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Kyruus: Big Data's Search for the Killer App

"At the bottom of the Oakland experiment was a willingness to rethink baseball: how it is managed, how it is played, who is best suited to play it, and why."

"First came radical advancements in computer technology: this dramatically reduced the cost of compiling and analyzing vast amounts of baseball data. Then came the boom in baseball players' salaries: this dramatically raised the benefits of having such knowledge. 'If we're going to pay these guys $150,000 a year [1977] to do this…we should at least know how good they are'… If this sounded compelling when baseball players were getting paid $150,000 a year, it sounded one hundred times more so when they were paid $15 million a year…"

— Michael Lewis, Moneyball[1]

Graham Gardner, CEO of Kyruus, looked around the room at his executive team. The room included the leaders of the technology, analytics, product, marketing and legal divisions of the company. He and his co-founder, Julie Yoo, were firm believers in hiring exceptional people with varied backgrounds and then empowering them to collectively steer the company in the right direction. This was exactly the situation for which he needed such a team. The company was preparing for the next Board of Directors meeting in the spring of 2012 and the team had a number of key decisions to make. The group was in agreement that Kyruus needed to identify the 'killer app' for the company. What was up for debate was how to manage the company's resources as it identified and pursued its most promising customers and markets.

Gardner and Yoo had founded Kyruus in August, 2010. (See **exhibit 1** for management biographies.) The company's vision was to optimize how organizations worked with their physicians' networks. It provided data and analytics about physicians to multiple customers (e.g. hospitals, payers and pharmaceutical companies) to help those organizations understand and manage both the risk and value of their networks. Since inception, the company had gathered information about the 800,000 physicians working in the U.S. The data included information about each physician's education, licensing, publication and patent history, interactions with industry, as well as prescription and medical device utilization patterns.

Kyruus had already developed and sold its first product, a regulatory compliance software package, to some of the leading academic medical centers. It was in negotiations to sell the next version of the product to three other major hospitals. The product helped academic institutions abide by regulations governing how physicians interacted with industry. Preliminary market research indicated that a number of other buyers were interested in physician data. Hospital CFOs indicated that Kyruus could help manage their revenues and costs better by focusing on patient "leakage" from their system. Pharmaceutical industry executives expressed interest in Kyruus developing more targeted marketing strategies. Constituents throughout the healthcare industry were excited about Kyruus' ability to help them improve their businesses.

Strategic Challenges

In fact, the excitement from potential customers was one of the challenges now facing Kyruus. The data set fueled myriad applications. The team was willing to work frantically to design multiple products for different healthcare verticals. However, it was becoming difficult to integrate product, engineering and sales teams across numerous products. As much as Gardner wanted to pursue multiple verticals, further doing so would increase Kyruus' burn and might cause the company to under-deliver to clients.

As Gardner listened to his team debate their strategy, he realized Kyruus had three options. First, Kyruus could concentrate on the regulatory compliance market. This option allowed the team to focus on a small client base of academic medical centers while perfecting the market positioning and product features for this audience. The company was beginning to develop real traction in this market. The American Hospital Association (AHA) had recently endorsed Kyruus' solution for meeting compliance requirements (see **exhibit 3**). Pursuing the compliance market was the least risky option. However, it arguably had the most limited upside and some internal executives questioned the ultimate size of this market opportunity.

The company's second option was to expand its reach within hospitals. Kyruus could develop tools for physician network development and patient referral operations. Early conversations with hospital CEOs and CFOs suggested that optimizing patient referrals was a top priority for hospitals. Reducing "leakage" of patients to other institutions was expected to significantly impact a hospital's bottom line. The market potential for this product was sizeable, and expected to be far larger than the compliance market. The team still had much to learn in order to develop and sell the referral and network products. Finally, the company could put more weight behind selling to the life sciences industry (*e.g.* pharmaceutical, medical device and diagnostics companies). Several team members felt that the budgets of these organizations were much larger than hospital budgets and that the shorter sales cycles made them logical clients. Kyruus had already developed a few products that were well received by industry sales forces, and many on the Kyruus team saw this channel as a potentially very profitable market.

Underlying all these options was the fundamental question of whether, when, and how to engage physicians themselves. During the first year of product and market development, Gardner and Yoo had chosen to serve hospital administrators in the management of their physician staff. However, Gardner was a big fan of "feedback loops" and suspected that the optimization of physician performance would ultimately require the direct engagement of physicians through Kyruus' technology platform. He knew they would only get one chance with doctors – any errors in the data could mean the instant loss of credibility for Kyruus. As he listened to his data scientist describe their latest progress, he wondered whether they should also be prioritizing applications for physician engagement as part of these three options.

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Some team members clearly favored the first option. They noted that Kyruus had just started to develop some real momentum in this area, and the marketing team was developing an entire set of campaigns surrounding the recent AHA endorsement. Just as importantly, the data team had prioritized the acquisition and processing of compliance-related information – making this some of the most immediately usable information in the database. "We should nail our first product and our first market," argued one of the team members as she looked at Gardner. "We have a completely unique and disruptive product for this growing market – succeeding here has to be our first priority."

As was the style of the executive team, another member pushed back in order to drive the conversation.

The hospital compliance market is a solid $50 million market and I agree that Kyruus is well on its way to providing an excellent product in this area. But, the real goal for our company is to identify the $500 million product. I worry that the compliance office is a difficult place to start if you want to expand into other parts of the hospital. As hard as it may be for the Kyruus team, I think we really have to prioritize our understanding of the patient referral market and aim our product team in that direction.

In support of the second option, another team member reminded the group about some initial research the team had done on the referral optimization opportunity. "If we can help redirect 1% of the patient flow (flow that would otherwise be lost to outside referrals) for a $1 billion health care system, that translates into $10 million in revenues – revenues that may well flow to the bottom line because of the fixed cost nature of these hospitals," he noted. "Given that many of these hospitals are operating on razor-thin margins, referral optimization is a 'must-have' for these medical centers." While the audience and product may have to be different, some team members felt that a referral optimization application was a logical extension of the company's data asset and would allow the sales team to approach potential hospital clients from several directions.

A third group argued for an even more aggressive approach: targeting the life sciences industry as well as hospitals. After all, hadn't Gardner and Yoo designed the company to iterate quickly with multiple clients in order to identify the products that would have the most impact? One member of the team noted that the identification of referral management as a product had originated from conversations with a medical device company. In addition, the iPad application platform for referral management had first been developed for a medical device sales force. A broader customer base was improving their current products and gave them ideas for novel markets. "In addition to the revenues we can make from industry, we are also learning a tremendous amount by working with different stakeholders across healthcare. We have made tremendous progress and a lot of people are interested in investing in our growth – why not put the foot on the accelerator and build our team to meet the demand for our products?"

Gardner looked at the clock. It was a great conversation, but he and the team needed to make a decision to present to the Board. He had frequently drawn an analogy to "moneyball" – recalling how the sport of baseball had embraced statistics and analysis as the game evolved a generation ago. Gardner knew that Big Data represented a similar leap forward in technology at a time when health reform demanded a new level of insight on the part of hospitals, payers, and life science companies. But, should they focus on one lead application or was the "killer app" actually the underlying platform that drove a portfolio of products? And what about the doctors? Was the right answer the option that would drive the greatest use of the data by physicians themselves?

The Founders

Graham Gardner

Gardner was born in Boston to Scottish parents who had immigrated to the United States to pursue higher education. After his parents completed their studies, Gardner moved to Scotland with his family where he lived for two years. His father then accepted a job with a pharmaceutical company in France where they lived for 6 years, before moving back to the States. The eldest of 3 sons, Graham was surrounded by many family friends who were physicians and knew from a young age that he wanted to become a doctor. However, the conversations during dinner with his father about the impact of the pharmaceutical industry also implanted the realization that healthcare was broader than just practicing medicine and that physicians could make a difference in many ways.

Gardner entered Brown University's combined BA/MD program where he majored in History and Biology. Keen on exploring the various roles physicians could play in the medical field, he accumulated diverse experiences doing basic science research, working in the marketing division of a pharmaceutical company, and even doing some consulting during his summers in medical school. At the same time, Gardner loved the learning curve inherent in medical education and wanted to absorb as much as he could before leaving the clinical setting. He decided to enter an internal medicine residency program at one of the Harvard hospitals in Boston and there fell in love with cardiology.

> Cardiology training was very meaningful for me. In addition to the privilege of caring for patients' lives, it was the first time that I began to realize that physicians were all different from one another. Until that time, I had always worried about the areas of medicine that didn't "stick" with me. Cardiology had always come easily to me, but I spent all my time worrying about the kidney while I was an internal medicine resident because I was responsible for all the different aspects of someone's health. Once I was a cardiologist, I was able to focus on what I did well. That had a profound impact on me. First, I became comfortable not knowing everything and even now, as a CEO, I am very open with my team and my Directors about what I do well and where I need support. Second, I realized that the more we could understand and leverage people's strengths in medicine, the more we could deliver high quality, cost-effective care to patients. If we could "match" physician styles to specific patients and conditions, we could move the needle on trillions of dollars of healthcare spend while empowering physicians to do what they are best at doing.

As his learning curve in medicine began to slow down, Gardner also realized that the best place to pursue his passions may lie at the intersection of business and medicine.

> Toward the end of my training, my parents moved to Boston so that my father could help start a new company with a long-time family friend, Bob Langer. That's when I was introduced to the venture capital and entrepreneurial world. I couldn't believe that people were actually paid to start companies and create things that hadn't been there before. After many conversations with mentors, I decided then to go to business school in order to learn more about the business world and explore where I could potentially play a role. During my time at Harvard Business School, I worked at both Boston Scientific and Highland Capital Partners. I was very fortunate to get invited to join the Highland team after graduation and initially had every intention of being a traditional venture capitalist. However, during my first year there, I realized what an incredible platform Highland could be to actually form companies. You are sitting with a pot of gold, meeting great people, and thinking about the ideas that will shape the future. You have all the tools to create the next great company.

While at Highland, Gardner helped to start Generation Health, a company focused on becoming a genetic testing benefit management company. After initially serving as a board member, he took on the role of Chief Medical Officer (CMO) during the company's first year in order to help build out the clinical team and first generation product. During that time, he reconnected with Julie Yoo, a TA of one of his classes during business school. Given Yoo's background in big data and thesis work in medical genetics, he asked her to come onboard as head of clinical informatics at Generation Health. The two worked closely over the next year through the acquisition by CVS Caremark.

Julie Yoo

Yoo was born to academic parents who began their careers as professors. Her father was a physicist and materials science engineer who spent several years leading research and development for a large Korean electronics conglomerate, before taking an entrepreneurial dive into a new venture towards the end of his career. Her mother was a linguistics major who taught English as a Second Language to students seeking to study in the U.S. While growing up, Yoo had wanted to go into medicine. When she was admitted to MIT, she enrolled as a Biology major. However, she happened to be in school during the dot-com boom of the late 90's, so as she observed the excitement surrounding technology and software companies grow around her, Yoo thought she might try her hand in Computer Science. She ended up finding it to be a great fit for her love of problem solving, so she switched her major to Computer Science while also completing her pre-medicine requirements.

During her college years, Yoo started taking on consulting projects with local start-ups to gain experience in application development and information architecture. In the summer after her junior year, she interned at Endeca Technologies, a venture-backed software company specializing in data-driven search and business intelligence for enterprises.[2] Thoroughly enjoying her experience there, she decided to join them full-time after graduation in a software engineer role, becoming the 37th employee at the firm. Over the course of her tenure at the company, Yoo was exposed to various industries, but her foray into the field of healthcare was the one that made the strongest impression. As Yoo explained:

> While working as a sales engineer at Endeca, I was exposed to various industries such as retail, financial services, manufacturing, and eventually healthcare. Healthcare was the one field where enterprise IT solutions that had demonstrated success in other verticals were not being readily adopted or successfully deployed. That posed a very intriguing challenge – what were the characteristics and nuances of healthcare and life sciences that might prevent the optimal use of data and technology? This question motivated me to explore this space in-depth.

> Thus, after 6 years at Endeca, I decided to gain deeper expertise in the healthcare industry through the Biomedical Enterprise Program, a joint MS/MBA program at MIT and Harvard Medical School that offered exposure to the intersection of basic science, clinical medicine, and entrepreneurship. While there, I did my thesis work in the fields of genomics and personalized medicine, where there was a great deal of opportunity to commercialize big data solutions for both research and clinical applications. During this time, I picked up my practice of working with local startups, this time in the healthcare informatics and analytics space, and realized there was huge potential to appropriately utilize data to better help physicians and organizations that worked with physicians.

Gardner tapped Yoo to join Generation Health (GH) after she completed her graduate studies. GH was looking for someone with a background in genomics and clinical applications of genetic testing to help payors set reimbursement policies for genetic tests. Yoo was a perfect fit.

Founding Kyruus

In the winter of 2009, Generation Health was acquired by CVS Caremark.[3] Highland Capital had realized a 6x gain on its investment in 13 months. Gardner left his position as CMO soon afterwards. As the genetic testing benefits field evolved, a large percent of its business was within oncology, and Graham felt that an oncologist should have the position of CMO. In early 2010, Graham returned to Highland Capital to resume his role as a venture capitalist. Yoo left Generation Health in July of 2010. She missed the flexibility and entrepreneurial spirit of a small organization, and was eager to explore new opportunities in the burgeoning Health IT and Analytics space.

That summer, Gardner and Yoo got together to compare notes, and Yoo recalled:

> We agreed that most healthcare IT companies were simply laying the plumbing for data collection, and that there was a relative vacuum in the analytics space. No one was asking: 'what does the data mean?' or 'how can we use data to improve performance?' The healthcare industry was a tremendous producer of data, but a very poor utilizer of that data. We saw an opportunity to change that.

In August 2010, Gardner and Yoo founded Kyruus. Kyruus' goal was to help organizations optimize their interactions with physicians by being the leading provider of physician data and physician engagement tools. While some leading healthcare data companies were already examining discrete aspects of physician behavior (e.g. IMS' physician prescribing data), none were bringing together all physician interactions in one place. Yoo described the ideal data set:

> Physicians are multi-dimensional professionals. They treat patients, conduct research, lead clinical trials, publish studies, work as consultants, get educated in different places, and train others as educators themselves. There are tons of data that describe all of these activities, but they aren't easily searchable in a single place. The first step for Kyruus is to enable basic access to and navigation of the information for different stakeholders across the healthcare system.

Before developing any product, however, they tried to understand the market for physician information. Gardner met with his contacts in medical device companies and hospitals to determine their needs. As it turned out, there was a big demand and high willingness-to-pay for information about physicians. As Gardner described:

> One of the things I had learned during my venture career was that companies that engaged with clients early on in their product development built things that the market wanted and generally had a better chance of success. So I went out and talked to anyone who would listen to me. After these meetings, Julie would then build a prototype to the company's specification – that would spur further discussions and also signal our ability to respond to customer needs very quickly. That is how we got our first pilots. People were willing to tell us what they wanted and they were willing to pay a lot for it.

While these conversations were informing a lot of different uses for physician data, the inspiration for Kyruus' initial product came when Gardner and Yoo attended a pharmaceutical regulatory compliance conference in October, 2010. At the conference, Gardner and Yoo realized how central physician interactions were to the entire healthcare ecosystem. Kyruus could create a comprehensive data platform that organizations could use to manage risk and optimize value in the context of those relationships. Gardner explained:

We noticed executive after executive from the major pharmaceutical and medical device companies visibly shaken after their company had been slapped with severe penalties for illegal interactions with physicians. I knew that physician-industry interactions were essential for driving innovation in healthcare, but these companies were acknowledging that they simply didn't have the data or the mechanism to engage with physicians in a transparent and compliant manner. We noticed a slew of law firms advertising their services, but there were no companies providing these organizations with data to drive compliant relationship management. That's when Julie and I realized we were sitting on a transformational data platform that could optimize physician interactions with companies, hospitals, and each other.

Background: Compliance, Healthcare IT and 'Big Data'

Physician-Industry Interaction: The Physician Payment Sunshine Act

The *Physician Payment Sunshine Act* (PPSA) was one of the key provisions of the healthcare reform law (*Patient Protection and Affordable Care Act*) of 2010.[4] The PPSA mandated that all payments greater than $10 to physicians or hospitals from pharmaceutical, medical device or medical supply companies be reported to the government. Failure to report payments could lead to penalties of up to $1 million.[5]

The impetus for the PPSA was a concern around the lack of transparency regarding the billions of dollars that physicians were paid by the pharmaceutical industry each year. While many of these payments went to support research, others wondered whether multiple interactions and/or financial relationships between the entities might create a conflict of interest in the clinical setting (See **exhibit 4**).

One of the unfortunate side effects of this regulation was that academic medical centers had to deal with a public relations catastrophe. While many of these institutions had robust conflict of interest policies, most of them relied upon physicians to disclose industry relationships. The hospital compliance officers were now facing questions from journalists who were collecting information from pharmaceutical companies and publishing stories about physicians who were making large sums of money from life science companies. In many cases, the compliance officers at the physician's academic institution were unaware of the interactions because they had not been disclosed, or because they had occurred in the time since the last disclosure cycle. Failure to adequately report potential conflicts of interest could threaten the federally-sponsored grant awards to institutions. At large institutions, these awards amounted to hundreds of millions of dollars annually.

Collecting the information released by pharmaceutical companies was not easy. The companies were posting the data in different formats, referring to the same physician by different names (John Reynolds vs. Jonathan Reynolds, MD) and using highly varied terms to describe the nature of their physician relationships (See **exhibit 5**). Some academic institutions had begun to hire analysts to log into each company's website and search through hundreds of thousands of transactions for their staff members' names. This was neither a reliable nor a scalable solution. Kyruus's Big Data approach was ideally suited for dynamically aggregating this information, "disambiguating" the physician identities, contextualizing the information, and then allowing institutions to benchmark themselves and their physicians with peer institutions around the country.

Gardner and Yoo saw an opportunity to help institutions with data management solutions in the name of regulatory compliance. Studies had demonstrated that physicians often failed to adequately disclose their industry relationships – leaving them exposed to public relations and regulatory risks.[6,]

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[7] They saw an opportunity to collect data proactively and help physicians avoid reporting errors. At the same time, they could develop individual portfolios of professional activities that would contextualize industry interactions. Gardner and Yoo hoped that these comprehensive narratives would protect the reputations of physicians and institutions as they interacted over the long term with industry.

Big Data

"Big Data" refers to very large data sets that cannot be managed, organized or analyzed using traditional database software tools.[8]   Data sets are ubiquitous, and their volume is increasing exponentially. Worldwide, 1.8 zettabytes of digital information was created in 2011, with 35 zettabytes projected to be produced in 2020.[a,9] Our capacity to store this data doubled every three years since 1980.[10] Troves of data were being collected across all industries. Facebook had 30 billion new items of content on its website every month.[11] Walmart processed 1 million transactions per hour, which were shared with a database containing 2.5 petabytes of data (more than ten times the amount of information in the books of the entire US Library of Congress).[12]

One popular framework for describing big data sets is the 3V's: volume (the amount of data produced), velocity (the speed with which the data is produced) and variety (the formats from which the data is derived, such as a database, blog, website, etc.).[13] Analysis of large data sets aimed to produce better information about potential customers, develop innovative products and services, and help with decision making to reduce risks.[14] Gardner and Yoo saw healthcare as a logical place to apply the benefits of big data. Gardner explained:

> One of my favorite definitions of Big Data is when data itself becomes part of the problem you are trying to solve. People didn't need more data, they needed to integrate their existing data, look at novel intersections of information, and then use the learnings to drive better outcomes. Information about physicians, the key players at these institutions, was generally distributed across hundreds of different silos, including HR departments, credentialing systems, electronic health records, and supply chain databases. The data was stored in different formats and impossible to join with a simple join key. And yet, at the intersections of these data were critical insights that organizations could use to steer and optimize their operations.

Healthcare IT Market

There are four major pools of healthcare data: pharmaceutical R&D data, claims and billing data, clinical data, and patient behavior data.[15] The integration of such data had the potential to create immense value for all members of the healthcare value chain.[16]

There had recently been a government-sponsored push to incorporate information technology in the healthcare industry. The American Recovery and Reinvestment Act (ARRA) of 2009 set out to provide $20 billion in stimulus funding over 5 years to encourage use of electronic health records by physicians and hospitals.[17] In 2010, the healthcare IT (HCIT) market was estimated to be $25 billion. Of the various sectors in healthcare, the HCIT market was expected to have the greatest annual growth, greater than 10%, for the next five years. The pharmaceutical, medical device, and diagnostics markets were expected to have single digit growth.[18]

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[a] Zettabyte=2^{70} bytes of information

Consequently, more VC funding was being directed toward the Health IT sector. In 2009, total U.S. venture funding was $21.4 billion, of which $7.73 billion was directed toward the healthcare sector. This had dropped 13% from 2008 when $8.93 billion was invested. The median healthcare financing round in 2009 was $5.9 million, also down from the previous year. However, funding to the HCIT sector grew from 2008 to 2009, from $363 million to $498 million.[19]

Developing the Kyruus Platform

Gathering Data On Physicians

Gardner was confident that Kyruus could create the leading comprehensive physician data set. He described this first stage as "becoming the Bloomberg of physician information." A number of companies had been successful in providing information to other industries, such as IHS in the manufacturing sector or ITA Software in the airline industry. (See **exhibit 6** for a description of non-healthcare information providers.) If Kyruus could create the leading, proprietary set of information about physicians, it could sell this data to multiple other entities including consultants providing guidance to the healthcare industry, such as The Advisory Board Company, data vendors such as HDS or Thomson Reuters, or application companies that might develop products that Kyruus had not even imagined.

However, Gardner wondered whether becoming strictly a data company might limit Kyruus' potential. He also feared the data-only path was risky:

> The healthcare industry is unique. In the financial industry, companies pay for data. They are used to buying it and have IT solutions that are capable of analyzing and sorting it. In healthcare, customers are not used to having data available and do not have the capabilities to analyze and sort external data. They don't buy data - they generally hire people to solve problems.

Yoo also wondered whether Kyruus needed to build vertically-integrated technology solutions on top of the data in order to be successful. After all, the conversations with potential customers were highlighting real problems that people wanted solved. Who better than Kyruus to develop applications from the data it aggregated?

Hiring Talent, Building the Platform and Deploying the First Product

Gardner believed, first and foremost, in hiring great people. "Early on in a company, I like to bring in 'all-around athletes' – people with different skills and different experiences, but with a clear passion for making an impact. My primary goal is to hire great people; I fill the positions on the team later." Gardner felt that this approach yielded very tangible benefits. He elaborated:

> Companies often succeed when they are able to make a key pivot early on and achieve product-market fit. You can't predict where that inspiration will come from, but you can optimize for those breakthrough moments by bringing in great athletes and allowing them to run at an interesting problem or market. Just as importantly, great people attract other great people. I am incredibly proud of the team we have assembled and I spend an enormous part of my time making sure that we continue to be the kind of culture and environment that attracts the best.

Central to ensuring the right culture was providing mentorship and career guidance.

I had a number of exceptional mentors in medicine who helped to shape the kind of person I am. Medicine is a field where older physicians take it upon themselves to mentor younger trainees. I try to do the same in business. The moment a potential hire walks in the room, I am thinking about his or her career trajectory. It needs to work for them as much as it does for us. We like to brag about all the great companies that our team has helped to build in the past, but my dream one day is to also think about all the great companies that our team members have been empowered to start after they leave Kyruus. (See **exhibit 7** for the welcome letter that all employees receive upon their arrival at Kyruus).

Gardner's and Yoo's first executive hire was Vinay Seth Mohta. Mohta had been an early software architect at Endeca, one of the first Big Data platform companies. There, he had worked closely with Yoo and had helped to build out much of the initial technology platform. He had most recently been working at Kayak.com, where he led the predictive analytics efforts – capabilities that Yoo and Gardner thought would be very relevant to Kyruus. Mohta's goal was to bring the best practices from the financial, consumer product and mobile industries to the healthcare industry: "I had learned a tremendous amount about managing large data sets by working in travel and e-commerce and I was excited to apply these paradigms to an industry where I could really make a difference." Working alongside Yoo again, Mohta quickly articulated his vision for acquiring data from multiple sites and then organizing it in a way that ensured quality but also enabled flexibility for the product team.

Later that summer, the team hired Puneet Batra as Chief Data Scientist. Batra was also new to healthcare but had previously led the analytics group at Aster Data. A particle physicist by training, Batra was fascinated by the algorithms and predictive models that could be built on top of large data sets to better understand behavioral patterns and archetypes of individuals. While his role was ultimately to generate novel insights from the data generated by Mohta and his team, he would also be integral to defining the infrastructure to ingest and QA the data.

Mohta, Batra and Yoo led the three divisions of Kyruus' data platform. Mohta was responsible for data acquisition, integration, and processing. Batra was responsible for analytics. Yoo was responsible for applications and user interface. Each had a team of developers with whom they worked. In August 2011, there were 5 engineers working at Kyruus. By December, they had hired 10 more software engineers and data scientists.

The Kyruus data platform relied on both public and private information. Between January and December 2011, Mohta and his data acquisition team had collected billions of data points from more than 1,000 public and commercial sources. At the same time, Gardner developed relationships with clients to generate proprietary data sources. With each new customer, Mohta integrated proprietary (customer-specific) data into the Kyruus database. The technology ensured that identifiable customer data would not be shared with other users, and that data sharing was in compliance with relevant privacy regulations. (See **exhibit 8** for an explanation of the Kyruus platform.)

The Kyruus platform generated a comprehensive view of individual physicians, including information on professional accomplishments, performance, industry interactions, relationships with other physicians, and clinical behavior (prescription history, billing data and utilization rates). (See **exhibit 9** for an example of a Kyruus physician profile.) Yoo's goal in product development was to design a "minimally delightful product." Other data companies sought to create MVPs, or minimally viable product. Yoo insisted that the product be more than viable. It had to be loved by customers, to be a joy to use. The programmers worked on an agile-based methodology, deploying a fully releasable product every two weeks.

Yoo worked with her team from January to May 2011 developing Kyruus' flagship product, a regulatory compliance software platform. The program used integrated data from both Kyruus' and institutional data stores. Yoo described the process of product development:

Developing our first product was a rapid process. We identified the opportunity in November 2010. We spent the next few months talking to potential users and brought some product hypotheses back to our development team in January 2011. They quickly developed a beta application, which we immediately showed to a few academic institutions for feedback. These early partners suggested several modifications to fit their needs and workflows, and our programmers turned those new features around within weeks. We made our first commercial sale within six months of product conception.

Barriers to Entry: Maintaining the Proprietary Nature of Kyruus' Products

Yoo felt that, historically, HCIT companies had a history of overpromising and under-delivering. She wanted to be sure that Kyruus products did what they said they would do and did it better than anyone else. First, Kyruus insisted on having the most accurate data available. This, Yoo felt, was a necessary but not sufficient ingredient to delivering their services. It was 'the price of admission.' In order to achieve this, Kyruus spent time and resources on data scrubbing. To combat the fact that data sets were often redundant, the engineers developed methods to provide the cleanest data set from disparate sources – leveraging their experiences at Endeca, Kayak, Aster Data, TripAdvisor, and IBM.

Secondly, Yoo wanted to ensure that Kyruus developed solutions with meaningful ROI. Each of its products had to provide financial benefits to its customers. She and the commercial team spent time understanding the existing workflows and alternative solutions that their customers depended upon. Then they worked on ways to demonstrate how Kyruus' product delivered a superior experience and payback.

Finally, Yoo worked with Mohta and Batra to understand how Kyruus could acquire and build a truly proprietary set of data. While the aggregation of disparate data sets was difficult and differentiating, could Kyruus collect or create data that no one else could claim? How could they work with clients to uncover data that was previously locked up or look at the way that clients were using the data to identify new patterns?

Choosing Customers: Providers, Pharma or Payors?

During the first few months of the company, Gardner had cast a wide net for potential customers – often leveraging relationships that he had at hospitals and in the medical device and pharmaceutical industries. As a result, the team had signed contracts with multiple institutions for varying applications and uses (see **exhibit 10**). The experience had been very enriching in terms of market learnings, but was impossible to sustain long-term. Gardner knew that one of the hardest things to do early on was to say no to certain opportunities. At the upcoming board meeting, he would have to recommend which market(s) to pursue. Right now, he needed his team to help him prioritize markets and decide where to commit company resources.

Provider as Customer: Regulatory Compliance Solutions for Academic Medical Centers

Yoo felt strongly that academic medical centers were optimal early customers. Kyruus' first product was a software product that helped academic medical centers meet the compliance

regulations of the PPSA. Academic institutions had considerable motivation to meet the regulations. First, they risked their reputation if they violated regulations. Academic institutions relied on their reputation to generate patient volume and referrals. Second, they would be fined if they did not meet disclosure rules. Finally, they would be denied future NIH funding if they were found to be in violation of the PPSA. Over 200 academic medical institutions received tens of millions of dollars in NIH grant awards annually. Large academic medical institutions received hundreds of millions of dollars in NIH grants annually. For example, in 2011 Massachusetts General Hospital received $324 million in NIH funding and Brigham and Women's received $288 million.[20]

Gardner and Yoo made their first sales pitch to the research and compliance departments at the most prestigious hospitals in the country. Yoo explained:

> We thought it was very important to our own brand equity that we affiliate early on with the best institutions. We wanted to be the gold standard for physician-industry interaction compliance, and we wanted our relationship with the world's top physicians to be at the core of what we did.

Kyruus landed its first commercial deal in April 2011 when a top-ten academic medical center signed a 3-year deal to use Kyruus' physician compliance platform. Within two months, Kyruus had signed three other deals with leading academic medical institutions.

The most attractive aspect of this market was the lack of alternative products and the overwhelming unmet customer need. Many customers Yoo spoke with had no means for meeting compliance regulations and were eager to test Kyruus' product. In addition, Kyruus was in the midst of developing a unique brand in the space. One of their first high-profile customers had helped Kyruus win the exclusive endorsement of the American Hospital Association for its compliance product. Yoo thought the publicity around the product would begin to generate additional business. She also recognized that a lot more work needed to go into product development to meet the needs of the broader marketplace. The first generation of tools had been aimed at administrative users, but a comprehensive compliance management system needed to engage physicians and researchers, as well. There seemed to be intense interest on the part of physicians to see and interact with this data (see **exhibit 11** for a 100-physician survey commissioned by Kyruus), and Yoo wanted to focus her team on delivering the "delightful" product that physicians deserved.

On the other hand, Gardner wondered about the long-term growth of the regulatory compliance market. The 400 largest teaching hospitals in the U.S. were all potential customers. There were 1,100 teaching hospitals in the U.S.; the largest third of these trained about 75% of the country's physicians. Would smaller teaching hospitals and non-academic hospitals need a compliance product? Would the sales cycles with smaller hospitals be longer? Would they be able to invest in compliance software, or would their HCIT budgets be restricted to revenue cycle management (RCM) and electronic health record (EHR) software? Or were there other compliance problems like Stark Law and data privacy that Kyruus could service with their Big Data approach in the long tail of the market? Finally, would sales to compliance officers really help with the up-sell to other hospital executives, such as network development administrators and medical directors?

If they couldn't convince themselves that the compliance product was a Trojan horse into other opportunities, their early commercial experience seemed to suggest that this was a limited market. Gardner figured that they could sell their basic data tool for $20,000-50,000 per year, depending on the size of the institution. The physician-facing workflow solution seemed to be commanding $100,000-250,000 in annual subscriptions. The annual costs to academic institutions for the software represented 0.33%-1% of the value of revenues from NIH contracts so there appeared to be a real ROI

for these institutions. At the same time, if only 400 hospitals were potential clients, the entire market might not be worth much more than $50 million. Should they invest the time with compliance officers to see what else was there?

Provider as Customer: Referral Optimization Solution for Hospital Systems

Kyruus had contemplated the development of a referral optimization product for hospital systems that addressed problems with "leakage". Leakage refers to the loss of patient visits or procedures to another hospital network. Consider a patient visiting a hypothetical hospital, Mercy Medical Center (MMC), with 400 affiliated physicians. MMC's earnings increase if its affiliates make referrals to one another. A patient who visits an MMC-affiliated primary care provider for back pain may be referred to either an MMC-affiliated spinal surgeon or an outside surgeon. When needed, the MMC-affiliated spinal surgeon will order images and perform a procedure, generating revenue to the hospital of $16,000. (See **exhibit 12** for a breakdown of fees for this procedure.) If this patient is referred to a physician at another hospital, MMC loses $16,000 in revenue. [b] Gardner explained the importance of leakage:

> "Healthcare is a relatively high fixed-cost business, in which hospitals invest heavily in operating rooms and imaging centers. Additional revenue sources, such as referrals, flow quickly to the bottom line. Hospital systems in the U.S. generally have operating margins of between -2 and +5%. If we were to change leakage rates by just a few percentage points, systems that were operating at a loss could become profitable." (See **exhibit 13** for operating margin of a large hospital system.)

Leakage rates varied considerably across the country and even within a specific region. "Some large health systems report upwards of 50% leakage from hospital networks, while best in class organizations have leakage rates of under 20%," noted Gardner. There were many reasons why leakage occurred, including the presence or absence of a certain service line (e.g., a burn unit) or patient preferences for getting a service close to home. But Gardner also felt that some leakage stemmed from an information deficit on the part of physicians. Often, he felt, referral patterns among physicians were set early in someone's career and were largely the result of word -of mouth.

> "The first time you saw a patient that needed a referral to an asthma specialist, you would ask your colleague who he thought was good. He might give you a name and it stuck. Rarely did you have any objective data about how often that specialist saw asthma, whether his or her outcomes were good, or whether patients liked seeing him. If that specialist moved to a different institution across the street, there was no particular incentive for you to stop using him and so, from the hospital perspective, patients began to "leak" out of the network."

Gardner figured that the information Kyruus was gathering could help reduce leakage for the hospitals. Thanks to all the work of their data science and engineering teams, a provider could search for 'asthma', and find specialists who frequently saw asthma patients, had published articles or led clinical trials in asthma, and/or had listed asthma as a clinical interest in their profile. Just as in compliance, Gardner expected to initially sell the product on a subscription basis. The annual fee would depend on the number of physicians in a provider's network. Approximate pricing would be $1,000 per affiliated physician per year. For a mid-sized hospital with 1,000 physicians in network, subscription fees would be $1,000,000 per year.

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[b] A patient who gets a pre-op scan at MMC's competitor, MRI Centers, Inc., represents lost revenue for MMC. The MRI machine at MMC, if not at full capacity, will be under-utilized. The same holds for lost operating room usage.

Alternatively, Kyruus could go at-risk for this product, charging no upfront or subscription fees. Kyruus could charge providers based on percent leakage reduction, which translated into additional revenues generated. As a model, revenue cycle management software companies often charged providers a percent of receivables and some took a share of increased collections. Kyruus could charge 0.5%-1% of increased revenue from leakage reduction. Because every hospital across the country would benefit from better patient retention, Gardner felt the market could be very meaningful.

Gardner explained the value proposition:

A large hospital system with 44% leakage on $1.1B in revenues is losing $880 million in revenues annually. If we move their leakage rate down to 40%- that's just 4%- we drive $80 million in additional earnings. And, if we charge 1% of increased revenues, we take in sales of nearly $1 million per year from this customer alone. I see a huge market potential for this product.

Pharmaceutical and Device Industry as Customer: Finding and Tracking Physician Collaborators

As a result of its early conversations with pharmaceutical and medical device companies, Kyruus had also developed applications to serve the pharmaceutical industry. Taking advantage of the industry interaction data that the company had collected during their first year, Kyruus had developed a compliance tool for the pharmaceutical industry that mirrored that for the hospitals in many ways. Compliance and brand teams at companies could now track the activities of their physician consultants to make sure that they remained consistent with the image and goals of the company. Gardner saw a day when the two sides of the industry (hospitals and life sciences companies) could be linked across a single portal that enabled the easy identification of potential clinical experts by industry while ensuring compliant and accurate reporting of the relationship to the physician's hospital. So far, Kyruus had been able to charge a similar subscription model to the pharmaceutical industry based on the number of physicians with whom they engaged every year.

Another application to sell to industry was a clinical expert identification and engagement tool. Bringing a new therapeutic to market generally took 12 years and $1 billion in research and development costs.[c]   Based on this timeline, every week that could be eliminated from the development timeline generated $1.5 million in cost savings. One bottleneck in the research and development pipeline was the time it took to perform clinical trials, and one of the slowest points in the clinical trial process was the recruitment of patients into trials.[d] If Kyruus could develop a tool that predicted which physicians were going to enroll patients quickly, pharmaceutical companies would be very interested. By tracking a physician's publication history, prior clinical trial work and enrollment rates and interactions with industry, Gardner thought that Kyruus could provide meaningful data to industry. For example, a company about to begin a trial in small cell lung cancer (SCLC) could find out who the top physicians in the US were in the field. They could also find out

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[c] Kalorama Information. Stem Cell Markets, January 2012.

[d] Since the length of a trial is fixed once a patient is enrolled, the only way to meaningfully reduce clinical development times was to improve enrollment speed. FDA response time is another factor in the clinical development timeline but this was not under pharmaceutical company control.

which of these physicians had run clinical trials before in SCLC, what their patient panels looked like, and how long it took them to enroll patients into the trial.

While these applications sounded exciting, conversations about the pharmaceutical industry always made Gardner reflect on their ultimate vision – helping physicians deliver higher quality, more efficient care. Could there be a conflict of interest for Kyruus itself if it sold physician data to industry marketing teams, or was it critical for the company to work with all the different stakeholders in healthcare (including the pharmaceutical industry) in order to optimize their interactions with physicians? Kyruus had already learned a lot by working with medical device companies – in fact, the applications developed for their use had been the inspiration for Kyruus' physician-facing products. If the company was still learning and developing products that people wanted, why not go where the market pulled them?

Charting the Course: How Much to Spend to Identify the 'Killer App'

There were only a few minutes before the executive team would have to break and attend their weekly staff lunch with the entire company. Over the next few days, the company would put together the slides for their next board meeting and Gardner hoped he would be able to articulate a coherent strategy for the company over the next several months. In addition to the vision, the decisions would affect how the company thought about its financing over the coming months and years.

The company had been careful with its financing and burn to date. Gardner wanted to minimize dilution to ensure that each of his investors and team members would benefit regardless of the ultimate size of the success.

> "If you look at the history of HCIT, most exits are actually less than $100 million in value. If a company has been careful about its financing, that can still be a very meaningful outcome for investors and employees. We had initially raised $8.5 million. If we could dominate the regulatory compliance market- a $50 million market- and realize a 5x revenue multiple at the time of sale, everyone would go home happy.
>
> At the same time, we had a dream of making a difference in healthcare. Were we losing out on the opportunity to chase this dream by focusing too much on the compliance market?"

If they focused solely on compliance, Gardner felt that they could reach cash-flow break-even (CFBE) with an additional investment of just $4 million. Kyruus' current investors were eager to support the company and had offered to invest this amount for an additional 10% of the company. This path would not only allow the team to focus its product development efforts, but also save the team the distraction of additional fundraising with outside investors.

If Kyruus chose to pursue additional opportunities in the hospital market (e.g. referral management), Gardner knew that they would need to raise $10 million in order to achieve a meaningful milestone. While this might mean a greater dilution for the existing employees and shareholders today, the market opportunity was much larger than compliance and could result in greater value for everyone if they were able to deliver across both products. He wondered whether he could secure a better pre-money valuation by talking about the "leakage" opportunity with outside investors and thus justify the time and energy spent raising a larger amount of money.

By pursuing the broadest approach, targeting both hospital and industry customers, Kyruus would maximize the impact of its data platform. This effort would require additional software

engineers, product managers, and sales representatives and an immediate investment of $20 million. Because this was a "bigger story," Gardner knew that Kyruus could likely command a valuation that would result in a similar dilution to the $10 million raise. That being said, he suspected the company would need to raise an additional $10-20 million down the road in order to deliver on the sales targets this scenario demanded.

At the end of the day, the decision for Gardner and Kyruus was as much about financing as it was about strategy. By focusing on compliance, the team could try to "nail" its initial market while raising the least amount of money possible. With an additional investment, the company could begin to explore additional opportunities in the hospital market that could multiply the value of the company but risk dilution of focus, talent, and shareholder value. By "going big," the company could capitalize on the excitement around the company and HCIT and seek to maximize the application and value of its data platform. Were they ready to go for it?

It was time to make a decision.

Exhibit 1   Management Biographies

Graham Gardner, MD, MBA - Chief Executive Officer

Graham is a Co-Founder and the CEO of Kyruus. Prior to Kyruus, Graham was a Venture Executive at Highland Capital Partners where he co-founded Generation Health and served as the company's Chief Medical Officer through the acquisition of a majority of the shares by CVS Caremark. Graham completed his clinical training in internal medicine and cardiology at Beth Israel Deaconess Medical Center and Harvard Medical School, where he also served as Chief Medical Resident. He is the author of several peer review articles and has served as a consultant to a number of leading pharmaceutical and medical device companies. Graham completed his BA and MD degrees at Brown University, and received his MBA from Harvard Business School.

Julie Yoo, MS, MBA - Chief Product Officer

Julie is a Co-Founder of Kyruus and serves as the company's Chief Product Officer. She was previously the VP of Clinical Product Strategy at Generation Health, where she oversaw the development of the company's clinical programs and data analytics platform. Julie also led the Product Management efforts at Knome, the private arm of George Church's Personal Genome Project, where she developed and launched a bioinformatics platform for conducting individualized genomic sequence analysis. Julie's passion for data-driven businesses began as a software engineer at Endeca Technologies, where she ultimately helped to lead Endeca's efforts in the healthcare industry as a Sales Engineer for Strategic Accounts. Julie has an undergraduate degree in computer science from MIT, an MS in biomedical sciences from the Harvard-MIT HST Program, and an MBA from the MIT Sloan School of Management.

Vinay Seth Mohta, MEng - Chief Technology Officer

Vinay is a Co-Founder and the Chief Technology Officer at Kyruus. Vinay was previously at Kayak, where he led the development of a 'Big Data' predictive analytics platform for measuring the impact of the company's multi-channel marketing efforts. Prior to Kayak, Vinay served as CTO for Global Health Delivery, a non-profit collaboration between Brigham & Women's Hospital, Harvard School of Public Health, Harvard Medical School, and Partners In Health, which was designed to systematize the study of global health care delivery and rapidly diffuse technology-driven innovations to practitioners around the world. Vinay began his career as a Software Architect and Product Manager at Endeca Technologies, where he worked on complex software engineering problems in the context of the company's core technology platform and analytics products. Vinay completed his BS and M.Eng. degrees in computer science at MIT.

Puneet Batra, PhD - Chief Data Scientist

Puneet Batra is the Chief Data Scientist at Kyruus. Puneet was previously the Lead Analytic Scientist at Aster Data, where he created new algorithms, data products and product strategies for Fortune 500 companies using their petabyte-scale data assets. Prior to joining Aster Data, Puneet designed a social network based model of customer churn for T-Mobile while a Scientific Associate at Dataspora. Puneet has worked with two of the world's largest experimental facilities, the Fermilab Tevatron and CERN's Large Hadron Collider, to identify anomalies and propose new models of fundamental physics. He has held research positions at Harvard, Stanford and Columbia Universities. Puneet has 15+ publications in elite academic journals and has over 300+ citations. Puneet completed his BA at Harvard University and has a Ph.D. in Physics from Stanford University.

Tim Crowley, MD

Tim is the Vice President of Business Development at Kyruus. Tim has over 30 years of experience in physician alignment issues, including the development and management of large physician groups and networks for both community hospitals and academic medical centers. Tim previously was Senior Vice President at Caritas Christi Health care, where he was directly responsible for over 400 employed physicians and 1,200 affiliated practitioners in the system. He also co-founded the Cardiovascular Institute (CVI) at the Beth Israel Deaconess Medical Center, which unified the physicians, nurses and administration of the Cardiac and Vascular Surgery and the Cardiology service lines under one operating structure. As Chief of Network Development, he negotiated arrangements with over 40 new cardiologists and several PCP groups which resulted in a significant increase in open heart surgeries and interventional cardiac procedures performed at CVI. Tim was a practicing physician in Internal Medicine for over 25 years. He received his B.A. from Yale University, his M.D from Tufts Medical School and his house officer training at the Hospital of the University of Pennsylvania. He was an Assistant Professor of Medicine and Preceptor at Mount Auburn Hospital (A community teaching hospital of Harvard Medical School), where he practiced for over 12 years.

Christie Smith, JD

Christie Smith is the Vice President of Legal and the company's Chief Privacy Officer. Christie is the founder of PriVault Co., a privacy law compliance, training and consulting firm. Previously, she was a partner at Smith + Pasalis LLP and a litigation associate at Testa, Hurwitz & Thibeault LLP, as well as Baker & Hostetler LLP. Christie received her undergraduate degree from Harvard College, her M.A. from McGill University, and her J.D. from Case Western University School of Law. Christie is a Certified Information Privacy Professional (CIPP) through the International Association of Privacy Professionals (IAPP).

Source: Company website (August, 2012).

Exhibit 2   Kyruus Board of Directors

Bob Higgins, Chairman of the Board of Directors

Bob is a Co-Founder and General Partner at Highland Capital Partners. He has more than twenty-five years of experience in venture capital and has served as a director of many public and private companies. Bob has also been a faculty member at the Harvard Business School and a faculty member at the Kennedy School of Government. He is a former director of the National Venture Capital Association and President of the New England Venture Capital Association. In addition, Bob has been recognized by the Forbes Midas List and AlwaysOn Venture Capital 100 as one of the top venture capitalists in the industry, and has earned the HBS Health care Alumni Achievement Award. Prior to his career in venture capital, Bob spent four years as the Executive Director of the John A. Hartford Foundation. He also was the Chief Executive of the Clark Foundation and the Burden Foundation. Bob is a former Assistant to the U.S. Secretary of Commerce and an Assistant to the head of the international division of the U.S. Treasury. Bob has an AB from Harvard University and received his MBA from Harvard Business School.

Bryan Roberts, Director

Bryan is a Partner at Venrock, joining the firm as a Kauffman Fellow in 1997. He is based in Venrock's Palo Alto office and focuses on a broad range of health care investments. Bryan is currently Chairman of the Board of Directors of Achaogen, Castlight Health, and Ironwood Pharmaceuticals (NASDAQ: IRWD) and also serves on the Board of several other private companies, including Coderyte, Intarcia, Kyruus and Tandem Diagnostics. Past investments include athenahealth (NASDAQ: ATHN), Illumina (NASDAQ: ILMN), Sirna Therapeutics (acquired by Merck) and Xenoport (NASDAQ: XNPT). Bryan was named a Henry Crown Fellow by the Aspen Institute in 2006 and has been the highest-ranking health care investor on Forbes' Midas List since 2008. Immediately prior to joining Venrock, Bryan received his Ph.D. in Chemistry & Chemical Biology from Harvard University. He previously held positions in corporate finance at Kidder, Peabody & Co and received his B.A. from Dartmouth College.

Alexander Saint-Amand, Director

Alexander serves as President and Chief Executive Officer of Gerson Lehrman Group Inc. Prior to his appointment as CEO, he served as the Chief Operating Officer and previously helped to build the firm's health care practice. He is a Co-Founder of The Councils of Advisors – thought-leading networks of academicians, scientists, and industry practitioners that help leading companies and investors learn more about critical industry trends. Prior to Gerson Lehrman Group, Alexander covered companies and financial markets for Bloomberg Business News in New York and Frankfurt. His work has been published in The New York Times and Frankfuerter Allgemeine Zeitung, among other publications. Alexander has volunteered as an emergency medical technician, is a licensed multi-engine pilot and trained sled dogs for the 1995 Iditarod Sled Dog Race in Alaska. He is a graduate of the University of Virginia.

Graham Gardner, CEO and Director- see management bio

Julie Yoo, Lead Product Officer and Director- see management bio

Source: Company website (August, 2012).

Exhibit 3. American Hospital Press Release

Kyruus Inc.'s Conflict-of-Interest Management Solution has been Exclusively Endorsed by the American Hospital Association

Kyruus Products Enable Provider-Centric Industry Relationship Management

Boston, MA - May 30, 2012 - Kyruus, Inc., a physician network optimization company announced today that its conflict of interest management solutions have been exclusively endorsed by the American Hospital Association (AHA). AHA Solutions awards the AHA Endorsement to products and services that help member hospitals and health care organizations achieve operational excellence. Kyruus will work closely with the AHA to help these organizations and their physicians manage the regulatory burden and PR risk associated with increased health care transparency.

AHA's Commitment to Innovation in Serving Hospitals
"The increasing importance of COI management was initially raised at a meeting of our Chief Compliance Officer Roundtable, which is made up of compliance officers from leading health systems across the country," said Anthony J. Burke, CEO of AHA Solutions, Inc. "After exploring this topic with our member organizations and evaluating the various solutions on the market today, we felt Kyruus represented the best solution for providing both the data collection as well as the physician engagement workflow tools essential for effective COI management," noted Michael Albion, Assistant Vice President for Strategic Alliances at AHA Solutions.

Partnering with Hospitals and Physicians to Improve Conflict of Interest Management
Regulation, corporate integrity agreements and professional codes of conduct are driving the need for greater collaboration between hospital administrators and physicians, and Kyruus' solutions meet these market demands. "Kyruus provides our office with up-to-date, actionable information that is critical for meeting today's compliance needs," said David Blake, Chief Compliance Officer at Cedars-Sinai Medical Center. "Kyruus Passport allows us to engage our staff and affiliated physicians to capture significant financial relationships and manage them in a proactive, collaborative manner. We are now automating the process of approving, monitoring and tracking industry interactions to better manage risk for both the institution and our doctors."

With the AHA Endorsement, Kyruus will continue to expand a growing number of clients that includes leading academic medical centers, specialty hospitals, integrated community care organizations and health care systems. "Kyruus is honored to receive the distinguished AHA Endorsement for our conflict of interest management solutions," said Graham Gardner, CEO of Kyruus. "We are deeply committed to helping physicians and hospitals optimize the ways in which they engage with the health care community. While many of these relationships are essential for driving innovation in healthcare, a comprehensive reporting and tracking system is required to protect physicians and institutions from the PR, financial, and regulatory risk that has been exposed given the explosion of information in the public domain."

About the AHA
The American Hospital Association (AHA) is a not-for-profit association of health care provider organizations and individuals that are committed to the improvement of health in their communities. The AHA is the national advocate for its members, who include more than 5,000 member hospitals, health systems and other health care organizations and 42,000 individual members. Founded in 1898, the AHA provides education for health care leaders and is a source of information on health care issues and trends.

About AHA Solutions
AHA Solutions, Inc. is a resource to hospitals pursuing operational excellence. As an American Hospital Association (AHA) member service, AHA Solutions collaborates with hospital leaders and market consultants to conduct product due diligence and identify solutions to hospital challenges in several operational areas, including finance, human resources, patient flow and technology. AHA Solutions provides related marketplace analytics and education to support product decision making. As a subsidiary of the AHA, the organization convenes people with like interests for knowledge sharing centered on timely information and research. AHA Solutions is proud to reinvest its profits in the AHA mission: creating healthier communities. For more information, visit www.aha-solutions.org.

About Cedars-Sinai
Cedars-Sinai Medical Center is one of the largest nonprofit academic medical centers in the Western United States. For 20 years it has been named Los Angeles' most preferred hospital for all health needs in an independent survey of area residents. Cedars-Sinai is internationally renowned for its diagnostic and treatment capabilities, as well as breakthroughs in biomedical research and outstanding medical education. It ranks among the top 10 non-university hospitals in the nation for its research activities.

About Kyruus
Kyruus is a health care Big Data company offering solutions for physician network optimization and industry interaction management to leading hospitals and health systems. For more information, visit www.kyruus.com.

Source: Company website (August, 2012).

Exhibit 4   Physician Payment Sunshine Act

Information on Implementation of the Physician Payments Sunshine Act
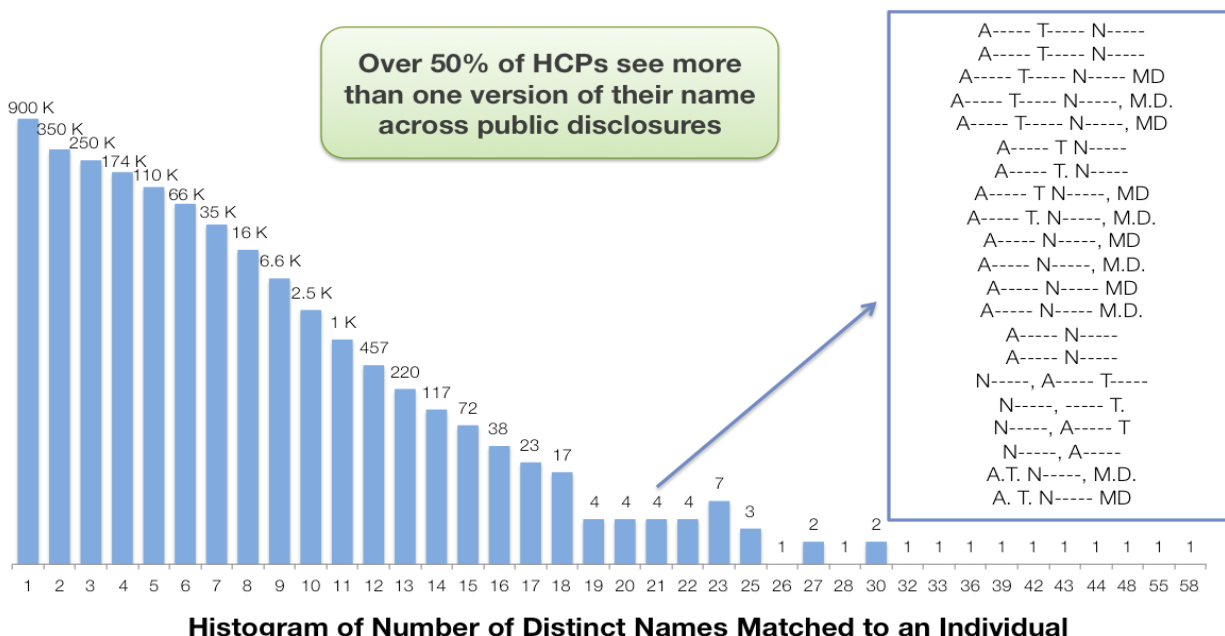
▦ MAY 3

On December 19, 2011, the Centers for Medicare & Medicaid Services (CMS) published a proposed rule implementing the Physician Payments Sunshine Act, which was included as section 6002 of the Affordable Care Act of 2010. This provision will provide important transparency in requiring reporting of payments or gifts to physicians, and physician ownership and investment interests. During the 60 day comment period, CMS received over 300 comments from a wide range of stakeholders.

CMS is committed to addressing the valuable input received during the comment period, and to ensuring the accuracy of the data collected. In order to provide time for organizations to prepare for data submission and to sufficiently address the important input we received during the rulemaking process, CMS will not require data collection by applicable manufacturers and applicable group purchasing organizations before January 1, 2013.

CMS intends to release the final rule later this year. This timing will provide CMS with additional time to address operational and implementation issues in a thoughtful manner, and the ability to ensure the accuracy of the data that is collected.

Source: CMS Blog website, http://blog.cms.gov/2012/05/03/information-on-implementation-of-the-physician-payments-sunshine-act/, accessed September 28, 2012.

Exhibit 5   Name Disambiguation and Phrase Reconciliation
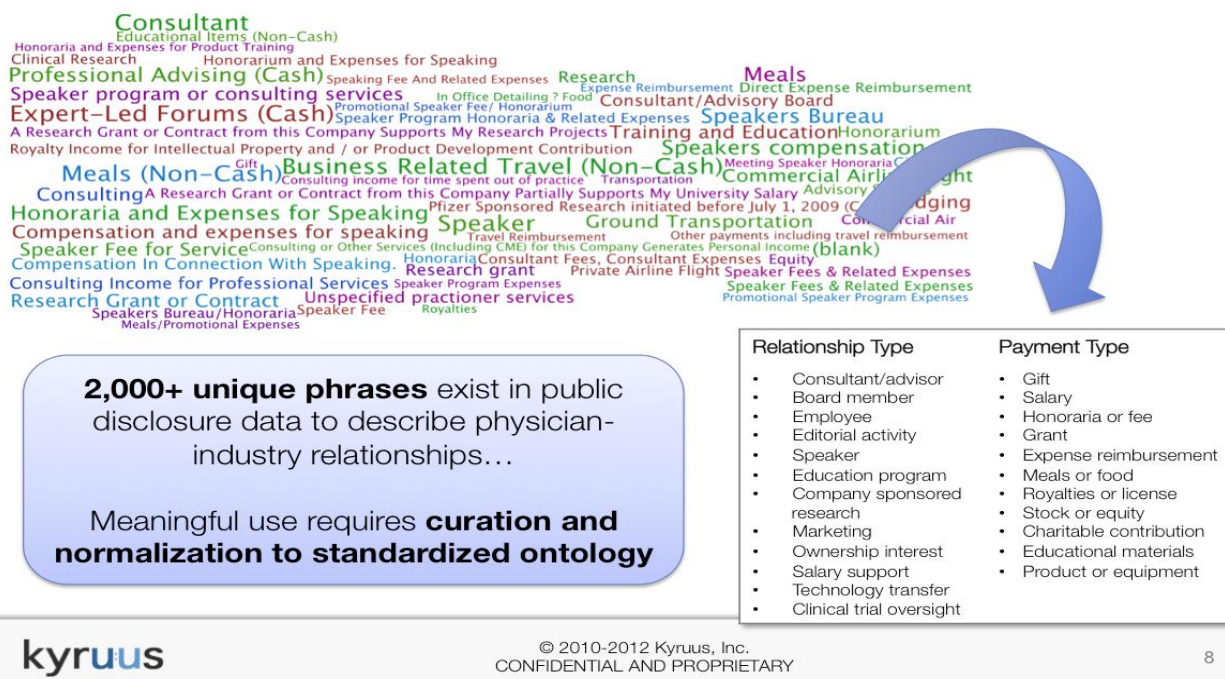
Source: Company documents.

Exhibit 6   Non-Healthcare Comparables: Information Providers in Industry

Manufacturing	Financial Services	Travel	Healthcare
Provider of data and intelligence on manufacturing parts and processes	Electronic library on publicly traded companies and key business people	Major provider of inventory and schedule data for airline industry	Information exchange to optimize physician network performance
→ **Current market cap of $4.4B**	→ **Estimated $6.6B in revenues**	→ **Acquired by Google for $700M**	→ **Addressable market of $6B+**

Source: Company documents.

Exhibit 7   Welcome Letter for New Kyruus Employees

Welcome to Kyruus. We are honored to have you on the team.

Kyruus is a company about people. Every day, we try to better understand people and help them maximize their potential. Sometimes that means helping a physician see how they measure up against their peers so that we can help match them to patients that they can treat better than anyone else. Sometimes it means helping an institution understand how to put together a team of care givers that can work efficiently together. We recognize that everyone is different and that means that everyone has a gift to offer that together can make us stronger. You are here because you are different. You are here because you have a gift. Together we will work to maximize the value of that gift for our company, for our customers, and for all the people we touch.

Kyruus is also a platform company. We integrate information from thousands of different places and provide our customers a platform to see things they couldn't see before. We hope that we will also be a platform for you. We hope our people and our vision help you to see things that you haven't seen before. We hope your insights will make our company better and our customers smarter. Most importantly, we hope our platform will launch you to do everything you have ever dreamed.

Thank you for joining us. We are excited to see where you help to take us next.

Source: Company documents.

Exhibit 8   Kyruus Technology Platform
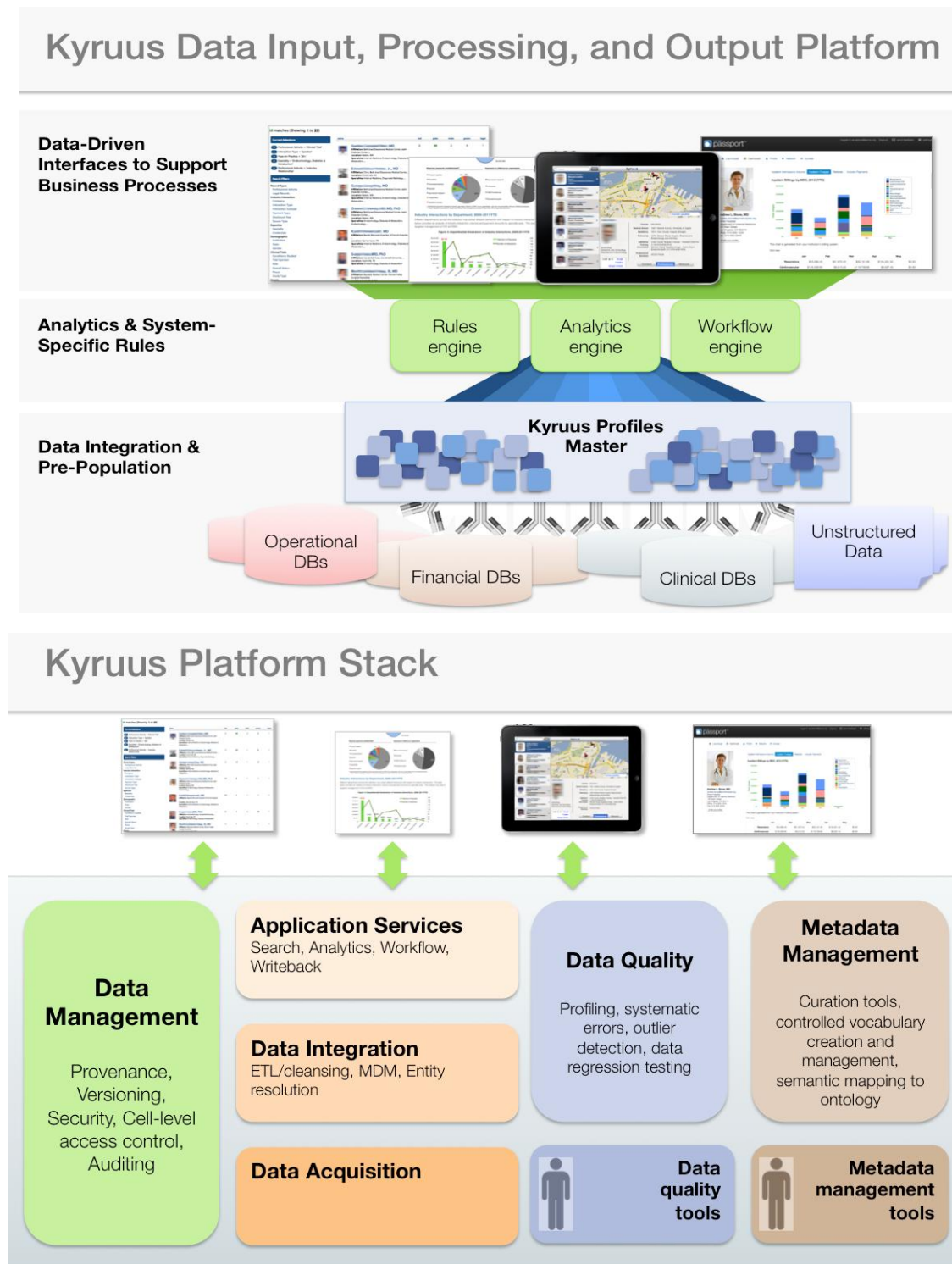
Source: Company documents.

Exhibit 9   Kyruus Passport – Physician Dashboards and Workflow Platform
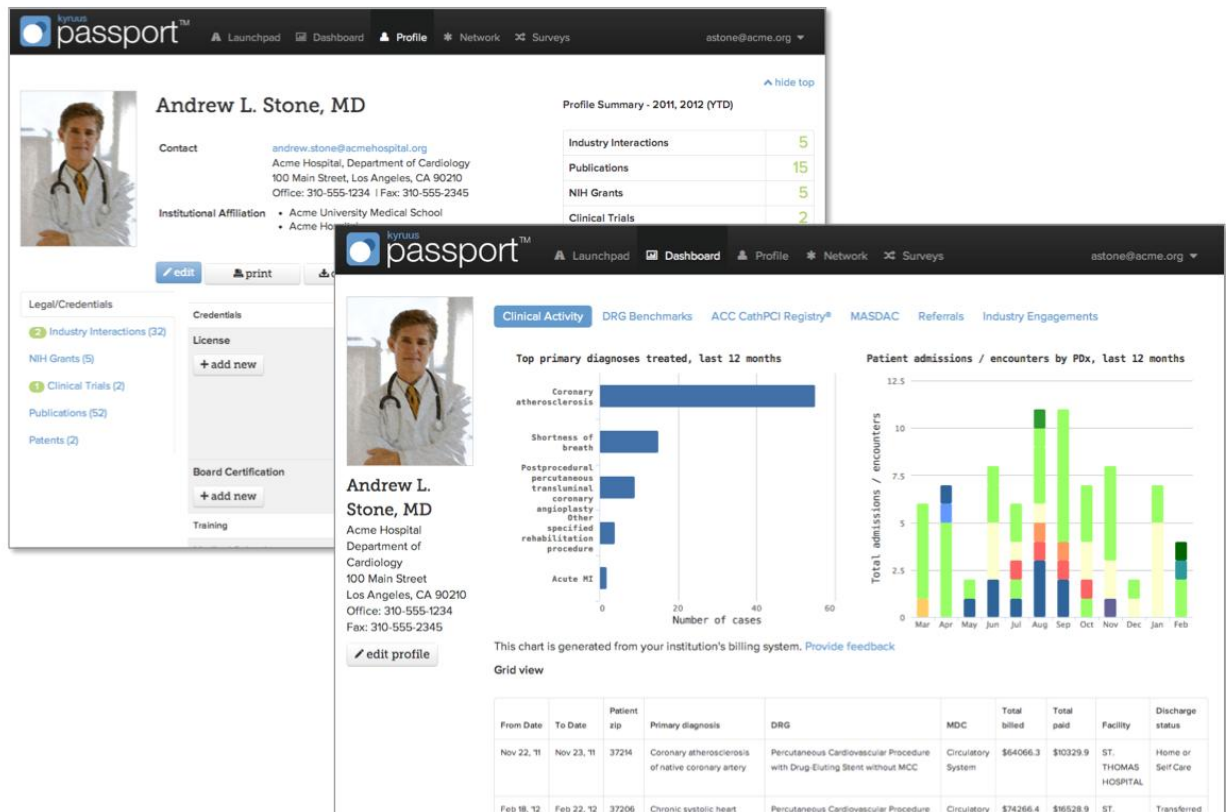
Source: Company documents.

Exhibit 10   Market Solution Areas

Kyruus provides solutions in the following application areas:

Regulatory Compliance Solutions

- Conflict-of-interest management
- Stark contract compliance
- Utilization management

Network Development Solutions

- Physician recruiting
- Mergers & Acquisitions diligence
- Physician market analysis

Referral Optimization Solutions

- Leakage management
- Patient retention
- Specialist marketing

Source: Company documents.

Exhibit 11   Kyruus Survey
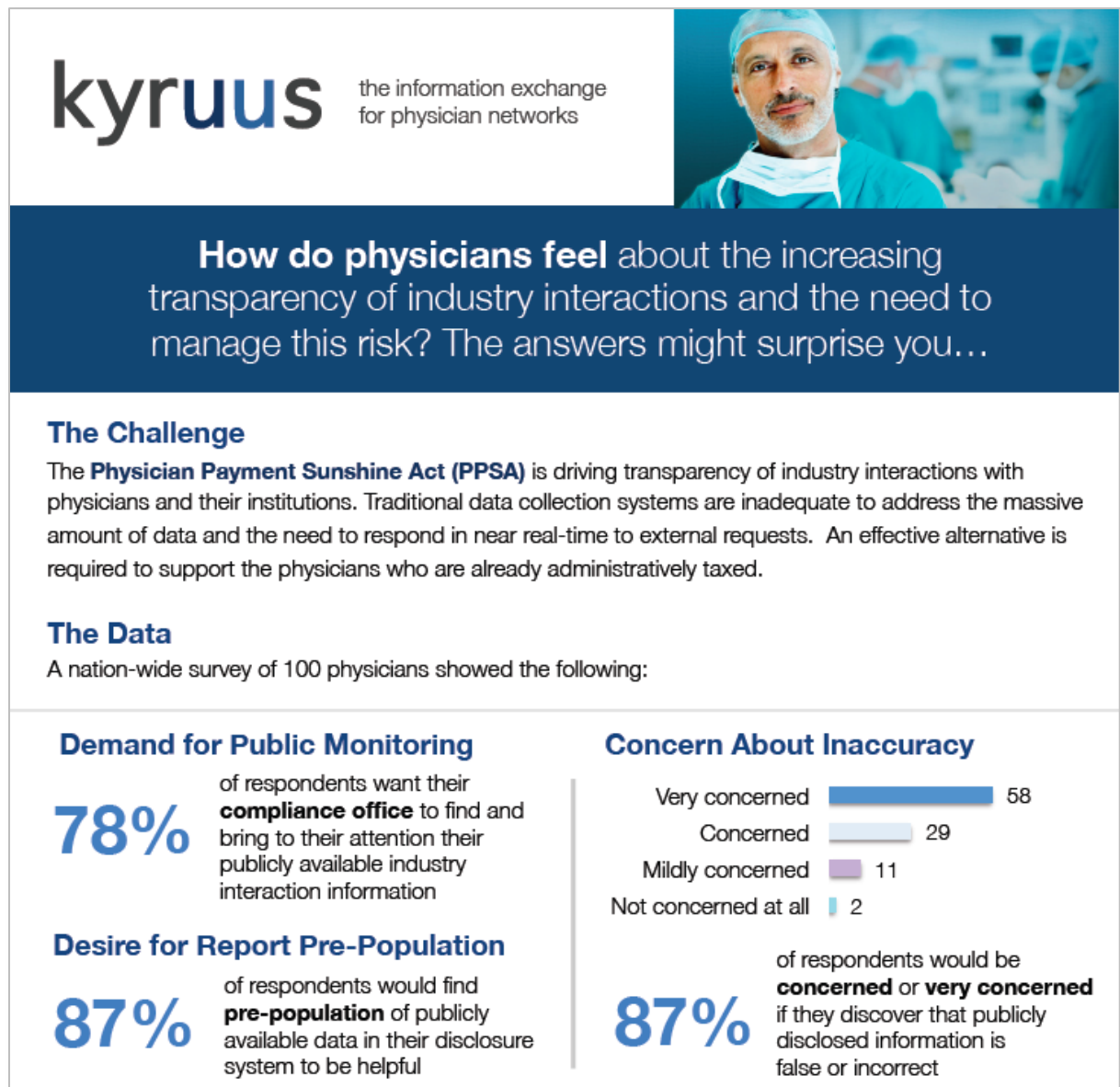
Source: Company documents.

Exhibit 12   Financial Implications of Leakage within an Institution

Case example: inpatient spinal fusion surgery*

Office visit	Pre-op imaging and lab testing	Spinal fusion and inpatient stay	Post-operative care	
$145 Physician fee	$120 Radiologist fee	$ 2,754 Surgeon fee $ 850 Consultation fees	$424 Physician fee	$ 4,438 **Physician Total**
$174 Facility fee	$652 Facility fee $129 Laboratory fee	$14,849 Facility fee	$647 Facility fee	$16,621 **Facility Total**

If the relevant physicians are employed, professional billing and outpatient facility fees are also captured; in a leakage scenario, those fees are lost to other facilities.

Figures are illustrative; representative of average amounts actually paid in a commercial insurance environment

Source: Company documents.

Exhibit 13   Leakage: Impact on Margin in Fixed-Cost Business

$1.1B hospital system

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Consolidated statement of operations ($M)	FY 2010
Net patient service revenue	1050
Rental and other revenue	14
Charity and grant revenue	36
Total revenue	1100
Expenses	
Salaries and professional fees	433
Employee benefits	187
Supplies	284
Depreciation	120
Rent and utilities	23
Uncollectible accounts	22
Interest and other	18
Total expenses	1087
Operating income	13
Net margin	1%

Typical standalone hospitals or multi-hospital systems have operating margins of between -2% to +5%.

Source: Company documents.

Endnotes

[1] Lewis, MM. <u>Moneyball</u>, W.W. Norton & Co, New York, NY; 2003. The inner quote regarding $150,000 salaries is from: Bill James, *Baseball Abstract*, 1977.

[2] Candace Lombardi, "Is Endeca really the Next Google?" *CNet News,* June 28, 2007, http://news.cnet.com/Is-Endeca-really-the-next-Google/2100-1038_3-6194010.html accessed October 11, 2011.

[3] "CVS Caremark and Generation Health Form Strategic Partnership to Offer Personalized Medicine," Highland Capital Partners website, http://www.hcp.com/news/newsdetails.php/id/79822, accessed August 8, 2012.

[4] Public Law 111-148, 111th Congress, "The Patient Protection and Affordable Care Act", March 23, 2010, http://www.gpo.gov/fdsys/pkg/PLAW-111publ148/html/PLAW-111publ148.htm, accessed August 8, 2012.

[5] David Hodgson and Seth Whitelaw, "Physician Payment Sunshine Act: Physicians and life sciences companies coming to terms with transparency?", Deloitte/ Forbes Insights, 2012, http://www.deloitte.com/assets/Dcom-Malaysia/Local%20Assets/Documents/Forbes%20Insights%20LSHC%20transparency%20report.pdf, accessed August 8, 2012.

[6] K Okike, MS Kocher, EX Wei, CT Mehlman, M Bhandari, "Accuracy of conflict-of-interest disclosures reported by physicians." *New England Journal of Medicine*, 2009: 361(15): 1466-74.

[7] TL Forbes, "Author disclosure of conflict of interest in vascular surgery journals." *Journal of Vascular Surgery*, 2011: 54(3 Suppl): 55S-8S.

[8] McKinsey Global Institute Report, "Big Data – The next frontier for innovation, competition, and productivity," June 2011, http://www.mckinsey.com/mgi/publications/big_data/pdfs/MGI_big_data_full_report.pdf, accessed October 12, 2011.

[9] Rolfe Winkler, "Oracle's Little Issue with Big Data," *Wall Street Journal*, April 9, 2012, via Factiva, accessed April 11, 2012.

[10] M Hilbert, and P Lopez, "The World's Technological Capacity to Store, Communicate, and Compute Information," *Science*, April 1, 2011: 332(6025).

[11] *Ibid*. McKinsey Global Institute Report, June 2011.

[12] "Big Data," Wikipedia website, http://en.wikipedia.org/wiki/Big_data#cite_note-15, accessed June 20, 2012.

[13] Christy Pettey, and Laurence Goasduff, "Gartner Says Solving 'Big Data' Challenge Involves More Than Just Managing Volumes of Data," Gartner website, http://www.gartner.com/it/page.jsp?id=1731916, accessed April 11, 2012.

[14] *Ibid*. McKinsey Global Institute Report, June 2011.

[15] *Ibid*. McKinsey Global Institute Report, June 2011.

[16] *Ibid*. McKinsey Global Institute Report, June 2011.

[17] *Ibid*. McKinsey Global Institute Report, June 2011.

[18] Salazar and Carlson, "Kalorama US Healthcare Industry Overview," *Kalorama Information*, New York, NY, February 2011.

[19] Brian Gormley, "Health Care, Not Tech, Wore Venture-Funding Crown in 2009," *Wall Street Journal Blog*, January 22, 2010, http://blogs.wsj.com/venturecapital/2010/01/22/health-care-not-tech-wore-venture-funding-crown-in-2009/, accessed June 12, 2012.

[20] "Massachusetts by the Numbers," Massachusetts Biotechnology Council website,

http://www.massbio.org/economic_development/the_massachusetts_supercluster/massachusetts_by_the_numbers, accessed August 8, 2012.