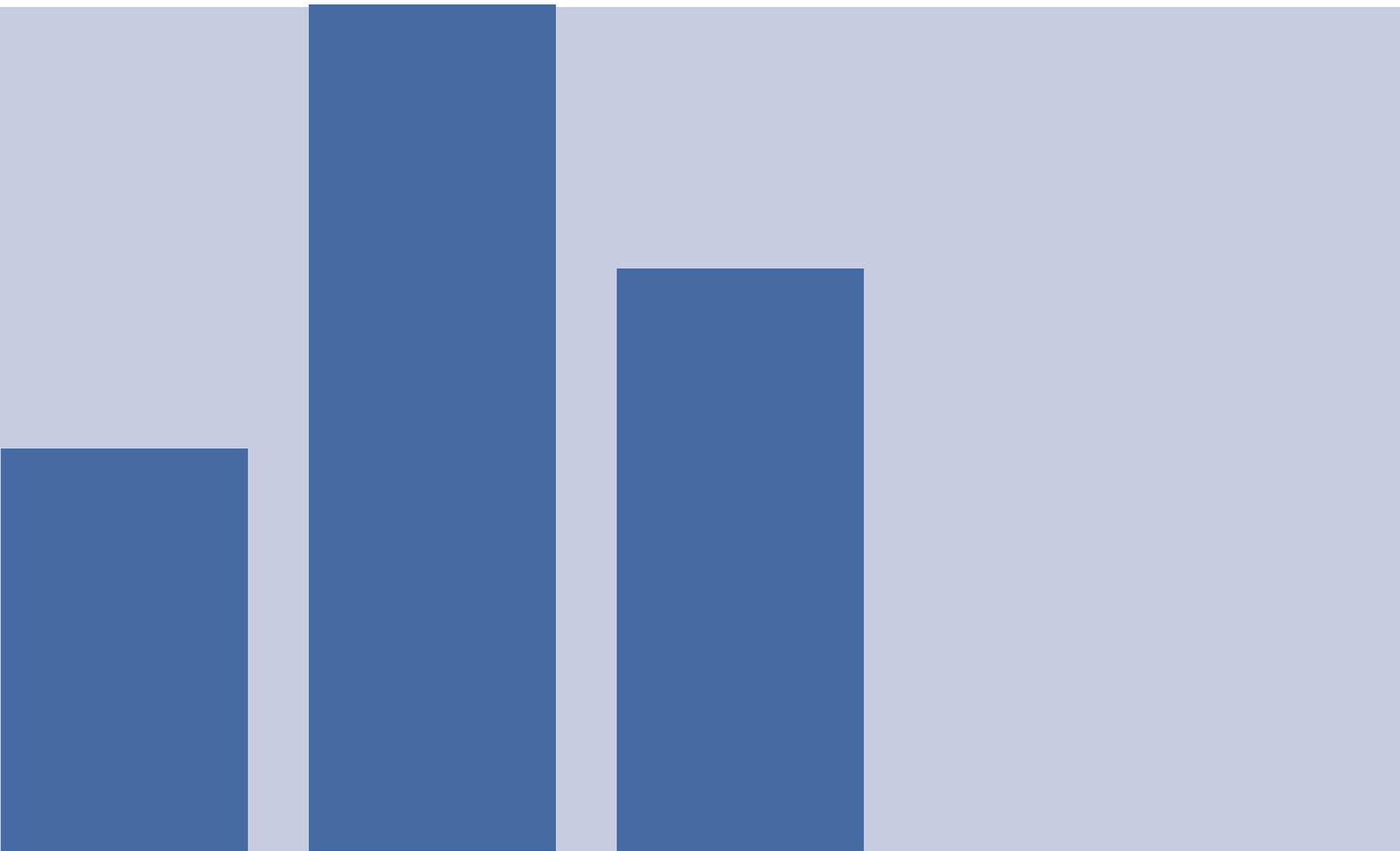


CASE STUDY SERIES:
MANAGING INNOVATION
Point-of-Care Ultrasound at Banner Health



Impact & Reach of The Academy Members

The Academy member health systems have evolved through consolidation and organic growth during the lifespan of The Academy. In most cases, they are the private sector leaders in their communities by developing fully integrated, population-based services. We have taken seriously our mission of assisting executives to build successful enterprises, which has led to the variety of services that now comprise The Academy.

1600+ Hospitals and Counting



Did You Know?

The Academy Top-100 Health Systems Represent:

- 65% Patient Revenue
- 67% Inpatient Visits
- 40% ER Encounters
- 46% Outpatient Visits
- 44% Healthcare Employees
- 44% Employed Physicians
- 4% GDP

“As pace of change in the healthcare industry increases, the value of learning from the best educators and your peers becomes more critical.”

– James H. Skogsbergh
President & CEO, Advocate Health Care

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The Academy Case Study Series

The Academy Case Study Series is designed to highlight the challenges and opportunities of Leading Health Systems. The cases, developed by The Academy researchers, present actual activities and events from Leading Health Systems that assist in The Academy's peer learning programs, including Executive Forums, Collaboratives, Fellowship Programs, and the Physician Leadership Program.

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The Innovation Case Study Series

Accelerating the adoption of innovative technologies across all units within the health system has become a greater priority as technology advancements, regulatory changes, payment transitions and clinical restructuring transform healthcare in increasingly rapid cycles. Through a five-part case study series, we use the example of point-of-care ultrasound, a potentially disruptive, yet adaptable imaging technology, to explore the stages of adoption from organic growth through facilitating innovation. Point-of-care ultrasound has a documented improvement in quality, patient benefit, and cost efficiency which made it an ideal technology to study and learn from.

Study Overview

Over the span of 13 years, Banner Health has incrementally adopted point-of-care ultrasound (PoCUS) across the health system through organic growth, unintended disruption and intended disruption. In all cases, Banner Health's operating processes led to PoCUS becoming a facilitating innovation, which improved diagnosis, treatment decision making, clinical outcomes and reduced costs.

Study Purpose

How did Banner Health, one of the largest health systems in the nation, successfully manage implementation of a technological innovation to improve its delivery of evidence-based patient care? This case study examines how Banner Health succeeded, in partnership with its point-of-care ultrasound (PoCUS) supplier, in leveraging its unique clinical improvement process to strategically adopt this flexible imaging innovation.

The Healthcare Environment

Multi-hospital integrated health systems are facing an evolving set of opportunities and challenges as the healthcare industry undergoes substantial transformation (Figure 1). Major transitions include:

- Providing more services for less reimbursement;
- Decreasing the variation of care and increasing efficiency;
- Transitioning from a volume-based payment system to one based on value.

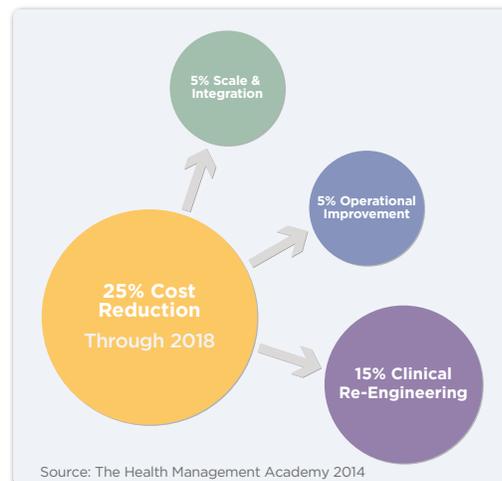
All health systems are lowering their expense structures and the largest contributor is clinical re-engineering.¹ The degree of clinical re-engineering required will necessitate extensive change. This study will focus on how institutions adapt and organize to not only accept change but embrace innovation. PoCUS can be a significant contributor to cost reduction while improving quality and patient care. This case study shows how Banner Health adopted PoCUS as part of its clinical restructuring program.

Point-of-Care Ultrasound

Point-of-care ultrasonography is a safe and effective form of mobile imaging well defined in literature as “ultrasonography brought to the patient and performed by the provider in real time.”² The time to action is immediate, with improved early diagnosis and treatment,^{3, 4, 5, 6} reduced complications when used for procedure guidance (particularly needle-based procedures such as venous access, drainage of fluid, and regional anesthesia/nerve blocks),^{3, 6, 7, 8, 9, 10, 11, 12, 13} decreased length of stay, substitution of ultrasound for other forms of imaging (e.g., CT and MRI) and lower cost of care. PoCUS is becoming a core part of clinical training as its application grows across specialties and clinical areas.

PoCUS is “disruptive” as it requires new equipment, changes workflow, moves the imaging to the point of care, alters provider roles, and requires standardized training and supervision of providers not previously necessary. Implementation requires careful planning to manage disruptions to the status quo of care management. The advantages of improved

Figure 1. The Healthcare Environment



quality, increased efficiency, and lowered costs in an era of “doing more for less” will outweigh disruption if implemented effectively.

Managing Innovation

An innovation can be an idea, a practice, or an object (technology, device, drug) that is perceived as new by an individual or group,^{14, 15} or in this case a health system. Assessment, adoption, and implementation of new technologies are analogous to the adoption and diffusion of innovation. Seminal work in both technology assessment^{16, 17} and diffusion of innovation^{14, 15} emphasizes organizational factors necessary for success:

- Integration and alignment of innovation and technology assessment with the strategic plan, mission and culture of the organization;
- A learning culture, open to change;
- Standardized, centralized approach for evaluation built around a formal, standing assessment committee and structured process for review;
- Broad engagement of clinicians and end users in the assessment, implementation, clinical use, and monitoring of effectiveness;
- Closing the loop - evaluation of clinical impact, outcomes, and cost savings – to define value and determine degree of ongoing use.

Managing Innovation at Banner Health

Banner Health, headquartered in Phoenix, Arizona, operates 24 hospitals and many ambulatory and other health delivery entities across seven states. It is one of the largest health systems in the nation. It generated 77% of its 2013 \$4.9 billion net patient revenue from services provided in Arizona.

Banner Health’s organizational culture and strategic plan embrace continuous learning and innovation. Innovation is defined as “the rapid identification and deployment of strategies leveraging Banner Health’s operating model and the science of care delivery to ensure a patient experience which is safe, efficient and effective.”¹⁸ One of Banner Health’s core strengths is its approach to change management and dedication to reducing the lag time between the identification of an evidence-based clinical practice and when the practice becomes widely accepted, implemented, and is a predictable part of daily care (Figure 2). A three-step approach is used:

- Define the clinical practice or clinical issue addressed by a new approach or technology;
- Design how the innovation will be implemented – includes training and education, changes in flow of care or order sets, and communication plans;
- Implement using clinical teams and project management tools and techniques.

Physician input and engagement is a critical part of all three phases, allowing for more rapid implementation and appropriate use. Banner Health’s Care Management Process is approved, funded, and monitored by a health system-level Care Management Council, composed of the organization’s clinical and administrative leadership.

Banner Health Profile

24 Hospitals Across 7 States:

Alaska, Arizona, California, Colorado, Nebraska, Nevada, and Wyoming

\$4.9 Billion 2013 Net Patient Revenue

675,438 Emergency Department Visits

2,636,000 Clinic Visits

256,000 Inpatient Admissions

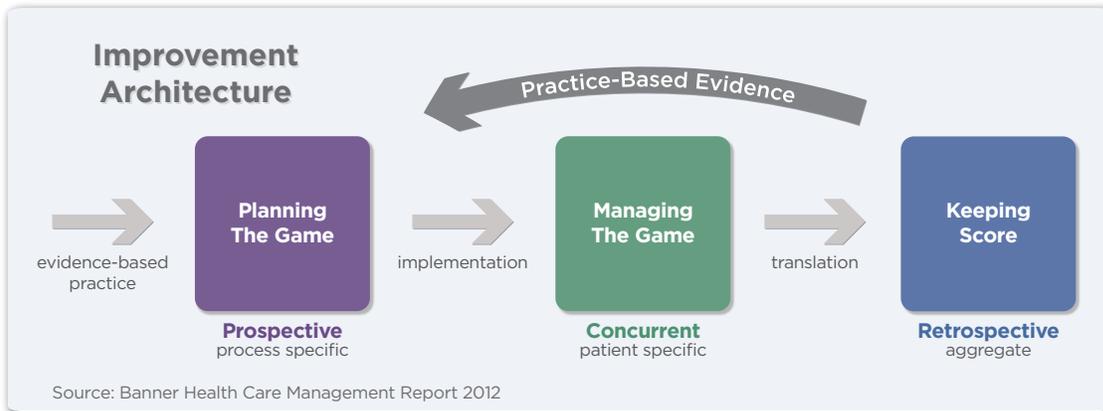
2nd Largest Private Employer in Arizona

36,000 Employees

821 Employed Physicians in Banner Medical Group

Roughly 7,000 Medical Staff Members

Figure 2. Banner Health's Care Management Process



Banner Health leveraged its culture, operating model, and collective decision-making process to implement a cluster of technologies and organizational structures, which provide the infrastructure that further enables and accelerates innovation, clinical redesign and quality improvement. The improvement architecture includes:

- Comprehensive electronic medical record (EMR) across all Banner Health facilities with resultant advanced information technology;
- Evidence-based automated Early Warning System (EWS) that identifies critically ill patients or patient deterioration and initiates evaluation;
- Clinical Simulation Center and Training Program.

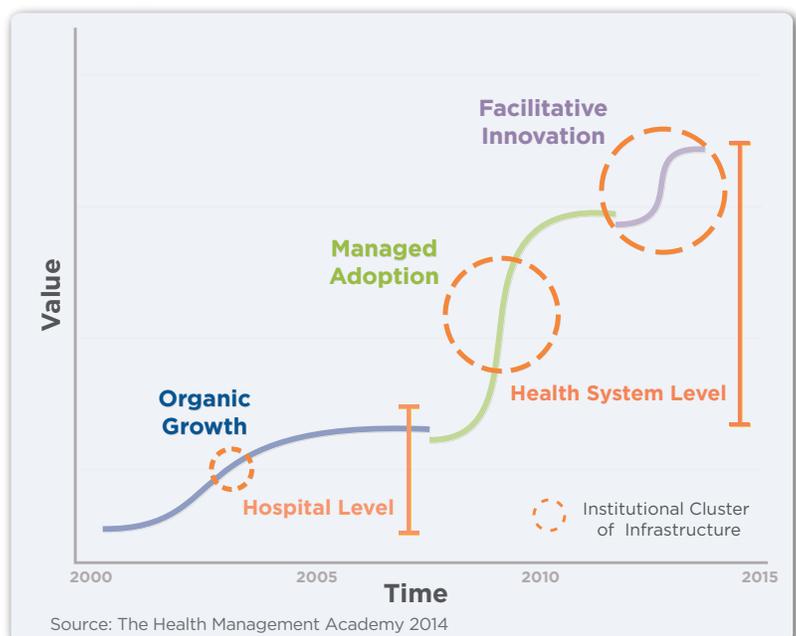
Adoption & Diffusion of Point-of-Care Ultrasound

The potential for a health system to derive maximum value from an innovation is contingent on its capability to embrace and adopt the technology into the infrastructure of the health system (Figure 3). The adoption process is initiated with the organic growth of technology at the local facility level by a core group of users. As the technology proliferates, engagement of organizational leaders promotes streamlined management of diffusion to other individuals and facilities. Systemic planning and implementation allows an organization to achieve proof of concept in building a strong infrastructural foundation. When this foundation is leveraged, the health system is able to reap significant value as the innovation facilitates important changes in clinical practice.

Early Organic Growth of PoCUS

While traditional uses for ultrasound in radiology and obstetrics had long existed, the introduction of PoCUS at Banner Health began in the early 2000s when a Chief Nursing Officer at the time, Deb Martin, borrowed a machine from the Radiology Department to enable her to successfully place a PICC line with ultrasound guidance in a patient with difficult access. Based upon positive clinical experience and evidence, Ms. Martin and Kathy Altergott, Director of Medical Imaging, supported initial diffusion

Figure 3. Progression of Innovation-Based Value



focused on vascular access. This spread across Banner Health by informal person-to-person instruction and was supported by local departmental budgets.¹⁹ The early pilots were successful; they validated patient safety, quality and resource savings.

The visibility of the success that the Nursing Department had with the PICC line placement led to further organic spread of PoCUS devices in a number of Banner Health hospitals as other departments and disciplines explored its use.

While PoCUS continued to proliferate amongst the nurses outside of the PICC team peer-observation, an adverse patient incident prompted further consideration of ultrasound. The sentinel event engaged Banner Health's Risk and Care Management teams to conduct a root-cause analysis resulting in an ultrasound-guided mandate for vascular access across the health system.

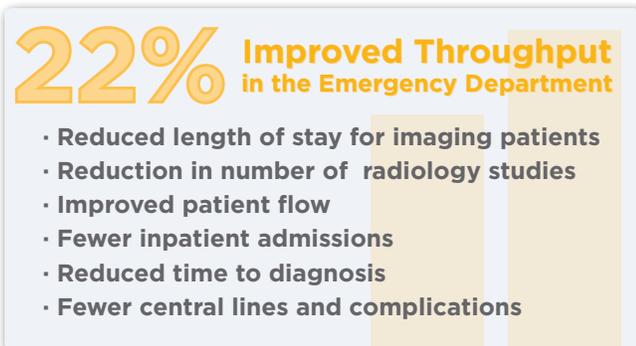
“ Ultrasound makes all the difference when starting IVs and PICC lines. It improved our nursing team's overall ability to start lines without guidance.”

- Kathy Altergott, Director of Medical Imaging

Managed Adoption and Diffusion of PoCUS

Execution of the ultrasound-guidance mandate was enhanced by the co-development of a training program by Banner Health's Simulation Center and its PoCUS supplier. In 2008, Banner Health developed and implemented its Define-Design-Implement process, and the over-arching organization and functional components of the Care Management Process, including the Clinical Consensus Groups and Care Management Council. All health system level technology requests were evaluated by a centralized Technology Assessment Committee, integrated with the capital planning process, which provided multidisciplinary expert review and a formal methodology for both assessment and implementation.

Figure 4. Results of ED Innovation



This cluster of changes to support innovation at Banner Health (Figure 3) resulted in the planned, organized and rapid health system-wide diffusion of PoCUS in multiple clinical areas (initially most notably the ED and ICU). The implementation plan anticipated and addressed the extensive clinical re-engineering necessary to minimize disruption. The evidence for improved throughput (Figure 4) in the Emergency Department validated the necessary disruptive

changes in practice patterns and flow of care. As a result of this planning process, PoCUS diffusion progressed from organic growth into managed adoption, setting the stage for rapid facilitative innovation.

Facilitative Innovation in the ICU

Once a cluster of supporting infrastructure exists, facilitation can accelerate. This facilitative adoption can be very rapid (months), builds upon existing infrastructure (Banner Health method), and takes advantage of prior innovation and technology clusters.

Intended Disruption

The Story - Dr. Khurana's Challenge at 3am

In 2011, Dr. Hargobind Khurana, a consulting ICU physician, was called to diagnose a patient in shock. He ordered an echocardiogram, which he felt to be a critical part of the evaluation. When the echocardiogram technician arrived and began the scan, Dr. Khurana learned that the cardiologist would not be available to interpret the echo until later that morning. Since he needed the results immediately, Dr. Khurana engaged an intensivist proficient in echocardiography through iCare, Banner Health's remote telemedicine central facility to interpret the results in real time. Within minutes, Dr. Khurana was able to accurately assess both the cardiac output and the adequacy of intravascular volume, make an appropriate diagnosis, and monitor the response to treatment in real time, saving the patient's life.²⁰

The Decision to Intentionally Disrupt

This incident in the ICU highlighted the need for the ability to capture and interpret ultrasound images 24x7, and the ability to use real-time imaging to monitor response to treatment 24x7. This also shed greater light on the tremendous utility and potential value of PoCUS. This situation was quickly elevated to the Care Management Council. Consensus was established around the need for a standardized care practice to partner PoCUS technology with iCare's 24x7 technical capabilities and immediate availability of remote consultative support.

During the Design Phase, it was decided to: (1) train respiratory therapists to capture the appropriate ultrasound images at the point of care; (2) train all of the iCare intensivists to assist the respiratory therapists in acquiring the necessary image via telemedicine monitoring, interpret the image in real time, and use ultrasound imaging to assess the fluid and cardiovascular status of patients in shock; (3) replace CVP monitoring with PoCUS monitoring, eliminating the need for central lines in many patients. Once this was validated through a pilot project, it evolved into a new protocol with an algorithm of evidence-based clinical actions to follow in response to data. Banner Health understood that bringing ultrasound to the bedside 24x7 would require both significant new infrastructure and disruption of the existing workflow; however Banner Health determined that using the pre-existing technical resource of iCare would be the most efficient, long standing and least disruptive strategy.

“ We merged our established technology assessment process with the clinical improvement architecture and the PoCUS technology to strategically break apart existing paradigms and develop an innovative e-ICU solution.”
- Dr. Robert Groves, Vice President, Health Management

Results and Impact of e-ICU PoCUS Innovation

Banner Health reduced the time to assess the status of patients with severe hypotension through an innovative protocol and reduced the time to diagnosis and appropriate treatment by 90%.²¹

In addition, the routine use of PoCUS in the ICU has reduced the need for central lines, resulting in fewer complications (e.g., punctured lungs and central line-associated blood stream infections) and improved overall ICU throughput (Figure 5).

Banner Health continues to extend the value and clinical performance benefits of PoCUS. Through engagement of Technology Assessment and Capital Planning Committee, Banner Health is actively evaluating the e-ICU for proof of concept as consideration is given to expanding tele-ultrasound applications.

Figure 5. Results of e-ICU Innovation



Lessons Learned

Over the span of 13 years, Banner Health has incrementally adopted PoCUS across the health system through organic growth, unintended disruption and intended disruption. In all cases, Banner Health's operating processes led to PoCUS becoming a facilitating innovation, which improved diagnosis, treatment decision making, clinical outcomes and reduced costs.

“The use of PoCUS has significantly reduced variation in our clinical practices which is driving down cost and improving patient quality across the organization.”

– Becky Kuhn, Arizona Vice President

1. As an organization, Banner Health has been able to leverage its learning culture, operating model, and collective decision-making process to adapt PoCUS to successfully advance its goals of:

- Transforming the care delivery model;
- Improving quality and patient safety;
- Increasing efficiency;
- Reducing costs.

2. Banner Health's change management process identified and addressed the following key challenges through its adoption process:

- Clinician learning curve;
- Technology standardization and supporting infrastructure;
- Re-alignment and development of standard care practices.

3. Banner Health's approach to managing the disruption of PoCUS included:

- Integration and alignment of innovation assessment with the strategic plan, mission, and culture of the organization;
- A learning culture, open to change;
- Standardized, centralized approach for evaluation built around a formal, standing technology assessment committee and structured process for review;
- Broad engagement of clinicians and end users in the assessment, implementation, clinical use, and monitoring of effectiveness;
- Active leveraging of existing resources;
- Closing the loop - evaluation of clinical impact, outcomes, and cost savings – to define value and determine degree of ongoing use.

Discussion Questions

What is the difference between a disruptive and facilitating innovation? Are there examples of each within your own health system?

What are key steps in the process of converting a disruptive innovation to a facilitating innovation?

How can you apply lessons learned from Banner Health's adoption strategy within your health system?

What are potential challenges you expect your health system to encounter in the adoption of an innovation and how can you prepare your organization accordingly?

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About The Academy

The Academy provides unique, executive peer learning, complemented with rigorous and highly targeted research and advisory services to executives of Top-100 health systems. These services enable executive health system and industry members to cultivate the perspective, knowledge and relationships not found anywhere else.

The Academy has created the first and only knowledge network exclusively focused on Top-100 health systems. This learning model is based on a proven approach refined over 16 years working side-by-side with members.

THE ACADEMY KNOWLEDGE NETWORK



The Academy Member Health Systems

Company	CEO Forum	CFO Forum	CHRO Forum	CIO Forum	CMIO Forum	CMO Forum	CNIO Forum	CNO Forum	CSO Forum	GRO Forum	ONC Forum	PHIL Forum	SRE Forum	TRS Forum	CFO Fellowship	CMO Fellowship	CNO Fellowship	SRE Fellowship	Institute
Grand Total	24	56	29	24	33	36	29	36	20	37	28	23	31	37	22	54	11	22	95
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Adventist Health System (FL)	1	1	1	1	1	1	1	1		2	1	1	1	1		2			2
Advocate Health Care	1	1	1		1	1		1	1	1	1	1	1		1	2	1	2	1
Allina Health	1																		
Ascension		2								1				1					
Atlantic Health System			1	1				2			1		1			3			1
Aurora Health Care	1	1	1	1		1		1		1	1	1		1	1	3		2	
Avera Health													1						
BJC HealthCare		1		1											1				
Banner Health	1	1	1		1	1	1	2	1	1	2	1	2	1	1	3		2	5
Barnabas Health								1											
BayCare Health System	1												1						7
Baylor Health Care System		1	1				1	1		1	2			1					
Beaumont Health System	1											1							
Bon Secours Health System	1	1	1	1	1	1	1	1					1	1		2	1	1	1
CHRISTUS Health		1												1					
Carilion Clinic		1																	
Carolinas HealthCare System		1	1	1				1			1			1					
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Hospital Sisters Health System		1	1																
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Inova Health System					1					1									
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Kaiser Permanente		1																	
Legacy Health System														1		1			
Lehigh Valley Health Network	1	1	1	1	1	1		1		1	1	1	1				1		
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McLaren Health Care	1																		
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MemorialCare Health System (CA)		1								1			1						

Company	CEO Forum	CFO Forum	CHRO Forum	CIO Forum	CMIO Forum	CMO Forum	CNIO Forum	CNO Forum	CSO Forum	GRO Forum	ONC Forum	PHIL Forum	SRE Forum	TRS Forum	CFO Fellowship	CMO Fellowship	CNO Fellowship	SRE Fellowship	Institute
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St. Joseph Health												1							
Stanford Hospital & Clinics		1			1			1					1						
Summa Health System							2												
Swedish Medical Center												1							
Tenet Healthcare Corporation						1	1	1											
Texas Health Resources		1					1							1					
The University of Chicago Medical Center		1																	
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UCLA Health System					1		1	1											
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Vanderbilt University Medical Center	1			1			1	1			1				1				
Vanguard Health Systems	1	1	1	1	2	1	1									1			4
Veterans Health Administration							1												
Virtua	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3		2	9
Yale New Haven Health System	1	1		1				1	1	1	1	1	1	1	1		1	1	5

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