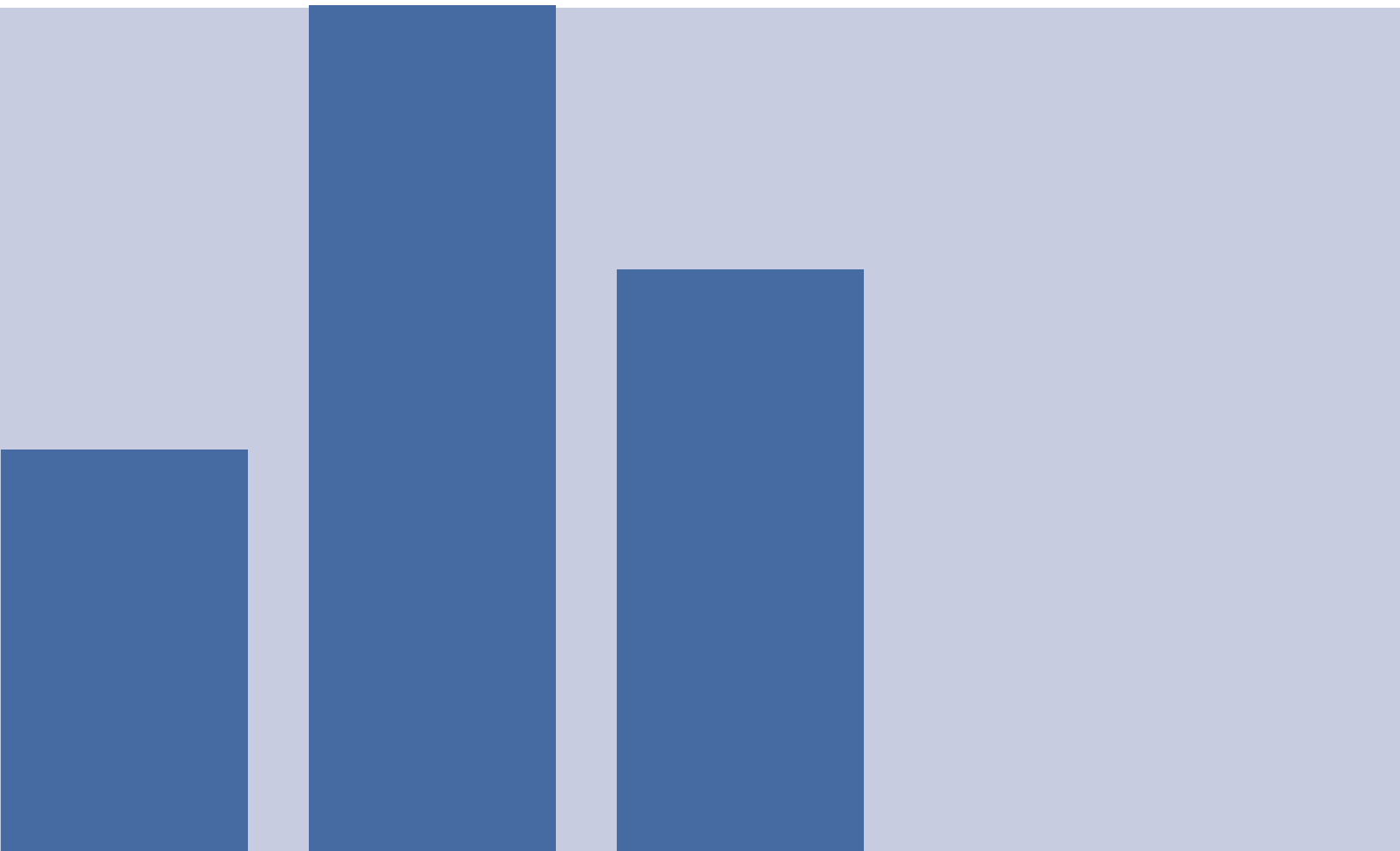


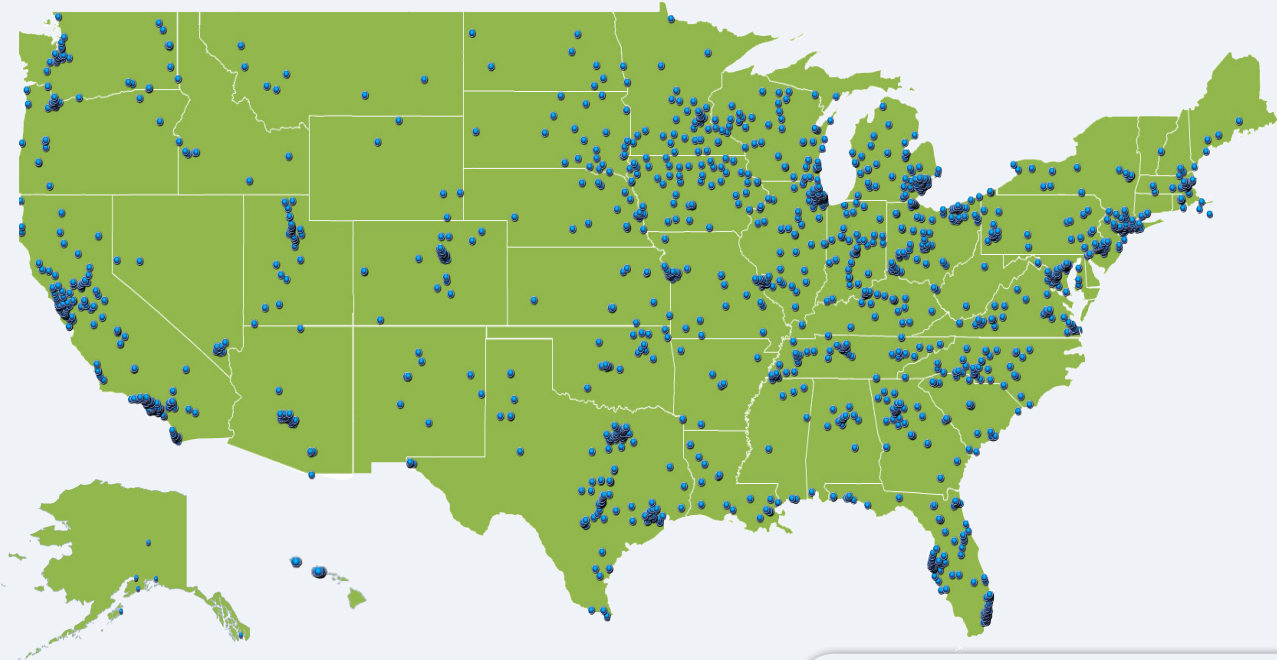
CASE STUDY SERIES:  
**CHAMPION-DRIVEN INNOVATION**  
Point-of-Care Ultrasound at Allina Health



## 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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### Acknowledgments

The Health Management Academy extends its appreciation to FUJIFILM SonoSite for providing the funding for this Case Study.



## 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: Cultivating a Champion to Drive Innovation

Allina Health has improved clinical outcomes, increased efficiency, reduced the usage of advanced imaging, and reduced costs through its organic growth and managed adoption of bedside ultrasound. The champion-driven adoption of point-of-care ultrasonography within Abbott Northwestern Hospital has re-engineered care pathways to improve clinical outcomes, providing Allina Health a facilitative foundation for its telehealth initiative.

### Study Purpose

Allina Health, one of the largest health systems in the Midwest, has systematically embraced and leveraged technologies to foster innovation. This case study examines how the physician champion-driven adoption of an innovative technology, point-of-care ultrasound, is promoting growth and increasing clinical efficiency in a competitive marketplace.

### The Transforming Healthcare Environment

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

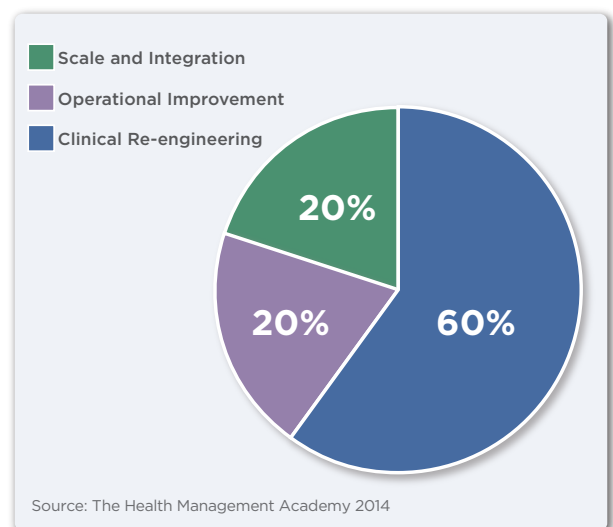
- Providing more services for less reimbursement;
- Decreasing the variation of care and increasing efficiency;
- Transitioning from a volume to value-based payment system.

Advances in technological innovations are changing how services are being delivered and paving the way to a new delivery model.<sup>2</sup> As health systems work towards lowering their expense structures, technological solutions are an integral part of the transformation by underlying clinical re-engineering, increased scale, the expanded continuum of care, and operational improvement (Figure 1).

### Innovation Promotes Growth and Value

Health system assessment, adoption and implementation of new technologies are a subset of broader innovation adoption and diffusion. An innovation can be an idea, a practice or an object (technology, device, drug) that is perceived as new by an individual or group,<sup>3,4</sup> in this case a health system. The potential for a health system to successfully derive value from an innovation is contingent on its capability to embrace and transform that innovation to serve a facilitating function through a strategic process<sup>5-7</sup> that anticipates disruption.<sup>8</sup>

Figure 1. Cost Reduction Through 2018



Seminal work in technology assessment<sup>9, 10</sup> and diffusion of innovation<sup>3, 4</sup> emphasizes key aspects of organizational culture and infrastructure necessary for success:

- A learning culture, open to change;
- Broad engagement of clinicians and end users in the assessment, implementation, clinical use, and monitoring of effectiveness;
- Integration and alignment of innovation and technology assessment with the strategic plan, mission and culture of the organization;
- Closing the loop – evaluation of clinical impact, outcomes and cost savings – to define value and determine the degree of ongoing use.

## Point-of-Care Ultrasound Provides Opportunity for Innovation

Point-of-care ultrasound (PoCUS) technology is a safe and effective form of mobile imaging defined as “ultrasonography brought to the patient and performed by the provider in real time.”<sup>11</sup> The time to action is immediate, with improved early diagnosis and treatment,<sup>12-15</sup> reduced complications when used for procedure guidance (notably needle-based venous access, drainage of fluid, and regional anesthesia/nerve blocks),<sup>12, 16-20</sup> decreased length of stay, substitution of ultrasound for other forms of imaging (e.g., CT and MRI), and lower cost of care.

Ultrasound is increasingly becoming the preferred imaging modality in patient care. A paradigm shift from select medical specialties (anesthesia, obstetrics, critical care, emergency medicine, and cardiology) to an array of specialties and care pathways, has allowed clinicians to address focused clinical questions in real time at the patient’s bedside.<sup>11</sup> Compelling outcomes data across these clinical areas suggest PoCUS presents a unique opportunity to significantly improve the physical examination and create efficiencies in care delivery pathways.

### Allina Health Profile

**12 Hospitals Across 2 States:**  
Minnesota and Western Wisconsin

**\$3.4 Billion 2013 Net Patient Revenue**

**320,000 Emergency Department Visits**

**3,000,000 Clinic Visits**

**1,200,000 Hospital Outpatient Admissions**

**113,000 Inpatient Admissions**

**26,400 Employees**

**5,000 Associated and Employed Physicians**

## Allina Health

Allina Health is a not-for-profit organization of clinics, hospitals and other health care services providing care throughout Minnesota and western Wisconsin. Abbott Northwestern Hospital (Abbott Northwestern) is the health system’s largest of 12 hospitals, contributing to over one-third of inpatient admissions. Allina Health has over 26,000 employees and more than 50 health and medical clinics united by a mission to “serve our communities by providing exceptional care, as we prevent illness, restore health and provide comfort to all who entrust us with their care.”

Committed to exceptional care and innovation-based value for cost reduction and clinical quality, Allina Health:

- Cultivates champions to drive clinical innovation;
- Adopts innovative technologies to broaden its market.

## Abbott Northwestern Cultivates a Champion for Clinical Innovation

### Champion-Driven Organic Growth for Procedure Guidance

Dr. David Tierney, Director of Abbott Northwestern’s Internal Medicine Bedside Ultrasound and Center for Clinical Simulation, recognized the value PoCUS offered physicians when used as an integral component of a patient’s physical examination during his medical education. Invested in the clinical utility of the technology, in 2007 as Chief Resident at

“Cultivating a local champion who possesses dynamic skill and intangible qualities is the seed for success.”

– Dr. Terry Rosborough, Director of Medical Education

Abbott Northwestern, Dr. Tierney, approached Dr. Terry Rosborough, Director of Medical Education, about establishing a formal team of trained Internal Medicine residents and hospitalists to perform PoCUS-guided procedures (e.g., vascular access, nerve block).

Dr. Rosborough recognized Dr. Tierney’s potential and offered his support. The Abbott Northwestern procedure

team was departmentally-funded and launched to immediate success, and has grown organically by 67% from performing 300 in 2012 to over 500 procedures in 2013. The incorporation of PoCUS-guided procedures at Abbott Northwestern has reduced complications yielding industry-leading,<sup>17, 18, 21-27</sup> low complication rates for several procedures (Figure 2).

Initially, limited educational and equipment infrastructure existed to support the procedure team. Even so, clinicians continued to hone their PoCUS skills and develop training curricula as Dr. Tierney and his team tracked clinical outcomes to support an evidence-based, best-practice model. As interest piqued informally in procedure-based ultrasonography through peer interactions, other departments independently pursued PoCUS within their specialty care practices.<sup>33</sup> As a result of the champion-promoted value proposition, PoCUS has been integrated into procedural practice across Abbott Northwestern in Anesthesia, Cardiology, Critical Care, Internal Medicine, Obstetrics, and Emergency Medicine.

The hospital’s leadership identified and cultivated Dr. Tierney as a champion capable of leading innovation and behavioral change. Dr. Tierney was able to establish the protocol and educational building blocks needed to enable the organic proliferation of PoCUS.

Figure 2. Abbott Northwestern’s Complication Rates

|                  |       |
|------------------|-------|
| Arterial Line    | 0.00% |
| Venous Line      | 0.52% |
| Paracentesis     | 0.46% |
| Thoracentesis    | 0.33% |
| Skin Biopsy      | 0.00% |
| Joint Aspiration | 0.00% |

\*Selected rates from 2011-2014, IMBUS-PCI Study<sup>37</sup>

## Managing Bedside Ultrasound for Diagnostic Evaluation

As the success for the Internal Medicine procedure team became visible to other clinical service lines and administrative leaders at Abbott Northwestern, demand for PoCUS, particularly for diagnostic clinical applications, increased. Consequently, in 2011 the Internal Medicine department incorporated PoCUS into the patient’s bedside evaluation by launching formally the Internal Medicine Bedside Ultrasound (IMBUS) Program (Figure 4). The IMBUS residency program follows a 3-year curriculum (Appendix A) designed to integrate PoCUS into the traditional physical exam, demonstrate how ultrasound can improve the sensitivity and specificity of a physical exam beyond that of a stethoscope, improve diagnostic acumen, and reduce time to diagnosis and treatment.

## Expanding Institutional Infrastructure to Support Adoption

PoCUS’ mobility and broad utility for diagnostics make it an advantageous innovation that enables efficient care processes at the patient’s bedside. Dr. Tierney anticipated that implementing PoCUS through the IMBUS program would be disruptive as it requires investment in equipment, changes in workflow, moves imaging to the point of care, changes provider roles, and requires standardized training and supervision.

“We’ve developed a hybrid examination with pieces from the traditional physical exam and PoCUS to provide the best for the patient.”

– Dr. David Tierney, Director of Internal Medicine Bedside Ultrasound & Center for Clinical Simulation

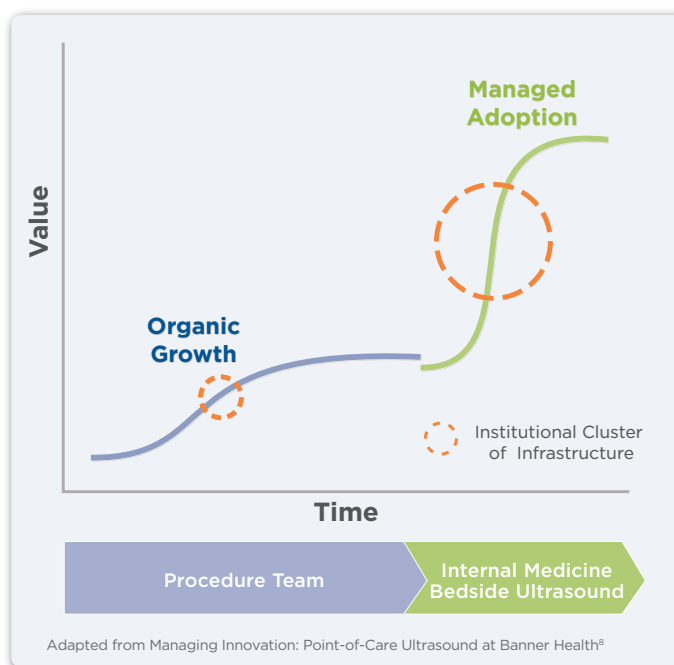
To prepare for disruption and widespread adoption, greater institutional infrastructure was necessary. With significant resources dedicated towards training and credentialing, Drs. Tierney and Rosborough established a formal training curriculum to equip residents with a comprehensive PoCUS skill set. The program employs a simple “see one, practice a bunch, do one” mantra incorporating an array



of learning disciplines (e.g., pulmonary, cardiovascular, abdominal, soft tissue, musculoskeletal and procedural ultrasound). The first step entails a 40-hour, intensive boot camp designed to introduce the basic ultrasound principles in knobology, anatomy, and utility by organ system. Residents acquire technical proficiency as they develop diagnostic evaluation and procedure skills at Abbott Northwestern's state-of-the art simulation center and at the patient bedside under faculty guidance. In addition to procedure guidance and incorporation into physical assessment, residents are trained to use PoCUS to evaluate critically ill patients with conditions such as shock, heart failure and severe shortness of breath.

To promote standardized training and credentialing for PoCUS learners, Abbott Northwestern adapted its information systems architecture, electronic medical record (EMR), and wireless network to connect the hospital's PoCUS devices to record ultrasound readings. Implementation of an intuitive and easy-to-use mobile tracking system facilitated PoCUS examinations record-keeping for review and certification by faculty. A resident's certification for a PoCUS competency (e.g., pulmonary) requires a minimum number of faculty over-read and approved ultrasound examinations to achieve adequate mastery. As illustrated in Figure 3, this growing cluster of infrastructure smoothed the transition from organic, champion-led growth for the procedure team to managed adoption of PoCUS through the introduction of IMBUS at Abbott Northwestern.

Figure 3. Innovation-Based Value at Abbott Northwestern



### Growth in PoCUS Procedures and Diagnostic Applications

Clinician engagement has been positive and PoCUS utilization has grown significantly through the IMBUS program. The use for patient diagnostics has more than doubled from 4000 to 9000 assessment applications between 2012 and 2013.

The IMBUS program operates under the hypothesis that routine use of PoCUS, as part of the physical evaluation and assessment of patients, will reduce the cost of hospitalization, improve efficiency of patient management (shorter time to diagnosis and ability to monitor response to treatment at the bedside), reduce complications, avoid consumption of additional resources (e.g., CT scans), and enhance patient engagement and satisfaction. Dr. Tierney and his team have been gathering data to test this hypothesis in a four-year, patient care improvement (IMBUS-PCI)<sup>32</sup> study to substantiate the observed improvements in internal medicine practice at Abbott Northwestern (Appendix B). Establishing PoCUS as a routine component of the physical exam has enhanced patient care, providing a foundation for other innovative programs at Allina Health including strategic expansion of the health system's telehealth initiative.

## Allina Health Adopts Telehealth to Broaden its Market

### Telehealth Strategy

Allina Health forecasts that it needs to double in size in order to remain competitive within its market. Whereas Minnesota regulatory constraints preclude significant acquisition of health facilities to meet this growth target, state regulatory policies regarding telehealth are less restrictive.<sup>28, 29</sup>

Telehealth refers to the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration. Technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications.<sup>30</sup>

Creating a climate conducive to telehealth expansion<sup>31</sup> will help Allina Health take advantage of its leading market position in specialty services, as well as support the transition to risk-based reimbursement where connections with patients are

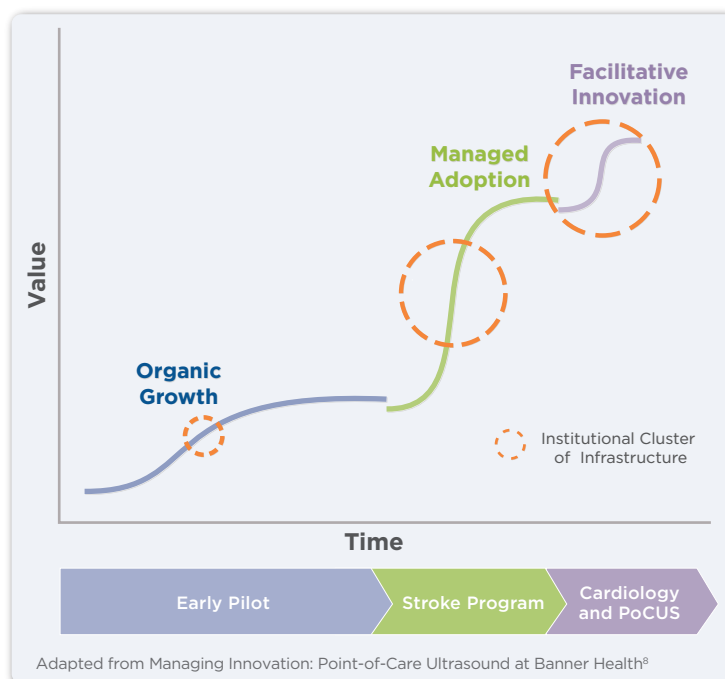


of greater value than discharges and visits.<sup>34,35</sup> While Allina Health is a leading resource for comprehensive specialty care (e.g., stroke, neurology), access to this level of expertise in its regional hospitals is limited. Telehealth adoption allows Allina Health to improve rural access to care in a lower-cost setting by connecting its providers to patients. This outreach strategy broadens Allina Health's market, increasing its reach to include the 80% of Minnesota's population outside of metropolitan areas.

## Organic Growth Leads to Early Telehealth Pilot

In pursuit of its growth objectives, Allina Health initiated an outreach strategy to develop a tight network of affiliated facilities and care providers for greater coverage across Minnesota's geographic areas. In the early 2000s, a pilot using telehealth's digital backbone was launched in effort to enhance care delivery in Allina Health's rural clinics and facilities patient population. The early pilot was successful in coordinating telehealth technologies and Allina Health's remote service offerings but technical difficulties (e.g., transmission quality, bandwidth) limited progress. The early pilot taught Allina Health that the cluster of audiovisual, EMR and telecommunications technology infrastructure (Figure 4) required for success needed enhancement to support an effective telehealth program.

Figure 4. Telehealth Innovation-Based Value at Allina Health



## Managing Intended Disruption to Treat Stroke Patients

Technological advancements over a decade and learnings from the early pilot, allowed Allina Health to strengthen and reorient its telehealth strategy. With this foundation in place, in 2010, Allina Health leadership pursued an initiative to refine its approach to managing and integrating telehealth for stroke treatment using a more advanced technology platform.

Allina Health anticipated disruption throughout the process of integrating tele-stroke care. The need to modify familiar protocols and to introduce new care pathways for remote physicians would be challenging. As clinicians adapted their clinical evaluation and treatment processes, the stroke initiative validated effective management of remote stroke patients using telehealth within Allina Health Network's infrastructure.

Continued expansion of the Allina Telehealth Network to a broad array of specialty services is strategic to Allina Health's goal to broaden its market while fulfilling its mission of providing exceptional care. Building from the stroke initiative, Allina Health capitalized on the existing infrastructure of the Allina Telehealth Network to begin developing its tele-cardiology service line.

## Facilitating Telehealth Expansion with PoCUS

The Minneapolis Heart Institute, in collaboration with Allina Health Network, expanded telehealth services to include cardiology. While the stroke and early stages of the cardiology initiatives succeeded in bundling Allina Health's clinical services, telehealth clinicians found themselves with limited diagnostic information hindering overall quality of patient evaluation and treatment.

To account for the lack of diagnostic cues typically obtained during a live physical exam, nurse practitioners and physician assistants in Allina Health's clinics and rural areas are being trained in PoCUS to assist with cardiovascular ultrasound physical examinations (CVUPE). The on-site provider will capture baseline images (e.g., heart, lungs, carotid arteries, abdominal aorta) which will then become available in Allina Health's EMR, allowing cardiologists to remotely review

in real time to direct care. The cardiology pilot will focus on select sites initially, and then expand to other locations and specialty services after a review of the program's clinical efficacy.

Launch of the PoCUS-integrated cardiology program in early 2014 builds upon Allina Health's telehealth foundation, established by the early, organic pilot and managed stroke initiative; and is facilitated by the comprehensive IMBUS educational program developed at Abbott Northwestern. Drs. Tierney and Rosborough will be responsible for coordinating the PoCUS training and education, while cardiovascular-specific training will be provided through the Minneapolis Heart Institute cardiology staff. One week of on-site training at Abbott Northwestern will be provided, including technical training on PoCUS operation and clinical training from designated faculty and staff. Further training will include rounding with Abbott Northwestern staff and continuous on-site mentoring.

“ We think the tele-ultrasound physical examination will be better than a traditional exam.”

– Dr. Robert Hauser, Minneapolis Heart Institute

## Looking Forward and Next Steps

Evaluation of the IMBUS Program's value will continue forward in effort to validate the observed anecdotal outcomes of Abbott Northwestern's use of PoCUS for clinical diagnostics. The results of this evaluation through the IMBUS-PCI study, projected for completion in 2015, will guide future applications of bedside ultrasound in other clinical areas.

Allina Health's hypothesis is that the PoCUS-integrated telehealth CVUPE will be at least as effective as the traditional cardiology examination. Plans have been established to measure the efficiency and efficacy of tele-ultrasound exams by evaluating:

- Concordance between traditional cardiology physical exams and the CVUPE;
- Variation in findings between the physical exam and CVUPE;
- Clinical value of adding CVUPE to the consultation (e.g., change in diagnosis or treatment);
- Average time to perform the CVUPE;
- CVUPE impact on patient convenience and satisfaction.

After evaluation of the cardiology tele-ultrasound program, the plan is to rapidly expand to other telehealth specialties, beyond the current coverage for stroke, mental health, psychiatry, and genetic counseling.

## Lessons Learned

Allina Health's strong culture of continuous learning, physician engagement and the practice of evidence-based medicine played a vital role in the physician champion-driven adoption of PoCUS innovation across Abbott Northwestern.

- The value proposition made by a physician champion promoted the transition from organic growth to managed adoption of PoCUS to re-engineer care pathways and diagnostic evaluations.
- Allina Health has observed clinical outcomes, increased efficiency, achieved greater patient satisfaction, and reduced the usage of advanced imaging through enhancement of the traditional physical exam with bedside ultrasonography and development of the IMBUS Program.

Abbott Northwestern's IMBUS program allowed Allina Health to couple expertise with telehealth to broaden its market.

- Integration of PoCUS technology with telehealth enhanced the value of the Allina Health Network in a competitive marketplace.
- Intended disruption through pursuit of the telehealth initiative facilitated the development of indispensable partnerships with health care providers and patients to grow Allina Health Network's coverage in support of its strategic vision.

## Discussion Questions

How can physician champions be encouraged to flourish and promote value-driving innovations?

How can lessons learned from Allina Health's use of innovative technologies to increase efficiency be transferred to another health system?

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

What are potential challenges expected in the adoption of an innovation and how can a health system best prepare for them?

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## Appendix A: Abbott Northwestern IMBUS Program Curriculum

### Basics of Ultrasound

- Physics, Artifacts, Bioeffects
- Machine mechanics and knobology
- Bedside ultrasound mechanics in a patient room
- Patient discussion & consent
- Draping of male/female patients
- Image annotation
- Integrative approach to clinical decision making at the bedside

### Pulmonary Ultrasound

- Pleural ultrasound: A-lines, lung sliding, pneumothorax, pleural effusion
- Interstitial syndromes: B-lines

### Cardiovascular Ultrasound

- Windows: Parasternal long/short axis, Apical 4/5, LA & 2 chamber, Subxyphoid 4-chamber & short axis
- Pericardial assessment
- LV/RV function assessment
- Semi-quantitative assessment of clinically significant valvular dysfunction
- Assessment of diastology & dysfunction\*
- Qualitative assessment of chamber size & overload
- Semi-quantitative assessment of volume status & fluid responsiveness
- Assessment of aorta for aneurysm\*
- Vascular 2-point DVT screening\*

### Abdominal Ultrasound

- Urinary
- Renal evaluation for hydronephrosis
- Kidney findings in chronic kidney disease
- Bladder assessment
- Hepatobiliary
- Hepatomegaly assessment
- Findings in cirrhosis
- Gallbladder & CBD assessment\*
- Assessment for splenomegaly
- Peritoneal free fluid evaluation
- Bowel
- Ileus & small bowel obstruction assessment
- Inflammatory bowel states assessment\*

### Soft Tissue Ultrasound

- Lymphadenopathy
- Cellulitis & abscess

### HEENT Ultrasound

- Thyroid\*
- Ocular\*
- Sinus\*
- ICP assessment with optic nerve sheath measurements\*
- Real-time intubation guidance & confirmation

### Musculoskeletal Ultrasound

- Assessment of the symptomatic joint, bursa, tendon/ligament\*

### Procedural Ultrasound

- Central & peripheral venous/arterial line placement
- Thoracentesis
- Lumbar puncture
- Paracentesis
- Abscess I&D
- Endotracheal tube placement verification
- Central venous line placement verification
- Joint, soft tissue, and bursa injections

\*advanced topic

Source: Dr. David Tierney, Director of IMBUS- Internal Medicine Residency Program & Center for Clinical Simulation, Abbott Northwestern Hospital

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## Appendix B: Abbott Northwestern IMBUS-PCI Study Evaluation Metrics

### Cost Reduction

- Resource Utilization (radiology studies, antibiotics, etc.)
- Length of Stay
- Days in ICU

### Patient Care

- Time to Diagnose/Treat
- Radiation Exposure (X-Ray/CT Scan)
- Safety

### Patient Experience

- Patient Satisfaction
- Patient Understanding



## 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 health system and industry members to cultivate the relationships, perspective, and knowledge 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 Member Health Systems

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|--------------------------------------|-----------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|----------------|----------------|----------------|----------------|-----------|
| <b>Grand Total</b>                   | <b>24</b> | <b>56</b> | <b>29</b>  | <b>24</b> | <b>33</b>  | <b>36</b> | <b>29</b> | <b>36</b> | <b>20</b> | <b>37</b> | <b>28</b> | <b>23</b>  | <b>31</b> | <b>37</b> | <b>22</b>      | <b>54</b>      | <b>11</b>      | <b>22</b>      | <b>95</b> |
| Adventist Health (CA)                |           |           | 1          |           |            | 1         |           |           | 1         |           |           |            |           | 1         |                |                |                |                |           |
| 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         |                |                |                |                |           |
| Catholic Health Initiatives          |           |           |            |           |            |           |           | 1         |           |           | 1         |            | 1         | 1         |                | 1              |                |                |           |
| Catholic Health Partners             |           | 1         |            |           | 1          |           |           |           |           | 1         |           |            |           | 1         |                |                |                |                |           |
| Cedars-Sinai                         |           |           |            |           |            | 1         |           |           |           |           |           |            | 1         |           |                |                |                |                |           |
| Christiana Care Health System        | 1         | 1         | 1          |           |            | 1         |           | 1         | 1         | 2         |           | 2          |           | 1         |                | 3              |                |                | 6         |
| Cleveland Clinic                     |           | 1         | 1          |           |            |           |           |           | 1         | 2         |           |            |           | 1         | 2              |                |                |                |           |
| Cone Health                          |           | 1         | 1          | 1         | 1          | 1         | 1         | 1         |           |           | 1         |            | 1         | 1         |                | 2              |                |                |           |
| Dignity Health                       |           | 1         |            |           |            |           |           |           |           |           |           | 1          |           | 1         | 1              |                |                |                |           |
| DoD/VA Interagency Program Office    |           |           |            |           | 1          |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Duke University Health System        |           |           |            | 1         |            | 2         | 1         | 1         |           | 1         | 1         |            |           |           |                | 2              | 1              |                |           |
| Einstein Healthcare Network          |           | 1         |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Elliot Health System                 |           |           |            |           | 1          |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Fairview Health Services             |           | 1         |            |           |            |           |           |           | 1         | 1         |           |            | 1         | 1         |                |                |                | 2              |           |
| Florida Hospital System              |           |           |            |           |            |           |           | 1         |           |           |           |            |           |           |                |                |                |                |           |
| HCA Healthcare                       |           |           |            |           | 2          | 1         | 1         | 1         |           |           |           |            | 1         |           |                | 3              |                |                |           |
| Hackensack University Medical Center |           |           |            |           |            | 1         |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Hawai'i Pacific Health               |           | 1         | 1          | 1         |            |           |           |           |           | 1         |           | 1          |           |           | 2              |                |                |                |           |
| Hoag                                 | 1         | 1         | 1          | 1         |            | 1         |           |           | 1         |           |           |            | 1         | 1         |                | 1              |                |                | 3         |
| Hospital Sisters Health System       |           | 1         | 1          |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Indiana University Health            |           |           |            |           |            |           |           |           |           | 1         |           |            |           |           |                |                |                |                |           |
| Inova Health System                  |           |           |            |           | 1          |           |           |           |           | 1         |           |            |           |           |                |                |                |                |           |
| Integris Health                      | 1         |           |            |           |            |           |           |           |           |           |           | 1          |           |           |                |                |                |                |           |
| Intermountain Healthcare             | 1         | 1         | 1          | 1         | 1          | 1         | 1         | 1         | 1         | 1         | 1         | 1          | 1         |           | 2              | 4              | 1              | 1              | 5         |
| Johns Hopkins Health System          |           |           |            |           |            | 1         | 1         | 1         |           |           |           |            |           |           |                |                | 1              |                | 1         |
| Kaiser Permanente                    |           | 1         |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Legacy Health System                 |           |           |            |           |            |           |           |           |           |           |           |            |           | 1         |                | 1              |                |                |           |
| Lehigh Valley Health Network         | 1         | 1         | 1          | 1         | 1          | 1         |           | 1         |           | 1         | 1         | 1          | 1         |           |                |                | 1              |                |           |
| Mayo Clinic                          |           |           |            |           |            |           |           |           | 1         |           |           |            |           |           |                |                |                |                |           |
| McLaren Health Care                  | 1         |           |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| MedStar Health                       |           | 1         |            |           | 1          |           | 1         |           |           |           |           |            | 1         | 1         |                | 1              |                |                |           |
| Memorial Healthcare System (FL)      |           |           |            |           |            | 1         |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Memorial Hermann                     |           | 1         |            |           |            | 1         |           |           |           | 1         |           |            |           | 1         |                |                |                |                |           |
| MemorialCare Health System (CA)      |           | 1         |            |           |            |           |           |           |           | 1         |           |            | 1         |           |                |                |                |                |           |

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|----------------------------------------------|-----------|-----------|------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|----------------|----------------|----------------|----------------|-----------|
| Methodist Le Bonheur Healthcare              |           |           |            |           |            |           |           |           |           | 1         |           |            |           |           |                |                |                |                |           |
| Montefiore Medical Center                    | 1         | 1         | 1          | 1         | 1          |           | 1         |           | 1         | 1         | 1         | 1          |           | 1         | 1              | 2              |                |                | 7         |
| Mount Sinai Medical Center                   |           |           |            |           |            |           |           |           |           | 1         |           |            |           |           |                |                |                |                |           |
| MultiCare Health System                      |           |           | 1          |           |            |           | 1         |           |           |           |           |            |           | 1         | 1              |                |                |                |           |
| NYU Langone Medical Center                   |           |           |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| NewYork-Presbyterian Hospital                | 1         | 1         |            |           |            | 1         |           | 1         | 1         | 1         | 1         |            | 2         |           |                |                | 1              | 2              | 8         |
| North Shore-LIJ Health System                |           | 1         | 1          | 1         | 1          |           | 1         | 1         |           | 1         | 1         | 1          | 1         | 1         |                | 2              | 1              | 2              | 8         |
| Northwestern Memorial HealthCare             |           | 1         | 1          | 1         | 1          |           |           |           | 1         |           |           | 1          | 1         | 1         | 1              |                |                |                | 3         |
| Norton Healthcare                            |           | 1         | 1          | 1         | 1          | 1         | 1         | 1         |           | 1         |           | 1          | 1         | 1         |                | 2              | 1              |                |           |
| Novant Health                                |           | 1         |            |           |            |           |           |           | 1         |           |           |            |           |           |                |                |                |                | 4         |
| OSF HealthCare                               |           |           |            |           |            | 1         | 1         |           |           |           |           |            |           |           |                |                |                |                |           |
| Oakwood Healthcare System                    |           |           |            |           |            | 1         |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Ochsner Health System                        | 1         | 1         |            | 1         | 1          | 1         | 1         |           | 1         | 1         | 1         |            | 1         | 1         | 1              | 3              |                | 2              |           |
| OhioHealth                                   |           | 1         |            |           |            | 1         |           |           |           |           | 1         |            |           |           |                | 2              |                |                | 6         |
| Palmetto Health                              |           |           |            |           |            | 1         | 1         |           |           |           |           |            |           |           |                |                |                |                |           |
| Partners HealthCare                          |           |           |            |           |            | 2         |           | 1         | 1         | 2         |           |            |           | 1         |                |                |                |                |           |
| Penn Medicine                                |           | 1         |            |           |            |           | 1         |           |           |           |           |            |           |           |                |                |                |                |           |
| Piedmont HealthCare                          |           | 1         |            |           |            |           | 1         | 1         |           | 1         |           |            |           |           | 1              |                |                |                |           |
| Presbyterian Healthcare Services             |           | 1         |            |           |            |           |           |           |           |           |           |            | 1         | 1         |                |                |                |                |           |
| Presence Health                              |           |           |            |           | 1          |           |           |           |           |           |           |            |           |           |                | 1              |                |                |           |
| Providence Health & Services                 | 1         | 1         | 1          |           | 2          | 1         | 1         | 1         | 1         | 1         | 1         | 1          | 1         |           | 1              | 4              |                | 2              | 5         |
| Regional Medical Center at Memphis (The MED) |           | 1         |            |           |            |           |           |           |           |           |           | 1          |           |           |                |                |                |                | 4         |
| SCL Health System                            |           | 1         |            |           |            |           |           |           |           |           |           |            |           | 1         |                |                |                |                |           |
| SSM Health Care                              |           | 1         |            |           |            | 1         | 1         |           |           |           |           |            |           |           |                |                |                |                |           |
| Scott & White Healthcare                     |           |           |            |           |            |           |           |           |           |           |           |            |           | 1         |                |                |                |                |           |
| Scripps Health                               |           | 1         | 1          |           |            |           |           |           |           | 1         |           |            |           | 1         |                |                |                |                |           |
| Sentara Healthcare                           |           | 1         | 1          |           |            |           |           |           |           |           |           |            |           | 1         | 1              |                |                |                |           |
| Sharp HealthCare                             | 1         | 1         |            | 1         | 1          | 1         | 1         |           |           | 1         | 1         | 1          | 1         |           | 1              | 1              |                | 1              |           |
| Spectrum Health                              |           |           | 1          |           | 1          |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| 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         |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| Trinity Health                               |           |           |            |           |            | 1         |           |           |           |           |           |            |           |           |                |                |                |                |           |
| UCLA Health System                           |           |           |            |           | 1          |           | 1         | 1         |           |           |           |            |           |           |                |                |                |                |           |
| UF Health Shands                             |           | 1         |            | 1         |            | 1         |           |           |           |           |           |            |           |           |                |                |                |                |           |
| UMass Memorial Medical Center                |           |           |            |           | 1          | 1         |           |           |           |           | 1         |            |           |           |                |                |                |                |           |
| UPMC                                         |           | 1         |            |           |            |           |           |           | 1         |           |           |            |           |           |                |                |                |                |           |
| UnityPoint Health                            | 1         | 1         | 1          | 1         | 1          | 1         |           |           | 1         | 1         |           |            | 1         | 1         |                |                |                |                |           |
| University Hospitals                         |           |           |            |           | 1          | 1         |           | 1         |           | 1         |           |            |           | 1         |                |                | 1              |                |           |
| University of Maryland Medical System        |           |           |            |           | 1          |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| University of Michigan Health System         |           | 1         |            |           |            |           |           |           |           |           |           |            |           |           |                |                |                |                |           |
| 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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