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The Anatomy of a Hospital System Merger: The Patient Did Not Respond Well to Treatment
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ABSTRACT

There is an ongoing merger wave in the US hospital industry, but it remains an open question how hospital mergers change, or fail to change, hospital behavior, performance, and outcomes. In this research, we open the "black box" of practices within hospitals in the context of a mega-merger between two large for-profit chains. Benchmarking the effects of the merger against the acquirer's stated aims, we show that they achieved some of their goals: they harmonized their electronic medical records and sent managers to target hospitals; after the acquisition, managerial processes were similar across hospitals in the merged chain. However, these interventions failed to drive detectable gains in profitability or patient outcomes. Our findings demonstrate the importance of hospital organizations and internal processes for merger research and policy in health care and the economy more generally.

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Hospital consolidation through mergers and acquisitions has been a ubiquitous feature of U.S. health care sector dynamics for more than two decades, with nearly 1,600 hospital mergers from 1998-2017 (Gaynor, 2020). A large economics literature has studied the impacts of this trend (see Gaynor et al., 2015 for an overview). Much of it has focused on measuring changes in market power and price effects (e.g. Cooper et al., 2019; Gowrisankaran et al., 2015; Tenn, 2011), though a substantial body of work has also looked at clinical outcomes (Beaulieu et al., 2020; Capps, 2005; Kessler and McClellan, 2000; Romano and Balan, 2011), and a number of papers examine impacts on costs (Burns et al., 2015; Schmitt, 2017; Tsai and Jha, 2014). While these are critical contributions that tell us what the impacts of mergers are, they do not tell us why – what the mechanism(s) are by which mergers affect these outcomes.

In this paper, we pull back the curtain on the inner workings of hospital mergers by leveraging a particularly large and consequential acquisition. The setting is ideal for this "opening the black box" exercise. First, this mega-merger was important in its own right: it involved two of the largest for-profit chains in the U.S. comprising over 100 individual hospitals.[1] Second, by focusing on a single merger, we can benchmark the changes we see against the claims the acquirer made, in particular about the use of particular inputs. To that end, we observe a host of rich metrics on inputs into the hospital production process that closely track the goals of the acquirer, including the purchase of new health information technology and the entry and exit of physicians and managers. Third, and unique to our study, we survey the leadership of these hospitals about management processes and strategies in order to see further inside the organization and how it managed the merger. Management is a key input in hospital performance (Bloom et al., 2012; McConnell et al., 2013) but is unobservable in typical producer data in the health care sector – or any other industry. Finally, we observe rich clinical and

[1] Our data use agreement prohibits us from revealing the names of the acquiring and target chains.

financial performance metrics that the existing literature on hospital mergers typically studies as outcomes. Our findings on these downstream outcomes tend to align with prior literature on average merger effects, suggesting that our results on mechanisms could have more general applicability.

Concisely stated, we find that improving hospital performance through mergers is difficult, as indicated by either metrics of private firm performance or social benefit. Despite having a long-standing strategy and history of growth through acquisition, the acquiring firm had difficulty improving either the financial or clinical performance of the target hospitals, even eight years after acquisition. The acquirer failed to improve performance even though the merger led to changes in intermediate inputs that might have seemed to herald success. It was able to install many new executives in the target hospitals (often coming from the acquirer's existing hospitals) and drive adoption of a new electronic medical record (EMR) system at target hospitals. Several years after the merger, we also see a great deal of similarity in management practices within the merged hospital network compared to other hospital chains.

Yet, despite these organizational changes, there were no substantial improvements in targets' outcomes. The profitability of the target hospitals did not detectably rise. Prices rose, but so did costs, with little detectable impact on quality of care. Patients' clinical outcomes, particularly survival rates, were little changed. Indeed, the only clear change in major outcomes tied to the merger was in the profitability of the acquiring firm's existing hospitals, and in a *negative* direction: relative to other for-profit hospitals, their profit rates fell by 3 percentage points after the merger. We speculate that this finding might reflect the consequences of post-merger shifts in the acquirer's attention and resources away from its existing operations and toward its newly purchased hospitals, evocative of the "new toy" effect of acquisitions found in other sectors (Schoar, 2002).

The paper is structured as follows. Section 1 provides a description of the setting for the study. Section 2 presents the econometric strategy, and Section 3 describes the data used in the

analysis. We present the main results in Section 4 and robustness checks in Section 5. Section 6 discusses the results and concludes.

1. Setting

The focal acquisition of this study occurred in 2007. At the time of the merger, the acquiring chain was the largest non-urban hospital chain in the U.S. and among the top five for-profit chains overall, whether measured in beds or revenues. The chain had a publicly declared strategy of growth by acquisition. Indeed, that is how it became one of the five largest chains. The firm acquired 43 hospitals in the six years prior to the merger we focus on; the total of that gradual expansion, largely driven by single-facility purchases, was of the same order of magnitude as the single acquisition we study. The past purchases tended to be small not-for-profit and faith-based institutions, and they were mostly situated in rural areas.

The acquisition we focus on in this paper differed from the previous mergers in two key ways. First, it involved a very large number of hospitals (49), while the past acquisitions typically were singletons. Second, the target facilities differed from legacy facilities including those previously acquired: the targets in this acquisition tended to have superior clinical and financial outcomes, and they were larger and more likely to be in urban areas (see Table 1 and the discussion in the next section). The acquisition nearly doubled the size of the acquirer as measured by hospital beds.

We now review the stated aims of the acquirer and note the metrics we use to monitor the achievement of these goals and impacts on consumers (patients). First, the acquirer claimed the merger would lead to tens of millions of dollars in savings from overhead reductions and renegotiated purchasing contracts. It also claimed cost savings would come from optimizing the allocation of resources across hospitals. We therefore track effects on hospital costs and employment. The firm cited expected performance gains from reducing unnecessary capital expenditures, which we aim to track in capital investment data; opening its physician recruitment program to the newly acquired

hospitals, which we measure by following inflows and outflows of physicians; and standardizing operations, which we track by measuring the adoption of new EMRs, the flows of managers within the merged chain, and by directly surveying leadership on management practices.[2]

The acquiring firm expected these forecasted efficiencies would be realized through the implementation of an aggressive integration plan overseen by a dedicated and experienced team. The stated goal was to implement the plan within 2 years following the acquisition. Still, the stock market reacted skeptically, and analysts noted this acquisition's departure from the firm's earlier expansion strategy (Appendix Figure 1).

We note that the firm could achieve its goals from the merger, substantially improve performance for its owners, but not pass the benefits of those improvements on to consumers (here defined as hospital patients). We therefore also assess metrics of patient and consumer impacts like price and quality of care to ascertain whether the merger's effects benefited them and improved social welfare beyond just the aims of shareholders.

2. Econometric Strategy

In what follows, we examine the impact of the merger on a wide range of measures of inputs and outcomes. For most measures, we assess their changes at target and acquirer hospitals from before to after the merger relative to a comparison group of for-profit hospitals. To implement this strategy, we estimate a regression specification using annual observations of acquirer and target hospitals as well as other for-profit facilities, excluding facilities that were acquired by the focal chain post-merger because their treatment status is unclear. Specifically, we estimate the following:

$$y_{ht} = \alpha_t + \delta_h + \beta_A acquirer_h \times post_t + \beta_T target_h \times post_t + X_{ht}\rho + \varepsilon_{ht}, \quad (1)$$

[2] The firm also claimed it would generate profits and efficiencies by selecting hospitals in growing markets and by making emergency room improvements. We do not directly test whether these goals were realized but note them here for completeness.

where y_{ht} is the outcome of interest for hospital *h* in year *t*, and α_t and δ_h are respectively year and hospital fixed effects. The interactions $acquirer_h \times post_t$ and $target_h \times post_t$ denote respectively acquirer and target chain hospitals in the post-merger period. X_{ht} denotes additional controls and ε_{ht} is the error term. For example, as additional controls all specifications include interactions between the $acquirer_h$ and $target_h$ indicators and $interim_t$, an indicator for the merger year, to remove transitory effects of implementing the merger; in robustness specifications we also add geographic area-year effects (we use Dartmouth Hospital Referral Regions as our geographic areas, see Center for the Evaluative Clinical Sciences, 1996).

The coefficients of interest are β_A, the effect of the merger on acquiring hospitals, and β_T, the effect on target hospitals. They are identified by the relative trajectories of acquiring and target hospitals vs. other for-profit facilities. The key identifying assumption is that absent the merger, outcomes for the two chains would have evolved in parallel to those of other for-profit facilities. Throughout the study, we examine this assumption by presenting event study plots showing that outcomes were on parallel trends prior to the merger and by showing the robustness of our estimates to additional statistical controls.

3. Data

To select the sample of hospitals, we produced a list of facilities in the acquirer and target chains immediately prior to the merger using data from the American Hospital Association (AHA) survey, which collects extensive, detailed data annually on the universe of hospitals in the US (AHA 2015). We used the same survey to assemble a comparison set for-profit facilities. Using public records, we identified hospitals that were acquired by the focal chain in later years and excluded them, as well as hospitals in the target chain that were immediately divested following the merger, from analyses. We focus on hospitals that are open through the analysis period (they must appear in the AHA data in

our first and final year of analysis). Data on hospital inputs and outputs are drawn from the following sources:

Factor Inputs: To track health information technology inputs, we use the 2003-2014 HIMSS surveys, which include adoption of EMR and related computer systems (Dorenfest Institute 2015). We track physician labor inputs in the form of physician flows with 2003-2014 Medicare inpatient and emergency department claims (CMS 2015a, CMS 2015b). We collected data on hospitals' capital investments from Medicare hospital cost reports (CMS 2020) and full-time employees from the AHA surveys. Over half of the target hospitals did not report capital investment in 2003, so we analyze this variable only from 2004-onwards.

Management Inputs: We collected data on management, which we treat as an input into hospital production, in two forms. First, we tracked the movement of hospital chief executive officers before and after the acquisition using data from the AHA survey over 2004-2014. Second, we conducted surveys of hospital managers using the World Management Survey (Bloom et al., 2020; Bloom and Van Reenen, 2007) in target and acquirer facilities by phone in 2015.

Outputs: Data to assess financial outcomes are drawn from the Medicare hospital cost reports spanning calendar years 2003-2014. We assess clinical outcomes in the form of survival and readmission rates through Medicare inpatient claims data from 2003-2014.

Table 1 presents descriptive statistics on acquirer, target, and other for-profit facilities in the year prior to acquisition. As previously noted, acquirer hospitals tended to be smaller and located in rural areas compared to target facilities and other for-profits. Acquirer facilities tended to use a distinct EMR vendor;[3] its use was rare among other for-profits and it was never used in the target. Physician churn rates, defined the combined rates of physician entry and exit (and described in more detail in

[3] We withhold the name of the vendor to avoid identifying the chain.

the subsequent section), were similar across the hospitals. The acquirer had less hospital staff (measured as FTEs) at its hospitals compared to other for-profits while target hospitals tended to employ more staff; the value of capital investment was similar at acquirer and other for-profit facilities but lower at targets. The acquirer had notably higher CEO churn than the target and other for-profits; in particular, nearly one-third of acquirer hospitals gained a new CEO in that year. Financial outcomes as measured by profit margins were poorer at acquirer hospitals than other for-profits; in contrast, target hospitals tended to be more profitable than other for-profit facilities. Clinical performance as given by risk-adjusted patient survival and readmission rates were also somewhat poorer for acquirer hospitals, while target facilities and other for-profits performed better on this dimension.

4. Results

4.1. Input Use

We first explore whether and how hospitals' use of key inputs changed after the merger. We focus on EMRs, a major capital input in the hospital production process; the flows of physician labor; hospital staff employment and capital investments; and, finally, flows of hospital managers. Our foci reflect the stated mechanisms by which the acquirer claimed it would improve performance at the target facilities. In the appendix, we show that our findings are similar restricting to observations with complete data on all inputs and financial measures (Appendix Table 1) as well as adding area-year controls, which addresses concerns that input utilization was on differing trajectories in acquirer and/or target hospital geographic areas compared to areas with other for-profits (Appendix Table 2).

4.1.1. *Electronic Medical Records*

A major planned initiative of the acquiring firm was to install its EMR system. Panel A of Figure 1 shows the evolution of the fraction of hospitals that had installed the system. Prior to the merger, the acquirer was still in the process of rolling the system out internally. Three years before the merger, 70 percent of its hospitals used the system; this rose to 86 percent by the time of the merger. As expected,

none of the target hospitals had installed EMRs from this relatively niche vendor before the merger, but the rollout began soon after. While progress in the first post-merger year was modest, it quickly accelerated. Three years after the merger, a third of target hospitals had installed the EMR system. By the fifth year that had risen further to just under 58 percent, where it plateaued. In target hospitals, we also noted a pattern of de-adoption of chain-specific EMRs during the post-merger period: 59 percent of target hospitals de-adopted a vendor they uniquely used while 34 percent de-adopted a self-developed EMR system.

These patterns strongly suggest that the target hospitals came to harmonize their EMR system with the acquirer's. To formally verify that such harmonization occurred, we calculate for each hospital in each year the average EMR discordance between it and the acquirer hospitals. Our measure of discordance between two hospitals is the count of vendors that have only been adopted by one hospital and not both. Column 1 of Table 2 presents regression results with this average as the outcome, and they confirm the visual findings: the discordance between the target and acquirer dropped sharply after the merger (relative to the same metric between other for-profits and the acquirer). The 2 unit decline is equivalent to, for example, the target chain de-adopting its own system and adopting the acquirer's system. Panel B of Figure 1 presents an event study version of this regression and shows that the harmonization of EMR systems begins shortly after the merger.[4]

4.1.2. *Physician Flows*

According to the acquirer's filings around the time of the merger, they expected to produce gains by expanding patient volume through aggressive recruitment and retention of new physicians, leveraging a centralized physician recruitment program that had been successfully used in prior years

[4] For symmetry with the other differences-in-differences and event study analyses, these exhibits also plot acquirer effects. When the focal hospital is in the acquirer chain, the outcome measures its discordance from other hospitals in its own chain. We generally find negative acquirer effects indicating that the acquirer also harmonized EMR systems across its legacy hospitals.

in legacy hospitals. To examine whether the merger led to the intended change in physician labor flows, we track the arrival and departure of physicians at hospitals using Medicare emergency department and inpatient claims data.[5]

We focus on physicians who are entering (they appear at the focal hospital in year t but not $t-1$) and exiting (they appear at the hospital in $t-1$ but not t). The hospital's entry rate is defined as its charges for patients treated by entering physicians in year t scaled by the hospital's average total charges for all patients in years t and $t-1$. Its exit rate is its charges for patients treated by exiting physicians in $t-1$ divided by the same denominator. We also measure the churn rate, defined as the sum of entry and exit rates (see appendix for more details on these measures).

The stated aims of the acquirer imply a rise in churn at target hospitals after the merger. We investigate whether this happened by studying the flow measures as outcomes. The event study analysis in Panels A and B of Figure 2 confirms that physician entry and exit were similar at acquirer and target hospitals in the years leading up to the merger as well as the years following it, though we note one exception. Physician exit is statistically significantly elevated for one year after the merger in target hospitals before falling again, suggesting that the acquirer may have briefly been able to move this outcome. There is no corresponding increase in entry, however, and averaging over the entire post-merger period, we detect no significant effects of the merger on any flows for the acquirer nor the target in Table 2, columns 2-4.

4.1.3. *Employment and Capital Investments*

Next, we consider whether the acquisition was followed by significant changes in other labor inputs measured as Full Time Equivalent (FTE) employees or capital investments (Table 2, columns 5 and

[5] We identify physicians using the attending physician listed on each claim. During the sample period, claims data transitioned to a new physician identifier which disrupts our ability to calculate flows for the year after the merger (we cannot reliably crosswalk old and new identifiers). We therefore omit that year from all analyses of physician flows.

6). FTEs fall significantly at acquirer hospitals relative to other for-profits after the merger, while capital investment falls at target hospitals.. The event study illustrates the dynamics of these results. In Panel C of Figure 2, we see that FTEs at hospitals in the merged chain begin a steady decline after the merger, particularly at acquirer facilities. Panel D shows that capital investments in acquirer hospitals have a large, significant, and transitory decline in the year of the merger, suggesting that these facilities engaged in short-term divestments. In contrast, cutbacks in capital investments at target facilities develop after the merger and are more persistent.

4.1.4. *C-Suite Flows*

In this section we examine the extent to which the acquisition was followed by the replacement of key managers in the target hospitals. We focus specifically on CEOs, and study whether target hospitals experienced an acceleration of turnover at top management levels and, to the extent that this was the case, whether the newly appointed managers were drawn from the pool of managers that had worked in the past with the acquirer.

Using AHA hospital survey data, we track anyone who was a CEO of one of the acquirer or target chain's hospitals over our sample, allowing us to see work history for each manager before and after the acquisition year. We proceed in three steps. Starting with acquirer and target hospitals at the time of acquisition, we restrict to those that have non-missing CEO names for at least 10 years over the period spanning 2004 and 2014, yielding 58 acquirer hospitals and 37 target hospitals. Second, we identify managers who have a CEO role for at least one year in one of these hospitals in the same time period. Third, we use the full AHA data to reconstruct the careers of these key executives, identifying whether they held a CEO position in another hospital prior to their appointment and whether that hospital belonged to the target, the acquirer, or an entirely different network.

We identified 316 acquirer and target CEOs during the analysis period.[6] The average CEO in the sample holds this position at 1.44 hospitals for managers ever employed by the acquiring chain, 1.43 hospitals for managers ever employed in the target chain, and 1.30 hospitals for managers ever employed by other for-profit chains (these statistics are computed across the years included in our sample). The average CEO tenure is 2.74 years at acquirer hospitals, 3.51 years at target hospitals, and 3.35 years at other for-profit hospitals.

The data show significant CEO turnover within the acquirer and target chains. In every given year between 2004 and 2014, 29% of acquirer hospitals, 20% of target hospitals and 22% of other for-profit hospitals experience a CEO change. These rates are elevated relative to turnover in other industries and other hospital contexts internationally.[7] Turnover was quite variable over time and occurred in waves, particularly compared to turnover at other for-profit facilities (Appendix Figure 2).

The patterns of turnover suggest that the acquirer sought to bring in new management at the facilities it had taken over and did so partly by sending its incumbent CEOs to these hospitals. In the year before acquisition, CEO turnover at target hospitals was similar to other for-profits (turnover was 22% in the target vs. and 24% in other for profits). Turnover rates at target hospitals rose substantially in the year after the acquisition, with another wave two years later. Acquirer hospitals also saw waves of turnover during this time. In contrast, other for-profit hospitals had stable turnover rates through the period.

A look at the job history of the newly appointed CEOs is instructive about the nature of the management turnover within target hospitals (Figure 3 and Appendix Table 3). In the years leading

[6] The subsequent statistics on these CEOs do not match those in Table 1 because we show them for the entire analysis period while Table 1 shows them for 2006, the year before the merger.
[7] For example, English NHS hospital CEOs spend an average of 3.7 years per hospital and 20% of hospitals have a newly appointed CEO in a given year (Janke et al., 2019); at Fortune 500 firms, only 17% appoint a new CEO annually from 2000 to 2007 (Kaplan and Minton, 2012).

up to the acquisition, newly appointed CEOs at target hospitals were all CEOs at other target hospitals, CEOs at other hospitals outside the acquiring chain, or were not a CEO at any hospital at all. Soon after the acquisition, however, there began a steady influx of managers who had been CEOs in the acquirer's hospitals in years prior. The influx of managers in target hospitals with experience within the acquirer's system is even larger when we focus on first-time CEOs.[8] 61% of these newly appointed CEOs had been previously employed in an acquirer hospital in a non-CEO role while 30% came from the target's hospitals. In other words, the years after the acquisition are characterized by a steady influx of target hospital CEOs who were either entirely new or had experience within acquirer's hospitals, and a steady decline of CEOs with origins in the target chain.[9]

4.1.5. *Management Practices*

We now turn to an aspect of acquisitions that we are usually unable to observe: whether the merger resulted in the harmonization of managerial practices between the target and acquirer firms. For context, the acquirer referred in public communications to its ability to disseminate and share managerial best practices across its hospitals—such as, for example, data standardization and the implementation of evidence-based methods in clinical care—to drive clinical and financial performance post acquisition.

To examine whether the acquisition resulted in the adoption of similar management practices across the chain, we collected data on the managerial processes used in subsets of both legacy and acquired hospitals using the World Management Survey (Bloom et al., 2020; Bloom and Van Reenen, 2007). The WMS instrument can measure the adoption of basic managerial practices across

[8] To assess whether these managers held non-CEO positions in acquirer hospitals, we conducted manual internet searches, including press releases and LinkedIn resumes, of the 26 new CEOs at target hospitals in the 3 calendar years after the merger. We focus on the 88% of these CEOs for whom we could find employment histories.
[9] We also investigated the qualifications of the new CEOs and found the share at target facilities who had clinical qualifications (i.e. graduate medical or nursing degrees) declined from 81% before the merger to 63% after.

organizations in manufacturing, healthcare and education.[10] The evaluation tool for healthcare scores a set of 20 basic management practices on a grid from one ("worst practice") to five ("best practice") in four broad areas. The *operations* section asks managers about the adoption of basic lean management practices; the *monitoring* section asks managers about their collection and use of information to monitor and improve the healthcare delivery process; the *targets* section asks about the design, integration, and realism of clinical and financial targets (separately); and the *human resource management* section asks about non-managerial and managerial bonus, promotion, and reassignment/dismissal practices.[11] Each question is scored on a 1-5 scale in which low values represent a very limited adoption of the specific practice and high values instead denote a high adoption of the practice. The management index is the average of scores on all 20 questions.

We ran the data collection in 2015 as part of a research study conducted with the support of the acquirer's top management team.[12] For the purposes of the study, we deployed both the standard WMS instrument—which is typically directed only at clinical managers (i.e. Chief Medical Officers, Chief Nursing Officers, Chiefs of Surgery, Directors of Surgery)—and a shortened and modified version of the survey for non-clinical managers (CEOs, COOs, and CFOs). The acquirer provided a list of hospitals they deemed suitable for the study (primarily to exclude hospitals that were likely to be divested during the year of the interviews), and contact information for managerial positions eligible for the survey. The survey was then announced in internal town hall meetings and through email communications, which clarified that the interviews were entirely voluntary, and that any data collected

[10] See Bloom et al. (2020, 2015, 2012) for earlier uses of the WMS in acute care hospitals.
[11] The survey instrument is available as an online attachment to this manuscript. A review of the instrument is available at https://worldmanagementsurvey.org/survey-data/methodology/
[12] The sampling frame included 38 hospitals in 2015, of which 11 were hospitals that were part of the acquirer chain prior to the acquisition, 18 were part of the target chain, and 9 were acquired in later years. The data was collected and saved in a password protected server not accessible by the acquirer, and the results of the survey were shared with the acquirer only in the form of hospital averages, and only if the within hospital sample was large enough to avoid disclosure of individual responses.

would be shared with the acquirer only in aggregate form, and on the condition that the anonymity of individual participants could be protected.

We hired and managed a team of interviewers to conduct the survey through in-depth phone interviews, using the standard WMS methodological approach to gather unbiased, high quality information (Bloom et al 2020). We were able to conduct interviews at 34 of the 38 hospitals that were selected, and 70 individuals were interviewed at these facilities. To maintain comparability with the rest of the WMS data we focus on the set of interviews conducted with clinical managers. We also omit hospitals that were acquired by the chain after the focal merger of this study. We end up with a final sample of 49 interviews conducted across 23 hospitals. When multiple interviews per hospital were available, we average them to obtain a single hospital management score.

We compare these data with WMS interviews of a sample of US hospitals conducted in 2009 with the same instrument and restricting to hospitals that were part of chains other than the target or acquirer (see Bloom et al., 2012 for more information). The subset of the WMS sample that we analyze includes data for 157 hospitals across 95 chains; for 29 of the chains we have data on multiple hospitals. While far from perfect, this data allows us to measure the extent to which the acquirer was able to enforce a common set of management practices across its hospitals, focusing in particular on the target facilities relative to facilities that had been part of the acquirer chain for longer. Through the WMS sample, it also facilitates comparisons to other hospitals in the US.[13]

We use this sample to estimate the average management score at the chain level as well as the variation in the score. We report the variation in management scores across hospitals in the merged chain as well as the subset of hospitals in the acquirer and target groups. To benchmark this variation,

[13] Given the limited sample size, we limit the analysis to the comparison of the raw management scores, i.e. without controls for hospital characteristics, and do not restrict the WMS sample to only for-profit facilities. Limiting the WMS sample to for-profits (N=28) yields qualitatively similar results, although as expected, they are more imprecise.

we report the within-chain variation in the WMS sample by estimating a model with random effects for chains and reporting the standard deviation of the residual.

This analysis is shown in Table 3. Three results are of note. First, hospitals in the WMS sample have significantly higher management scores than acquirer hospitals ($P<0.001$) and target hospitals ($P<0.01$). Second, the within-chain variation in the management scores in the WMS sample is higher than variation in scores at acquirer hospitals ($P=0.06$) and at target hospitals ($P=0.01$)—the difference is significant at the 10% level for the former comparison and at the 5% level for the latter. Third, though the sample is relatively small for this comparison, the target hospitals appear very similar to the acquirer hospitals, which had been part of the chain for a longer time period at the time of the survey, both in terms of average management scores and variations thereof. We fail to reject that the means and standard deviations of the two groups differ. In other words, while not necessarily converging to an industry-best level of managerial quality (at least according to the WMS scoring grid) the data supports the idea that the chain was able to enforce a common set of practices across its hospitals some years after the acquisition.

4.2. Financial Outcomes

We now investigate the effects of the merger on financial performance at the chain's hospitals. We begin by focusing on hospital costs and prices, metrics which have been the focus of much of the prior literature on merger effects. Table 4 reports the results. In column 1, we show that the merger raised costs per inpatient discharge by 10 percent (10 log points) at acquirer facilities, an economically large and statistically significant change, but had no detectable impact on costs at target hospitals.[14] In

[14] We investigated the sources of these cost increases at acquirer hospitals by analyzing finer measures. Of the 7 broad categories of costs that are consistently reported in the HCRIS data, we only detected increases in one category, general service costs, which account for 60% of the total at acquirer facilities. Within that broad category, we saw statistically significant increases in the following cost lines (the finest level at which costs are reported in data): central services/supply, medical records, nursing administration, pharmacy, capital equipment, and laundry. A key caveat to interpreting these findings is that the values for these narrow cost components were often set to zero, raising the possibility of mismeasurement. Still, for completeness we report these findings in Appendix Table 5.

column 2, we analyze the effect of the merger on estimates of hospital prices for non-Medicare patients (our approach is similar to that of Dafny, 2009 and Garmon, 2017; see appendix for more details). Point estimates show a statistically significant and economically meaningful rise in prices at acquirer facilities of 37 percent (32 log points), while effects for target facilities are 11 percent (11 log points) but not statistically significant. Column 4 reports that revenues per inpatient discharge rose significantly at acquirer facilities (5 percent or 5 log points). We do not find a significant effect on revenue per bed for target hospitals. Overall, the increase in revenues at acquirer facilities change was outpaced by the cost increases reported in column 1, resulting in a statistically significant deterioration in hospital profit margins (computed as revenues less costs divided by revenues) of 3.3 percentage points, as shown in Column 4.

We investigate the trajectories of profit margins in more detail in an event study depicted in Figure 4. It shows flat pre-trends for acquirer hospitals and, if anything, slight upward (though not pointwise statistically significant) pre-trends for target facilities. After the merger, however, there is divergence. While the target hospitals saw at best a transitory and statistically insignificant improvement, profitability at the hospitals already owned by the acquiring firm prior to the merger slipped continuously throughout the post-merger period. Relative to other for-profit hospitals, profitability at these facilities declined by a bit under 1 percentage point per year. These visual patterns align with the point estimates in Table 4. They demonstrate that the profitability of target hospitals failed to detectably grow post-merger relative to other for-profit facilities. On the other hand, profits at the acquirer's existing hospitals fell significantly relative to other for-profits.

The results were similar restricting to hospital-years with data on all inputs and financial measures, though the price and revenue gains for acquirer hospitals were attenuated (Appendix Table 4). Findings were also qualitatively similar when we augmented this model with area-by-year effects to account for the potential for the focal chains to locate in areas on differing profitability trajectories

(Appendix Table 6). This specification therefore compares performance of hospitals in the same geographic area, which we define as Dartmouth Hospital Referral Regions (Wennberg et al., 1996). One subtle difference is that the effect on acquirer profitability attenuates, indicating that the drop in the profitability of the acquirer chain's hospitals was due partly to the declining profitability of the areas in which they were located.

4.3. Clinical Outcomes

We now examine key clinical outcomes before and after the acquisition: patient survival and readmission rates.[15] Using Medicare inpatient claims and enrollment files, we develop four cohorts of emergency patients for whom these outcomes are commonly studied and particularly relevant: acute myocardial infarction (also known as heart attack), heart failure, pneumonia, and stroke. These are all serious health conditions with significant risk of death and further hospital admissions. We focus on hospital-level survival and readmission rates for patients in these cohorts because they are tracked by CMS as inputs into its hospital performance incentive programs and they are publicly reported as quality measures on the CMS Hospital Compare website. Patient survival is also a key outcome of clinical trials for emergency conditions like the ones we study (see e.g. Keeley et al., 2003) while high readmission rates are widely regarded as a sign of low-quality care and have become an important input in hospital pay-for-performance schemes (Gupta, 2020; Jencks et al., 2009).

The cohorts consist of the inpatient admissions of patients for the given condition. We exclude admissions if the patient was previously hospitalized for the condition within the past year to remove follow-up care. We track whether each patient survives 30 days from admission or is

[15] Our approach is adapted from Chandra et. al. (2016), and readers may consult that study for full details on how the cohorts are assembled, how survival and readmission are measured, and how illness histories (called risk-adjusters) are constructed. We note two key changes from its methods: we use different three-year periods (described in the current text) and we construct a stroke patient cohort instead of a hip and knee replacement cohort. The latter change allows us to track survival and readmission for all the cohorts (CMS does not track hip and knee replacement survival as a hospital performance metric because these surgeries tend to be elective with very high survival rates).

readmitted as an inpatient to any hospital within 30 days of discharge. The data also include indicators for patient demographics (age-race-sex interactions) as well as controls to adjust for patient risk factors and severity of illness (we construct indicators for 25 key illness histories, defined as having a diagnosis for the illness on an inpatient stay in the past year).[16] Studies have cross-validated this approach to estimating hospital quality for emergency patients and found it correlates strongly with quality as measured by patients quasi-randomized to hospitals (Doyle et al., 2019; Hull, 2020)

To improve precision, we group years into four periods: 2004-2006 (pre-merger), 2008-2011 (early post-merger), and 2012-2014 (late post-merger); we omit 2007 (the merger year) to remove temporary implementation effects. Then, for each cohort c in each period t, we estimate clinical outcomes (survival rates, readmission rates) for all hospitals h adjusting for differences in patient severity. Specifically, we run regressions of patient survival and readmission, respectively, on hospital fixed effects, patient demographics, and patient illness histories. We extract the estimates of hospital fixed effects and define them as the adjusted outcomes measures (o_{cht}); they capture hospital-level survival and readmission rates purged of the observed aspects of patient severity.

We then augment equation (1) to produce the following "stacked" regression model to assess the impacts of the acquisition on our severity adjusted measures of clinical outcomes:

$$o_{cht} = \alpha_{ct} + \delta_{ch} + \beta_A acquirer_h \times post_t + \beta_T target_h \times post_t + X_{cht}\rho_c + \varepsilon_{cht}, \quad (2)$$

where X_{cht} allows for additional controls for robustness analyses.

We focus first on survival. Column 1 of Table 5 reports the results, which do not indicate any post-merger improvement in survival outcomes at acquirer or target hospitals relative to the

[16] In the stroke cohort, we additionally control for whether the stroke was ischemic or hemorrhagic.

trajectories of other for-profits. The point estimates are negative but small and statistically insignificant. The estimate for target hospitals indicates a 0.2 percentage point drop in average survival rates off a base of 89%. The implied 0.6 percentage point decline in survival at the acquirer's hospitals is larger in magnitude but also does not rise to the level of statistical significance. Regardless, the point estimates show that if anything, survival outcomes deteriorated due to the merger, particularly at acquirer facilities.

We next turn to readmission rates. Column 2 of Table 5 shows that target hospitals saw a small but statistically insignificant rise in their readmission rates after the merger relative to other for-profits. Acquirer hospitals saw small but statistically significant declines in readmissions. The implied drop among acquirer hospitals is modest, a 0.7 percentage point drop off a pre-merger average of 15%. It is notable that this is the one beneficial result (financial or clinical) of the merger that we find among the acquiring chain's hospitals—yet taken together with the estimated decline in survival of similar magnitude, it is hard to conclude that clinical outcomes improved overall even for this set of hospitals.

In Appendix Table 7, we add cohort-area-period fixed effects to allow us to capture flexible trends across geographies. Results are qualitatively unchanged; the drop in survival rates at acquirer hospitals becomes significant at the 10% level while the drop in acquirer hospitals' readmission rates becomes statistically insignificant, though the latter development is due to a reduction in statistical precision rather than an attenuation of the point estimate.

5. **Discussion and Conclusion**

Mergers are a critical part of the health care landscape and the economy more generally. In spite of their importance, there are significant gaps in the literature on the effects of mergers, and in particular the organizational mechanisms which drive these effects. In this study we focus on a set of acquisitions by a single large hospital chain as a means of gaining deeper insight into the outcomes of mergers and the factors that drive them. By focusing on hospitals we are able to employ rich and detailed data on

inputs and outcomes that are tracked in existing and regularly collected administrative and survey data. We further augment these data with management surveys, which provide a window into the firm's organization. This permits us to look deeply and thoroughly into the effects of these hospital mergers on the firms involved and on consumers (patients).

We find evidence that the acquirer was able to exert some influence on intermediate inputs in the production process at target hospitals. In particular, it harmonized their health IT systems with its own and sent its personnel to manage the acquired facilities. Target and acquirer hospitals came to use similar managerial practices, although not necessarily high-quality ones. Yet, over the seven years following the merger, there is little sign that clinical or financial performance improved at targets. Meanwhile, financial outcomes at facilities already part of the acquirer chain deteriorated almost continuously, a potential unintended consequence of shifting resources to targets. These patterns align with those of Schoar (2002), who suggested that mergers can damage the performance of incumbent divisions due to an outflow of resources to newly acquired entitles, a "new toy" effect.

Our findings provide lessons for future research on mergers in health care and other sectors. The prior literature has largely and appropriately focused on estimating the average effect of mergers. This approach aggregates together a variety of mergers in which acquirers may have intended to influence performance through differing organizational channels. As a consequence, this work does not typically uncover the mechanisms that drive merger outcomes. For example, when mergers fail to generate benefits on average, it is hard to know whether this failure reflects poor implementation of useful changes, good implementation of ineffective changes, or no implementation of changes at all. This perspective connects to work on performance differences related to managerial pathologies (Gibbons and Henderson, 2012).

Our approach is to leverage a mega-merger as a case study, benchmarking the changes we see at the target and acquiring hospitals against those the acquiring firm planned to implement, evaluating

whether their intended organizational changes materialize and whether they lead to improved outcomes for the firms and for patients. By using rich data on hospital inputs and outputs, and following the facilities for an extended period, we demonstrate that the promised efficiencies from the merger ultimately fail to materialize. Future research can further our understanding of the mechanisms of mergers by opening the black box of organizations, systematically studying how management processes and the managers who influence them flow within the firm.

We note a key puzzle of this merger: the organization we study was financially motivated to change and improve, yet the merger led to no clear benefits in hospital performance. In this way, the effects closely align with existing findings that hospital mergers fail to improve patient care. Our evidence on mechanisms suggests that of all the levers it could have moved to raise performance, the chain exerted its strongest influence on those that were straightforward to implement, but likely to have little payoff absent changes in other complementary organizational factors: it purchased new health information technology and moved around its CEOs. It is particularly hard to imagine substantial benefits from these interventions, given that pre-merger outcomes at the target facilities tended to be superior to those of acquirer facilities.

Regarding merger policy, our findings provide a new perspective for antitrust authorities evaluating the claimed efficiencies of mergers. We show the value of taking an organizational view that considers the stated aims of the merger, how the firm intends to implement these aims internally, and whether these changes are likely to yield performance improvements. Such an approach could help to evaluate merging parties' efficiency claims and assess the likelihood they will be realized post-merger. This would help sharpen assessment of the efficiency claims that are made in every merger, debunking those that are implausible and have little support, and helping to identify "good mergers" (Dafny and Lee, 2015). For example, in the case of the merger we evaluate in this paper, an evaluation of the acquirer's stated organizational strategies would have raised skepticism that the acquirer's

approach to the merger (having the target adopt its technology and practices) would improve quality or cut costs.

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Tables

Table 1: Descriptive Statistics on Acquirer, Target, and Other For-Profit Hospitals in 2006

	(1) Acquirer Hospitals	(2) Target Hospitals	(3) Other For-Profits
Beds	119.1	171.5	175.4
	(79.7)	(81.4)	(144.2)
Rural	0.667	0.250	0.234
Has acquirer EMR vendor	0.860	0.000	0.063
Physician churn rate	0.084	0.078	0.087
	(0.058)	(0.055)	(0.076)
FTEs	481.9	729.1	660.8
	(329.0)	(382.7)	(582.2)
Capital investments ($millions)	5.471	4.787	5.625
	(6.779)	(13.26)	(7.568)
Tenure of CEO in 2006 in years	2.103	2.405	2.321
	(0.852)	(0.832)	(0.839)
Has a new CEO in 2006	0.310	0.216	0.235
Profit margin	0.040	0.058	0.047
	(0.088)	(0.072)	(0.093)
Price Index (Mean = 100)	68.58	81.89	107.0
	(98.02)	(89.51)	(105.0)
Costs per inpatient ($)	6,659.8	8,142.9	8,280.2
	(1,573.9)	(1,989.3)	(3,008.2)
Revenue per inpatient ($)	7,107.0	8,833.1	8,700.2
	(2,032.2)	(2,373.0)	(3,156.4)
Survival rate*	0.879	0.894	0.893
	(0.032)	(0.033)	(0.036)
Readmission rate*	0.150	0.126	0.138
	(0.031)	(0.019)	(0.030)
Hospitals	57	36	350

Notes: Each cell reports an average (or, if in parentheses, standard deviation) for the given hospital characteristic in 2006, the year before the merger. Profit margins, capital investment, price index, costs, and revenues are winsorized at 5% on each side. Costs and revenue are measured in millions of dollars per inpatient (specifically, we divide costs and revenues by the measure of adjusted inpatient discharges laid out in Schmitt, 2017).

* 30-day survival or readmission rate for each hospital defined as the average of its rate across 4 cohorts (acute myocardial infarction, stroke, hip fracture, and pneumonia) after adjusting for patient risk factors as described in the main text.

Table 2: Inputs

	(1) No. of Discordant Vendors	(2) Physician entry rate	(3) Physician exit rate	(4) Physician churn rate	(5) Log of FTE	(6) Log of 1 + capital investment
Post * Acquirer	-1.292***	0.008	-0.001	0.007	-0.091***	0.065
	(0.163)	(0.011)	(0.006)	(0.011)	(0.027)	(0.084)
Post * Target	-2.047***	-0.002	0.005	0.003	-0.029	-0.308**
	(0.247)	(0.007)	(0.004)	(0.009)	(0.033)	(0.125)
Observations	3538	4562	4562	4562	5267	4554

Notes: This table displays the results of estimating equation 1 with hospital input measures as the outcome. Each observation is a hospital-year. All regressions include hospital and year fixed effects. Column 1 studies the count of discordant EMR vendors between the hospital and the acquirer; higher values of this outcome mean the hospital and the acquirer tend to use different vendors. Columns 2-4 study physician flows: the share of the hospital's Medicare charges for patients who are new to the hospital (physician entry rate), the share by physicians who are leaving the hospital (physician exit rate), and the sum of entry and exit rates (physician churn rate), respectively. The text provides more details on the definitions of these measures. Column 5 studies the logarithm of full time equivalent (FTE) employment. Column 6 assesses the logged value of 1 + capital investment (we add unity to accommodate hospitals with no capital investment in a year); this outcome is winsorized at 5% on each side in each year. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Table 3: Management Practices

	(1) Average Score	(2) Standard Deviation	(3) Observations (Hospitals)	(4) Chains
1. Merged Chain	2.81 (0.06)	0.27 (0.04)	23	1
a. Acquirer	2.74 (0.09)	0.30 (0.06)	11	
b. Target	2.87 (0.07)	0.24 (0.05)	12	
2. WMS sample	3.08 (0.04)	0.43 (0.03)	157	91

Notes: Table reports the average and standard deviation of management scores across hospitals. Row 1 reports these statistics for the merged chain, consisting of the acquirer and target hospitals. Rows 1a and 1b report statistics for only acquirer and target hospitals, respectively. Row 2 reports the statistics for the WMS sample; the reported standard deviation is within-chain. Standard deviations are the derived from restricted maximum likelihood models (all rows) absorbing random effects for chains (row 2 only). See text for more details. Standard errors in parentheses.

Table 4: Financial Outcomes

	(1) Log of costs per inpatient	(2) Log of price index	(3) Log of revenue per inpatient	(4) Profit margin
Post * Acquirer	0.095***	0.318**	0.049**	-0.033***
	(0.020)	(0.134)	(0.022)	(0.010)
Post * Target	-0.003	0.105	0.015	0.009
	(0.028)	(0.092)	(0.026)	(0.010)
Observations	5257	4879	5257	5242

Notes: This table displays the results of estimating equation 1 with hospital financial measures as the outcome. Each observation is a hospital-year. All regressions include hospital and year fixed effects. Columns 1 and 3 study the logged costs and revenue, respectively, per inpatient discharge (specifically, we divide costs and revenues by the measure of adjusted inpatient discharges laid out in Schmitt, 2017). Column 2 studies a logged measure of prices for non-Medicare patients. Column 4 studies the profit margin, defined as income less costs divided by income. These measures are winsorized at 5% on each side in each year. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

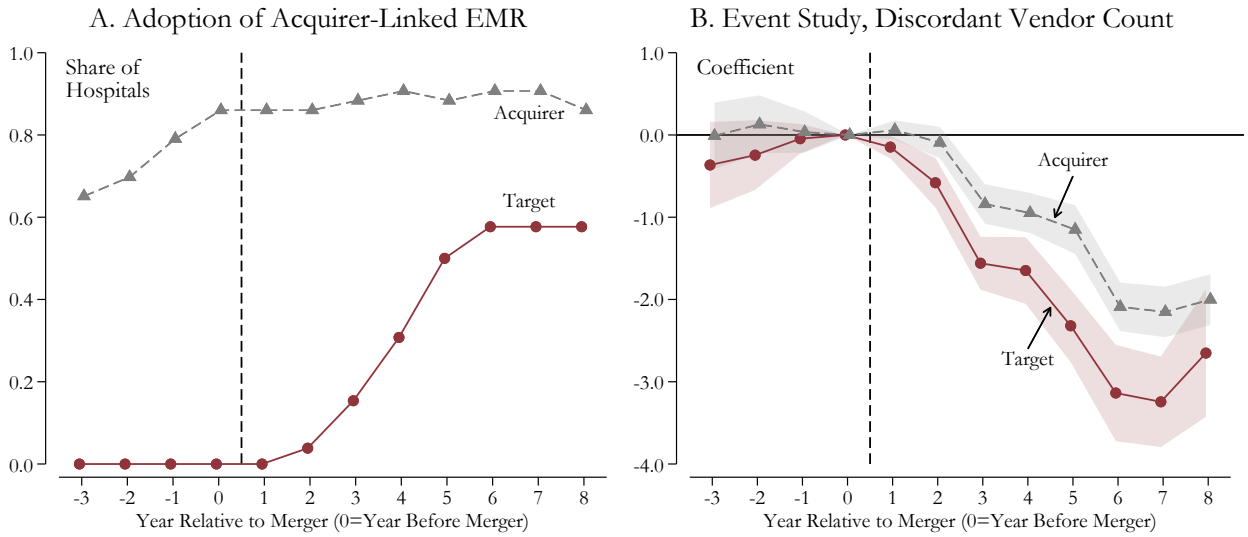
Table 5: Clinical Outcomes

	(1) Survival	(2) Readmission
Post * Acquirer	-0.006	-0.007**
	(0.004)	(0.003)
Post * Target	-0.002	0.005
	(0.004)	(0.004)
Observations	5610	5610

Notes: This table displays the results of estimating equation 2 with patient clinical measures as the outcome. Each observation is a cohort-hospital-year group. The cohorts are acute myocardial infarction, heart failure, pneumonia, and stroke. The year groups are 2004-2006, 2008-2011, and 2012-2014. All regressions include hospital-cohort and year group-cohort fixed effects. The clinical measures are derived from a first-stage patient-level regression of survival or readmission on hospital fixed effects adjusting for patient demographics and risk factors. A separate first-stage regression is run for each cohort-year group. The hospital fixed effects are extracted and can be interpreted as risk-adjusted outcomes for each cohort-hospital-year group. See text for more details. Column 1 studies risk-adjusted 30-day survival from hospital admission. Column 2 studies risk-adjusted 30-day survival from hospital discharge. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

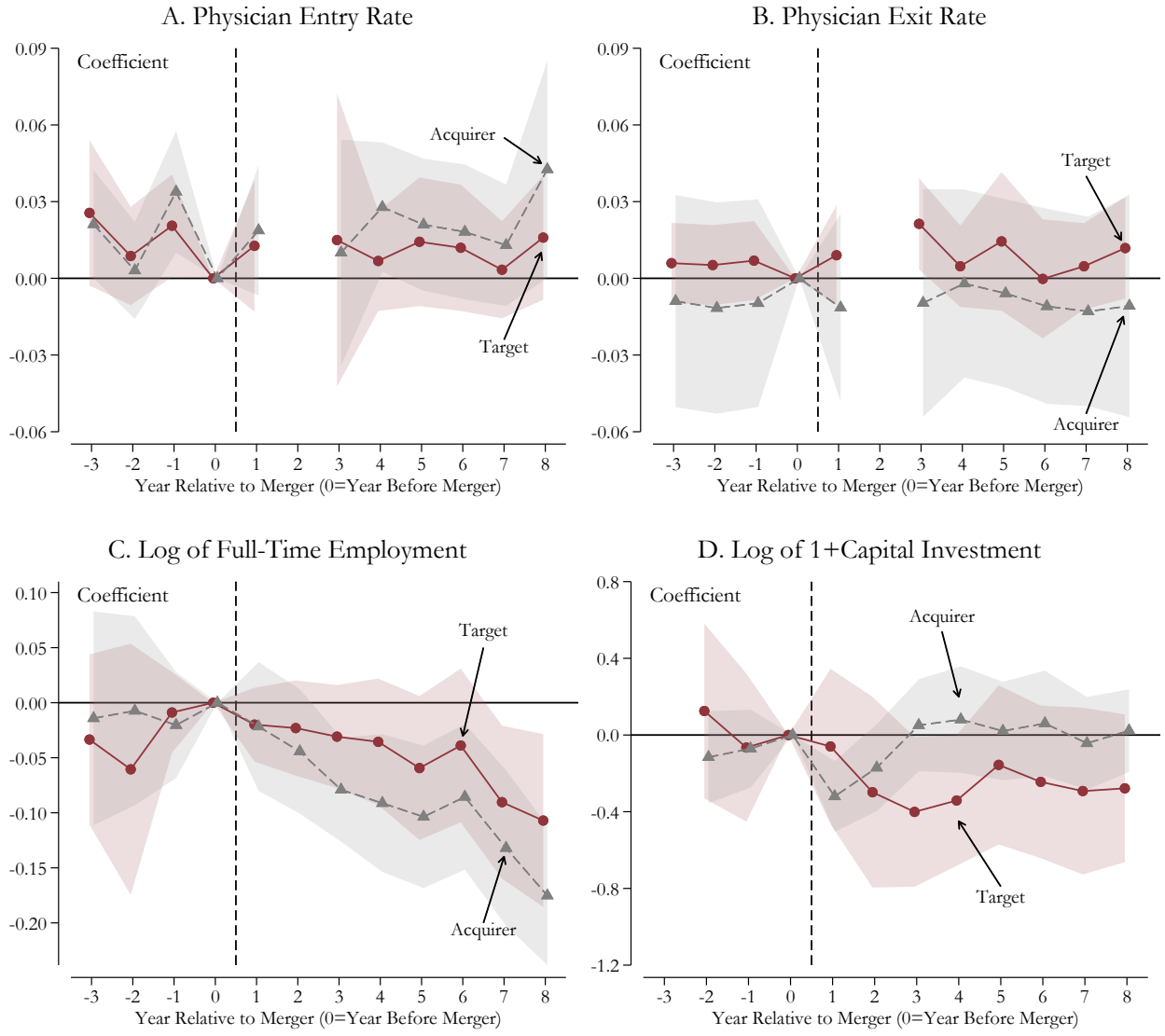
Figures

Figure 1: Effect of Merger on Health Information Technology Inputs



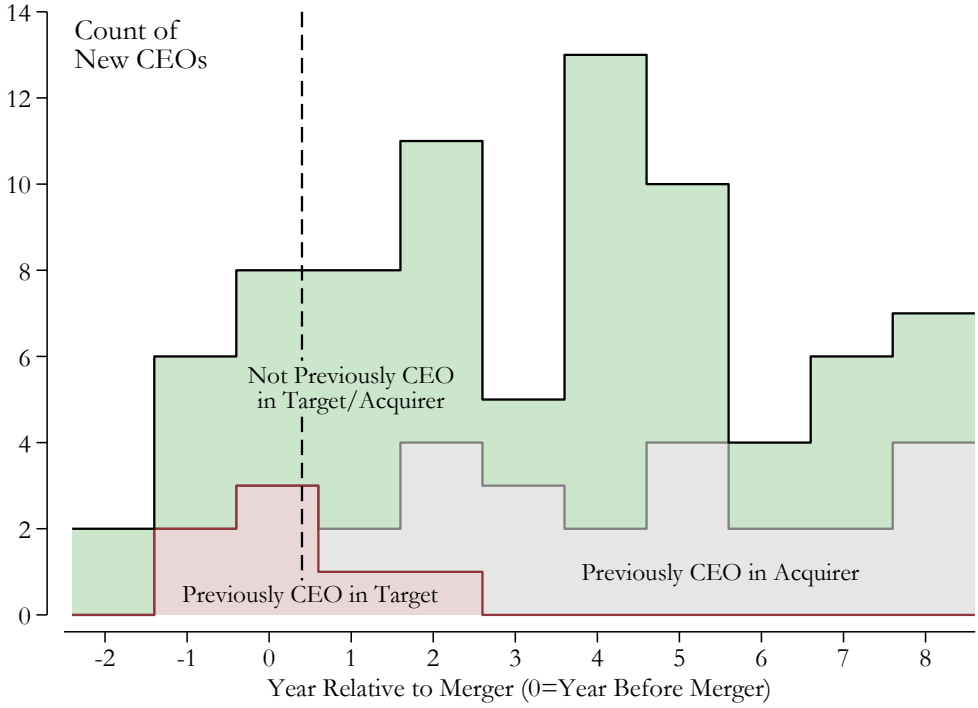
Notes: This figure shows the evolution of health information technology vendors at acquirer and target hospitals before and after the merger. Panel A depicts the share of hospitals in the two chains that have adopted an EMR vendor closely linked with the acquirer. Panel B depicts event study estimates of the effect of the merger on dissimilarities in EMR vendors. Specifically, it estimates an event study version of equation (1) in which the outcome is a measure of EMR dissimilarity between the focal hospital and the acquirer. This outcome is defined as the average number of EMR vendors with discordant adoption status between the focal hospital and hospitals in the acquirer chain. The event study is normalized to the year before the merger. Shading represents 95% confidence intervals derived from robust standard errors clustered at the hospital level. The vertical dashed line depicts the time immediately before the merger.

Figure 2: Event Studies of Merger Effects on Physician Flows, Employment, and Investment



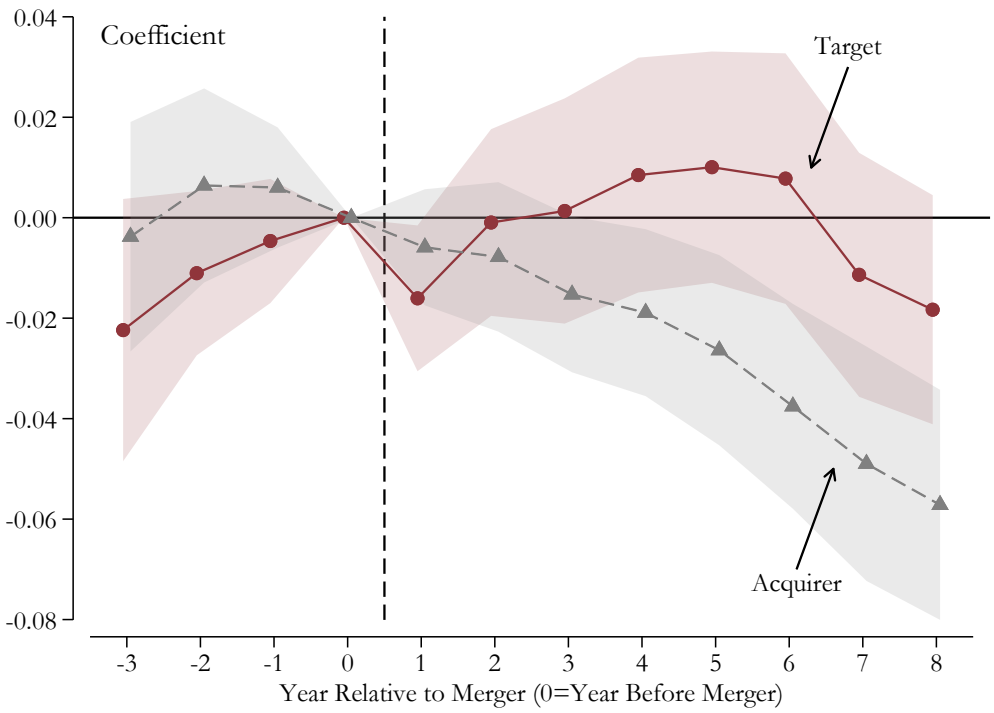
Notes: This figure shows event study estimates of the effect of the merger on physician flows, hospital employment, and capital investment at acquirer and target hospitals. Specifically, it estimates an event study version of equation (1) in which the outcome is the physician entry or exit rate (Panels A and B), the logarithm of full-time employment (FTE) (Panel C), and the logarithm of 1 + capital investment (Panel D). We omit the year after the merger from the physician flows analyses because they are not observed due to a physician identifier transition. We add unity to capital investment to accommodate hospitals with no capital investment in a year; capital investment is also winsorized at 5% on each side in each year. See text for more details. The event study is normalized to the year before the merger. Shading represents 95% confidence intervals derived from robust standard errors clustered at the hospital level. The vertical dashed line depicts the time immediately before the merger.

Figure 3: Origin of New CEOs among Target Hospitals



Notes: This figure shows the number of new CEOs in a balanced panel of *N*=36 target hospitals, broken out by origin into those who were previously CEOs in the target chain, those previously CEOs in the acquiring chain, those who were not previously CEOs in either chain. See text for more details. The vertical dashed line depicts the time immediately before the merger.

Figure 4: Event Study of Profit Margin



Notes: This figure shows an event study of the effect of the merger on profits by estimating an event study version of equation (1) in which the outcome is the profit margin. Profit margins winsorized at 5% on each side in each year. See text for more details. The event study is normalized to the year before the merger. Shading represents 95% confidence intervals derived from robust standard errors clustered at the hospital level. The vertical dashed line depicts the time immediately before the merger.

Appendix To:

The Anatomy of a Hospital System Merger: The Patient Did Not Respond Well to Treatment

For Online Publication

A. **Constructing the Hospital Price Index**

To develop a price index for non-Medicare hospital payments, we draw on Dafny (2009), which notes an approach that relies on hospital cost report (HCRIS) data. We use the same data to construct our measure combined with public CMS data on hospital case-mix indexes (CMIs) in Medicare. Following Dafny (2009) and Garmon (2017), we define the price index as:

$$\frac{\text{Discounted charges} - \text{Medicare primary payer amount} - \text{Medicare total amount payable}}{\text{CMI} * (\text{Total discharges} - \text{Medicare discharges}) * 1000},$$

where Discounted charges is:

$$(\text{Inpatient routine service charges} + \text{Intensive care charges} + \text{Inpatient ancillary charges}) * \frac{\text{Net patient revenue}}{\text{Total patient charges}}.$$

B. Measuring Physician Flows

We track physician entry and exit across hospitals using Medicare claims data. First, we identify hospital claims using 100% data on inpatient stays and emergency department visits in each year. Second, we use the claims to construct a panel of physicians linked to hospital workplace(s). To identify hospitals, we use the hospital provider number on each claim. To identify physicians, we use the attending physician identifier on each claim.

The physician identifier available in the claims transitions during the 2006-2008 period from the Unique Physician Identification Number (UPIN) to the National Provider Identifier (NPI). UPINs are reported on the vast majority of claims through 2007 and NPIs are reported on nearly all claims beginning in 2008. We thus identify physicians using the UPIN through 2007 and the NPI starting in 2008. Since the flow measures for year t rely on data in years t and $t-1$, the change in identifiers leaves us unable to measure flows for the year 2008, and we omit this year from our analysis. To further omit cases where the identifier was not a physician, we limit the data to

individual provider UPINs (using the first character of the identifier) and NPIs (using the provider type code in the NPPES, the NPI directory).

As a final step, we aggregate the claims data to a construct a physician-hospital pair panel for all years excluding 2007. For each physician-hospital pair in each year, we sum the charges on the claims. The result in a panel of physicians matched to the hospitals in which they worked in each year along with information about charges accrued for their patients treated in the hospital inpatient and emergency department setting.

Using the panel, we define the following hospital entry, exit, and churn rates:

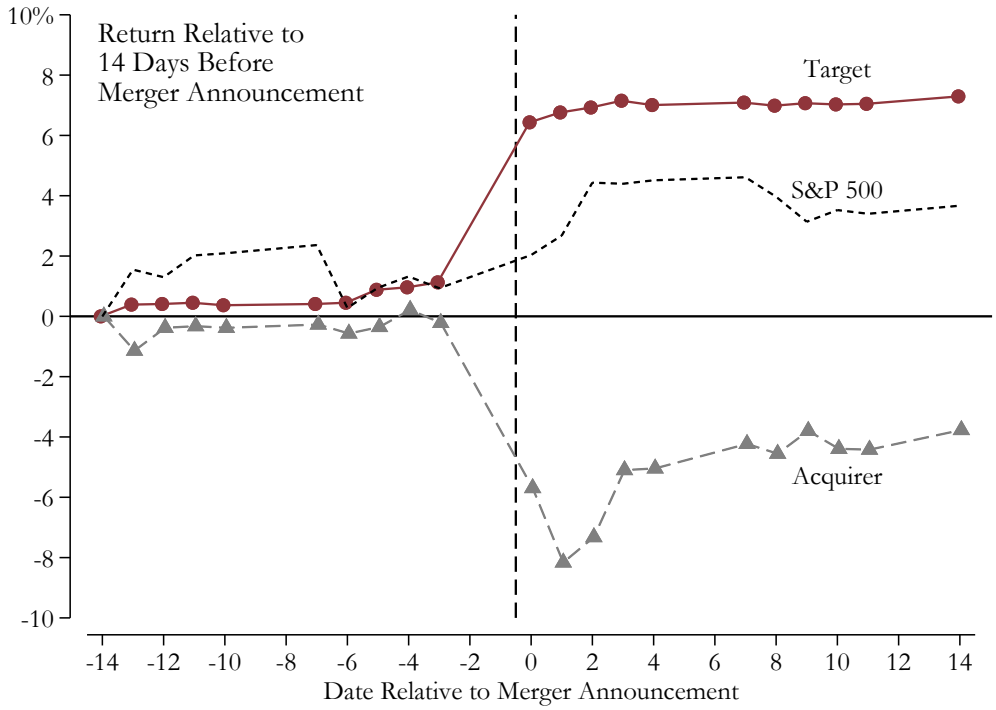
$$entry_{h,t} = \frac{\sum_{p \in E_{h,t}} charge_{p,h,t}}{\text{AVG}(charge_{h,t-1}, charge_{h,t})}, \; exit_{h,t} = \frac{\sum_{p \in X_{h,t}} charge_{p,h,t-1}}{\text{AVG}(charge_{h,t-1}, charge_{h,t})},$$

$$\text{and } churn_{h,t} = entry_{h,t} + exit_{h,t},$$

where p indexes physicians, h indexes hospitals, t indexes years, $charge_{p,h,t}$ is the total charges for all patients treated by the physician-hospital pair in that year, $charge_{h,t}$ is the total charges for all patients treated at that hospital in that year, $E_{h,t}$ is the hospital's entering physicians (they have charges at the hospital in t but not $t-1$), and $X_{h,t}$ is the hospital's exiting physicians (they have charges at the hospital in $t-1$ but not t).

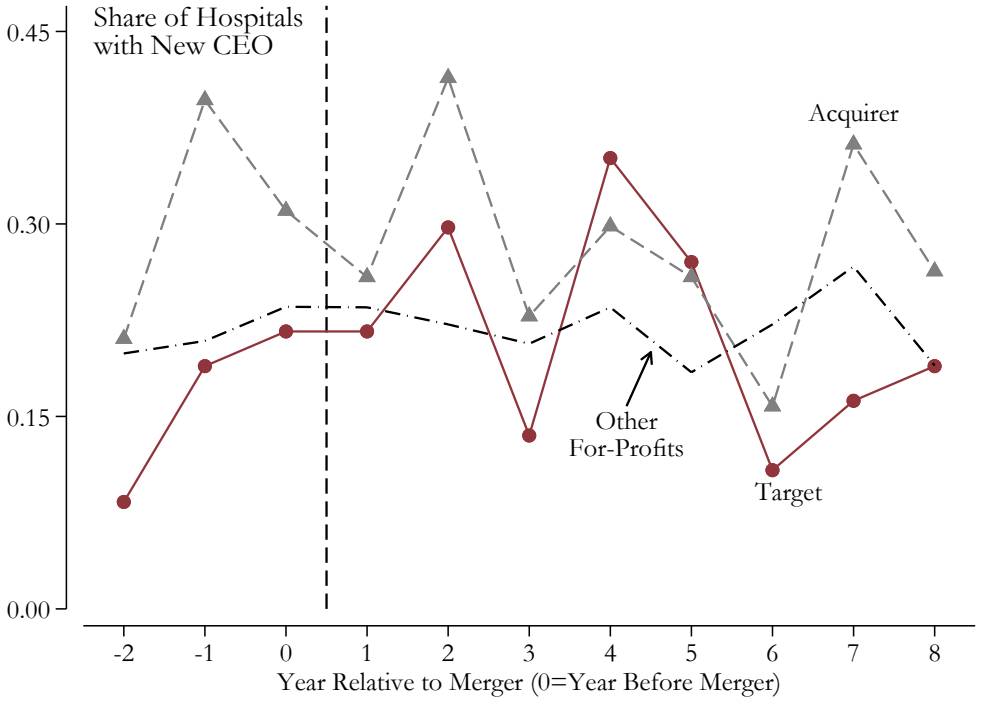
Appendix Figures

Appendix Figure 1: Stock Market Reaction to Acquisition Announcement



Notes: This figure depicts the evolution of stock returns for the acquirer and target firms from two weeks prior to the merger announcement to two weeks after it. Returns for the S&P 500 are shown as a point of comparison. Returns are relative to prices two weeks prior to the announcement. The vertical dashed line depicts the time immediately before to the merger announcement.

Appendix Figure 2 : CEO Turnover Rates



Notes: This figure shows the rate of CEO turnover at acquirer, target, and other for-profit hospitals. Turnover is defined as the share of hospitals in the group with a new CEO in that year. The vertical dashed line depicts the time immediately before the merger.

Appendix Tables

Appendix Table 1: Inputs (Robustness to Uniform Sample)

	(1) No. of Discordant Vendors	(2) Physician entry rate	(3) Physician exit rate	(4) Physician churn rate	(5) Log of FTE	(6) Log of 1 + capital investment
Post * Acquirer	-1.307***	-0.001	-0.002	-0.002	-0.064**	-0.000
	(0.166)	(0.007)	(0.006)	(0.010)	(0.029)	(0.093)
Post * Target	-2.142***	-0.004	0.006	0.002	0.001	-0.424***
	(0.261)	(0.007)	(0.005)	(0.009)	(0.045)	(0.140)
Observations	3305	3305	3305	3305	3305	3305

Notes: This table displays the robustness of the findings on inputs (Table 2) to restricting to the sample of observations with complete data on all inputs and financial outcomes. See notes to Table 2 for more details. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Appendix Table 2: Inputs (Robustness to Area-Year Controls)

	(1) No. of Discordant Vendors	(2) Physician entry rate	(3) Physician exit rate	(4) Physician churn rate	(5) Log of FTE	(6) Log of 1 + capital investment
Post * Acquirer	-1.408***	0.004	-0.007	-0.003	-0.053	0.224*
	(0.266)	(0.013)	(0.007)	(0.014)	(0.039)	(0.115)
Post * Target	-3.226***	0.002	0.015	0.017	-0.059	-0.209
	(0.649)	(0.010)	(0.009)	(0.017)	(0.067)	(0.195)
Observations	2853	3802	3802	3802	4387	4055

Notes: This table displays the robustness of the findings on inputs (Table 2) to the inclusion of hospital geographic area (HRR) – year fixed effects. Sample sizes differ because they do not count singleton observations (e.g. area-years containing only one hospital). See notes to Table 2 for more details. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Appendix Table 3: Origin of New CEOs Before and After Acquisition

	Target		Acquirer	
Source of CEO	Before	After	Before	After
Target	0.31	0.03	0.00	0.02
Acquirer	0.00	0.28	0.19	0.34
External system or hospital	0.25	0.07	0.40	0.15
Not previously hospital CEO	0.44	0.62	0.40	0.49

Notes: This table displays the source of new CEOs arriving at target and acquirer hospitals before (2004-2006) and after (2007-2010) the acquisition.

Appendix Table 4: Financial Outcomes (Robustness to Uniform Sample)

	(1) Log of costs per inpatient	(2) Log of price index	(3) Log of revenue per inpatient	(4) Profit margin
Post * Acquirer	0.101***	0.127	0.042	-0.037***
	(0.024)	(0.141)	(0.028)	(0.013)
Post * Target	0.015	0.106	0.023	0.008
	(0.032)	(0.107)	(0.029)	(0.012)
Observations	3305	3305	3305	3305

Notes: This table displays the robustness of the findings on financial outcomes (Table 4) to restricting to the sample of observations with complete data on all inputs and financial outcomes. See notes to Table 4 for more details. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Appendix Table 5: Selected Granular Cost Outcomes

Outcome: 1+Log of Costs per Inpatient	(1) Total	(2) General Service	(3) Central Services/ Supply	(4) Medical Records	(5) Nursing Admin	(6) Pharmacy	(7) Capital Equipment	(8) Laundry
Post * Acquirer	0.095***	0.213***	0.152***	0.020***	0.026***	0.080***	0.054***	0.004**
	(0.020)	(0.028)	(0.022)	(0.003)	(0.004)	(0.011)	(0.011)	(0.002)
Post * Target	-0.003	0.331***	0.355***	0.012***	0.058***	0.096***	0.189***	0.004*
	(0.028)	(0.047)	(0.026)	(0.004)	(0.006)	(0.018)	(0.014)	(0.002)
Observations	5257	5059	5059	5059	5059	5059	5059	5059

Notes: This table displays the results of estimating equation 1 with hospital cost measures as the outcome. Each column presents a different cost measure; only cost measures with statistically significant and positive effects at the 5% level for the acquirer are shown. The outcome is defined as the logarithm of 1 + the cost measure per inpatient discharge (specifically, before adding 1 and logging, we divide cost by the measure of adjusted inpatient discharges laid out in Schmitt, 2017). Each observation is a hospital-year. All regressions include hospital and year fixed effects. Column 1 studies logged total costs (repeated from Table 4; unlike the other columns we do not add unity before logging to match estimates in the main text and because this outcome is rarely zero). Column 2 studies logged general service costs, a subset of total hospital costs. Columns 3-8 study varying subsets of general services costs. These measures are winsorized at 5% on each side in each year. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Appendix Table 6: Financial Outcomes (Robustness to Area-Year Controls)

	(1) Log of costs per inpatient	(2) Log of price index	(3) Log of revenue per inpatient	(4) Profit margin
Post * Acquirer	0.059**	0.539***	0.066*	-0.005
	(0.029)	(0.200)	(0.037)	(0.012)
Post * Target	0.038	0.059	0.083	0.006
	(0.052)	(0.195)	(0.063)	(0.019)
Observations	4380	3995	4380	4363

Notes: This table displays the robustness of the findings on financial outcomes (Table 4) to the inclusion of hospital geographic area (HRR) – year fixed effects. Sample sizes differ because they do not count singleton observations (e.g. area-years containing only one hospital). See notes to Table 4 for more details. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Appendix Table 7: Clinical Outcomes
(Robustness to Area-Year-Cohort Controls)

	(1) Survival	(2) Readmission
Post * Acquirer	-0.009*	-0.008
	(0.005)	(0.005)
Post * Target	-0.003	0.004
	(0.007)	(0.005)
Observations	4582	4582

Notes: This table displays the robustness of the findings on clinical outcomes (Table 5) to the inclusion of hospital geographic area (HRR) – year – cohort fixed effects. Sample sizes differ because they do not count singleton observations (e.g. area-year-cohorts containing only one hospital). See notes to Table 5 for more details. Robust standard errors clustered at the hospital level in parentheses. Effects significant at 10% (*), 5% (**), and 1% (***).

Attachment To:

The Anatomy of a Hospital System Merger: The Patient Did Not Respond Well to Treatment

World Management Survey Instrument

Head of Department

Hospital ID _____

Scheduler
◯ [redacted]

Date _____

Time _____

Status
◯ Conducting interview
◯ Listening to interview

Interviewer
◯ [redacted]

Listening to interview/double coding
◯ [redacted]

My name is XXXX. I'm calling from [redacted] How are you doing today?

Thank you very much for agreeing to talk with me today. We are conducting a study to understand management practices across and within hospitals, and your time today will greatly contribute towards this study. The interview should last around 90 minutes. How does this timing still work with your schedule?

This interview is entirely voluntary so you can choose to stop the interview at any point or ask to skip any questions you don't want to answer. However, nothing you say in our interview will be attributed back to you and your name will not be identified in any publications or presentations. We will only be compiling aggregate results. I want to mention that I have another colleague in the room who will be taking notes to make sure I capture everything that we discuss.

Before we begin, do you have any questions about the project or about today's interview?

Interviewee Position
◯ HOD Surgery
◯ HN Surgery
◯ Other

Notes re: interviewee position

Tenure in post (number of years) _____

If less than 6 months, stop the interview*

Tenure in hospital (number of years) _____

Number of other hospitals within 30 minute drive with the same specialty _____

OPERATIONS

1. Layout of Patient Pathway

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) Can you briefly describe the patient journey or flow for a typical episode? How does this impact patient flow?

b) How closely located are wards, operating rooms, diagnostic centers and supplies?

c) How often do you run into problems with the current layout and pathway management?

What is done to manage obstacles that you've identified?

Who becomes involved in making a change?

d) Have you introduced any operational improvements to the patient pathway/layout? (examples)

2. Rationale for Improving Patient Management

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) Can you take me through the rationale for making operational improvements to the management of the pathway?

Note: what the motivation was behind the changes to the patient pathway? Why did the hospital introduce these changes to the patient pathway (e.g. health outcomes, financial pressure, reactive, proactive)?

b) How often do you challenge/streamline the patient pathway?

Who is involved in challenging or improving the patient pathway?

3. Standardization and Protocols

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) How standardized are the main clinical processes? (or: Does the hospital have any standard operating procedures when it comes to patient care, diagnosing, treatment, etc.)

b) How clear are clinical staff members about how specific procedures should be carried out?

c) What tools and resources does the clinical staff employ, for example, to ensure that they have the correct patient or conduct the appropriate procedures?

Where have they been applied and for how long (certain depts. or whole hospital)?

d) How are managers able to monitor whether clinical staff are following established protocols?

If applicable: how often do managers monitor whether protocols are being followed correctly?

4. Continuous Improvement

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) How do problems typically get exposed and fixed?

Who is involved in the process and in what way?

b) Can you talk me through the process for a recent problem that you faced?

c) When processes do change, what is the main driver of change?

d) Who within the hospital typically gets involved in changing or improving?

How can different staff groups get involved in this process? If so, is it voluntary or mandatory?

Is there a system for staff to make suggestions?

5. Good Use of Human Resources

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) With respect to your staff, what happens when different hospital areas become busier than others?

Is there a system to coordinate this? If so, how often is it done?

b) How do you know which tasks are best suited to different staff?

Is there a registry of staff skills and competencies that is used to guarantee that managers are moving the right staff to the right place?

Are the staff cross-trained? If so, how is this done?

c) What kind of procedures do you have in place to assist staff flow between areas, for example, is there one central person or center that coordinates this process?

d) Who decides how work is allocated across clinical staff?

PERFORMANCE

6. Performance Tracking

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) What kind of performance indicators do you use for performance tracking in your department? (examples)

Note: what do they measure to determine performance?

b) How frequently are these measured?

c) Who gets to see these data? (and how?)

d) If I were to walk through your hospital wards and operating rooms, how could I tell you how you are doing against your performance goals?

If applicable: what data is displayed, where is it displayed, and how often is it updated?

7. Performance Review

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) How do you review your main performance indicators?

How is this done (e.g. meeting)? How often?

b) Can you tell me about a recent review meeting?

c) Who is involved in these meetings?

Besides those present, who gets to see the results of this review? By what means (e.g. published or informal meetings)?

d) After reviewing your performance indicators, what does a typical follow-up plan look like?

How is this follow-up plan communicated, and to whom?

8. Performance Dialogue

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) Going back to the review meetings, briefly, how are these meetings structured?

How is the agenda determined?

b) During these meetings do you find that you generally have enough information for review?

c) How useful do you find these meetings?

What type of feedback occurs in these meetings?

d) For a given problem, how do you generally identify the root cause?

9. Consequence Management

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) Let's say you've agreed to a follow-up plan at one of your meetings. In terms of operations, what would happen if the plan was not enacted?

b) How are follow-up plans monitored?

If there was a problem with a follow-up plan, when would you identify it? How would you address it?

Can you give me a recent example?

c) How do you deal with repeated failures within a follow-up plan?

Note: obstacle vs. weakness in follow-up plan

TARGETS

10. Target Balance

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) Could you tell me, in general terms, what types of targets are set for the department?

Note: find out the categories the targets fall into without asking this directly

b) Tell me about goals that are not set externally (e.g. by the government, regulators), but rather ones that are set internally by the hospital?

Which ones are part of a manager's appraisal?

11. Target Interconnection

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) Now considering all the goals you have mentioned, what is the motivation behind these goals?

b) Are these goals communicated to all staff?

If so, how?

If not, to what level (e.g. managerial or team)?

c) Are these goals broken down into smaller targets?

If so, to what level (e.g. individual, managerial, team)?

d) How are your department targets linked to overall hospital performance and its goals?

12. Time Horizon of Targets

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) What kind of timescale are you looking at to achieve your targets?

Note: always check if only given one timescale

b) In terms of the timescale, which goals receive the most emphasis?

c) Are long-term and short-term goals set dependently or independently of each other?

d) Could you meet all your short-term goals but miss your long-term goals?

13. Target Stretch

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) How tough are your targets? How pushed are you by the targets?

b) On average, how often would you say that you meet your targets (%)?

How are your targets benchmarked?

Note: Try to get at least a ballpark %, doesn't have to be exact.

c) Do you feel all specialties or staff groups receive the same degree of difficulty in terms of targets?

14. Clearly Defined Accountability For Clinicians

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) Can you tell me about the role that clinicians have in improving performance and achieving targets?

b) How are individual clinicians responsible for delivery of targets?

Does this apply to cost targets as well as quality targets?

c) In what way do clinicians take on roles to deliver cost improvements?

Are they selected for this role or do they volunteer?

Can you think of examples?

15. Clarity and Comparability of Targets

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) If I asked your staff directly about department targets, what would they tell me?

Note: are targets clearly communicated to staff and do they know what they have to do?

b) Does anyone say that the targets are too difficult to understand?

c) How do people know about their own performance compared to other people's performance?

Is this published or posted in any way?

TALENT

16. Rewarding High Performers

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) How does your performance evaluation system work?

b) How does your staff's pay relate to the results of this review?

Do you have a bonus system in place? If so, how does it work?

c) Are there non-financial rewards for the best performers across all staff?

d) How does your reward system compare to that at other similar hospitals?

Would you be willing to share information about your bonus?

- ◯ Yes
- ◯ No
- ◯ Interviewer did not ask
- ◯ Not applicable

e) What is your bonus as a % of salary? _____

What % of your bonus is based on individual performance? _____

What % of your bonus is based on team performance (unit/specialty)? _____

What % of your bonus is based on company performance? _____

17. Removing Poor Performers

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) If you had an employee who could not do his/her job, what would you do?

Could you give me a recent example?

b) How long would underperformance be tolerated once it has been identified?

c) Do some individuals always manage to avoid being fixed/fired?

18. Promoting High Performers

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

a) Tell me about your promotions system?

How often are individuals promoted?

Note: If manager struggles to answer this question ask, "when was the last time someone was promoted?"

Are all employees eligible for promotion?

b) How do you identify and develop your star performers?

What types of professional development opportunities are provided?

c) Are better performers likely to be promoted faster or are promotions given on the basis of tenure/seniority?

19. Instilling a Talent Mindset/Managing Talent

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) How does the hospital attract and develop new talent? (examples)

b) Is this part of a manager's appraisal (i.e. are they held accountable for attracting and developing talent)?

Are they rewarded specifically for attracting and developing talent?

20. Retaining Talent

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) If you had a top performing staff member that wanted to leave, what would the hospital do?

b) Could you give me an example of a star performer being persuaded to stay after wanting to leave?

c) Conversely, could you give me an example of a star performer leaving the hospital without anyone trying to keep them?

21. Attracting Talent

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

a) What makes it distinctive to work at your hospital as opposed to other similar hospitals?

b) Let's say I'm a very good candidate for a position at your hospital, how would you convince me to accept the position?

c) What do you think people may not like about working at your hospital?

ORGANIZATION

a) To hire a full-time permanent nurse, what agreement would your hospital CEO need?

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

-1 the hospital/ CEO has no authority to do this

-2 the hospital/ CEO can recommend that this be done to an external body

-3 the hospital/ CEO requires sign-off from outside the hospital on the typical case (typically agree, 80-90% of the time)

-4 the hospital/ CEO has the authority to do this, but MUST inform an external body (if it requires a sign off or the external body can veto it, it is a 3, not a 4)

-5 the hospital/ CEO has complete authority to do this- it is their decision entirely

Note: IF NO AUTHORITY IN A, SKIP

b) To the extent that the hospital decides over hiring a full time permanent nurse, who within the hospital would make that decision?

Alternate way to ask: If the hospital has decided to hire a full-time permanent nurse, who within the hospital has made that decision?

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

-1 the hospital CEO decides entirely

-2 the specialty the nurse is going to join can recommend that this be done

-3 The hospital CEO and the specialty the nurse is going to join decide jointly

-4 the specialty the nurse is going to join has the authority to do this, but MUST inform the CEO (if it requires a sign off or the CEO can veto it, it is a 3, not a 4)

-5 the specialty the nurse is going to join decides this entirely

c) Where are decisions taken on adding new beds to the specialty (for example 5% more bed spaces)?

◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ -99

-1 the hospital/ CEO has no authority to do this

-2 the hospital/ CEO can recommend that this be done to an external body

-3 the hospital/ CEO requires sign-off from outside the hospital on the typical case (typically agree, 80-90% of the time)

-4 the hospital/ CEO has the authority to do this, but MUST inform an external body (if it requires a sign off or the external body can veto it, it is a 3, not a 4)

-5 the hospital/ CEO has complete authority to do this- it is their decision entirely

Note: IF NO AUTHORITY IN C, SKIP

d) To the extent that the hospital decides over adding more beds, who within the hospital would make that decision?

Alternate way to ask: If the hospital has decided to add more beds to a specialty, who within the hospital has made that decision?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

-1 the hospital CEO decides entirely

-2 the specialty can recommend that this be done

-3 The hospital CEO and the specialty decide jointly

-4 the specialty has the authority to do this, but MUST inform the CEO (if it requires a sign off or the CEO can veto it, it is a 3, not a 4)

-5 the specialty decides this entirely

e) To what degree do individual departments have autonomy to set their own budget and make strategic investments?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ -99

-1 departments are seen as cost centres which are allocated pre-determined budgets: no autonomy

-2 departments are seen as cost centres which are allocated pre-determined budgets: can recommend

-3 departments function as business units where departments leaders and senior management set budget and make decisions jointly

-4 departments are seen as revenue centres which function as independent business units: can makes decisions unilaterally but MUST inform the CEO

-5 departments are seen as revenue centres which function as fully independent business units: complete authority

What is the largest capital investment your specialty could make without prior authorization from the CEO? _____

For example, "what about buying a new computer-would that be possible?" Please check any "zero/none" response

How many people report directly to you? _____

Note: anything above 15 is high-probe further

Ignoring yourself, how well managed do you think the hospital is on a scale of 1-10? (1 worst, 10 best)

	1	2	3	4	5	6	7	8	9	10
Overall	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Operations (patient care processes)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Talent (people, promotions, incentives, etc.)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Employment and education (phone or CV)

Establishment name 1 _____

Location 1 _____

Title 1 _____

Start and end years 1 _____

Establishment name 2 _____

Location 2 _____

Title 2 _____

Start and end year 2 _____

Establishment name 3 _____

Location 3 _____

Title 3 _____

Start and end year 3 _____

What is the highest level of education completed to date?

◯ Graduate/professional (=bachelors)
◯ Post graduate (=masters)
◯ Doctoral (PhD)
◯ Medical
◯ DS

Undergraduate school name _____

Undergraduate course _____

Start and end year _____

Master's school name _____

Master's course _____

Start and end year _____

Doctoral or medical school name _____

Doctoral or medical course _____

Start and end year _____

Place of residency _____

Residency course _____

Start and end year _____

Place of fellowship _____

Fellowship course _____

Start and end year _____

Does the interviewee have a clinical background (nurse/physician)?
- ◯ Yes
- ◯ No
- ◯ DS

Has the interviewee ever practiced as a nurse/physician?
- ◯ Yes
- ◯ No
- ◯ DS

Does the interviewee hold an MBA or equivalent degree (exclude executive education programs)?
- ◯ Yes
- ◯ No
- ◯ DS

Has the interviewee ever attended an executive education program in business administration?
- ◯ Yes
- ◯ No
- ◯ DS

Post interview (scale 1-5) to be completed by interviewer

	1	2	3	4	5
Interviewee knowledge of management practices	◯	◯	◯	◯	◯
Interviewee willingness to reveal information	◯	◯	◯	◯	◯
Interviewee patience	◯	◯	◯	◯	◯

Confirm manager's name _____

Confirm direct contact phone number _____

Confirm interviewee's email _____

Total interview duration (minutes) _____

Number of times rescheduled _____

Age of interviewee (do not ask, guess if not told) _____

Gender of interviewee
- ◯ Male
- ◯ Female
- ◯ Unknown

Comments

FOR BELOW:
Incomplete=interview not completed or demographic info not collected
Unverified=interview com lete per interviewer
Complete=only for [redacted] to select after she checks data