	1.38E-02
					Hypertension				
Mortality	475,549	1.49E-04	1.22E-02	208,545	9.59E-05	9.79E-03	263,868	2.46E-04	1.57E-02
Acute cardiac	248,590	0.046	0.210	127,749	0.049	0.216	116,077	0.046	0.210
AMI	458,434	0.003	0.057	202,136	0.004	0.065	250,673	0.003	0.058
Ischemic HD	241,406	0.027	0.163	112,424	0.034	0.182	125,990	0.021	0.144
					Diabetes				
Mortality	195,700	2.25E-04	1.50E-02	78,218	1.02E-04	1.01E-02	113,126	2.92E-04	1.71E-02
Asymptomatic	181,492	0.005	0.071	72,957	0.007	0.084	102,381	0.005	0.070
Symptomatic	126,739	0.026	0.161	51,812	0.034	0.181	66,793	0.025	0.156
Glaucoma	152,462	0.007	0.081	62,944	0.009	0.094	86,300	0.005	0.068

Table 3: Estimated effects of acquisitions on health-state transition probabilities

	Age and quarter only				Full set of controls				
	Men		Women		Men		Women		
Specification	Coef (SE)	Marg Eff (SE)	Coef (SE)	Marg Eff (SE)	Coef (SE)	Marg Eff (SE)	Coef (SE)	Marg Eff (SE)	N
					Mortality				
Full	-0.681	-0.166	0.120	0.011	-0.706	-0.172	-0.049	-0.012	1,945,801
	(0.816)	(0.204)	(0.739)	(0.068)	(0.767)	(0.171)	(0.752)	(0.188)	
Hyptertension	-0.794	-0.195	0.095	0.009	-0.749	-0.182	0.029	0.007	1,470,680
	(0.792)	(0.195)	(0.729)	(0.066)	(0.777)	(0.173)	(0.752)	(0.187)	
Diabetes	0.103	0.035	1.313*	0.035	0.628	0.270	1.898*	0.131	539,007
	(0.613)	(0.046)	(0.602)	(0.046)	(0.798)	(0.152)	(0.823)	(0.160)	
					Hypertension				
Acute Cardiac	0.092	0.005	0.125	0.013	0.104	0.015	0.112	0.019	783,422
	(0.077)	(0.020)	(0.074)	(0.007)	(0.073)	(0.010)	(0.069)	(0.012)	
Ischemic HD	0.034	0.005	-0.051	-0.006	0.005	0.001	-0.073	-0.009	681,609
	(0.132)	(0.020)	(0.124)	(0.049)	(0.098)	(0.012)	(0.094)	(0.012)	
AMI	-0.164	-0.008	-0.246*	-0.011	-0.220	-0.011	-0.354*	-0.021	1,412,910
	(0.112)	(0.007)	(0.111)	(0.008)	(0.139)	(0.009)	(0.134)	(0.013)	
					Diabetes				
Asymptomatic compl	0.151	0.029	0.037	0.009	0.325	0.051	0.229	0.042	610,142
	(0.250)	(0.049)	(0.218)	(0.053)	(0.214)	(0.041)	(0.198)	(0.038)	
Symptomatic compl	0.214	0.051	0.240	0.048	0.126	0.031	0.177	0.043	416,950
	(0.143)	(0.035)	(0.122)	(0.023)	(0.122)	(0.030)	(0.113)	(0.027)	
Glaucoma	0.030	0.008	0.078	0.013	0.229	0.056	0.296	0.072	449,040
	(0.206)	(0.051)	(0.179)	(0.032)	(0.213)	(0.052)	(0.192)	(0.046)	

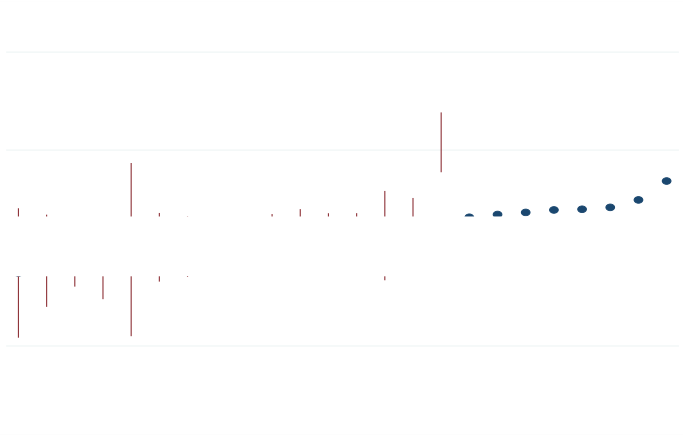
*Statistically significant at the 5% C.I.. Marginal effects evaluated for 77-year old in the 044 3-digit ZIP code among the treated 1Q2006. The full set of controls includes race and its gender interaction, physician specialty, patient ZIP code, and major ICD-9 condition characteristics in addition to age dummies, age category interactions with sex, and quarter dummies. Samples have different observation counts since we omit periods following the first observance of a condition. Observations represent counts in the "age and quarter only" specification. All estimates derive from a discrete-time hazard model. Marginal effect estimates are calculated as $ME = (X\hat{} + \hat{}_{PM}) \quad (X\hat{})$ and reported as percentages/100.

Figure 1: Marginal e ect estimatesseparatelyby acquisition - full samplemortality

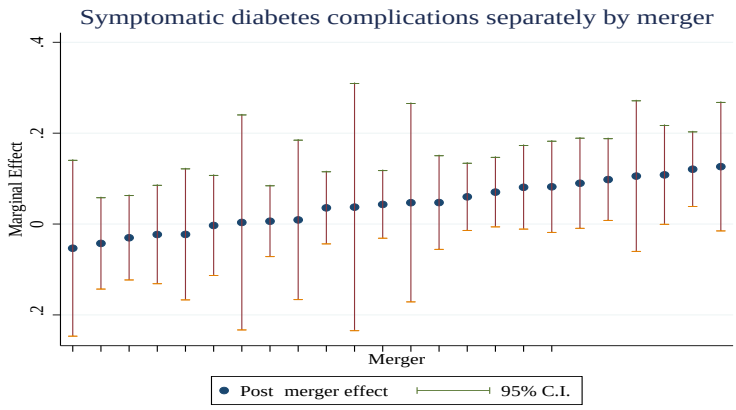


*Pooled mergers are Legacy-SW Community, Bridgeport-Radiation Oncology, Christ-Ohio Heart, Aurora-Comprehensive, Aurora-N. Lake, Je erson-Je erson Hills, Butler-DiCuccio, Good Samaritan Su ern-NY Day Surgery, Texas Childrens-Women's Health, Scripps-PennElm, and ThedaCare-NelsonFamily. The pooled group has the largest marginal e ect = 1.9%. Marginal e ect estimates are reported as percentages/100.

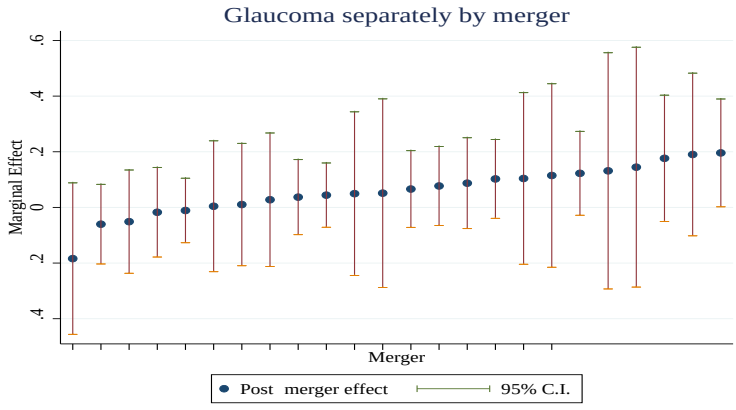
Figure 2: Marginal e ects separatelyby acquisition - diabetes*



(a) Asymptomatic complications



(b) Symptomatic complications

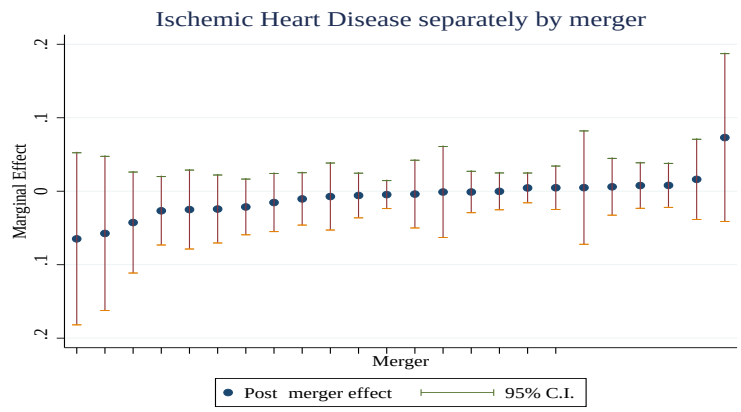


(c) Glaucoma

*Marginal e ect estimates are reported as percentages/100.

Figure 3: Marginal e ects separatelyby acquisition - hypertension*

(a) AMI

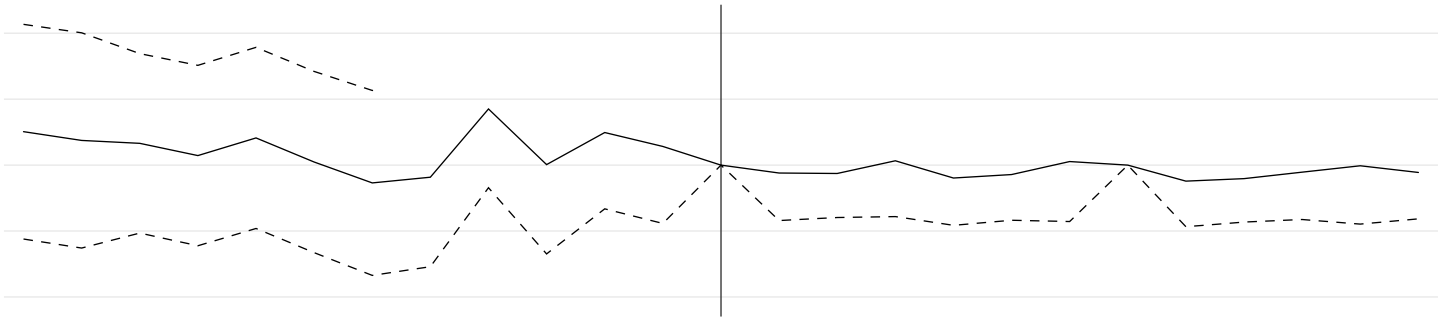


(b) Ischemic heart disease

(c) Acute cardiac conditions

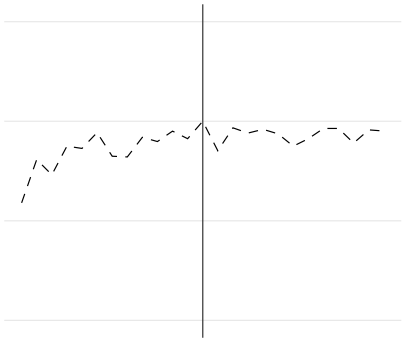
*Marginal e ect estimates are reported as percentages/100.

Figure 4: Period-specific acquisition marginal effects - mortality*



*Marginal effect estimates are reported as percentages/100 on the y-axis.

Figure 5: Period-speci c acquisition marginal e ects - diabetes*



*Marginal e ect estimates are reported as percentages/100 on the y-axis.

Figure 6: Period-speci c acquisition marginal e ects - hypertension*

*Marginal e ect estimates are reported as percentages/100 on the y-axis.

A Additional gures and tables

Table A-1: ICD9 Chapter headings

ICD9 Codes		Chapter Descriptions
001	139	Infectious And Parasitic Diseases
140	239	Neoplasms
240	279	Endocrine, Nutritional And Metabolic Diseases, And Immunity Disorders
280	289	Diseases Of The Blood And Blood-Forming Organs
290	319	Mental Disorders
320	359	Diseases Of The Nervous System
360	389	Diseases Of The Sense Organs
390	459	Diseases Of The Circulatory System
460	519	Diseases Of The Respiratory System
520	579	Diseases Of The Digestive System
580	629	Diseases Of The Genitourinary System
630	679	Complications Of Pregnancy, Childbirth, And The Puerperium
680	709	Diseases Of The Skin And Subcutaneous Tissue
710	739	Diseases Of The Musculoskeletal System And Connective Tissue
740	759	Congenital Anomalies
760	779	Certain Conditions Originating In The Perinatal Period
780	799	Symptoms, Signs, And Ill-De ned Conditions
800	999	Injury And Poisoning
E and V		External Causes Of Injury And Supplemental Classi cation

Table A-2: Hypertension and its complications

ICD	Description	Type
348.20	benign intracranial hypertension	Benign
401.10	benign essential hypertension	Benign
405.11	benign renovascular hypertension	Benign
405.19	other benign secondary hypertension	Benign
401.00	malignant essential hypertension	Malignant
365.04	ocular hypertension	Malignant
405.01	malignant renovascular hypertension	Malignant
405.09	other malignant secondary hypertension	Malignant
401.90	unspeci ed essential hypertension	Other
405.91	unspeci ed renovascular hypertension	Other
405.99	other unspeci ed secondary hypertension	Other
416.00	primary pulmonary hypertension	Other
459.30	chronic venous hypertension without complications	Other
459.31	chronic venous hypertension with ulcer	Other
459.32	chronic venous hypertension with in ammation	Other
459.33	chronic venous hypertension with ulcer and in ammation	Other
459.39	chronic venous hypertension with other complication	Other
572.30	portal hypertension	Other
796.20	elevated blood pressure reading without diagnosis of hypertension	Other

Table A-3: Diabetes and its complications

ICD Range	Description	Complication
250.00-250.03	diabetes mellitus without mention of complication	None
250.10-250.13	diabetes with ketoacidosis	Asymptomatic
250.20-250.23	diabetes with hyperosmolarity	Asymptomatic
250.30-250.33	diabetes with unspeci ed complication	

50.33 diabetes with

250.20

100

Appendix Table A.4 { continued from previous page

NHIS Code	Chronic Disease Description	ICD-9
235	Clubfoot	X78
236	Other	X75, X76, X85, X86
237	Other Deformities/Orthopedic Impairment	X79, X89
238	Cleft Palate	X91
239	Color Blindness	368.5
240	Tinnitus	388.3
241	Cataracts	366
242	Glaucoma	365
243	Diseasesof Retina	361, 362.1, 362.2, 362.3, 362.4, 362.5, 362.6, 362.7, 362.8, 362.9
300	SELECTED DIGESTIVE CONDITIONS	
301	Gallbladder stones	574
302	Liver diseasesincluding cirrhosis	571, 572, 573.0, 573.3, 573.4, 573.5, 573.6, 573.7, 573.8, 573.9
303	Gastric ulcer	531
304	Duodenal ulcer	532
305	Peptic ulcer	533
306	T1_1 1 Tf ( )Tj EMC /TD <</MCID 33 >>BDC /T1_2 1 TC /TD <</MCID /TD <</MCID 33 >>BDC /T1_2 1 TC /T Tf ( )Tj /T	
	306	15.1NtereBj E550-55 7.731 0 Td (T1_1 1 Tf ( )Tj EMC /TD <5C /TD <</MC
		306 (306)Tj /T 44 >>BDC Epilepsy2 1 Tf -10.625 -1.187s

Appendix Table A.4 { continued from previous page
NHIS Code Chronic3 0 Td (previous)Tj /T1_1 1 Tf ( )2 708f ( )Disease

Table A-5: Summary and

Table A-6: Summary and balance statistics for the sample of hypertensives

Variable	Pot Controls Mean	SD	Matched Mean	SD	Treated Mean	SD	Norm Match	Di s P.C.
Propensity Score	0.020	0.041	0.141	0.119	0.147	0.128	0.053	1.338
				Patient demographics				
Age	76.84	8.09	77.78	7.58	77.87	7.58	0.011	0.131
Male	0.367	0.482	0.379	0.485	0.378	0.485	-0.004	0.021
White	0.844	0.363	0.906	0.292	0.905	0.293	-0.003	0.184
Metro >1 million	0.444	0.494	0.459	0.494	0.469	0.495	0.019	0.051
Metro 500k - 1 million	0.214	0.402	0.244	0.421	0.230	0.412	-0.035	0.039
Metro < 500k	0.115	0.309	0.096	0.283	0.091	0.271	-0.018	-0.084
Non-Metro area	0.227	0.411	0.201	0.392	0.211	0.395	0.025	-0.040
				Patient health				
Diabetes	0.323	0.468	0.333	0.471	0.335	0.472	0.005	0.026
Musculoskeletal	0.556	0.497	0.610	0.488	0.610	0.488	0.000	0.109
Endocrine	0.480	0.500	0.494	0.500	0.497	0.500	0.005	0.033
Sense organ diseases	0.377	0.485	0.398	0.489	0.398	0.489	-0.001	0.043
Gastrointestinal	0.329	0.470	0.378	0.485	0.378	0.485	0.000	0.103
Genito-urinary	0.261	0.439	0.285	0.452	0.283	0.450	-0.005	0.049
Respiratory	0.255	0.436	0.299	0.458	0.296	0.457	-0.007	0.092
Signs/symptoms	0.245	0.430	0.292	0.455	0.293	0.455	0.002	0.108
Blood disease	0.222	0.415	0.239	0.426	0.239	0.426	-0.001	0.040
Skin conditions	0.186	0.389	0.204	0.403	0.206	0.405	0.004	0.052
Neoplasms (cancer)	0.132	0.338	0.147	0.354	0.149	0.356	0.008	0.051
				Provider characteristics				
Family Practice	0.604	0.489	0.683	0.465	0.681	0.466	-0.004	0.161
Other	0.428	0.495	0.495	0.500	0.491	0.500	-0.007	0.127
Diagnostic radiology	0.225	0.417	0.279	0.449	0.282	0.450	0.005	0.131
Cardiology	0.176	0.381	0.231	0.421	0.246	0.431	0.035	0.171
Opthalmology	0.138	0.345	0.153	0.360	0.155	0.361	0.005	0.046
Podiatry	0.101	0.301	0.125	0.331	0.121	0.326	-0.014	0.064
Firm size <5	0.968	0.176	0.975	0.155	0.977	0.150	0.010	0.054
Firm size 5 -24	0.904	0.294	0.970	0.170	0.974	0.158	0.024	0.297
Firm size 25 - 49	0.631	0.483	0.821	0.384	0.825	0.380	0.012	0.448
Firm size 50 - 99	0.522	0.500	0.747	0.435	0.749	0.434	0.003	0.485
Firm size 100 - 200	0.389							