

Healthcare 2.0: The Age of Analytics



Tyler: Good day and welcome to all who have joined us for today's webinar. Healthcare 2.0: The Age of Analytics. Sponsored by Health Catalyst.

My name is Tyler Morgan and I will be your moderator today. Throughout our presentation, we encourage you to interact with our presenters by typing in questions and comments using the questions key in your control panel. We will be answering questions at the end of the presentation during our questions and answers time. If we don't have time to address your question during the webinar, we will follow up with you afterward. We are recording today's session, and shortly after the event, you will receive an email with a link to the recording.

I am happy to introduce our presenter today. Dale Sanders has a diverse 30-year background in IT, including 8 years as a CIO in the US Air Force. Most recently, he has spent the last 17 years in healthcare as a senior research fellow for The Advisory Board Company, CIO for the National Health System in the Cayman Islands, CIO and chief data architect at the Northwestern University Medical Center, and regional director of Medical Informatics and chief data architect at Intermountain Healthcare.

I will now turn the time over to Dale Sanders. Dale...

Dale: Thanks, Tyler. And thanks everyone for joining today. It's my sincere honor and pleasure to share this time with you and hopefully it will be time well spent. I did my best to put a lot of information in 20 or 30 years of experience with this topic into one

hour. It's a little challenging but it's fun. And I tried to create content here that bridged the gap between the technical and non-technical audiences. A large part of our audience today is not from IT, but in this day and age, when our business moves at the speed of software and data, I believe we all need to be somewhat technically aware, especially around this topic of data and analytics and especially at this time in the history and the industry. So hopefully I have found that balance today.

Overview



Time Allowing: Health Catalyst Screen Shots

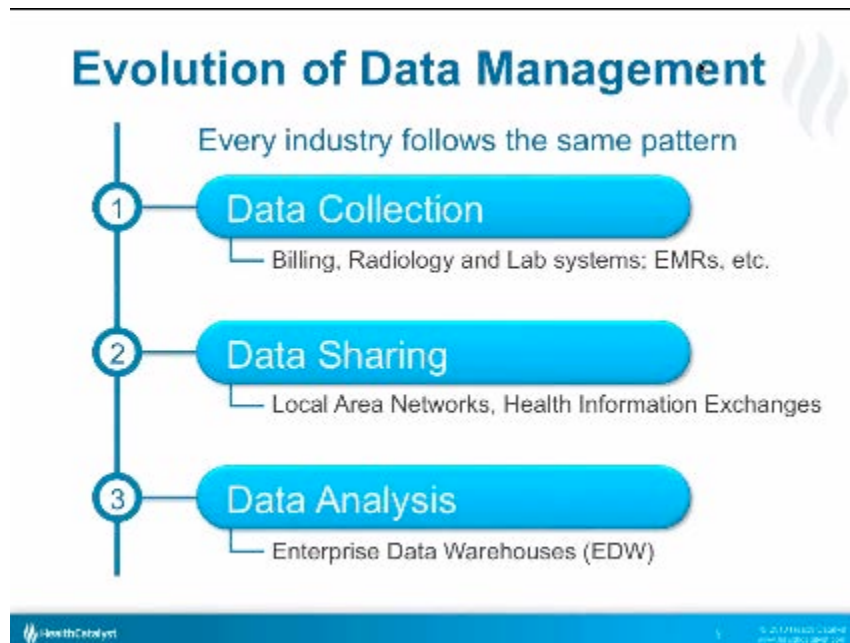


Overview

So we'll cover 3 main topics today – 1) Key Principles, 2) Evaluating Options for Analytics and 3) some of the Organizational Issues that you'll face as you transition into this Healthcare 2.0 analytic environment. If there's time allowing, I will blast through a handful of Health Catalyst screen shots because I promised I would do that to the sales team. But the majority of the content today has nothing to do with sales. It's just about the lessons learned that I've benefited from in my career.

So under key Industry or key principles rather, we'll talk about how data management evolved with virtually every industry and we're seeing the same pattern right now in healthcare. We'll talk about how to preserve agility because as a C-level executive in healthcare, I'm not constrained anymore by budgets or facilities or people. I'm constrained by software that can adapt in your business model and that is going to be the case with analytics as well. So analytic agility is really important. We'll talk a little bit about this notion of closed loop analytics in the context of the triple aim and we'll present a Healthcare Analytic Adoption Model that is basically a roadmap and a recipe for the progression of analytics in healthcare.

We'll talk about some of the options that you have, both the strategy options for implementing analytics, as well as some of the vendors in each of those strategy categories. I'll offer a checklist for population health management, some of the functions that you have to have in order to achieve population health management. And then I'll talk a little bit about some of the organizational issues that you'll face. And I'll propose an ACO data acquisition timeline (I'll use ACO in a broader definition than the federal term in this presentation today). And I put it under organization because data acquisition in the future of accountable care is every bit as important as hospital acquisitions or physician acquisitions or the typical mergers in acquisitions that we see in the market. Data acquisition is really, really important in the success of an ACO. And then we'll talk a little bit about data governance which is an hour long conversation in and of itself. And if there's enough interest, just we might follow up with another webinar on that.



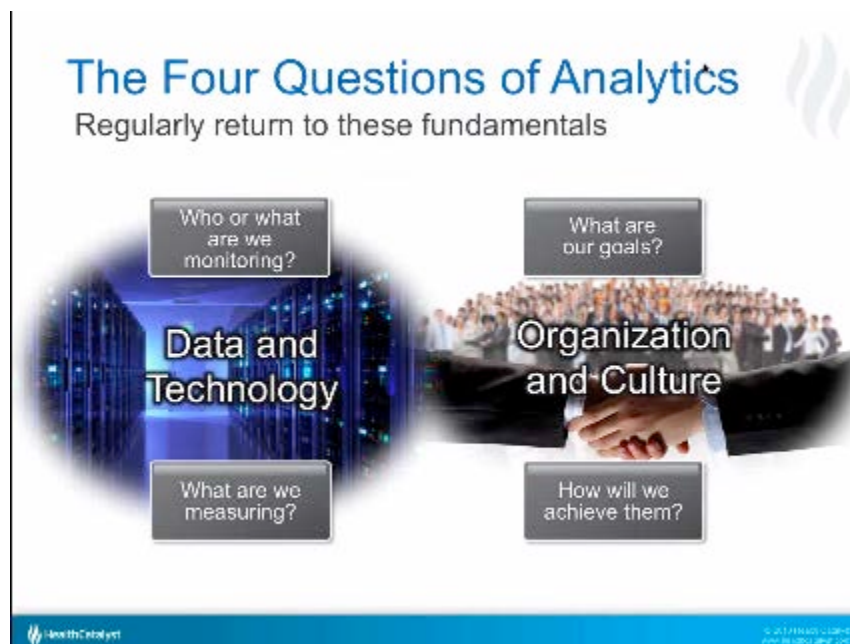
Evolution of Data Management

So let's talk a little bit about the Evolution of data management. In virtually every industry, (and again I'm kind of blessed to work in quite a few different industries before coming in to healthcare and I've seen this pattern emerge historically as an IT professional), we start off with collecting data that support particular workloads. In healthcare, that's reflected in billing, radiology, lab systems, EMRs.

Then we move to sharing that data. So the next stage of IT adoption is typically installation of local area networks so that the enterprise can be networked and share data among members of the workloads. In healthcare, health information exchanges are the extension of the add-in to the external environment, so moving beyond the local area network to business partners and other members of the care delivery industry.

And then the third phase is data analysis, and that's the phase in which we collect the data from stage 1 of this pattern and analyze the workload that is a reflection of that data collection. So far, there are no viable alternatives to analytics than an Enterprise Data Warehouse. Let me just say that one more time. There really is no viable alternative to the development of an Enterprise Data Warehouse if you're going to achieve high performance analytics. I wish there were. And if there were, I would be among the first to adopt it. You know, I'm the CIO first, and anything that I can do that is better, faster and cheaper with IT investments, I would do in a heartbeat. But there are certain fundamental issues associated with the collection and analysis of data in the human world that requires that it be aggregated.

And Google is a great example of that. If anyone was going to do this well, they would be Google. But there's a reason they have 15 data centers and 900,000 servers supporting data analysis. They're just a large data warehouse, they collect information from the web, and there's no way to get around it right now. There are some query reporting tool vendors that will tell you that you can create a virtual desktop data warehouse by connecting to just with data source within the enterprise. But I can tell you right now that's impossible to do, and not only it's impossible to do on a regular basis, but it's impossible to bind data in those query reporting tools into more complicated information models. So we'll talk a little bit about that concept of binding later on.



The Four Questions of Analytics

There are four fundamental questions of analytics in healthcare. And I want to encourage everyone to regularly return to these fundamentals. Just like a sports team,

practice is fundamental over and over. Sometimes we forget to return to these fundamentals in analytics, and we overlook or we miss some of the very important issues.

The first and most fundamental thing in the analytics of healthcare is "who or what are we monitoring?" And for the most part, that comes down to patients and clinicians. Patients and clinicians and their interaction is what constitutes a healthcare transaction. Those activities tend to be the center of everything that we're doing. So we have to define very specifically and very precisely who we're monitoring, what kind of patients, what kind of clinicians, or in some cases, what kind of events. If you're analyzing laboratory information or radiology information, typically you're analyzing the events that pass through those systems.

The second step in those four questions of analytics is "asking what is it about those people or things that we are measuring". So what's important about a diabetic patient, what's important and what do we want to know about a heart failure patient.

The next thing is establishing goals around those analytics. So we define who we're interested in monitoring, we define what it is we're measuring about those people and processes, and then the third step is identifying and establishing goals around those metrics. So we want to trend out those measurements to go up or down or stay the same.

And then finally, how are we going to achieve those goals? And the key thing to remember here is, as the diagram depicts, half of what we're doing is organizational and cultural in nature. It doesn't have anything to do with data and technology. And one of the things that I've learned is as a technology person that's traveled around the country and advised organizations on the development of data warehouses, I can tell you all day long about the fast, easy way to develop a data warehouse. The technology piece of this is actually relatively easy. What I haven't done well in my career is follow up with those organizations to make sure that they are establishing goals and implementing cultural and organizational processes to achieve those goals. So it's not unusual for me to give advice on the technology, revisit those folks two or three years later, and see the technology essentially collecting dust.

So remember that the meaningful use of analytics is every bit as hard and difficult as the meaningful use of EMRs and maybe even more so. Again, I just want to emphasize these are fundamental questions, and everytime you get involved in a process improvement or an analytic strategy, make sure that you document and you have a clear understanding of the answers for each of these four questions.

Binding Data to Create Information

Atomic data must be "bound" to business rules about that data and to vocabularies related to that data in order to create information

Vocabulary binding in healthcare is pretty obvious

- Unique patient and provider identifiers
- Standard facility, department, and revenue center codes
- Standard definitions for gender, race, ethnicity
- ICD, CPT, SNOMED, LOINC, RxNorm, RADLEX, etc.

Examples of binding data to business rules

- Length of stay
- Patient relationship attribution to a provider
- Revenue (or expense) allocation and projections to a department
- Revenue (or expense) allocation and projections to a physician
- Data definitions of general disease states and patient registries
- Patient exclusion criteria from disease/population management
- Patient admission/discharge/transfer rules

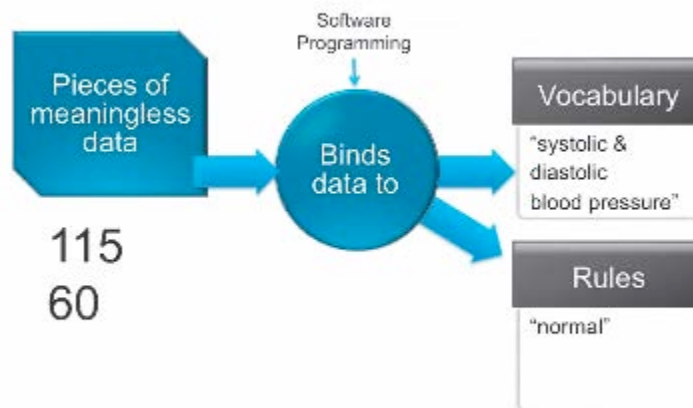
Binding Data to Create Information

I mentioned binding data earlier on and the importance of that. And I want to talk about this concept. And it's a little technical but again I don't think it's too technical for the non-IT members of the audience as I think C-level executives need to have an understanding of this given the importance of analytics to the future of healthcare. And the concept is this – Atomic data must be "bound" through software programming to business rules about that data and to vocabularies related to that data in order to create information. So we're moving from a kind of meaningless data to binding that data to rules and vocabularies to create information. Some of the vocabulary examples in healthcare are pretty obvious, right? We need unique patient and provider identifiers that associate my name with a unique numeric identifier. My identity, I should say. Standard facility codes, department codes, revenue center codes, gender, race, ethnicity, ICD, CPT, SNOMED, LOINC – all of these are standard vocabularies that are important for us to bind to in order to transform data into information.

The next layer of complication in binding is the business rule layer, and some of the examples of business rules are the algorithms around calculating length of stay, methods for attributing a patient through a provider in an accountable care organization, revenue or in the future expense allocation and projections to a department, same thing to a physician, data definitions of disease states. It's interesting for me to observe as an outsider when I came in to healthcare that we don't have a comprehensive and persistent definition of disease states. As I've moved from organization to organization in the CIO and as I have advised organizations across the country, I'm amazed at how inconsistently we define disease states from a data perspective.

Patient exclusion criteria from registries is very important as well. So sometimes patients can't participate in a treatment protocol in an accountable care organization because they have religious aversions to that, they have cognitive disabilities that prevent them from participating in the protocol, or they may have comorbid or contraindicated ambitions that prevent that. Being able to flag those patients as a different type of management challenge in the disease registry is very important. There are algorithms that we've developed to help establish those exclusion criteria for different management of those more challenging patient types. And then of course, another example is patient admission and discharge and transfer rules. And I suspect those of you that have been around healthcare know that if you move from organization to organization, there's great variability in the definitions around the binding of these data to these kinds of rules.

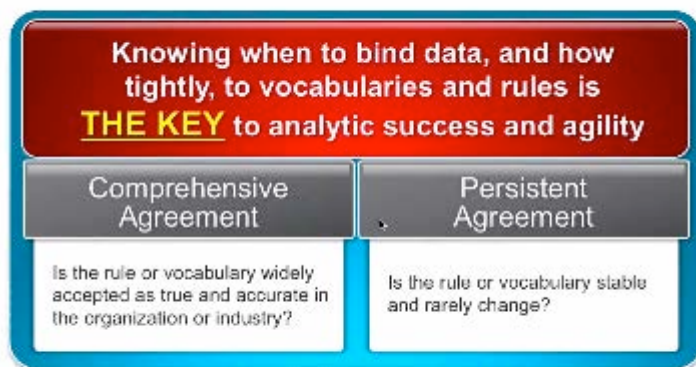
Data Binding



Data Binding

So here's a diagram that depicts this notion of data binding. We collect what amounts the meaningless pieces of data, for example 115 and 60. What does that mean? It doesn't mean anything until we find through software programming that data to vocabulary – right? They tie to systolic and diastolic blood pressure measures. And we define that according to our clinical and business rules. So that's what this notion of data binding is all about. And the data binding is at the heart of agile and adaptable analytics. This is actually a problem that's plaguing the industry right now that we need to get ahead of.

Why Is This Concept Important?



Two tests for tight, early binding

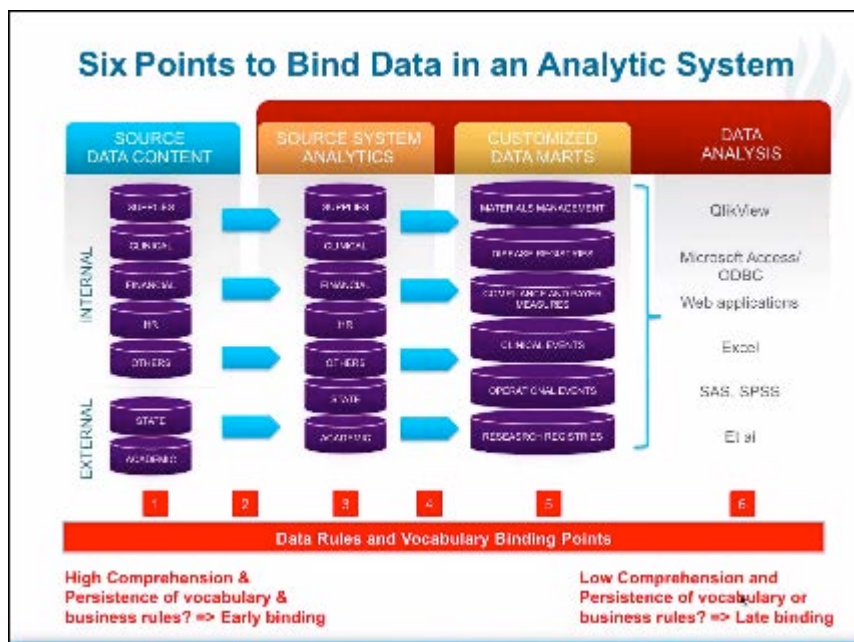
Acknowledgements to Mark Beyer of Gartner

Why Is This Concept Important?

Why is this concept important? The knowing when to bind data and how tightly to vocabularies and rules is the key to analytic success and agility. And when I say tightly, what that implies is the way you bind to that data in your software programming. You can program that binding with a flexible structure that allows you to change that binding if the definition changed, right? So how tightly and how early you bind to these vocabularies and rules is critically important. And there are two tests for tight and early binding – when it's safe to bind tightly, and when it's safe to bind early. And that is, is there comprehensive agreement about the rule or the vocabulary, and is it accepted as true and accurate in the organization or in the industry? Okay. Likewise, is it persistent? In other words, does the agreement stay that way for a long time or is it volatile?

So let's go back to this previous slide for just a second. I would argue that there aren't really even comprehensive or persistent definitions of what amounts to normal and hypertensive patients. There's still a fair amount of data about that. Right? It's something as simple as hypertension and normal blood pressure, especially at your age. I've seen recent clinical studies that basically say we're guessing at what hypertensive rules are as we age. So what that implies is that this binding must be adaptable as we progress in healthcare – because as an industry, there aren't very many things that we agree to comprehensively or persistently.

And I want to acknowledge Mark Beyer from Gartner. He introduced me to these two terms. I was using different terms prior to conversations with Mark earlier in the year. So credit to him for asking this concept, not many people do, and I appreciated him giving me these two terms. They're very, very appropriate.



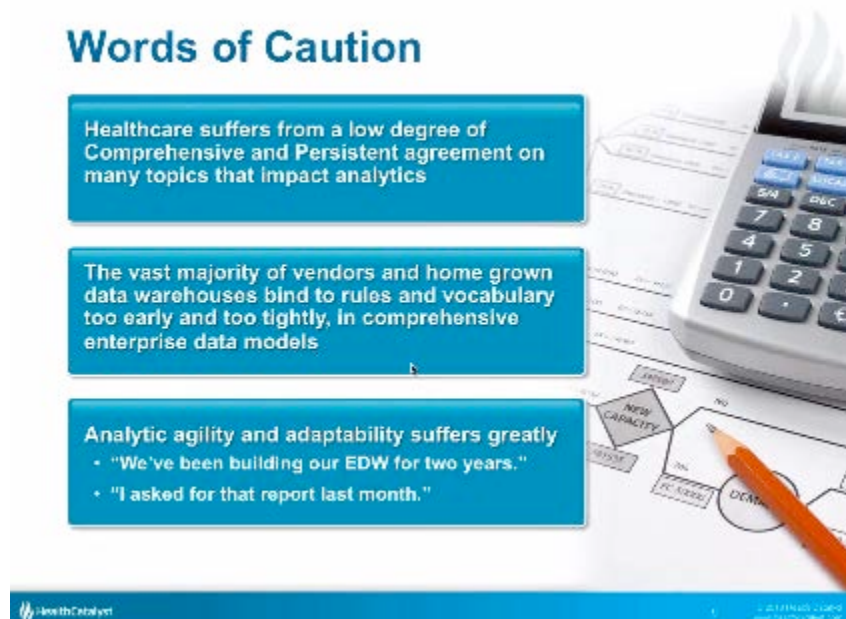
Six Points to Bind Data in an Analytic System

So here's a rather complicated diagram. For those of you in IT, you've probably seen this before. But those of you who are not in IT, it depicts a type of standard enterprise data warehouse. So source system data content is on the left, the analysis of data is on the right, and the flow of information from the source systems is from left to right. And as it turns out, there are six different points in an enterprise data warehouse at which you can either accept or apply binding to rules and vocabulary. And if you accept or re-apply binding at these levels, at points 1 and 2, everything downstream of that including the analysis, everything downstream of that binding must depend upon that binding. You can't unwind it. So that's early and tight binding. So that means every analytic use case, downstream of points 1 and 2, becomes co-dependent upon what you decided is appropriate to bind to with those two levels. But as I mentioned earlier, there aren't very many topics in healthcare that pass the comprehensive and the persistent tests.

And this is one of the important things, and again I'm not necessarily marketing Catalyst but more of marketing the great teammates that I have managed to accumulate over the years. Data engineers at Catalyst and the data engineers that you need to hire need to have not only a technical understanding of data and software programming and SQL programming, but they have to have an understanding of the industry – because as they go through this process of moving data from the source system down to the visualization and the data analysis layer, they need to scratch their head and ask themselves, is this rule or vocabulary that I'm about to bind to, is it comprehensive in the industry that comprehensively understood in the organization, and is it persistent? And if it is, then you can bind in points 1, 2 or 3 in the flow of information. If it's not,

you have to delay that until 4, 5 and maybe even 6 until there is comprehensive and persistent agreement on the concepts and the rules and the vocabularies.

And one of the problems that we face with a lot of vendors during this stage right now is that they apply these comprehensive enterprise data models at layers 3 and 4. And what that means is by the binding of those data models, those comprehensive models, and assuming that you know everything about the enterprise of healthcare analytics, you've eliminated the flexibility for changing those rules and exploring new bindings in layers 5 and 6. So we'll talk a little bit more about that later but that early binding that is kind of a hallmark of many vendor solutions right now is going to be very problematic as we grow and mature in analytic use cases in healthcare.



Words of Caution

- Healthcare suffers from a low degree of Comprehensive and Persistent agreement on many topics that impact analytics
- The vast majority of vendors and home grown data warehouses bind to rules and vocabulary too early and too tightly, in comprehensive enterprise data models
- Analytic agility and adaptability suffers greatly
 - "We've been building our EDW for two years."
 - "I asked for that report last month."

Words of Caution

So again these are the words of caution.

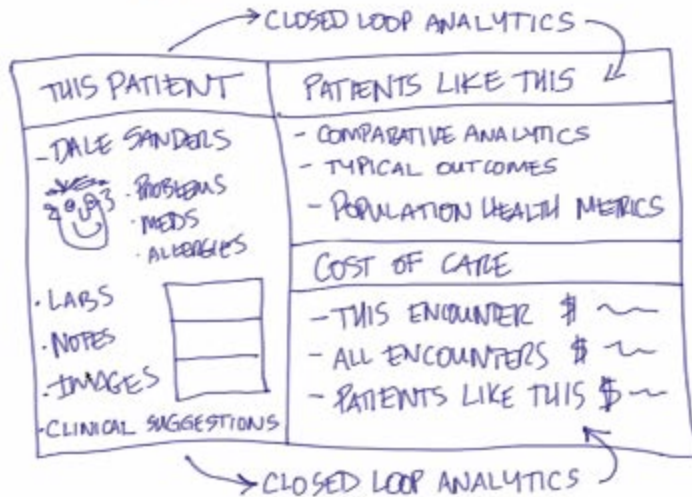
Healthcare suffers from a low degree of comprehensive and persistent agreement on a lot of topics that impact analytics. Most vendors and a lot of home grown data warehouses are binding to rules and vocabulary too early and too tightly in these comprehensive data models, and it's going to paint you and the industry in an analytic corner. And some of the vital signs that indicate that this is happening are questions and statements like these: "We've been building our EDW for two years." You know what, if it takes any more than six months to build an EDW now and start exposing analytic concepts, you're waiting too long and the amount to process is probably at the heart of that delay.

And the other thing that is an indicator of problem is this statement that we've all heard of and it is "I've asked for that report last month". And typically what that means is it's a

slight variation on a report that already exists, but because that data had been bound to a particular representation of rules and algorithms, early on in the process of data management, it's hard to go back and unwind that degree of variation on it.

Closed Loop Analytics: The Triple Aim

Google: "Intermountain antibiotic assistant"



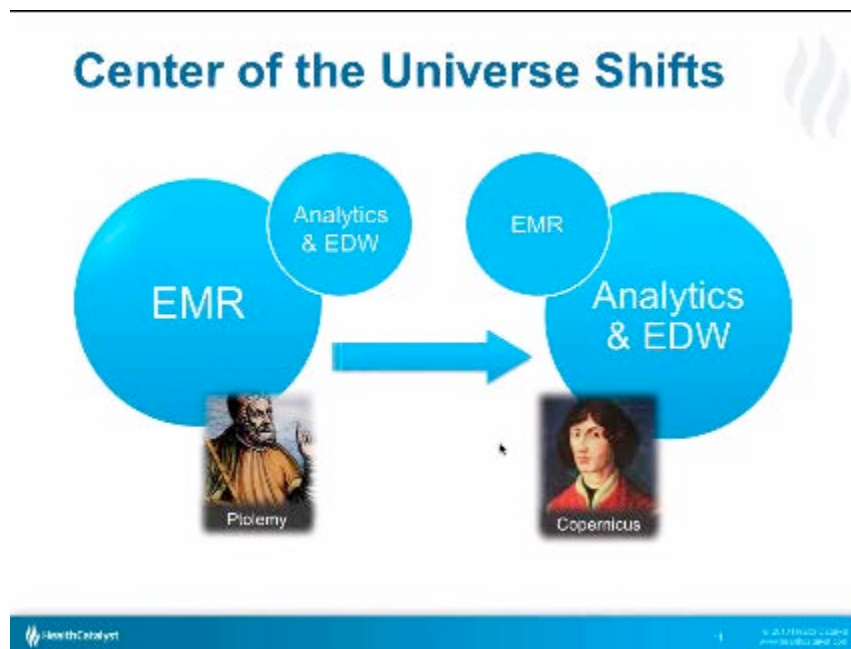
Closed Loop Analytics: The Triple Aim

So let's talk about this concept of closed loop analytics and the Triple Aim. I encourage you to Google "Intermountain antibiotic assistant". Dave Classen and Scott Evans developed that tool. I was lucky enough to work with them when I was at Intermountain at LDS Hospital. It's an impressive decision support tool about predicting the efficacy of antibiotic protocols based upon the clinical profile of patients on a new patient setting. And it's very cool, I mean it's had great success at Intermountain for its benefit to patients.

But one of the things that is very cool about it is not just the specificity of antibiotic management but it's a general model for where we need to go. It really is the background behind the Triple Aim. Dan Berwick and I had a conversation out in Cambridge in 2006-2007 about how impressive the antibiotic assistant was for its ability to combine patient care data, population-based data and economic-secured data all in one user interface. So the antibiotic assistant has patient-specific information in the user interface, it has analytics about patients like me, for example, and then it also has recommendations for the best antibiotic protocol along with the costs. And what we witnessed as physicians used that tool, they made very natural trade-offs between predicted efficacy and cost of care. And quite often they would choose maybe a second or third lower predicted efficacy for protocol at perhaps a hundred times difference in the cost per case. What we saw over time was no decline in the overall effectiveness clinically and the outcomes clinically, but there was about a 34% decline in the average

cost for per patient. And so, Dan Berwick did a great thing by labeling this "The Triple Aim," and it represents the future and where we need to go with analytics in the future.

So, in the user interface of some kind of future new EMR, there will be a combination of data about me specifically, there will be aggregated data about patients like me that exposes comparative analytics, it exposes outcomes for patients like me, and it all will expose some of the emerging population health metrics about patients like me, especially if I have a chronic disease. And the other part of this is very very important. It will expose the cost of care at the point of care, so that the patient can make informed decisions and the physician can participate in the decisions to balance economics, while securing quality of care. And until we get to this user interface, we're going to be in trouble with EMRs because they're not going to support the broader accountable care organization mandate.



Center of the Universe Shifts

So the center of the universe is shifting and I couldn't help but kind of go back to my days of physics and philosophy and recall the evolution of the way we perceive the universe. So Ptolemy was the philosopher and scientist who thought that earth was the center of the known universe. Copernicus came along many years later and said, "You know what, my observations indicate that the sun is the center of our known universe and solar system." And the same thing is going to happen. It needs to happen around EMRs. Unfortunately, we've invested in a lot of very mediocre EMRs. I've managed the health system at Intermountain, I've managed Cerner, and I've managed Epic, I've managed the E-Clinical Works, and I've been around Meditech. Unfortunately, they're coming out with new products at premium prices. The functionality between all of them is barely noticeable now. In the future, they will become a commodity product. I

wish EMR vendors would start giving away the EMR and make their money on analytics and EDW and data warehouses because I think it would be better for the industry. And that's what we're seeing. The future has to shift from this very patient-specific billing-centric EMR into an analytic-centric environment in the future, so that we can tailor the care and customize it for patients based upon what we know and learn from analytics at the point of care. So it's shifting and I encourage all of you to encourage the shift. Put pressures on the EMR vendors to make this transition. This is very important to all of us.

Healthcare Analytic Adoption Model

Level 8	Cost per Unit of Health Reimbursement & Prescriptive Analytics	Contracting for & managing health. Customizing patient care based on population outcomes.
Level 7	Cost per Capita Reimbursement & Predictive Analytics	Diagnosis-based financial reimbursement, managing risk proactively, measuring true outcomes.
Level 6	Cost per Case Reimbursement & The Triple Aim	Procedure-based financial risk and applying "closed loop" analytics at the point of care.
Level 5	Clinical Effectiveness & Population Management	Measuring & managing evidence-based care.
Level 4	Automated External Reporting	Efficient, consistent production; agility, and governance.
Level 3	Automated Internal Reporting	Efficient, consistent production; widespread access to KPIs.
Level 2	Standardized Vocabulary & Patient Registries	Relating and organizing the core data.
Level 1	Integrated, Enterprise Data Warehouse	Foundation of data and technology.
Level 0	Fragmented Point Solutions	Inefficient, inconsistent versions of the truth.



Healthcare Analytic Adoption Model

So that leads us into the [Healthcare Analytic Adoption Model](#). A group of us have been working on this, chipping away at it for the better part of 15 years. The first version of this, I called the Analytic Capability Maturity Model and that was maybe 15 years ago. More recently, it's become a more important topic. And so I would say the last 18 months a number of us have participated in the development of this and the intent is to take advantage of the metaphor and the lessons that we learned from the HIMSS Analytics EMR adoption model. This provided a great roadmap for the industry. We could use it internally to measure our progress of adoption for EMRs, we could measure the industry-wide adoption of EMRs with that model, and vendors could use it to help with their product development. And that's the same thing that we tried to do here with the Analytic Adoption Model.

And just like the EMR Adoption Model, it presupposes that you have to build and/or purchase an enterprise data warehouse. You can't adopt an EMR without buying or building one, and that's our assumption here too. There are no alternatives right now to an enterprise data warehouse to move up this analytic adoption model. So we'll be

moving from these fragmented point solutions that I think most of us agree that had been in the trenches are inefficient and inconsistent productions of the truth.

The next step up from this then is the integrated, enterprise data warehouse and creating a foundation of data and technology that you can leverage in the levels above level 1.

And in level 2, we start to organize that data, we start to create patient registries and we start buying new data to standardize vocabularies that are comprehensive and are persistently agreed upon.

At level 3, we're moving up to automating the internal reporting process. This is the production of basic KPIs and dashboards for the executives in the organization down to the managers in the organization. And I don't know about you but a lot of my career has been spent in fire drills producing these reports every month. They are inefficient and they also tend to be quite inconsistent. And they're not that differentiating. We want to get past that as quickly as possible into the differentiating levels with this model.

Level 4 is about automating external reporting requirements. These are the reports that I have to give the government and other agencies. And because they're changing a lot, again because they don't always pass that test of comprehensive and persistent understanding, you have to retain some data model and data binding agility in this level for the foreseeable future. Level 3 is a little more stable. We've been there, we know how to manage hospitals and clinics and things like that. There's not as much to change about the rules as there is at level 4.

At level 5, we're now starting to move up and measuring the clinical effectiveness and population management. It's all about measuring our adherence to evidence-based care. It's not about measuring outcomes yet, it's about measuring our adherence to evidence-based care.

The next step up in Level 6 moves to cost per case reimbursement and the triple aim. So we're now moving into some financial risk, based around procedures, typically CPT kinds of billing and bundled cases, and we're applying closed loop analytics at the point of care. Now, achieving level 6 assumes that we have made some progress in the industry and we had influenced the EMR vendors to open up their API, their Application Programming Interface, to allow us to bend that loop back on the user interface. So it's going to require some collective pressure from all of us on the industry to make sure that happens.

At level 7, we're taking on greater financial risks with that I call diagnosis-based financial reimbursements. So now you will be paid on a per-capita basis, for patients that have diabetes or patients that have congestive heart failure and that sort of thing. We are

also starting to move into predictive analytics. And I want to make note that we haven't been as positive with predictive analytics below that yet, and I will talk more about why that's the case later on. We're also starting to measure true outcomes which are the missing piece in predictive analytics in the market right now. We truly don't really measure outcomes. The only outcome that we're measuring right now is readmission, and I think that's a really sad state of affairs. What we should be trying to predict are admissions. We should be proactively trying to keep people out of the hospital right now. But the best that we seem to be satisfied with right now is readmissions. So we have to move that upstream in the health management process.

And finally the aspirational level that we all hope for in time is that care providers are reimbursed on some unit of health. So now the healthcare provider that we're contracted with is being reimbursed to completely keep me out of the clinic and the hospital, and manage my health out in the community. And like the antibiotic assistant, not only are we predicting at level 7 the effectiveness of a protocol but we are actually suggesting and prescribing based upon analytics a better protocol tailored for that specific patient. So it is about customizing patient care based upon population outcomes and it's what Toyota and Lean calls mass customization.

Healthcare Analytic Adoption Model

Level 8	Cost per Unit of Health Reimbursement & Prescriptive Analytics: Provides analytic insights separate to wellness management and remote patient care. Physicians, hospitals, employers, payers and members/patients collaborate to analyze and reward (e.g., financial shared savings) or penalize (e.g., health plan cost) performance for the use of best practices, analytics, and interventions and care support. Physicians and/or payers analyze all the risks of care to improve shared financial outcomes based upon population outcomes. Data content expands to include genomic and financial data. The EHR is updated with a few minutes of delay for the source systems.
Level 7	Cost per Unit Reimbursement & Predictive Analytics: Analytic insights separate to address a population, location or care area reimbursement model. Focus remains on management of risks to collaborate with clinicians and care partners to manage population of care using predictive modeling, forecasting, and risk stratification to support diagnosis, prognosis, and referrals. Providers are focused to require additional care or visit patient care in care process. Data content expands to include additional pharmacy data and protocol-specific patient reported outcomes. On average, the EHR is updated within one hour or less of source system changes.
Level 6	Cost per Unit Reimbursement & The Triple Aim: The Triple Aim is the goal of the organization. Analytic insights separate to address the Triple Aim. At least 20% of population data is integrated into the Triple Aim. Analytic insights separate to the goal of care to support the Triple Aim. Data content expands to include additional care, prediction, management, and the response of care. Data content expands to include health plan, pharmacy and population. On average, the EHR is updated within one day of source system changes. The EHR supports organizations to be cost-effective, care accessible, or relationship oriented care and quality of care.
Level 5	Clinical Effectiveness & Population Management: Analytic insights focused on managing clinical effectiveness, health care use, and clinical outcomes and variability. Data governance expands to support care management levels that are focused on improving the health of patient population. Performance and regulatory teams are placed in a continuous manner opportunities to improve quality, and reduce risk and cost across care processes of care and care partners and care partners and third party payers. Provider and patient data are collected from clinical, pharmacy, and other organizations to the extent of the patient record. EHR content is organized into evidence-based, standardized data that contains clinical and cost data associated with patient regimen. Data content expands to include insurance claims. On average, the EHR is updated within an hour of source system changes.
Level 4	Advanced External Reporting: Analytic insights focused on compliance, risk and standard of reports required by regulatory and accreditation requirements (e.g., CMS, Joint Commission, Joint Regulatory, Accreditation, etc.), payer incentives (e.g., MCO, POS, VBP, Reimbursement reduction), and quality safety objectives (e.g., HEDIS, NCQA, etc.). Measures to reduce quality and compliance risk. Clinical data content is available for single day and multiple day governance, data governance, data review, and approval of externally released data.
Level 3	Advanced Internal Reporting: Analytic insights focused on compliance, efficient reduction of work supported by data, risk assessment and approval of the health care system. Key performance indicators are easily accessible from the population level to the clinical manager. Corporate and business unit data analysis is readily available to all levels of the EHR. Data governance expands to allow the data literacy of the organization and develop a data governance strategy for internal and external.
Level 2	Standard and Reporting & Patient Regimen: Major regulatory and compliance data identified and standardized external standards (e.g., payer, etc.) are used to standardize data. Reporting and compliance are done over with local standards. Patient regimen are defined using the EHR. Data governance focuses on the definition and evolution of patient regimen and measure data management.
Level 1	Integrated Enterprise Data Warehouse: All information and business data are located in a single data warehouse. Key performance indicators (KPIs) are defined. Data content includes insurance claims, if possible. Data warehouse is updated within one month of changes in the source system. Data governance is formalized and the data literacy of the organization. The EHR content organization is in the EHR.
Level 0	Fragmented Point Solutions: Vendor-based and internally developed applications are used to connect data to analyze measures. Key areas: The fragmented Point Solutions are neither connected to a data warehouse nor integrated into a single data warehouse. The applications are developed in a siloed manner and are not integrated. Data governance is non-existent.

And here are the integrated details but obviously I won't go through this with all of you but what we try to do is provide enough detail in here that you could take this one page document and use it as a self-inspection guide.

And I think, Tyler, do you have a poll?

Tyler: Yes, we do have a poll prepared.

Dale: Okay. So Tyler is going to pop up a poll here and we're going to ask you to respond. Where do you think the industry is right now on the analytic adoption model? At what level do you think we consistently on average operate in this model? Now go ahead, Tyler.

Tyler: Alright. Well we have the poll up. Folks are answering. We'll leave this up for another 25 seconds and then we'll close the poll and show results.

Dale: While folks are responding. One thing that I'd like to comment on here is that this is as much a course curriculum for analytic adoption as it is a roadmap. And by that, I mean if you progress through this curriculum deliberately by satisfying the requirements of level 1, 2, 3, 4, before you start moving up to level 6, 7 and 8, you'll find the journey to be a lot more successful, and frankly it will be faster. Even though it feels like and you may want to and you'll be tempted to move up and operate at level 5 and 6 where some of the ACOs are right now, if you don't have level 3 and 4 and even level 2 and 1 established, you're going to find that you cannot achieve the aspiration of these upper levels and you'll have to go back in the curriculum and repeat those classes.

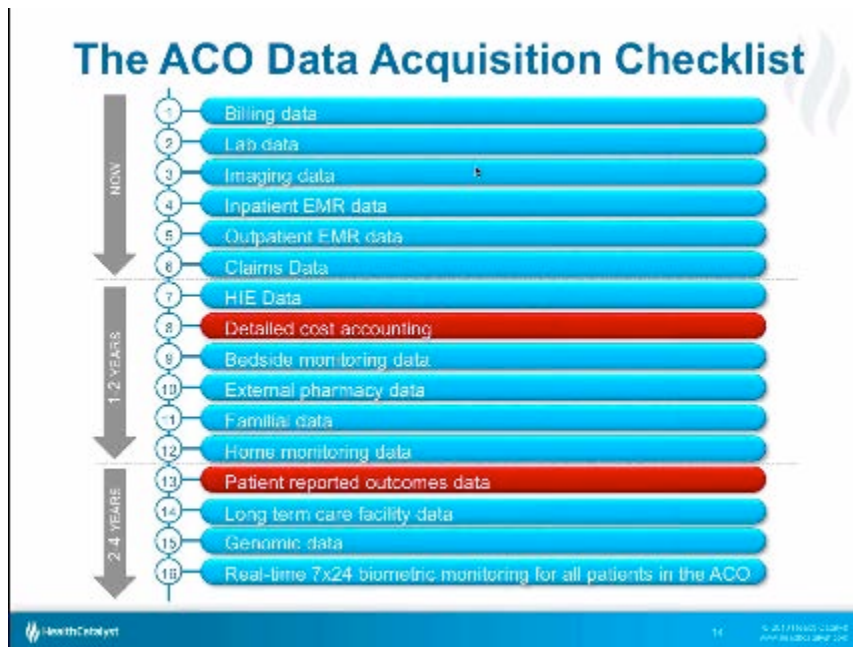
Tyler: Alright. We are closing the poll now and we'll share those results with you.

Dale: Okay. Do you want to share those now, Tyler?

Tyler: I am sharing. I just clicked the share. It looks like we got 62% of respondents say that we're in levels 1 or 2, with 21% in levels 3 or 4 and 15% suggest that the industry level is still at level 0.

Dale: Okay. Great. Thanks everybody. Very interesting. Very consistent with other polls that we've run.

Okay. So let's move on to this – and oh let me back up just a minute. There are a couple of themes actually that appear or subtly appear in this analytic adoption model. One is the progressive complexity of data binding. So as you move up, your data binding algorithms become more and more complicated, the data governance issues and the data governance involvement in analytics increases, so the organizational complexity can be increased as well, and the data content increases. So at level 1 we're establishing basic data content. At level 8, we've added things like familial data, we're using NLP to process text, and we're adding genomic data. So the ecosystem of data increases as well when you progress up to level 8.



The ACO Data Acquisition Checklist

It is, I mentioned earlier, as important to acquire data as it is to acquire businesses in the future of accountable care. And this is the checklist. There are 16 data sources that you need to collect and analyze if you're going to fully understand the continuum of care in an accountable care organization. You should be working right now on the collection and analysis of billing data, lab data, imaging, EMR data, outpatient EMR data, and claims data. You're actually beyond your roadmap and in your organizations right now. Over the next one to two years, you need to make sure that you have HIE data, detailed cost accounting data, pharmacy data, familial, etc. And then finally on the two to four-year roadmap, a data acquisition strategy in this area.

I highlighted two of these because we're not making any progress in the industry on these two areas right now, and I think it's going to be a big giant hole in our data analytic strategy if we don't do something. And that is we really don't understand number eight, we don't have a good idea of detailed cost accounting on a per patient basis what it really costs to deliver care. And you know, the way that we currently cost out care is very averaged out, it's very smeared across RVUs in patients and things like that. There's no detail in it. You cannot take on the kind of financial risk associated with capitated payments in an ACO if you don't have detailed cost accounting data. So somewhere out there I hope there's an entrepreneur listening to this that says, I'm going to come in to healthcare with lessons learned from other industries, and I'm going to sell a detailed cost accounting system in healthcare because it's absolutely critical to be a part of the data analytics puzzle in the next one to two years.

The other is patient reported outcomes data. So it's just amazing to me that my Toyota maintenance guy collects more outcomes from me than my physician does. We really

don't know whether the protocols in healthcare are working or not outside of a clinical trial, and the only 15% of the time those clinical trials apply to real patient care. So we have to start putting in place the mechanisms and the systems to allow patients to report on their outcomes data. It's a really important missing piece of the data puzzle right now.

These other areas are actually making some progress. There are products and progress being made on all these other areas of data collection and data acquisition but not right now. Big missing areas.



Evaluating Options

So let's talk about some of the options. We've covered a lot of the principles and the strategy. Now we need to get down to how are we really going to implement analytics in our organization?

Strategy and Analytic Options

Strategy Option	Pros & Cons	Example Vendors
Buy & Build from an Analytics Platform Vendor	<ul style="list-style-type: none"> Highest degree of analytic flexibility and adaptability Requires a data driven culture with high aspirations that views analytics as a clear business differentiator Best suited for a culture with a higher degree of data literacy and data management skills Slow initial time-to-value plagues some vendors Inconsistent ROI track record, but when ROI occurs, it's big 	<ul style="list-style-type: none"> Caradigm Intelligence Platform Health Catalyst Healthcare Data Works IBM Healthcare Data Model Oracle Healthcare Data Model Recombinant (Deltek)
Buy from an Analytics Service Provider	<ul style="list-style-type: none"> Best suited for cultures that want to avoid the details of analytics and data management, but aspire to improve basic internal and external reporting Inter-organizational benchmarking and comparative analytics is a natural part of the business model and service Limited analytic flexibility and adaptability Substantive ROI is not well-documented nor widely acknowledged 	<ul style="list-style-type: none"> Explorys Humedica Lumeris Premier Alliance Truven Analytics Suite
Buy "Best of Breed" Point Solutions	<ul style="list-style-type: none"> Leverages expertise and very specific analytic applications in business and clinical areas that are not always available in other options Does not facilitate data integration; i.e., does not provide a single analytic perspective on patient care and costs Costly and complicated to maintain 	<ul style="list-style-type: none"> AbtGen Orion Suite EPS MedioAnalytics Medventive Midas Omnicell
Buy from your EMR Vendor	<ul style="list-style-type: none"> Offers the possibility of "closed loop analytics" driving analytics back to the point of care, in the EMR and clinical workflow No proven track record with analytics to date from the EMR vendors Tend to be very focused on analytics that are specific to the EMR vendor's data Less flexible and adaptable to new sources of data and analytic use cases, especially complex ones 	<ul style="list-style-type: none"> Allscripts Sunrise Denix PowerInsight Epic Clarity & Cogito McKesson Horizon Meditech Data Repository Siemens Decision Support

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Strategy and Analytic Options

And this is a bit of an eye chart. Tyler will make these slides available for everyone later by the way. There are really about four strategy options right now to address analytic needs. I'm assuming that nobody really wants to build their own data warehouse anymore. There's really no need to do that just like in the early days of EMR adoption. That would be the only option you had. That's not the case anymore. There are some emerging vendors in this market that offer a pretty good build option.

So the first option here is to buy and build from an analytics platform vendor. And that's the category that we are in. Caradigm is in that category, Healthcare Data Works, IBM, Oracle, Recombinant. I consider them members of the same category where you will work very closely with those teams to build your data warehouse together. It tends to require a lot of cultural involvement and high aspiration. These clients are typically those that really want to get their hands dirty in the data. The good news about this option is it tends to offer the highest degree of analytics, flexibility, and adaptability.

ROI for these has been kind of inconsistently measured and acknowledged. But when ROI happens in this situation, it's big. One of the things that we do at Catalyst is we set up all of our projects with targeted ROI, and then we come back one year and two years later to see how we're moving against that ROI. And if you're not seeing greater than 50% return on your analytics investment within 18 to 24 months, there's something wrong. So again, you need to see some pretty high return on investment from these systems.

The next option is buying from an Analytics Service Provider. And the business model for these vendors, Explorys, Humedica, Lumeris, Premier, Truven, is around comparative

analytics. I have some skepticism and cynicism about comparative analytics because there's so much variability in healthcare. You really don't know what you're comparing yourself against. And we've had comparative analytics for years which hasn't done much to improve the industry. But be that as it may, the option or the benefit of this option is you can somewhat ship your data up to these vendors and they typically will produce dashboards and things like that for you in the cloud, so you don't have to get your hands as dirty in the environment as you would in the first option. These folks tend to focus on levels 3 and 4 of the Analytic Adoption Model. That's kind of their sweet spot.

The "Best of Breed" Point Solutions is where the industry is right now. We all have a proliferation of these kinds of products in our analytic environment now. The good news about this approach is they tend to be very deep within the subject area that they are addressing. Crimson, for example, has some very nice dashboards around physician productivity and that sort of thing that those of us in this category may not ever address. So the benefit is you get some really deep analytic experience here. The huge drawback is that these solutions do not support the continuum of care and they will never get you above, at most, level 3 and level 4 of the Analytic Adoption Model.

The other option that's emerging is buying from your EMR vendor. The EMR vendors have been slow coming to the game. They haven't done very well with analytics, they've been very transaction-oriented, and their analytic solutions have been pretty bad, frankly. And again, I've been right in the middle of that as a CIO, and of course my background in analytics being what it is, I may be more critical than the average CIO. The good news about the EMR vendors getting involved here is it does offer the possibility of "closed loop analytics". So that's encouraging. I'm not sure that they have the ability to really support progression up to level 7 and 8 of the Analytic Adoption Model. I think there are some inherent design flaws that are kind of early binding in their nature from a lot of EMR vendors, but I'm still involved as a policy advisor and a technology advisor in the Cayman Islands. And we don't really have the skills and the access to technology that we would like to in the Cayman Islands. So buying and building a platform at this level is a little risky for us. If I could buy something from Cerner, they would satisfy my near term needs, in that kind of setting it would be very appealing. So it's kinda ironic that I'm in the analytics business but as a CIO I still haven't quite defined what my long-term analytic strategy will be in the Cayman Islands National Health System.

Population Health Management

A Checklist for Requirements and Functionality

1. Evidence based definitions of patients to include in the PHM registries
2. Clinician-patient attribution algorithms
3. Discrete, evidence based methods for flagging patients in the registries that are difficult to manage in the protocol, or should be excluded from the registry, altogether
4. Evidence based triage and clinical protocols for single disease states
5. Evidence based triage and clinical protocols for comorbid patients
6. Metrics and monitoring of clinical effectiveness and total cost of care (to the system and the patient)
7. Risk stratified work queues for outreach that feed care management teams and processes
8. Access to test results and medication compliance data outside the core healthcare delivery organization
9. Patient engagement and communication system about their care, including coordination of benefits
10. Patient education material and a distribution system, tailored to their status and protocol
11. Patient reported outcomes measurement system, tailored to their status and protocol
12. Inter-physician/clinician communication system about

Population Health Management

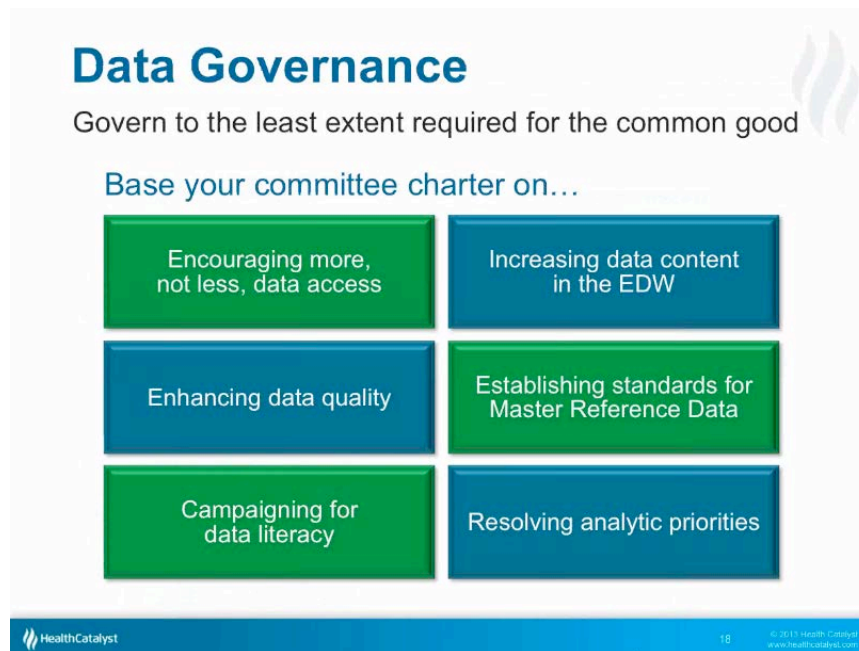
Okay. This is a bit of an eye chart. It doesn't follow a good PowerPoint etiquette but again take this with you and study it later. This is a checklist for the requirements and functionality of Population Health Management. And it's numbered in again kind of sequential order in which I believe you need to tackle the problem of Population Health Management. Just know right now that there isn't a vendor in the market nor do I see it ever on the horizon that can meet all 12 of these functional requirements. So we are all going to have to figure out a way to patch together various vendor solutions to support the functionality of Population Health Management. We're getting a little shorter of time, so I can't go through these like I'd like to, but I'll breeze through them very quickly.

Evidence based definitions in patients. It's important to include those precise definitions of patient stays in your Population Health Management strategy. Those clinician-patient attribution algorithms are very, very important. You have to collect evidence-based methods for flagging patients that are difficult to manage in the protocol. We talked about that a little earlier. Or those that should be excluded altogether. You have to develop evidence-based triage and clinical programs for single disease states with a magnitude more complicated for comorbid patients. For example, BMJ does pretty well with single disease states but it's very, very difficult to do the same thing for comorbid patients. You need to establish metrics and monitoring of clinical effectiveness, again reflected back in the analytic adoption model, and the cost of care, getting back to that triple aim.

You have to be able to develop risk stratified work queues for outreach that feed your care management teams. You have to have access to outside tests and medications.

And again, this builds in complexity and in functionality as we go through this. Don't try to take on number 9 if you haven't addressed the 1, 2 and 3.

Patient engagement. You have to have a way to effectively communicate with patients. Patient portals are just one simple way to do that including coordination of benefits information. How do you educate patients, how do you get patient-reported outcomes back into your analytic environment? And then finally, how are you going to facilitate inter-physician and clinician communication systems about the patient's under-management?



Data Governance

Govern to the least extent required for the common good

Base your committee charter on...

Encouraging more, not less, data access	Increasing data content in the EDW
Enhancing data quality	Establishing standards for Master Reference Data
Campaigning for data literacy	Resolving analytic priorities

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Data Governance

Data Governance. Again, this is worthy of a separate topic or a separate webinar. Let me just summarize this by saying “keep it simple.” What I see a lot of organizations do is establish a data governance body before they even have a data warehouse. And so like all governance bodies, they start governing things that they don't necessarily need to govern yet. It slows the entire process down. So while the data governance committee encourages access through data, your information security committee should be pulling the other way. So this is a healthy tension between restricting access and encouraging access. And I will say this. The analytics leaders in healthcare are really good about erring on the side of greater access to data and not less. So when you build your committee, what you want as a principle is to encourage access, not lesson access to data. You want to play a role in enhancing data quality in the source systems. You want to engage in campaign for data literacy. You want to be an advocate for increasing the data content in the EDW. We showed that roadmap for requiring data in the ACO. You want to be involved in reforming the master reference data in the

organization, and eventually resolving analytic priorities. And again, we'll publish a whitepaper on this and maybe in a whole separate webinar.

In Summary



- **Analytics is the R in the ROI of IT investments**
 - This is a new chance for healthcare to do the right thing, the first time, with IT strategy and investments
 - Unlike the bumpy road of EMR adoption
- **C-level executives need to be highly literate in data management**
 - You can't delegate all the details. The consequences to the business are too significant.
 - All industries now move at the speed of software and analytics
 - Test for Comprehensive and Persistent understanding
- **Follow the curriculum of the Analytics Adoption Model**
 - Be deliberate and stick to the fundamentals

In Summary

In summary, analytics is the R in the ROI of IT investments. It really is. This is where you can actually measure the value of an EMR. This is the chance for healthcare to do the right time with IT strategies and investments. We're starting out early. Unlike the bumpy road of EMR adoption, we can do it right, we know how to do it right, and there's no reason we can't do it right from the very beginning.

C-level executives outside the CIO need to be highly literate in data management. You can't delegate all the details because the consequences in the future of delegating mistakes are too significant. All industries are moving at the speed of software and analytics. You kind of have to accept that as a C-level now. Software runs the business unfortunately. And remember the notion of testing for comprehensive and persistent understanding before you decide to really bind rules and vocabularies to your data.

If you're very deliberate about following the curriculum of the Analytics Adoption Model, you'll be very successful. Stick to those fundamentals, those four questions that we talked about, and be very deliberate about your progression and movement through that Analytics Adoption Model, and you'll get there. It's very easy to do. Trust me. You can do it.

Thank You!



- Questions?
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Alright. So that's the end of the presentation. There are a bunch of screenshots. I won't go through those. Again, they'll be out there on the slides that Tyler shares. Feel free to contact me in any of these various ways. And if you have any questions, I'd be happy to engage those. And I wanna make sure – Tyler, did we have another poll? I can't remember.

Tyler: We did have one other poll. That poll is in regards to voting for topics of greatest future interest.

Dale: Okay. Oh yes. Right. Wow! We blew right back then.

Tyler: Should I go ahead and launch that poll there?

Dale: Sure. And we can maybe address some of that.

Tyler: Okay. Just to let everybody know, this is actually a multiple choice. Select all those that you find to be of most interest. You can select one or more of the various topics that you're interested in. And as a note, as you're voting on these things, I would, like they know, we've received a lot of questions in regards to the availability of the slides. I will let you all know that everyone that has registered for this webinar will receive a follow-up email. That email would be a link to the recording, as well as a link to the full slides including the screenshots at the end, and it will be available to everyone.

Dale: I'm going jump in and answer some of the questions. I can see these now, Tyler.

Tyler: Oh. Alright.

Dale: While the poll is accumulating. There's a question here. It's a great question. In terms of the questions regarding analytics, what are we monitoring? Are you seeing a need to monitor location?

Yeah. The answer to that is most definitely. And that location, that's why defining your location not to reference data is so important. Not only can it help you reveal the care and cost of care based upon location, but I think there's a big untapped geographic information system opportunity in the analytics of healthcare as well. That's a good question and I'm actually going to make note of that and see if I can incorporate that into the Analytic Adoption Model. Thank you.

Tyler: We will close the poll now and share the results. It looks like 78% of respondents said they're very interested in predictive analytics with the Population Health Management and analytics in vendor options in the second and third place.

Dale: Okay. So let me comment a little bit on predictive analytics. And again, this is probably a topic that we could discuss in a separate webinar. I'm a bit of a skeptic and proponent of predictive analytics. I spent a number of years working for the National Security Agency, where we had unlimited access to data tools, mathematicians and budget trying to predict human behavior. And it's really, really difficult. There are a few things that we could be doing better in healthcare, and we will, and we have some things in Catalyst that are going to be very innovative around predictive analytics, but until we start collecting outcomes on patients, what are we left to predict? This is the problem. We don't collect outcomes right now. So predictive analytics is being oversold right now. Just be very cautious about it. If readmissions are the best we can do with predictive analytics, that is a pretty sad state of affairs. We have to patient reported outcomes nailed down first for predictive analytics to be very successful. So, look for more information from me on that. I'm trying to think if there's anything else on that topic that I can share in the short time we have left but I think that's probably it.

Let me just comment on population health management. You know, it might be worth holding a separate webinar on that topic. It's a big and very timely topic. We can share some of the lessons that we learned at Intermountain which was one of the early proponents to population health management. So let's make note of that and we'll do that.

Thanks, Tyler.

Tyler: Alright. We do have a couple more questions, Dale.

Dale: Okay.

Tyler: One of the questions is, the adoption model seems geared to hospitals. Where are the smaller providers in this now and where should they aspire to be?

Dale: Well darn, I don't mean the model to be geared specifically to hospitals. So I'll go back and look at that. We're gonna publish a new version of this model in the next couple of weeks. I can share with you that we used the model to inform our strategy in physician groups, and so far it's working. The problem with small providers right now – and by the way just let me comment that I believe the future of the ACO is going to be centered around physicians and not hospitals and not insurance companies, and I see progress in that regard. I think the nature of accountable care and the patient relationship is more suited for physician ACOs than in the hospital ACOs. So, the reality is I think there is going to be a lot of consolidation and acquisition in the smaller providers. There's just no way that they can participate in the efficiencies of volume if they don't, and they're struggling. But we're working with one of the best provider organizations in the country right now. I can't mention them by name yet. We're still in the final stage of the contract negotiation. But I think they have 300 providers, and I think that's the lower limit of what I think an effective physician-centric accountable care organization can be.

Okay. Thanks, Tyler. Next.

Tyler: Alright. The next question that was asked, what is your answer to the poll question in regards to where you feel the industry is in the Analytic Adoption Model?

Dale: Oh yeah, that's a great question. I think on average we're still in the fragmented level 0 on average. That's where we're consistently operating and that based on my organization in the Cayman Islands as well.

Okay. What's next?

Tyler: Alright. We do have a comment. This is providing patient with actionable data and progress reporting options on that data are also important. Speak to that.

Dale: Yeah. I agree. And that it's going back to the Population Health Management checklist. I think that notion is encompassed in your strategy for communicating to and engaging patients. And I mean God bless all of us that have used a patient portal to that effect. It's helpful, but it doesn't go far enough, right? Actionable data for the patients is what can they do about their behavior and what can they do about their choices in healthcare to improve their health and lower their costs and that's how I see that. Thanks. Good comment.

Tyler: Alright. It looks like we have a short time for one last question. So this is, "I have heard the term "small data analytics". Are you aware of this term and what it means? Can you comment on that?"

Dale: You know, I've heard the term but I'm not so sure that I understand it, so I couldn't give a good answer to that. I'm sorry. I will – you'll prompt me to Google that and spend a little more time on it.

Tyler: Alright. Well we have reached the time limit for this webinar. I would like to thank everyone who has participated. Great questions. Thank you so much for joining us. As this meeting closes, you'll have the opportunity to take a short 5-question survey. Please take a few minutes and fill out the survey, so we can continue to bring you relevant content. Later today, you will be receiving email with a link to the recording of this webinar, as well as the slides that we just presented. On behalf of Dale Sanders, as well as the folks that helped Catalyst, thank you for joining us today. Have a great day. This webinar has now concluded.

Dale: Thanks everyone. Bye bye.

Tyler: Thank you.

[END OF TRANSCRIPT]