

Hospital Merger Benefits: Views from Hospital Leaders and Econometric Analysis - An Update

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Introduction

In 2016, we conducted a two-part analysis of the effects of hospital acquisitions on costs and quality of care. Our research, which included both structured interviews and econometric analysis, found that hospital acquisitions generate substantial benefits.² In structured interviews, the leaders of approximately 20 hospital systems identified several mechanisms through which acquisitions reduce costs, including by increasing hospitals' scale and reducing their cost of capital. Hospital leaders also noted substantial benefits in clinical quality attributable to standardization of clinical protocols and investments to upgrade services at acquired hospitals. These benefits were confirmed in our econometric analysis of hospital costs, revenues, and indicators of quality: annual operating expenses of acquired hospitals were reduced below those of comparable non-acquired hospitals and were accompanied by a commensurate decline in revenue, both of which were statistically significant. Modest improvements in outcome measures of quality were also observed, although these improvements were generally statistically insignificant.

Nearly three years later, we revisit our findings through updated analyses we describe in this report. We conducted structured interviews with ten health systems and extended the econometric analysis to include three additional years (2015-2017) of data on the cost, quality, and revenue outcomes from hospital transactions. The new findings presented below reinforce and strengthen the previous report's conclusions that hospital acquisitions result in benefits that accrue to patients in the form of better care at reduced cost.

- Acquisitions decrease costs due to the increased scale of the combined system and the data-driven clinical standardization that can be realized. Consistent with our previous analysis, hospital acquisitions are associated with a statistically significant 2.3% reduction in annual operating expenses at acquired hospitals.
- At the same time, quality is enhanced: our new empirical analysis shows statistically significant reductions in rates of readmission and mortality. This is consistent with health system leaders' reports on their extensive efforts to use their systems' data to develop clinical best practices and hold hospitals accountable to measurable outcomes in ways that require scale and resources that individual community hospitals may lack.
- Revenues per admission at acquired hospitals also decline relative to non-merging hospitals by a statistically significant 3.5%. These results suggest that savings that accrue to merging hospitals are passed on to patients and their health plans.

Hospital executives interviewed reiterated the themes expressed three years ago in the initial study. Scale is increasingly critical, not only to increase the volume of services over which fixed overhead expenses can be

spread, but also to maintain and advance the infrastructure necessary to promote data-driven, value-based care, and to align with other components of the health care industry to promote population health. As the health care landscape evolves with the emergence of new players focused on advances in information technology and consumer-directed management of chronic disease, traditional independent hospitals frequently benefit from alignment with larger systems to best serve the health needs of their communities.

Background On The Issues

As we noted in our original study, hospitals are experiencing rapid change in the competitive dynamics that shape the industry. Pressures to deliver cost-effective, value-based care continue to develop, resulting in an increasing need to gain scale and scope. The ability to take financial responsibility for the total cost of patients' care requires both volume and scale to mitigate risk and coordinate the continuum of health care services that patients require.

Even more pronounced than three years ago is the key role played by sophisticated data-based analytic tools that rely on an information technology (IT) infrastructure. These tools incorporate extensive clinical and financial data from all components of the health care system and are costly to implement and operate. While these tools are critical in the increasingly data-driven approach to clinical and cost standards of care and the development of targeted treatment approaches, the scale and investment needed to develop them further enhances the need for scale.

Simultaneous with the increased need for IT investment at hospitals, hospitals' reliance on revenue from government payors – primarily Medicare and Medicaid – has increased. However, payments from these programs do not cover hospitals' costs, let alone fund investments in programs that improve care. Over the 10 years from 2007 to 2017, the proportion of total hospital costs accounted for by Medicare and Medicaid rose from 54% to 60%.³ At the same time these programs fail to cover a growing portion of costs: in 2007 they covered between 88 and 91% of costs, while in 2017 they each covered just 87% of costs.⁴ In addition, hospitals face financial pressures as demand for inpatient services continues to decline: the number of inpatient days per thousand people has fallen by over 13% in the last 10 years.⁵ As a result it is not surprising that nearly one third of hospitals have negative operating margins, with the percentage rising from 30% to 33% between 2007 and 2017.⁶

As hospitals seek to find ways to adapt to these changing financial pressures, competition from new types of health care providers such as the vertically integrated CVS Health – newly combined with the health insurer Aetna – is emerging. In addition, large groups such as the joint venture Haven, formed by Amazon, Berkshire Hathaway, and JPMorgan Chase, are themselves investing in technology and research to better control health care utilization and cost.

Structured Interviews

Methodology

Interviews were conducted with the leaders of ten hospital systems (five that were included in the previous study and five new participants) during the spring of 2019. The participating health systems, while not randomly selected, represent a wide range of characteristics, in terms of geographic location and breadth, size, and ownership (for profit, secular non-profit, religious). In addition, the interviewed systems have participated in different forms of acquisitions and affiliations, ranging from the combination of pre-existing systems to the development of looser

vertical affiliations. Appendix 1 presents the characteristics of the systems we interviewed for this update. As in the previous round of interviews, interviewees were sent a list of possible questions before the scheduled discussion (Appendix 2), and were promised anonymity to encourage candor.

Benefits Achieved Through Horizontal Merger

Many of the benefits that were articulated during the last round of interviews three years ago—achievement of scale, reduced capital costs, greater clinical standardization, and ability to bear risk for the cost of care—remain important objectives and accomplishments. However, the priorities of hospital systems have been refined and extended as health care markets focus increasingly on addressing the continuum of care needs in a value-based framework. Beyond horizontal combinations of general acute care hospitals, there is increasing emphasis on vertical transactions that combine providers at different stages of the care continuum (e.g., the acquisition of urgent care clinics by general acute care hospitals). Moreover, the emergence of alternative providers such as Haven and CVS-Aetna is causing traditional health systems to evaluate and increase their focus on the ultimate consumers, their patients.

Scale-related Benefits. In our interviews, the cost-reduction benefits of scale associated with hospital combinations were now frequently described as “table stakes.” They are a required and desired outcome of hospital consolidation, and reductions in duplicative administrative back-office operations and consolidation of supply chain (purchasing) operations can yield substantial savings. The systems we interviewed reported savings of approximately 1.5 to 3.5% of total expenses through these mechanisms, and such savings may often be critical to preserve the financial viability of community hospitals. However, these cost efficiencies rarely drive the decision to merge. Rather, systems focus on the benefits that they can achieve through other means, such as more sophisticated data analytic capabilities, the ability to improve the quality of care, and a greater ability to bear risk in contracts with payors.

(i) Scale allows investment in and use of sophisticated data analytic capabilities

There is increasing focus on how greater scale allows the development of sophisticated data analytic capabilities, including the advancement of telemedicine and the use of artificial intelligence in analyzing health information. Scale matters in the context of using data analytics to drive increases in the cost effectiveness of health care for several reasons. First, the fixed costs necessary to develop the data warehouse and associated IT infrastructure that combines both clinical (medical record) data with administrative revenue and cost (billing and margin) data from numerous clinical settings and sites are substantial. Second, once the data warehouse and IT infrastructure has been developed, significant ongoing effort and expenditures are required to ensure that all relevant data are uploaded into it continuously and consistently across the health system. Third, a larger entity can support much more sophisticated analytic capabilities, both because the analytics themselves can be used to improve quality and lower costs over many more patients, i.e., the payoff is much larger, and because a larger database (with more patient records) permits more sophisticated and targeted analyses.

Interviewees provided several examples of how scale has allowed them to use their data to improve care and lower costs. One interviewee indicated that if a health system doubled in size from \$5 to \$10 billion in annual revenues, per-patient IT costs would decline by 30%. Another described savings of \$2,000 per colorectal surgery case after his system implemented data-based protocols to enhance post-operative recovery. A third described using data to address an observed pattern of high readmission rates for heart failure patients: analyzing data

on patterns in the care these patients received led to standardization of prescribing patterns, more proactive outpatient medical management, and the recruitment of two specialists in heart failure who now supervise the protocols used to care for more than 30,000 patients. Data on many patients made possible the sophisticated analysis necessary to account for the impact of controllable and uncontrollable factors associated with heart failure patients and the care provided to them. Based on the findings of this analysis, the system refined care practices and made investments, resulting in a reduction in readmission rates. A fourth system described using their data to address human trafficking victims among their patients: the system could identify and describe patterns associated with such patients and have now implemented routine recording of a diagnosis code that enables more effective interventions with these patients. A fifth described how their database of 87,000 births annually allowed them to reduce maternal deaths. Such an analysis would not have been possible with a smaller database of births given the relative rarity of maternal deaths and the many potential factors that affect maternal health.

System leaders described similar processes of using “big data” to improve care delivery. Systems develop data warehouses that include comprehensive financial and clinical data from across all their facilities and physician clinics. They then assemble groups of clinicians who represent different specialties and facilities to develop evidence-based clinical protocols for specific clinical conditions or issues (e.g., how to reduce MRSA or sepsis) based on these data. Scorecards are developed to report various cost and quality metrics, which are disseminated to hospital clinical and operation leaders across the system on a regular basis, often monthly. Key staff at individual hospitals are generally provided with their own metrics as well as summary metrics for the entire system, enabling individual hospitals to assess their own performance against the system-wide average. The system convenes meetings of representatives of the different hospitals to discuss the results of these analyses, and hospital leaders are held accountable to meet certain standards related either to the absolute level of their own facilities’ performance or to improvement in their performance.

System leaders consistently explained that these reports based on their own data are much more powerful tools to reduce variation in practice patterns than off-the-shelf benchmarking products provided by external vendors or specialty societies. By utilizing their own data, systems can incentivize physicians to respond to comparisons with their peers, as participating physicians are unable to dismiss any observed deviation of their own results from system norms as resulting from their own “unusual patient base.” Improvement at hospitals or in specific departments that are performing below their peers often occurs rapidly.

This approach can have both reduce costs and improve quality. One system that was created from the merger of multiple independent hospitals described successful standardization of orthopedic and cardiac care across all its hospitals. This standardization resulted from providing physicians across the hospitals with cost and clinical data and allowing them to develop the best practices that led to delivery of more cost-effective (higher quality and lower cost) care. Adopting these best practices reduced the variety of physician preference items (e.g., defibrillators, implants) purchased, standardized operating room organization (facilitating staff training), and resulted in the adoption of common protocols related to, for example, lab testing and antibiotic prescribing regimens. While this system’s effort to develop a useful database and analytic tools for the medical staff to work with was substantial, it was not significantly harder to provide the results to 200 physicians than it would have been to 30.

(ii) Scale is critical to state of the art use of information technology to extend care

System leaders also cited larger scale and associated data as critical to making progress in developing state of the art algorithms that use artificial intelligence to identify ways in which care patterns can be streamlined in areas

such as imaging, or to detect patterns that predict which patients are likely to develop sepsis. Given the dearth of skilled specialists in artificial intelligence and competition to hire them in fields outside of health care, it is difficult to imagine smaller health systems being able to afford investment in artificial intelligence programs even if they had sufficient data to implement them. Similarly, investments in the technology necessary to provide telemedicine services to treat patients in remote areas experiencing strokes, for example, effectively also rely on scale. Such services can also permit monitoring and care of remote patients in their homes.

(iii) Ability to bear risk

While system leaders acknowledge that shifting of capitated risk to providers is still developing in many areas of the country, all hospitals face some exposure to the financial consequences of not delivering cost-effective care. Scale reduces the volatility in financial performance that unexpectedly complex patients can otherwise cause, allowing systems to better absorb these fluctuations. In addition, as discussed above, implementation of standardized clinical protocols reduces unnecessary variation in the costs associated with treating a broad patient population.

In summary, scale permits the critical advances in the delivery of health care that are necessary to meet simultaneous demands for quality improvements and cost reductions. The hospital system leaders we interviewed voiced substantial skepticism that independent community hospitals, many of which are currently struggling to maintain financial and operational health, can remain relevant or viable as the industry continues to increase its reliance on scale-based approaches to designing and delivering health care services.

Organization of Services Post-acquisition. Despite fears sometimes expressed by patients and local boards prior to acquisitions of community hospitals, interviewees indicated that they do little service consolidation following the acquisition of hospitals, unless the acquired facility is very close to a hospital already owned by the acquiring system. Rather, there is focus on keeping as much care appropriately local as possible by augmenting, rather than eliminating, local services. As a result, the breadth of services available at acquired community hospitals often expands post-acquisition. Moreover, patients in these communities gain more seamless access to the advanced quaternary services that, in general, only large, sophisticated hospitals (often associated with medical schools) have the volume and expertise to deliver effectively and safely.

Acquired hospitals have often been struggling financially and have been unable to maintain their facilities and staff in the wake of rising expenses and an inability to achieve efficient scale by themselves. Services at these hospitals may have suffered as these hospitals have lost staff and been unable to make important infrastructure investments. As a result, we heard from hospital systems leaders that acquired hospitals have often experienced a downward spiral as their patient volumes declined, thereby reducing the revenues critical to maintain quality operations, leading to further reductions in patient volumes and revenues, and an inability to reduce expenses (many of which are fixed, at least in the short term) commensurately.

These hospitals require substantial capital investments to reverse these trends. They benefit not only from the capital infusion that an acquisition provides, but can also be assisted in the recruitment of physician and other clinical personnel necessary to attract more patients. In addition, medical staff exposure to the data-driven clinical protocols and guidelines that help to educate their clinical staff directly improves quality: as an example, one system reported improving Leapfrog quality scores from C to B following two recent acquisitions of independent hospitals. Another reported reducing sepsis incidence and deaths of patients in the intensive care

unit substantially after implementation of system-wide data-driven protocols. A third reported improvement in all measures of patient experience quality measures.

In some cases, acquiring systems – in addition to providing financial investments and clinical expertise – can also improve recruitment efforts of both physicians and other clinical staff because of their well-established brands. These investments result in substantially increased patient volumes at the acquired community hospitals: one system reported a greater than 10% increase in patient encounters at an acquired community hospital a year following its acquisition. Indeed, several interviewees indicated that the clinical workforce of acquired hospitals rarely declines post-acquisition but, rather, increases to meet increasing demand resulting from an improvement in the services offered at the acquired hospital.

At the same time, we heard that acquisitions improve capacity utilization at the flagship hospitals of the acquiring systems, which are often stretched beyond comfortable operating levels due to their reputations, broad range of complex services available, and subspecialists on their staffs. As a result, clinical and capital investments to expand services and deliver care locally at acquired, underutilized community hospitals can help alleviate capacity constraints at the flagship academic hospitals. In some cases, capital investments in expanding academic or flagship hospitals can even be forestalled or at least reduced. This movement of patients from academic hospitals to community hospitals also benefits patients and payors financially because community hospitals often have lower costs than academic hospitals.

Vertical Affiliations: The Choice Between Ownership and Joint Adventure

Consistent with increased attention given to population-health initiatives, system leaders discussed a heightened focus on vertical acquisitions and affiliations in this round of interviews. These arrangements provide a system with increased control over the entire continuum of health care services, including, among many examples, urgent and emergent care provided at freestanding locations, imaging, dialysis, rehabilitation, skilled nursing, and home health. They also encompass affiliations with health plans.

As health systems prepare to take on increasing amounts of financial risk for the total cost of care for the patients they serve, they need to be able to manage expenditures on all the types of care – not just hospital inpatient and outpatient care – that patients require. Even those systems that are not involved in capitated arrangements with payors all still face downside risk in at least some of their payment arrangements and see this becoming more common.⁷ In addition to the benefits of scale described above, managing expenditures on health care services is easier when it is possible to internalize decisions related to “right care at the right place and time.” For example, one system noted that it has invested in urgent care centers throughout its service area because patients tend to use urgent care centers located within only a few miles of their homes. As a result, to maintain care within the system and manage patients’ total cost of care, they need to provide multiple convenient access points.

Health systems that we interviewed generally follow two common principles in determining the optimal affiliation structure for these arrangements. The first principle is that systems prefer ownership over a looser affiliation when the system has (or can develop) the necessary expertise to operate the service. There is a general belief, discussed extensively in the previous round of interviews, that ownership enhances the system’s ability to foster more cost-effective care delivery through better alignment of financial and clinical incentives across different parts of the system. As a result, the universal preference, expressed in the initial interviews and confirmed in this update, is to acquire general acute care hospitals (where the system has extensive expertise) rather than to enter looser affiliations. The second principle is that expertise of a business segment is also critical, and systems – even

large ones – recognize that cannot not excel in the management of every service. As a result, the leaders with whom we spoke said that in some situations it is preferable to enter into joint ventures with non-hospital partners that specialize in a particular service and possess more expertise in providing that care than the hospital system itself does.

Interviewees described situations in which they have acquired, for example, imaging or urgent care companies and then hired management with the expertise to operate them. They also described joint ventures with successful ambulatory surgery center (ASC) companies that have the capability to operate the ASCs that the hospital-based leadership lacks. Interviewees also identified health system acquisitions that they have undertaken that combine complementary expertise. For example, one system acquisition combined a participant experienced in operating home health entities with another that was proficient in urgent care. As a result, their combination not only created a more expansive system of acute care hospitals but also extended their ability to deliver care in other parts of the health care service continuum.

Interviewees also noted factors other than specialized expertise that they consider when evaluating vertical affiliations that are short of ownership. For one, as hospital systems, they often receive referrals from other independent participants in the health care chain, such as urgent care facilities. As a result, they may not always want to compete with such entities by vertically integrating into the referring service. Second, even large health systems have limited access to capital and management expertise and must determine where best to invest their money and management attention. In some situations, if systems can achieve sufficient operational control in a joint venture, such an arrangement allows them to utilize less capital to achieve substantial vertical integration of services.

In general, however, as in our previous study, interviewees indicated concerns regarding the lack of ability to enforce clinical standards in non-owned entities and resultant quality and brand degradation. Capital investments and sharing of data systems and associated analytics are also not always possible without the control that ownership provides.

“Big Picture” Trends Affect System Priorities

In addition to the growing importance of data analytics, vertical integration and the ability to deliver cost-effective care, system leaders noted other emerging trends that influence their priorities.

Several system leaders indicated that they are paying more attention to entities that they have not traditionally viewed as competitors. One such example is CVS-Aetna, which has announced plans to “transform the consumer health experience and build healthier communities through a new innovative health care model that is local, easier to use, less expensive and puts consumers at the center of their care” by focusing on, for example, “self-management for patients with chronic conditions.”⁸ Another is Amazon. While to date, Amazon’s forays into health care have not involved the core clinical services provided by hospital systems, its interests appear to be expanding. Following the practices of health systems we discussed earlier, Amazon is exploring the use of artificial intelligence to streamline care. In addition, its well-publicized Haven collaboration with Berkshire Hathaway and JPMorgan Chase intends to influence the delivery of care in order “to create better outcomes, greater satisfaction, and lower costs for their U.S. employees and families.”⁹

Moves by these and other companies are forcing health systems to think more broadly about their competition and to focus increasingly on patient/consumer-centric care. While hospitals have traditionally relied on physicians

to refer patients to them, interviewees indicated that they are now focusing more on outpatient and retail settings as the “front door” to their health systems. In addition, increasing out of pocket cost-sharing is forcing patients to become more cost conscious in their choices of health care providers, increasing the focus on receiving care outside of the traditionally more expensive hospital environment.

Hospital leaders also noted that an increased focus on the role of socioeconomic conditions on population and individual health status¹⁰ has forced systems to think more holistically about the services that they provide. Recent AHA survey data indicate that 91% of hospital are involved in some sort of community partnership to address community needs.¹¹ Other organizations such as CVS Health are also addressing these needs.¹²

Some interviewees noted that data on the diverse patient population they serve—in terms of age, ethnicity, and socioeconomic status—is critical to research to determine the most effective approaches to population health initiatives that address the social determinants of health. Combining hospitals and health systems that serve populations of varying needs—not just with respect to health care services, but also as related to food, housing, education, and employment—greatly enhances research on how best to facilitate coordination of myriad services for high-need patients. Moreover, larger systems have the capital that individual community hospitals lack to invest in community services such as subsidized housing or urban grocery stores located in underserved communities. Systems have partnered with communities and states to invest in, for example, subsidized housing for disadvantaged patients: one such initiative resulted in a 50% reduction in homelessness in the community in which the system operates.

Quantitative Analyses of the Cost and Quality Effects of Hospital Acquisitions

As in our original study we supplement the findings of our interviews with an empirical analysis of the cost and quality benefits associated with hospital acquisitions. This analysis compares cost per admission, revenue per admission, and inpatient quality measures for hospitals that have been acquired with similar hospitals that have not been recently acquired. Our previous analysis utilized a database that tracked acquisitions of all non-federal short-term acute care hospitals in the United States between 2009 and 2014. While we use the same general approach as in our original study, we have updated our analyses to include hospital acquisitions that occurred between 2015 and 2017. In addition to having the benefit of being able to study the effects of additional acquisitions, the longer time period included in our present study provides us with a longer period of cost, quality, and revenue data with which to evaluate the effects of hospital acquisitions that occurred between 2009 and 2014.

Utilizing this expanded dataset reinforces our previous conclusions related to operating expenses and net patient revenue per admission. Previously we reported that acquisitions were associated with a 2.5% reduction in operating expense per admission at the acquired hospitals.¹³ Our current results indicate that these acquisitions were associated with a statistically significant 2.3% reduction in operating expense per admission at the acquired hospitals. We continue to find that acquisitions are also associated with a reduction in net patient revenue per admission.¹⁴

Importantly, our analyses now show statistically significant improvements in outcome measures of quality at acquired hospitals. Whereas our previous findings using measures of readmission rates and mortality rates were relatively imprecise and suggestive that hospital acquisitions may lead to quality improvements, our updated results now reveal highly statistically significant improvements across both readmission and mortality quality measures at acquired hospitals.

In the next section, we briefly describe the cost, revenue, and quality measures that we use in our analyses, as well as other data sources that we use. These measures are the same as those used in our initial analysis and are described in greater detail in our first report.

Data Description

Hospital Transaction Data. We use the AHA's Annual Survey to identify hospital acquisitions, including those reported in the AHA's *Landscape Changes in US Hospitals*, which accompanies the Annual Survey data, or by identifying changes in a hospital's affiliation as reported in the AHA Annual Survey itself. To ensure that we have a comprehensive list of all hospital acquisitions, we supplement the AHA data with information on hospital acquisitions compiled by Irving Levin Associates.¹⁵ While the Levin data have been relied on in many previous studies of hospital acquisitions, they are limited in their utility as they report *announced* transactions, but do not note when or if the transaction was consummated. Since many hospital transactions are abandoned after being announced, the Levin data by themselves overstate the number of consummated hospital transactions. Moreover, identifying the date at which a transaction is completed is critical to being able to assess when the benefits, if any, might start accruing. For each hospital transaction identified by either AHA or Levin, we independently verify that the transaction closed and determine the date on which it closed.

Using these sources, we compile a list of acquisitions involving non-federal short term acute care hospitals in the United States between 2009 and 2017.¹⁶ As described in more detail below, we also collect data on all non-federal short term acute care hospitals that were not acquired during this period to serve as a benchmark against which to measure changes in cost, revenue, and quality. Many hospitals are involved in looser affiliations that fall short of full asset acquisitions. As we do not eliminate hospitals involved in these looser affiliations from our set of benchmark hospitals, to the extent these looser affiliations provide some of the same cost and quality benefits that acquisitions do, including these hospitals in the comparison group would tend to understate the benefits of acquisitions.

Cost and Revenue Data. We use hospital cost and revenue data from CMS's Healthcare Cost Report Information System (HCRIS). Among other things, the HCRIS database contains annual financial reports that all hospitals participating in the Medicare program must file. We measure costs as expenses incurred during the ordinary course of operating the hospital, which include expenses associated with both inpatient and outpatient care. To control for differences in costs associated with the size of the hospital, we normalize these costs by dividing them by the number of adjusted admissions to the hospital.¹⁷ Several hospital leaders with whom we previously spoke indicated that they monitor this financial metric as part of their hospitals' operations, and the metric has also been used in other studies of the effect of hospital acquisitions on costs.¹⁸

We also examine the effect of hospital acquisitions on revenue, using a measure of hospital revenue that is used by hospitals in managing their operations and which has also been used in previous studies of hospital acquisitions.¹⁹ To measure revenue we use net patient revenue per adjusted admission, which includes revenue associated with both inpatient and outpatient care and accounts for contractual allowances and other discounts given by the hospital. This measure includes revenue for traditional Medicare and Medicaid beneficiaries, which is set administratively, and for commercial, Medicare Advantage, and managed Medicaid plans, which is negotiated by the hospital and health plans. Consistent with our cost measure, we normalize revenue by the number of adjusted admissions to control for the size of the hospital. While not solely a measure of prices negotiated by hospitals and health plans, we would expect (all else equal) revenue per adjusted admission to increase if

negotiated commercial or Medicare Advantage prices increased following an acquisition. However, since changes in revenue per adjusted admission may also be affected by changes in payor mix or service mix, results involving this measure should be interpreted with care.

Hospital Quality Data. We measure hospital quality using metrics published in the Hospital Compare database compiled by CMS. We focus on outcome measures of quality – rather than process or patient satisfaction measures – because outcomes of care provided by hospitals are of greatest concern in the evolution to value-based care. Six outcome measures are consistently collected by CMS over the time period of our study: three measures of 30-day readmission rates for acute myocardial infarction (AMI or heart attack), heart failure (HF), and pneumonia (PN) and three measures of 30-day mortality rates for heart attack, heart failure, and pneumonia. To reduce the variability in these measures of quality, we combine the six separate outcome measures tracked by CMS into three composite outcome indices: one for mortality, one for readmission, and one that combines both mortality and readmission measures.²⁰

Date on Other Factors Affecting Cost, Revenue and Quality. We also account for other factors unrelated to acquisitions that may affect hospitals' cost, revenue, or quality. Briefly, we rely on the AHA Annual Survey to identify the ownership type (for-profit, not-for-profit, or public) and whether the hospital self-reported as being a rural hospital or was located in an area defined as rural by the Office of Management and Budget. We identify major teaching hospitals as those that belong to the Council of Teaching Hospitals.

We also account for differences in hospitals' payor mix and size based on the numbers of Medicare days, Medicaid days, and total inpatient admissions as recorded in the AHA Annual Survey. To account for service mix we use the percentage of gross revenue accounted for by outpatient services from the CMS HCRIS database. To account for differences in the cost of services provided by the hospitals, we use the hospital's case mix index (CMI), which is a measure of the complexity and resources associated with inpatient services provided by the hospital to Medicare beneficiaries, and the hospital's wage index, which is used by CMS to adjust for geographic differences in the cost of employing the hospital's patient care staff. We obtain both of these measures from CMS.

Finally, we compare merging hospitals with nearby non-merging hospitals based on each hospital's Hospital Referral Region (HRR), as defined by the Dartmouth Atlas.²¹ HRRs are commonly used to group hospitals into relatively homogeneous geographic areas.

Overall, our analysis includes data for approximately 3,000 non-federal short-term acute care hospitals between 2009 and 2017, corresponding to slightly less than 20,000 hospital-year observations. Among these hospitals, 611 were involved in an acquisition (as the target, not the acquirer) between 2009 and 2017.

The table below summarizes the data used in our analyses. (The number of hospital-year records for the quality measures is lower because these measures for some hospitals are occasionally not recorded in the CMS Hospital Compare database.)

Measuring the Effects of Hospital Acquisitions

As before, we use a "difference-in-differences" method to measure the effect of hospital acquisitions on cost, quality, and revenue. Using this approach, we compare changes in cost, revenue, and quality at acquired hospitals to changes in those same measures at similar control hospitals not involved in an acquisition. In so doing, we

Summary of Cost, Revenue, Quality Measures, and Hospital Characteristics

	Count	Mean	St. Dev	Min	Max
Net Patient Revenue (\$)	19,879	261,493,513	338,603,159	1,940,501	6,414,278,253
Cost (\$)	19,878	261,958,134	347,138,695	2,603,336	5,415,535,406
Readmission Rate (AMI)	14,967	0.183	0.018	0.131	0.274
Readmission Rate (HF)	19,302	0.232	0.023	0.155	0.338
Readmission Rate (PN)	19,438	0.177	0.016	0.129	0.276
Mortality Rate (AMI)	16,328	0.150	0.017	0.097	0.249
Mortality Rate (HF)	19,263	0.116	0.016	0.062	0.185
Mortality Rate (PN)	19,428	0.127	0.027	0.067	0.268
For Profit	19,879	0.165	0.371	0	1
Teaching	19,879	0.093	0.290	0	1
Rural	19,879	0.197	0.398	0	1
Wage Index	19,879	0.976	0.174	0.685	1.802
% Medicare Days	19,879	0.514	0.144	0.00	1.00
% Medicaid Days	19,879	0.200	0.131	0.00	1.00
Inpatient Admissions	19,879	11,179	11,300	9	150,770
% OP Revenue	19,879	0.53	0.15	0.02	1.00
CMI	19,879	1.49	0.29	0.56	3.62

assume that absent the acquisition (after controlling for other factors included in our model), cost, revenue, and quality would have changed at the acquired hospitals in the same way that those measures did at the benchmark non-acquired hospitals. In our analyses, we study the effect of the acquisition only on the target hospital of the deal, not on the acquiring hospital or hospital system. To the extent that the acquiring hospital or hospital system also benefits from the acquisition, our estimates would err on the side of finding no effect. We assume that any effect of the acquisition on the acquired hospital is realized in the first full year after the transaction was closed.

As described above, our analyses include controls for factors other than the transaction which may have affected hospitals' costs, revenues, or quality. Following the previous literature, we control for whether the hospital is for-profit, whether the hospital is a teaching hospital, and whether the hospital is located in a rural area. To control for geographic variation in hospitals' labor costs, we include the wage index that is used in determining Medicare fee-for-service reimbursement rates for hospitals. Differences in the payor mix at hospitals are controlled for using the percentage of inpatient days accounted for by Medicare beneficiaries and of the percentage of inpatient days accounted for by Medicaid beneficiaries. To account for variations of hospital size, we include the number of inpatient admissions at the hospital. Finally, to control for differences in hospitals' service mix and the cost of services provided by the hospital, we include the fraction of the hospital's revenue attributable to outpatient services and the logarithm of the hospital's CMI.²²

In our analyses, changes in the merging hospital's costs, revenue, or quality are measured relative to non-merging hospitals in the same Hospital Referral Region in the same year.²³ As mentioned above, we assume that any effect of the acquisition is realized in the first year following the closing of the transaction, and that the effect is constant during the post-acquisition period.

Results and Discussion

Consistent with our previous findings, we find that hospital acquisitions are associated with statistically significant decreases in both cost and revenue. Specifically, we find that an acquisition is associated with a statistically significant decrease in operating expense per adjusted admission of 2.3%. (A table presenting the complete set of our results for cost, revenue, and quality measures is shown below.) The average annual operating expenses of the acquired hospitals in our data was approximately \$271 million, implying acquisition-related savings of \$6.2 million per year. We also find that an acquisition is associated with a statistically significant decrease of 3.5% in net patient revenue per adjusted admission.²⁴ Applied to an average annual net patient revenue of \$271 million among acquired hospitals, this decrease in net patient revenue per adjustment admission translates to a reduction in expenditures of \$9.2 million per year. These results suggest that savings that accrue to merging hospitals are passed on to patients and their health plans.

An important difference from our previous findings is that our current results show that acquisitions are also associated with statistically significant improvements in quality, measured as decreases in all three composite indices: the 30-day readmission rates composite index, 30-day mortality rates composite index, and the overall outcome composite index. To give content to the magnitude of the effects we find, assuming, for example, that the reduction in readmission rates is due entirely to changes in the readmission rates for heart attacks (but there is no effect on readmission rates for either heart failure or pneumonia), the estimated effect is equivalent to a decrease of 1.1% in the 30-day readmission rate for heart attacks. Similarly, assuming, for example, that the reduction in mortality rates is due entirely to changes in the mortality rate for pneumonia (but there is no effect on mortality rates for either heart attack or heart failure), the estimated effect is equivalent to a decrease of 1.7% in the mortality rate for pneumonia.

These quality findings show clear progress towards the goals articulated by hospital system leaders in standardizing clinical care, reducing variability in practice patterns, benchmarking hospitals' and physicians' performance against peers, and development of advanced data analytical capabilities, which is having success in terms of reducing mortality and costly readmissions. While we cannot disentangle the mechanism through which hospital acquisitions have improved the quality of care being delivered to patients, these results and the improvements that hospitals have demonstrated in the three years since our initial study provide a foundation for optimism about future gains.

Regression Results: Cost, Revenue, and Quality Measures

Variables	log: Revenue	log: Expense	Readmission Composite	Mortality Composite	Outcome Composite
Post-Acquisition	-0.0347*** (0.00735)	-0.0233*** (0.00710)	-0.0383*** (0.0133)	-0.0281** (0.0140)	-0.0332*** (0.00971)
For Profit Hospital	0.0738*** (0.00616)	-0.0163*** (0.00595)	0.162*** (0.0111)	0.0622*** (0.0117)	0.112*** (0.00813)
Teaching Hospital	0.164*** (0.00809)	0.250*** (0.00781)	0.264*** (0.0146)	-0.153*** (0.0154)	0.0556*** (0.0107)
Rural Hospital	-0.0137** (0.00610)	0.00737 (0.00589)	0.00721 (0.0110)	-0.0119 (0.0116)	-0.00234 (0.00805)
log: Wage Index	0.527*** (0.0406)	0.403*** (0.0392)	-0.163** (0.0735)	-0.370*** (0.0772)	-0.267*** (0.0536)
log: % Medicare Days	-0.111*** (0.00562)	-0.121*** (0.00543)	0.0169* (0.0102)	0.0114 (0.0107)	0.0142* (0.00742)
log: % Medicaid Days	-0.0259*** (0.00345)	-0.00171 (0.00334)	0.0481*** (0.00626)	0.0742*** (0.00656)	0.0611*** (0.00456)
log: IP Admissions	-0.0172*** (0.00340)	-0.0384*** (0.00328)	-0.0120* (0.00615)	-0.0215*** (0.00646)	-0.0168*** (0.00449)
log: % OP Revenue	-0.196*** (0.0107)	-0.200*** (0.0103)	-0.242*** (0.0193)	0.128*** (0.0203)	-0.0572*** (0.0141)
log: CMI	1.147*** (0.0169)	1.035*** (0.0164)	-0.712*** (0.0307)	-0.130*** (0.0322)	-0.421*** (0.0224)
Constant	8.568*** (0.0302)	8.816*** (0.0292)	0.639*** (0.0548)	0.432*** (0.0575)	0.535*** (0.0399)
Observations	19,879	19,883	19,886	19,886	19,886
R-squared	0.642	0.632	0.608	0.365	0.432
HRR Code FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses.
 *** p < 0.01, ** p < 0.05, * p < 0.1

Conclusion

Hospitals and health systems are striving to deliver higher quality care in a more cost-effective manner. To accomplish this goal, health systems are making substantial investments to harness repositories of cost and clinical data to determine and implement optimal care patterns across the spectrum of patient needs. Scale is increasingly critical, not only to increase the volume of services over which fixed overhead expenses can be spread, but also to maintain and advance the infrastructure necessary to promote data-driven, value-based care. As the health care landscape continues to evolve with the emergence of new players that are steeped in a focus on advances in information technology and consumer-directed management of chronic disease, traditional independent hospitals will benefit from alignments with larger systems to best serve their communities.

Hospital leaders expressed a heightened interest in aligning with other types of health care providers to improve patients' access to care and to ensure that patients receive care in the optimal settings from a clinical and cost perspective. While hospital leaders continue to favor ownership arrangements over looser affiliations for hospital transactions, the increased focus of hospital systems on working with health care providers at other points in the care continuum has led to partnering with non-hospital providers whose expertise can be used to complement that of the system.

Our updated quantitative analyses provide strong evidence that hospital systems have been successful in reducing costs, lowering expenditures, and improving quality through hospital acquisitions. In addition to finding further evidence that hospital acquisitions lowered operating costs, we find that mortality rates and readmission rates decreased at hospitals following their acquisition. While we cannot determine which of the efforts undertaken by the acquiring hospital systems led to these improvements, our results are consistent with the views of interviewed hospital leaders, who consistently articulated the benefits that hospital acquisitions can deliver.

Sources

1. The authors are economists at Charles River Associates. The conclusions set forth herein are based on independent research and publicly available material. The views expressed herein are the views and opinions of the authors and do not reflect or represent the views of Charles River Associates or any organizations with which the authors are affiliated. Financial support was provided by the American Hospital Association.
2. Monica Noether and Sean May. Hospital Merger Benefits: Views from Hospital Leaders and Econometric Analysis. January 2017.
3. American Hospital Association 2019 Chartbook, Chapter 4.
4. American Hospital Association, Underpayment by Medicare and Medicaid Factsheet, January 2019.
5. American Hospital Association 2019 Chartbook, Chapter 3.
6. American Hospital Association 2019 Chartbook, Chapter 4.
7. A June 2019 survey by the Health Care Financial Management Association and Navigant found that 64% of hospital finance leaders said they anticipated assuming additional risk with commercial payors and 51% indicated anticipating additional risk in Medicare Advantage contracting. <https://www.navigant.com/-/media/www/site/insights/healthcare/2019/risk-readiness-infographic.pdf?la=en>

8. "CVS Health Completes Acquisition of Aetna, Marking the Start of Transforming the Consumer Health Experience." Press Release, November 20, 2018.
9. <https://havenhealthcare.com/vision>. See, also: "What is Haven? Amazon, JPMorgan, Berkshire revamp healthcare." March 13, 2019. <https://www.cnn.com/2019/03/06/amazon-jp-morgan-berkshire-hathaway-health-care-venture-named-haven.html>
10. See, for example, Artiga and Elizabeth Hinton. "Beyond Health Care: The Role of Social Determinants in Promoting Health and Health Equity. Issue Brief. Kaiser Family Foundation. May 2018. <http://files.kff.org/attachment/issue-brief-beyond-health-careSamantha>
11. American Hospital Association. Addressing Social Determinants of Health. 2018. <https://www.aha.org/addressing-social-determinants-health-presentation>
12. Bruce Japsen. CVS Health Launches Social Determinants Provider Network. *Forbes*. July 24, 2019. <https://www.forbes.com/sites/brucejapsen/2019/07/24/cvs-health-launches-social-determinants-provider-network/#2fd8bfac1bae>
13. All of the quantitative measures described in this section are calculated relative to a comparable group of hospitals. That is, for example, a "2.5% reduction in operating expense per admission" implies that operating expense per admission at the acquired hospitals increased 2.5% less than operating expense per admission at comparison hospitals. The statement does not, however, necessarily imply that operating expense per admission at the acquired hospitals went down in absolute terms.
14. In our original study we found that an acquisition is associated with a statistically significant decrease of 3.9 percent in net patient revenue per adjusted admission. Our current results now indicate a statistically significant 3.5 percent decrease in net patient revenue per adjusted admission. In both the previous and current analyses, the revenue decline that we measure is not statistically different than the expense decline.
15. See Hospital Merger Benefits: Views from Hospital Leaders and Econometric Analysis.
16. We exclude critical access hospitals, which are generally small, geographically isolated hospitals.
17. Using data reported to the AHA in its Annual Survey, the number of adjusted admissions is calculated by taking the number of inpatient admissions and adding to that value a number of imputed "outpatient admissions" based on the relative magnitudes of inpatient and outpatient revenue reported at the hospital (i.e., outpatient revenue is converted to an equivalent number of inpatient admissions).
18. See, e.g., Connor et al. (1998), Radach et al. (2001), and Alexander et al. (1996).
19. See, e.g., Connor et al. (1998) and Radach et al. (2001).
20. To construct these composite indices, we normalize each component of the index by calculating the difference between each hospital's rate and the average rate of all hospitals, and then divide this difference by a measure of the dispersion of the rate. (In more technical terms, we transform each component to have a mean of zero and a standard deviation of one.) The composite outcome index is calculated as the simple average of these normalized components.

21. See The Dartmouth Atlas of Health Care, available at <http://www.dartmouthatlas.org>.
22. All of these variables are measured in logarithms.
23. All of these variables are measured in logarithms.
24. In more technical terms, our analysis includes both Hospital Referral Region and year fixed effects.
25. Although these estimates suggest that acquisitions are associated with larger decreases in revenue, costs in our sample decline by a smaller percentage than does revenue. The precision of the estimates is such that the magnitudes of the reduction in costs and revenue are not statistically significantly different from each other.

Characteristics of Health Systems

Measure (Median)	Number of Systems
Beds (5,553)	
< 2,000	0
2,000 to < 5,000	4
≥ 5,000	6
Acute Discharges (253,858)	
< 100,000	0
100,000 to < 300,000	7
≥ 300,000	3
Net Patient Revenue (\$6.8B)	
< \$5B	3
\$5B to < \$10B	4
≥ \$10B	3
States	
1 State	4
2 or 3 States	2
> 3 States	4

Measure (Median)	Number of Systems
Core Based Statistical Areas	
< 3 CBSAs	2
3 to 4 CBSAs	1
5 to 9 CBSAs	2
≥ 10 CBSAs	5
Total Medicare Inpatient Days (48%)	
< 40%	0
40% to < 50%	7
≥ 50%	3
Total Medicaid Inpatient Days (24%)	
< 20%	1
20% to < 30%	9
≥ 30%	0
Total Combined Medicare and Medicaid Inpatient Days (72%)	
< 65%	0
65% to < 75%	9
≥ 75%	1

Sources: Total Medicare and Medicaid inpatient days: AHA's 2017 Annual Survey; Net Patient Revenue: HCRIS database for 2017; All other measures: American Hospital Directory.

Benefits to Consumers of Hospital Mergers: Questions for Hospital Leader Interviews

1. Have you undertaken any mergers with, acquisitions of or looser affiliations with other hospitals since 2015? If so, please describe.
2. What are your primary motivations for mergers or acquisitions with/of other hospitals? e.g.:
 - Increased need for scale related to, e.g., enhanced IT infrastructure requirements;
 - Scale and scope expansion in order to undertake population health initiatives and risk sharing and to respond to other health reforms;
 - Investment demands for replacement of aging facilities or addressing capacity constraints, and associated difficulties in obtaining access to capital;
 - Better ability to use existing space to allocate patients across several campuses;
 - Clinical service consolidations to take advantage of volume-related quality improvement and operating cost reductions;
 - Ability to adopt best practices by combining two clinical staffs;
 - Development of “hub and spoke” approaches to care delivery across a broad geography;
 - Reduction in supply chain costs or other non-labor operating expenses;
 - Reductions in labor costs or productivity/satisfaction improvements for acquired workforce.
3. For any of these motivating factors that have factored into your decision making, discuss:
 - Whether, why, and how the goal can be more effectively accomplished through a complete merger or acquisition rather than through a looser affiliation;
 - Provide specific examples of your attempts to accomplish the objectives cited above through looser affiliations or unilateral activities rather than complete mergers;
 - Were you successful in these attempts to accomplish these objectives through affiliations looser than complete merger? What difficulties, if any, did you encounter?
 - Have your motivations changed in recent years?
 - Has your ability to accomplish your objectives changed?

4. Has the prospect of new non-traditional entrants, e.g., Amazon, Aetna-CVS, affected your merger and acquisition strategy?
5. If you have participated in mergers (or looser affiliations), please address the following (preferably with data and metrics):
 - Have operating costs been reduced—and if so, in what areas and by how much?
 - Has quality improved—and if so, in what areas and measured how?
 - What new programs, if any, have been initiated?
 - What clinical consolidations have occurred?
 - Have any capital costs been avoided?
 - Have you invested in the hospitals' IT infrastructure?
 - Have you entered into risk-sharing arrangements with insurers?
6. Could these savings or quality improvements been accomplished from a looser affiliation?
 - Why or why not?
7. Have you considered “vertical” arrangements with other health care providers (e.g., physicians or outpatient providers) or health plans as an alternative or in addition to horizontal combinations with other hospitals?
 - Do other factors relating to the benefits of merger vs looser affiliation enter into such considerations?