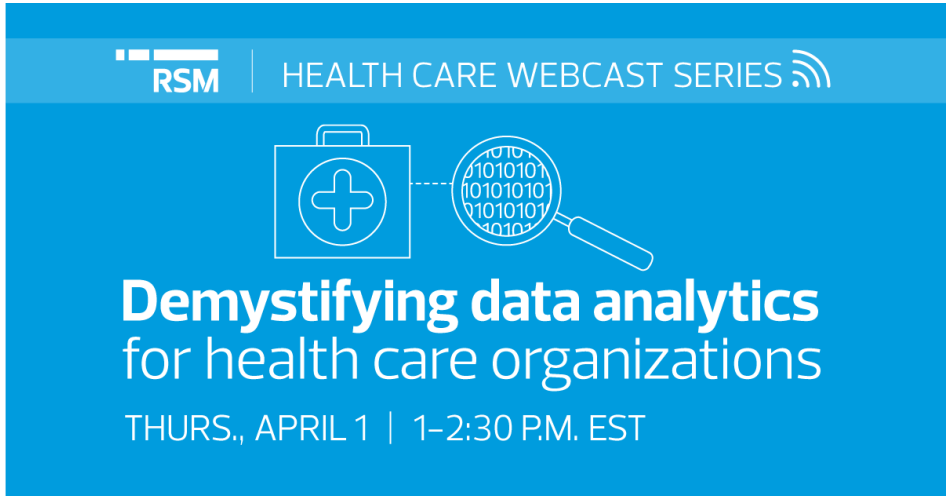
DEMYSTIFYING DATA ANALYTICS FOR HEALTH CARE ORGANIZATIONS

APRIL 1, 2021

RSM

Agenda

Topic	Minutes
Presenters and RSM	5
Past, Present and Future of Data Analytics in Health Care	15
Introduction and Concepts	10
Use Cases • Population Health • Inpatient Quality • Utilization • Capacity Management • Perioperative and Procedural Areas	50
Review	5
Questions & Answers	5



RSM Introductions

Jamie McGlothlin

Director | Dallas, Texas

National Healthcare Analytics Leader

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- PhD in computer science
- 30 years experience,
  10 years in health care analytics consulting
- 13 peer-reviewed research publications in leading health care conferences
- Millions of $ in ROI generated for health care clients

Jamie provides health care analytics for health systems to drive performance improvement in clinical quality, patient safety, operational efficiency and cost reduction.

RSM Introductions

Matt Wolf

Director | Nashville, Tennessee

- Health care senior analyst
- Health care valuation practice lead
- matt.wolf@rsmus.com
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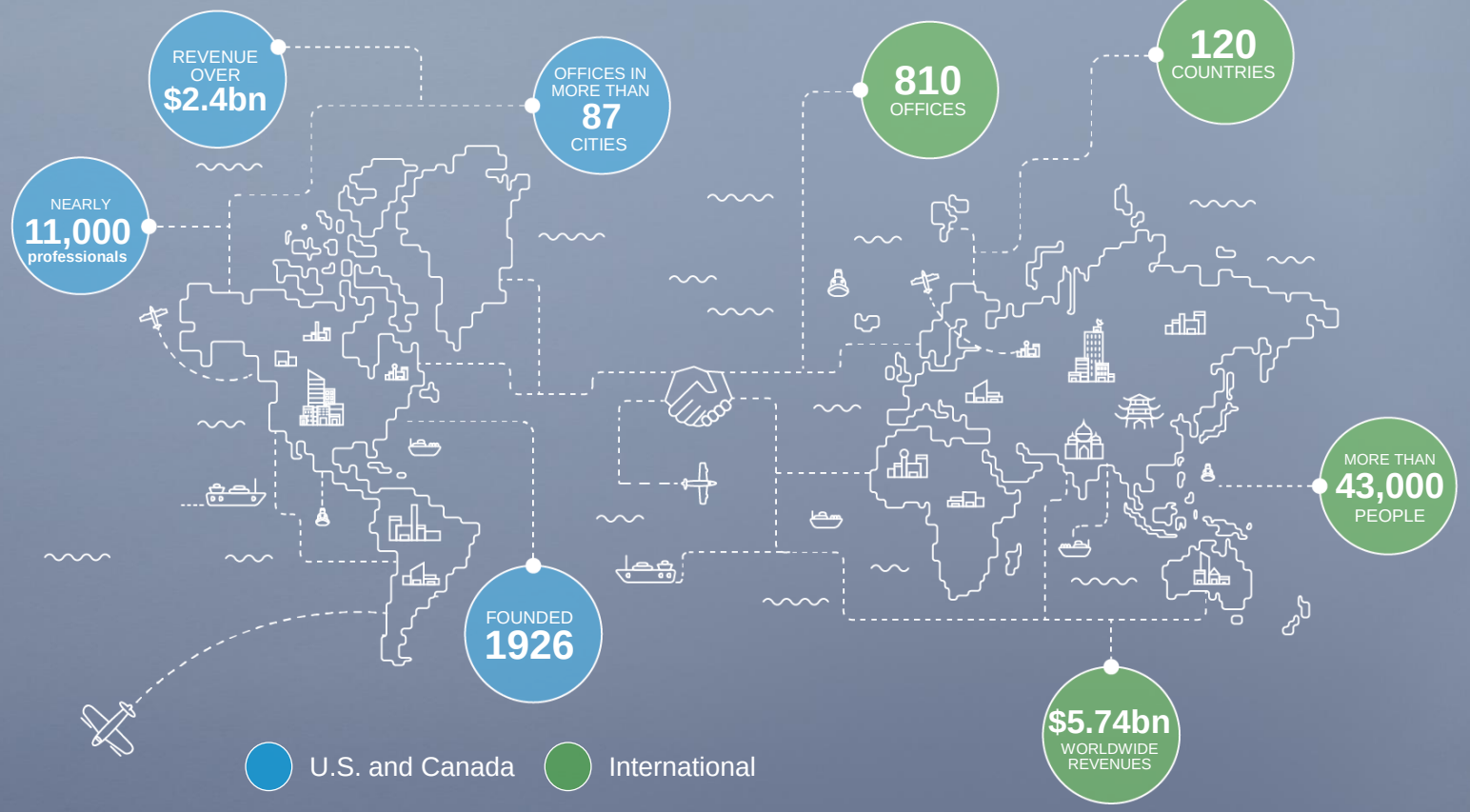
Matt helps health care organizations navigate the incredible change and complexity facing the industry, particularly with respect to inorganic growth strategies and solutions.

- BA and MBA in finance and statistics
- Exec education program in health care analytics from MIT
- 15 years health care and valuation experience

RSM Background

Fifth largest audit, tax and consulting firm in the U.S.
First Choice Advisor in the middle market



RSM Background: Health Care Consulting

13
Modern Healthcare ranks RSM among the nation's top largest health care management consulting firms

400
RSM health care professionals

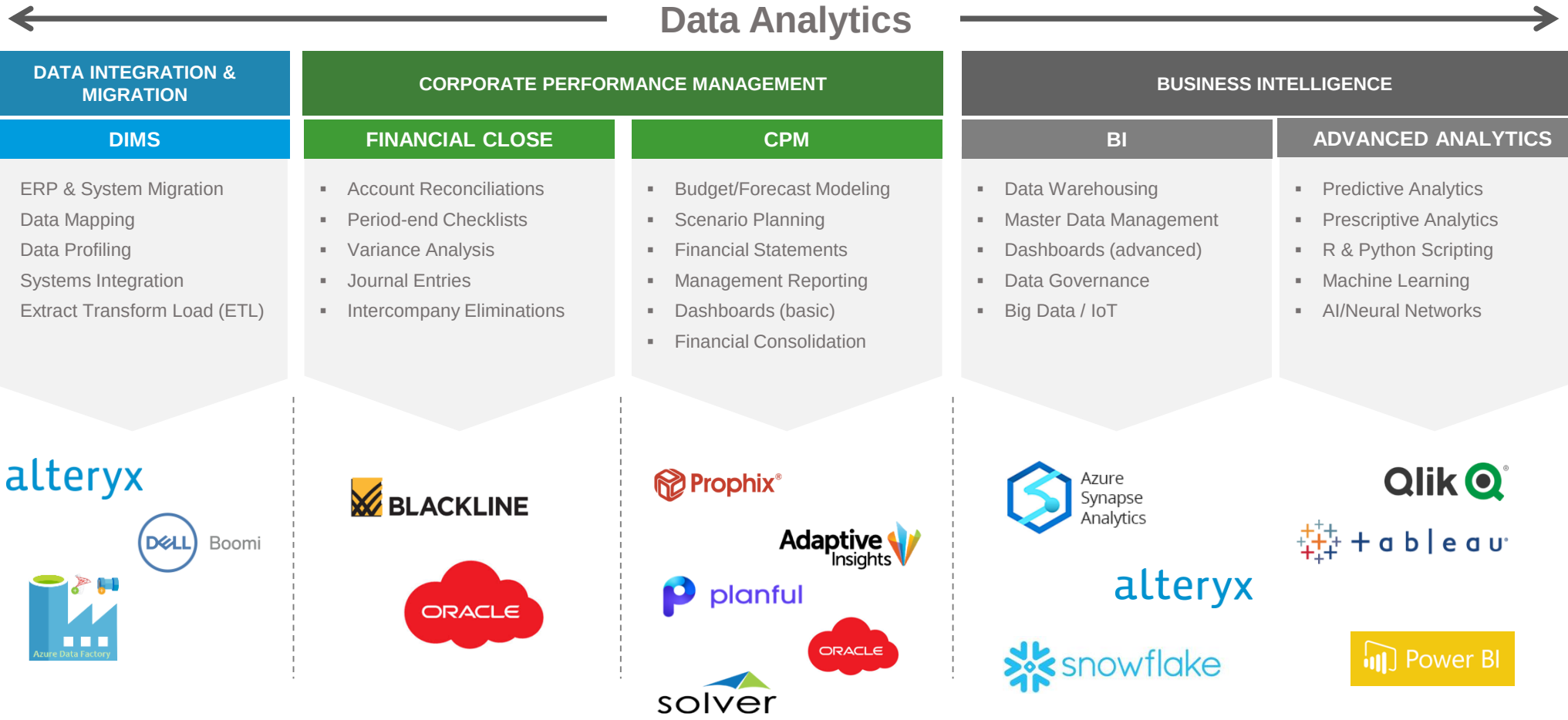
150
RSM health care consulting professionals

~3,000
Health care clients

1,440
Physician clients

$100M
RSM U.S. health care industry revenues

RSM Background: Data Analytics and Example Solutions



RSM Background: Health care analytics

We have solutions for all health care organizations: Highlights include:

Hospitals	Ambulatory	Surgery	Behavioral Health	Payers	Other
• Adult • Children's • Academic • Community	• Physician Practices • Ambulatory Networks • Provider Groups	• ASCs • Periop Suites • Procedural Areas • Anesthesia Practices	• Physician Practices • Addiction Treatment • Hospitals • Networks	• Health Plans • ASO plans • CINs and ACOs	• Senior Living • Clinical Research • Life Sciences • …

Our solutions are not limited to finances and revenue cycle

- *Focus is clinical and operational: Quality and efficiency*

Our goal is performance improvement

- *We do not just provide dashboards and data*
- *All of our analytics are designed to help organizations improve*

Analytics provide high ROI

- We have demonstrated ROI including increasing revenue ($7million in one project) and reducing cost ($11million in one project)

RSM Health Care Data Analytics: Approach

Data-driven

Use data to choose opportunities

Augment not replace

Leverage EMR and existing data warehouses and solutions

Use the client's tools

Tool agnostic

No new silos

Clients have too many tools and too much data already

Time to Value

Short term ROI, Long term sustainability

Solutions build on each other

MULTI-PHASED AGILE APPROACH

- ✓ Deliver short term return on investment
- ✓ Design data solutions which build a long-term foundation reusable for many analytics

LEVERAGE & AUGMENT EXISTING SOLUTIONS

- ✓ Utilize your data warehouse and business intelligence tools
- ✓ Leverage your EMR (Epic, Cerner, Meditech)

INTEGRATE SOURCES & ELIMINATE SILOS

- ✓ Join EMR data with other sources such as patient experience, cost, registries
- ✓ Create a single version of the truth, an enterprise analytics data source

PROVIDE INTUITIVE & INTERACTIVE VISUALIZATIONS

- ✓ Consistent look and feel
- ✓ Reduce learning curve
- ✓ Tool agnostic but we have deep experience with Tableau, PowerBI and Qlik

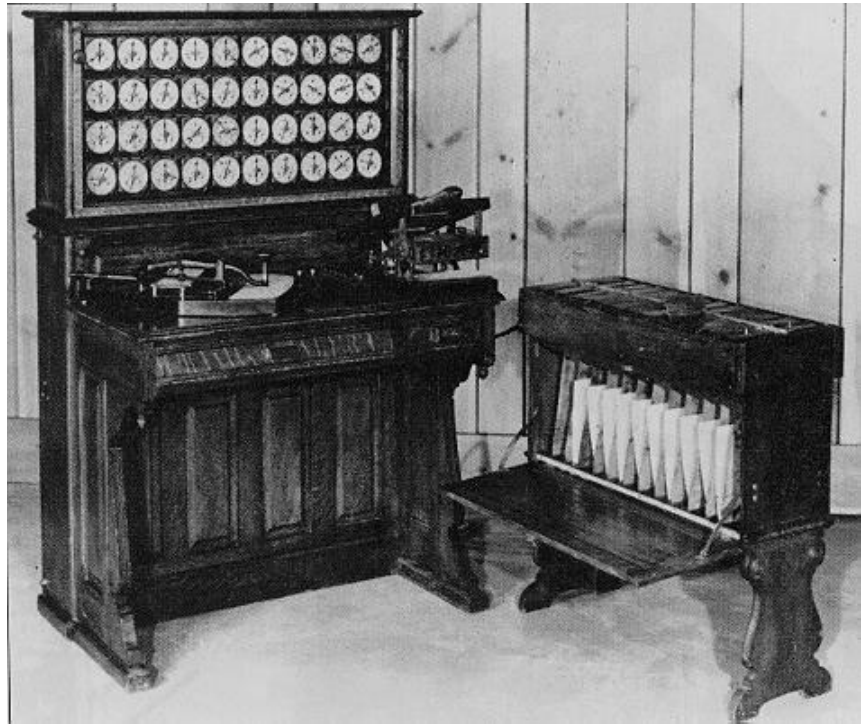
PAST, PRESENT AND FUTURE OF DATA ANALYTICS

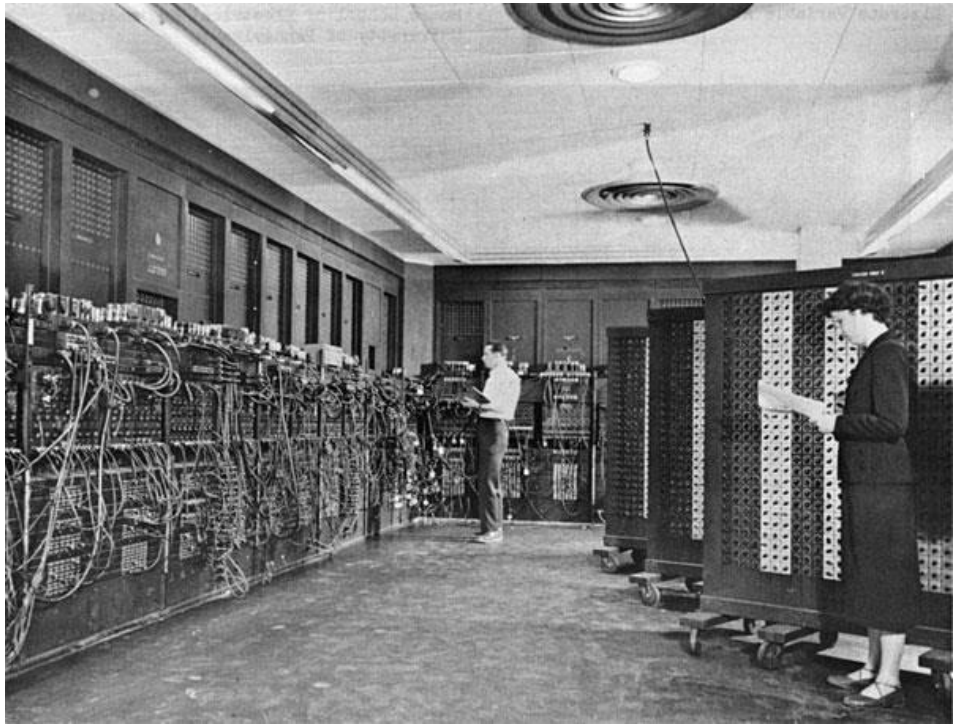
Fact vs. Fiction

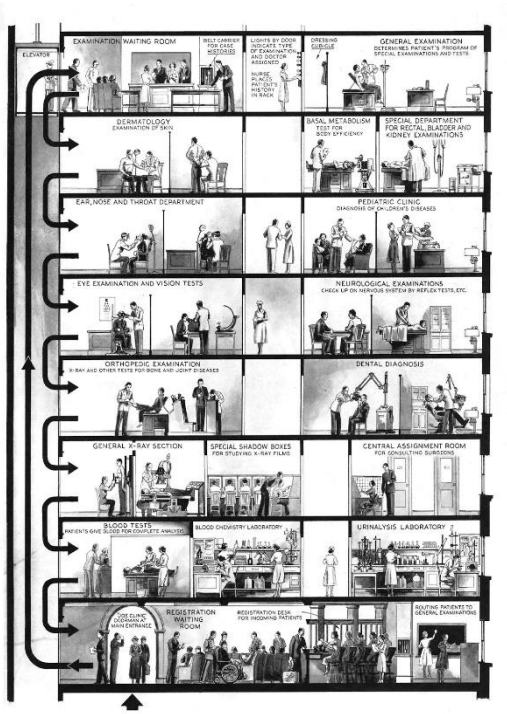
Data science [and analytics] encompasses a set of principles, problem definitions, algorithms, and processes for extracting non-obvious and useful patterns from large datasets.

MIT

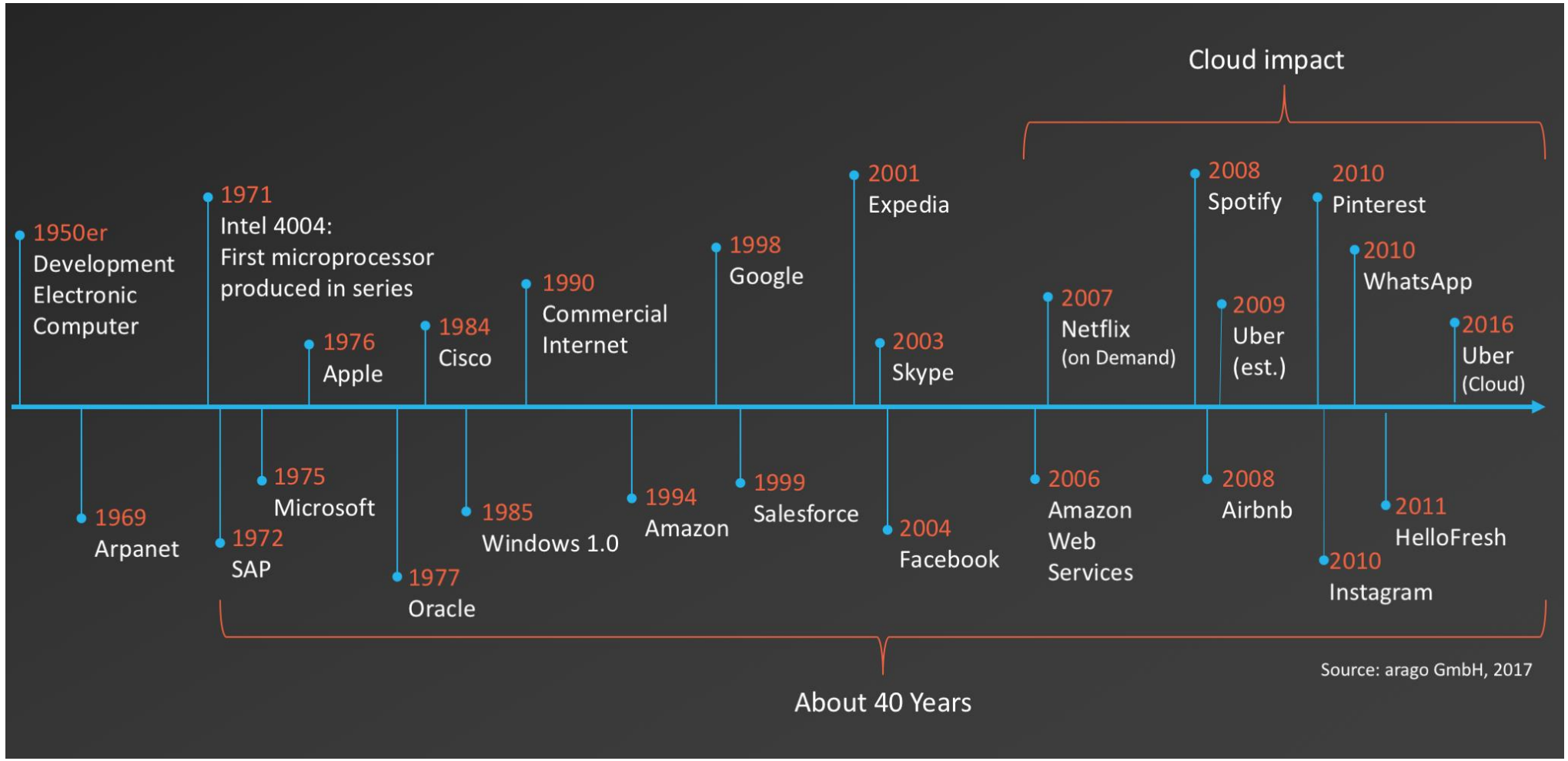
Data analytics has its roots in data computation



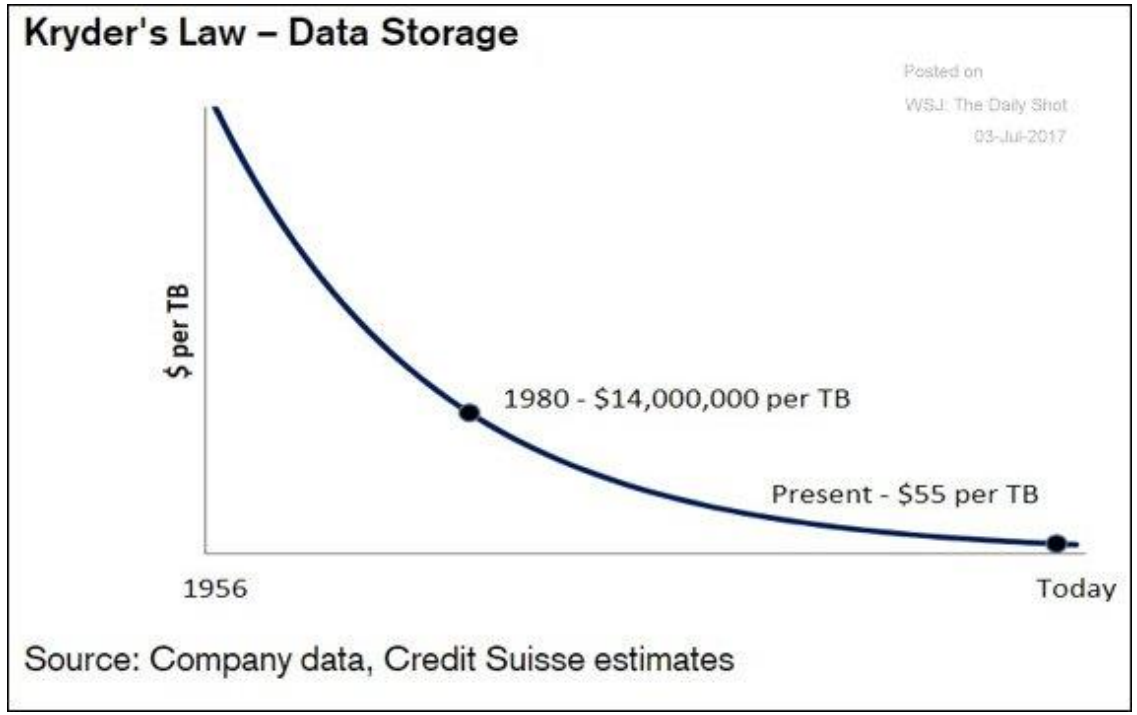


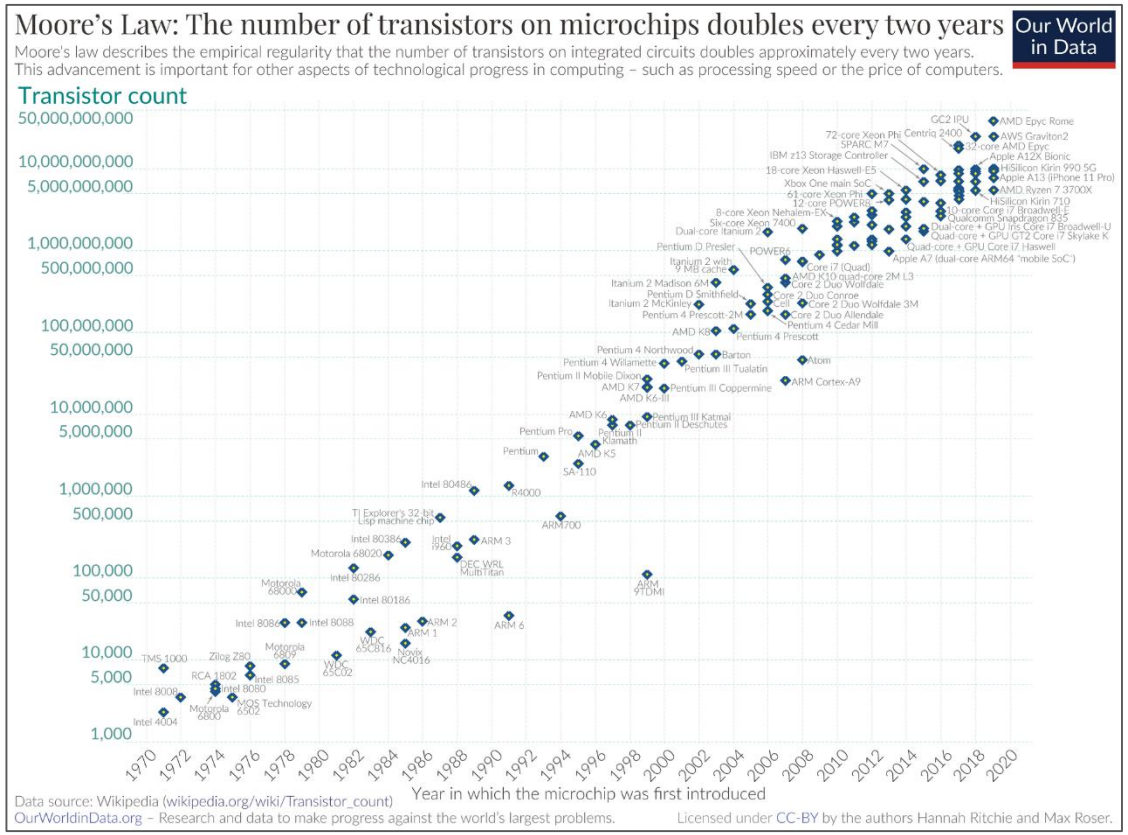


Evolution of digital

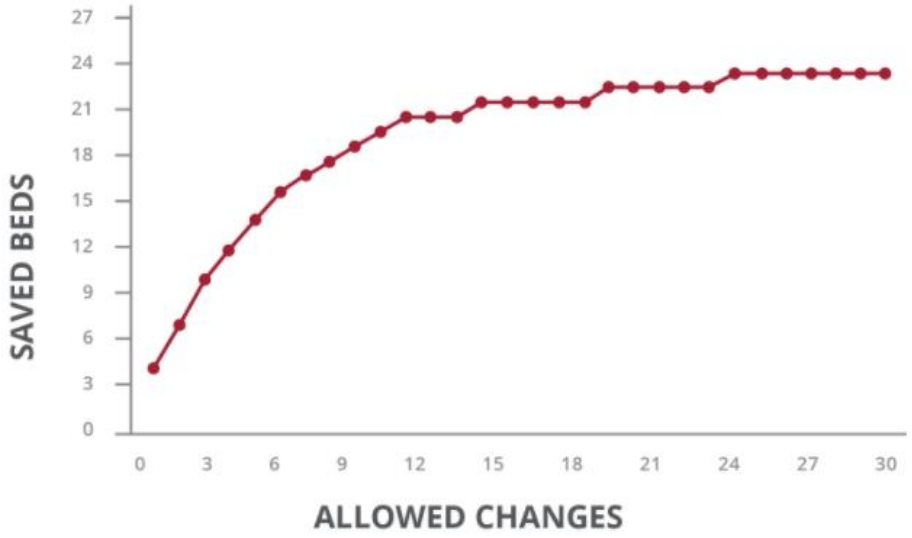


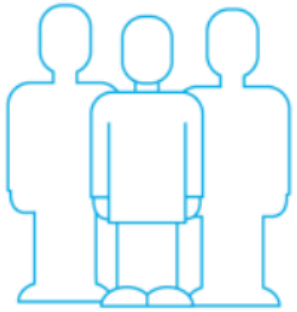
Democratization of processing power and storage via cloud





So how close are we to AI replacing humans?

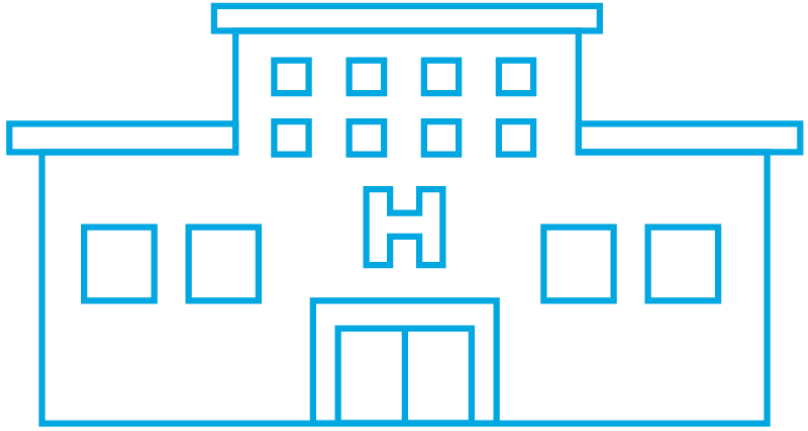




- Spoiler: not very
- General cognitive AI is different
- When people say AI they generally mean ML
- The real value is using AI (ML) to augment human tasks

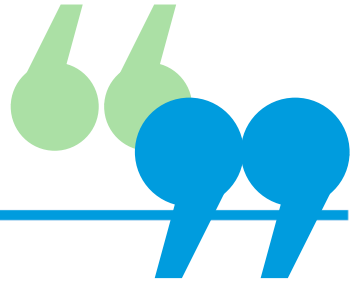
The pandemic has thrust analytics on health care

> "We continue to believe the consumer will be the single largest disrupter in health care"
>
> - J.P. Morgan research



The path forward will require finding useful and non-obvious patterns in our data

What we're hearing



KEY FINDINGS FROM QUANTITATIVE SURVEY

Digital enables health care to scale, improve process and connect the organization.
Scalability, process efficiency and transparency are top 3 benefits for health care

5G, AI, analytics and data technologies are most important for health care.
5G, AI, BI and cybersecurity were rated as most important by 42% or more; mobile was in the top 5

Aligning legacy systems to maximize value and meet future needs are top 5 challenging prioritization considerations.
Compliance is also top 2 priorities among legacy system alignment, value assessment and meeting future needs/scalability

KEY VERBATIMS FROM QUALITATIVE INTERVIEWS

"Making our care offerings available to the wider rural areas around [our market] is a key focus."– HC CFO

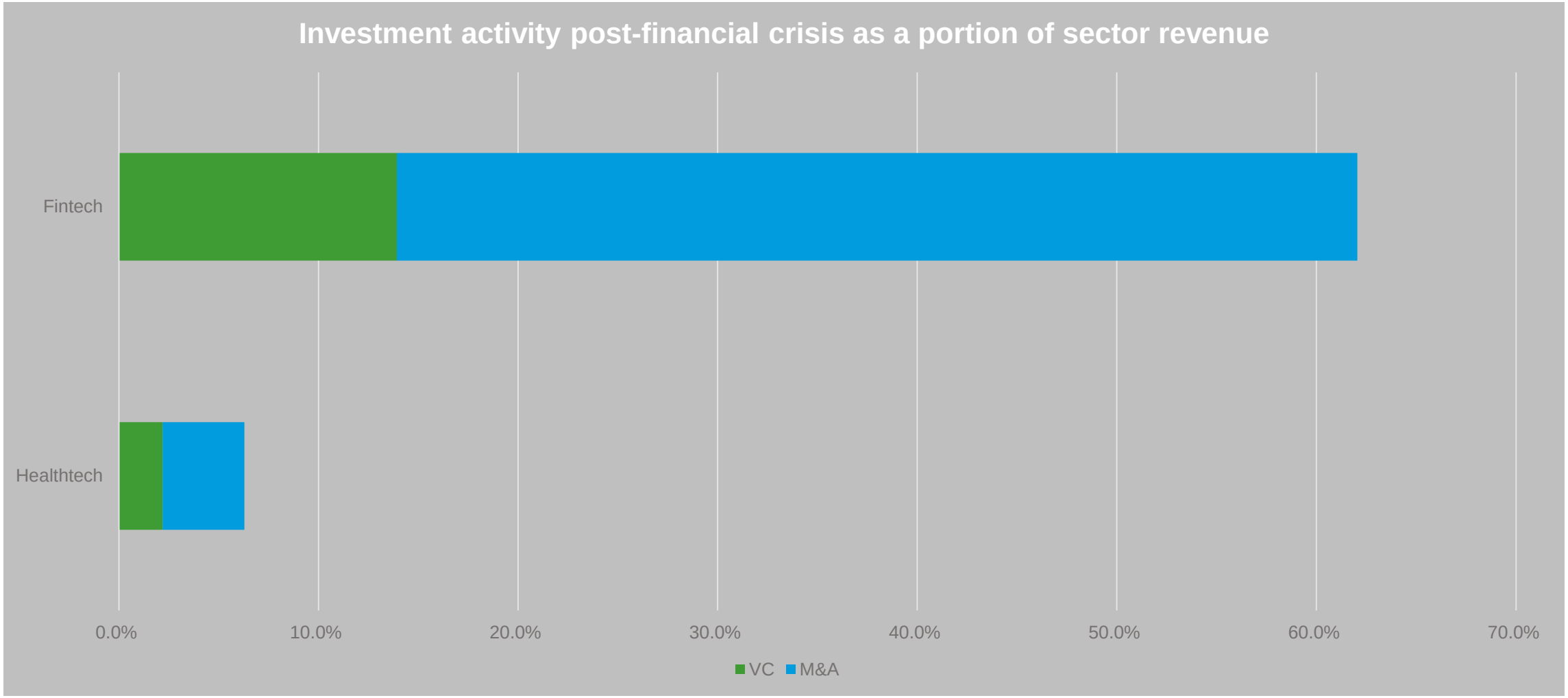
"We want to create a front door by which people can access us. Once we get them inside digital housing, we can provide them different features or solutions."– HC CIO

"We are looking for a more robust, comprehensive system where we can do data analytics on population health and integrate it into budgeting, forecasting and capital needs."– HC CFO

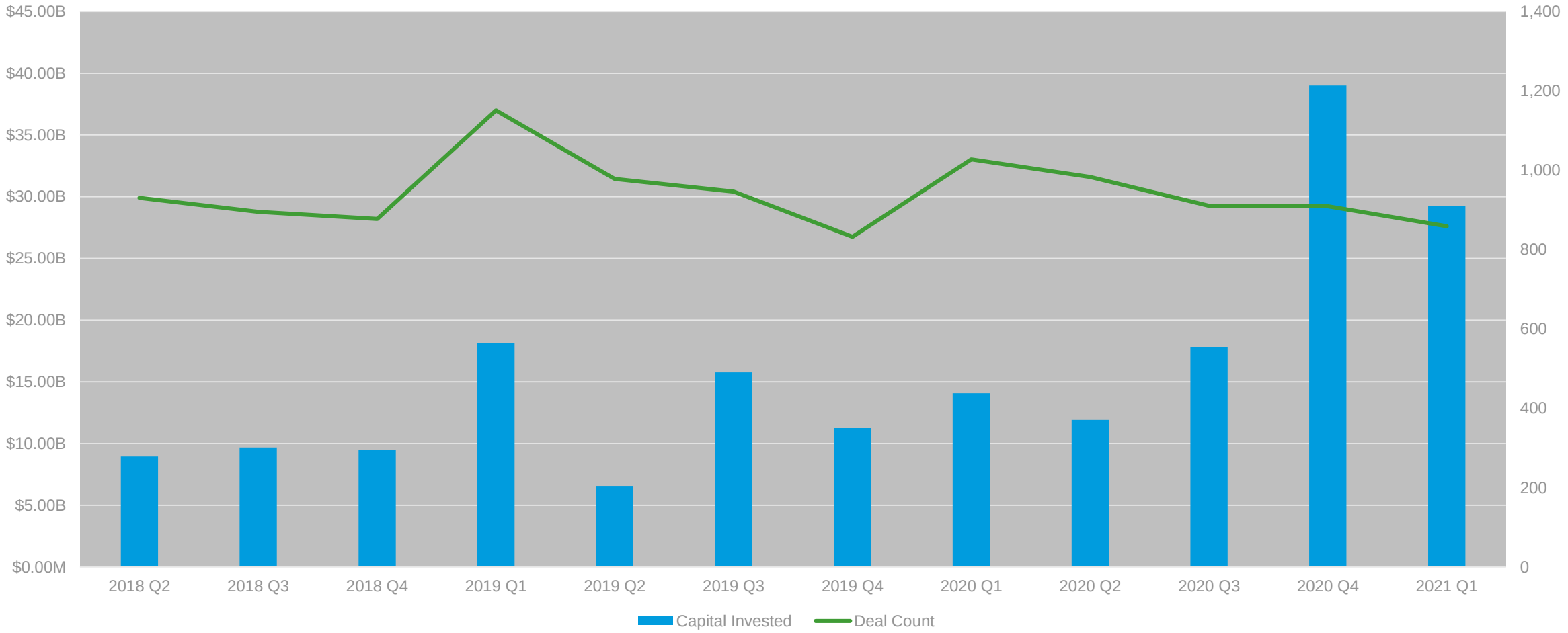
"We are leveraging Epic tools for business analytics, which applies to business, especially when it comes to care coordination and value-based care." – HC CIO

"It's hard to look into a crystal ball to know what the future looks like." – HC CFO

Health care has underinvested in disruption…



...which has attracted incredible investment in health technology solutions



INTRODUCTORY CONCEPTS

What is Analytics?

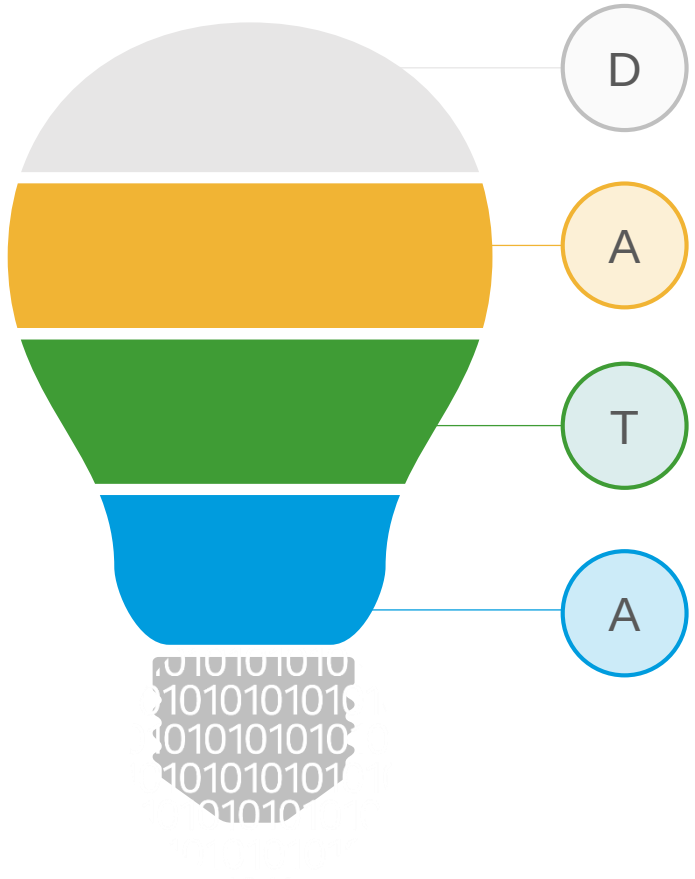
DATA → REPORTING → INFORMATION → ANALYTICS → INSIGHTS

Analytics lets the user ask questions.

Analytics can identify problems but can also evaluate **SOLUTIONS**

- What is happening?
- Why is it happening?
- How can it be fixed?

Goal and Potential of Health Care Analytics



QUALITY
- Decrease mortality
- Avoid readmissions
- Avoid ER visits
- Implement better care paths

- Reduce complications
- Enhance patient experience
- Improve quality metrics scores

- Reduce gaps in care
- Improve preventive care
- Manage chronic diseases
- Increase medication adherence

COST
- Decrease length of stay
- Avoid unnecessary tests and treatments
- Reduce clinical variation

- Optimize staffing levels
- Reduce supply costs
- Reduce risk

REVENUE
- Treat more patients
- Perform more surgeries
- Capture more revenue

- Minimize denials
- Accept more transfers
- Increase referrals

- Streamline authorization process
- Achieve financial incentives

EFFICIENCY
- Avoid delays
- Reduce wait times
- Accelerate throughput

- Increase productivity
- Avoid empty beds
- Optimize utilization

- Accelerate availability
- Reduce cancellations and bumps
- Improve care coordination

EMR Tools vs. Analytics

When Should You Use EMR Reporting Tools?

- Today's advanced EMRs provide reporting tools and dashboards
- These are great for operational reporting, e.g., understanding what is going on now
- They are limited in regard to:
  - Analyzing the past to find insights
  - Forecasting the future

What is a data warehouse?

Foundation for data analytics and data mining

Integrated
- Consolidate date sources

Time-Variant
- Well suited for historical information

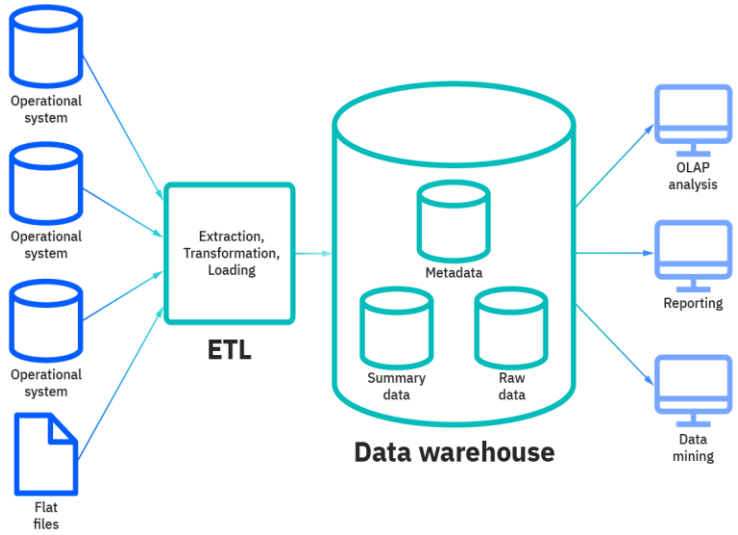
Non-volatile

Subject-Oriented
- Defined based on business model not source details
- Used to measure business processes

Copy of Operational Data
- Separate research and decision support functions from the operational systems

Value Added Data
- Focuses on aggregated transactions

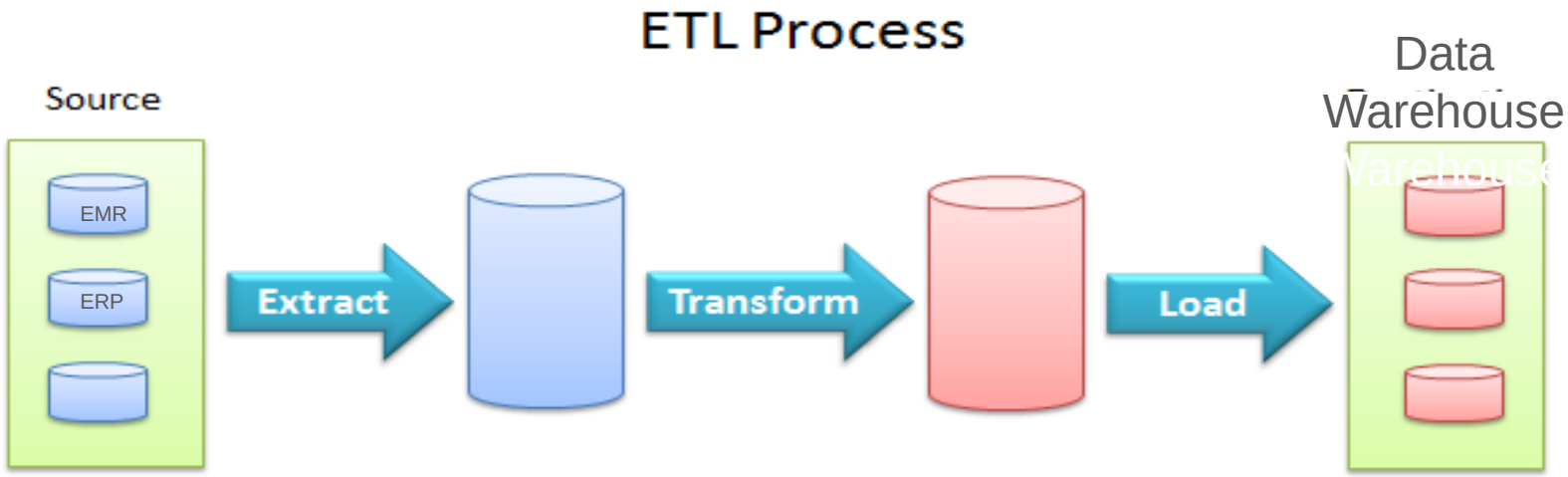
Optimized for ad-hoc or unpredictable queries



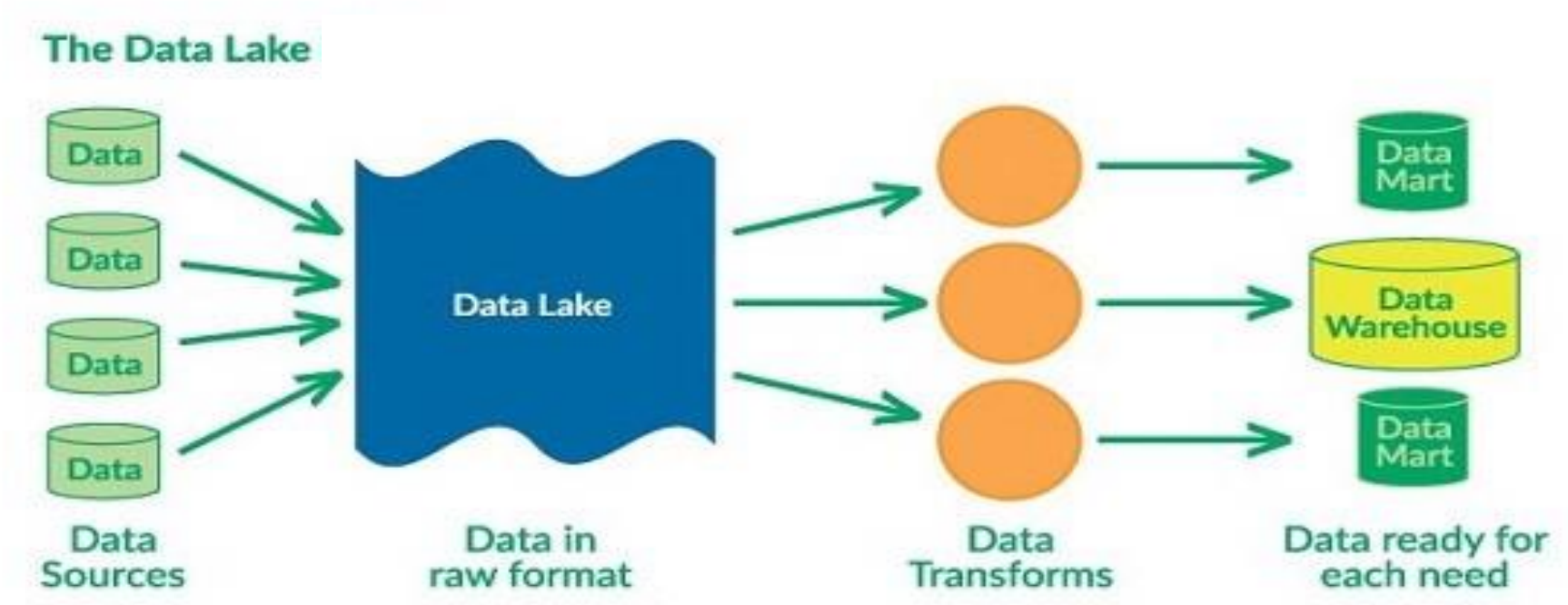
"A data warehouse is a copy of transaction data specifically structured for query and analysis"
– Ralph Kimball

"A single, complete and consistent store of data obtained from a variety of different sources made available to end users in a what they can understand and use in a business context."

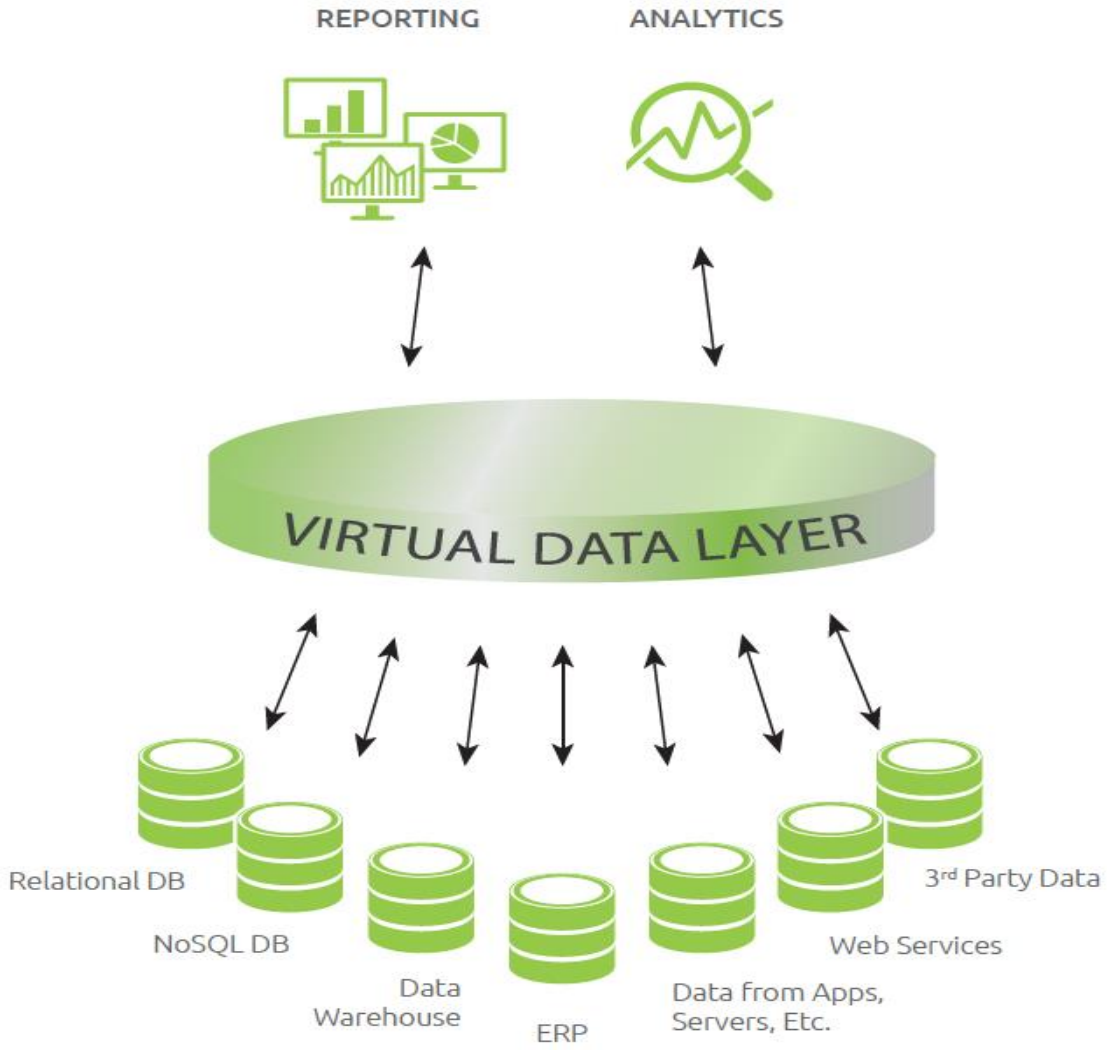
Loading the Data



Data Lakes



Data Virtualization



USE CASES

- Ambulatory quality and population health
- Inpatient quality
- Utilization
- Capacity management
- Perioperative and procedural analytics

AMBULATORY QUALITY AND POPULATION HEALTH

Ambulatory Quality Metrics

- Metrics about preventive care, population health, chronic disease management
- Over 500 metrics defined
- Numerous standards: HEDIS, Pay for Performance, Medicare Stars, MIPS, ACO, PCMH, NCQA
- All metrics define a population (denominator) and rules for compliance (numerator)

EXAMPLES

Colorectal Screening

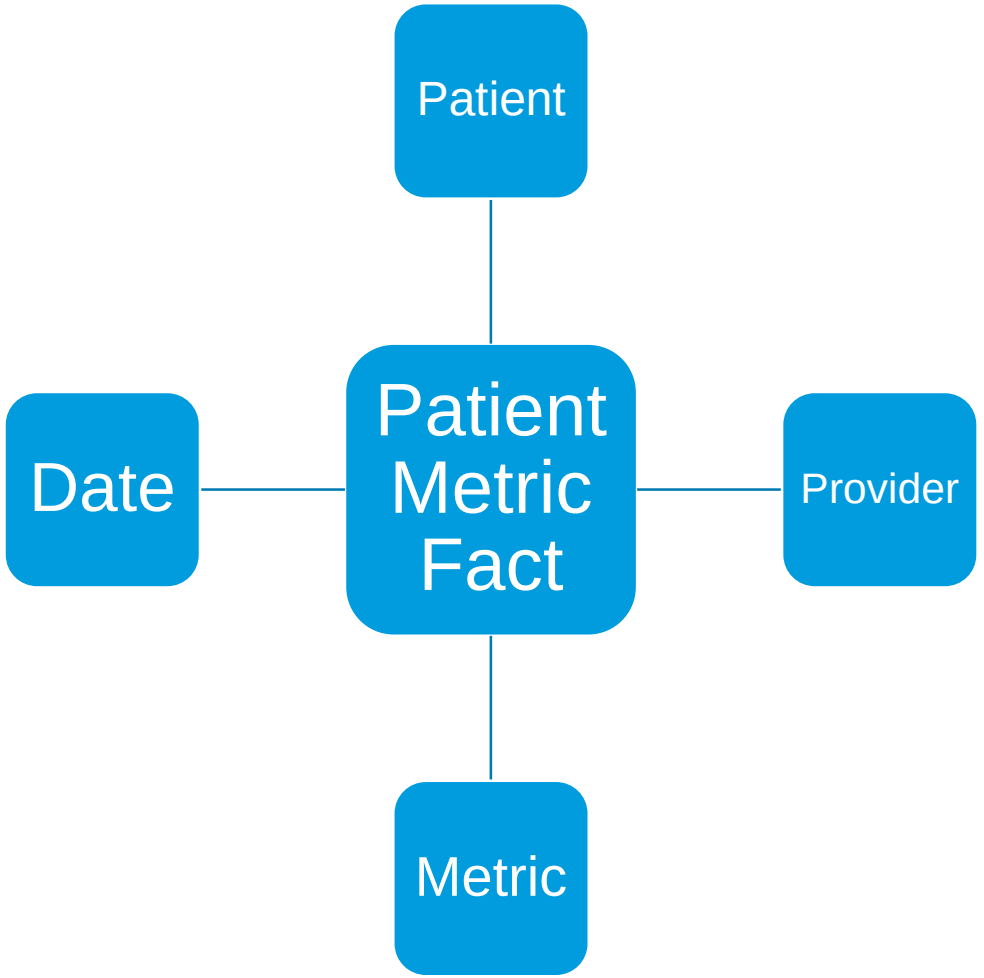
Denominator:	Patients 50-75 years old EXCEPT Patients with colectomy
Numerator:	Colonoscopy in last 10 years
	OR flexible sigmoidoscopy in the past 5 years
	OR stool DNA test in the past 3 years.

Diabetes Foot Exam

Denominator:	Patients 18-75 years old diagnosed with type 1 or 2 diabetes
	EXCEPT patient with gestational diabetes, steroid induced diabetes, or bilateral foot amputation
	Numerator: Foot Exam in past 12 months
Challenges:	Provider Attribution, Measurement Year Definition, Different standards and documentation

Analytics for Ambulatory Quality Metrics

- Generic Framework
  - Can consume any metric
- Rolling 12 time periods
  - Allows trending
  - Earlier information, supports care gaps
- Benchmarks
  - Compare against any benchmark
  - Compare against peers
- Drill down
  - Enables care management for care gaps
  - Design includes reasons

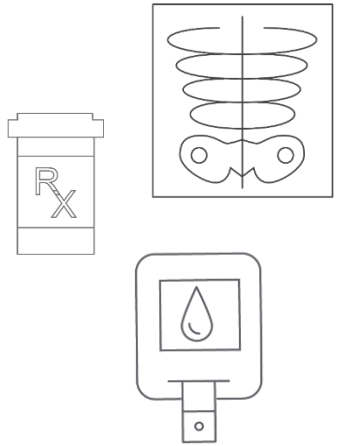


Care Gaps

A care gap is the discrepancy between recommended best practices and the care that is actually provided.

HOW TO CLOSE CARE GAPS

1. Analyze patient medical records (diagnoses, procedures, schedules, surgeries, images, registries) identify patients with care gaps or in need of follow-up
2. Engage patients and schedule assessments as needed



Advantages:

- Improve quality by closing care gaps and providing better preventive care
- Increase revenue by increasing office visits, procedures and surgeries
- Reducing cost by avoiding acute events and unnecessary emergency encounters

CASE STUDY:
COPD population health

PROBLEM	GOAL	APPROACH	RESULTS
COPD patients frequent emergency room for asthma attacks or other flare ups	Improve chronic disease management for COPD population to reduce acute events	1. Combine EMR data with claims data from payors 2. Identify care gaps • Medication adherence (inhalers) • Regular wellness visits • Diagnostic tests (spirometry) 3. Patient outreach	Reduced avoidable ER visits by 27%

Can also be applied to any chronic disease with preventive care recommendations, including:

- ✓ Diabetes
- ✓ Coronary Artery Disease
- ✓ Depression

CASE STUDY:
Congenital Heart Defects (CHD)

PROBLEM	GOAL	APPROACH	RESULTS
Patients born with heart defects often do not follow-up after diagnosis or surgical repair	Improve care and increase revenue by identifying CHD patients overdue for follow-up and reach out to them	1. Identify forgotten CHD patients mine data including STS Registry, echocardiograms, diagnosis and billing history 2. Classify CHD patients by diagnosis and repair status and clinic/provider 3. Prioritize 4. Enable Follow-up	> 14,000 patients identified > 1,000 follow-ups scheduled > 300 interventions ordered > $7million revenue

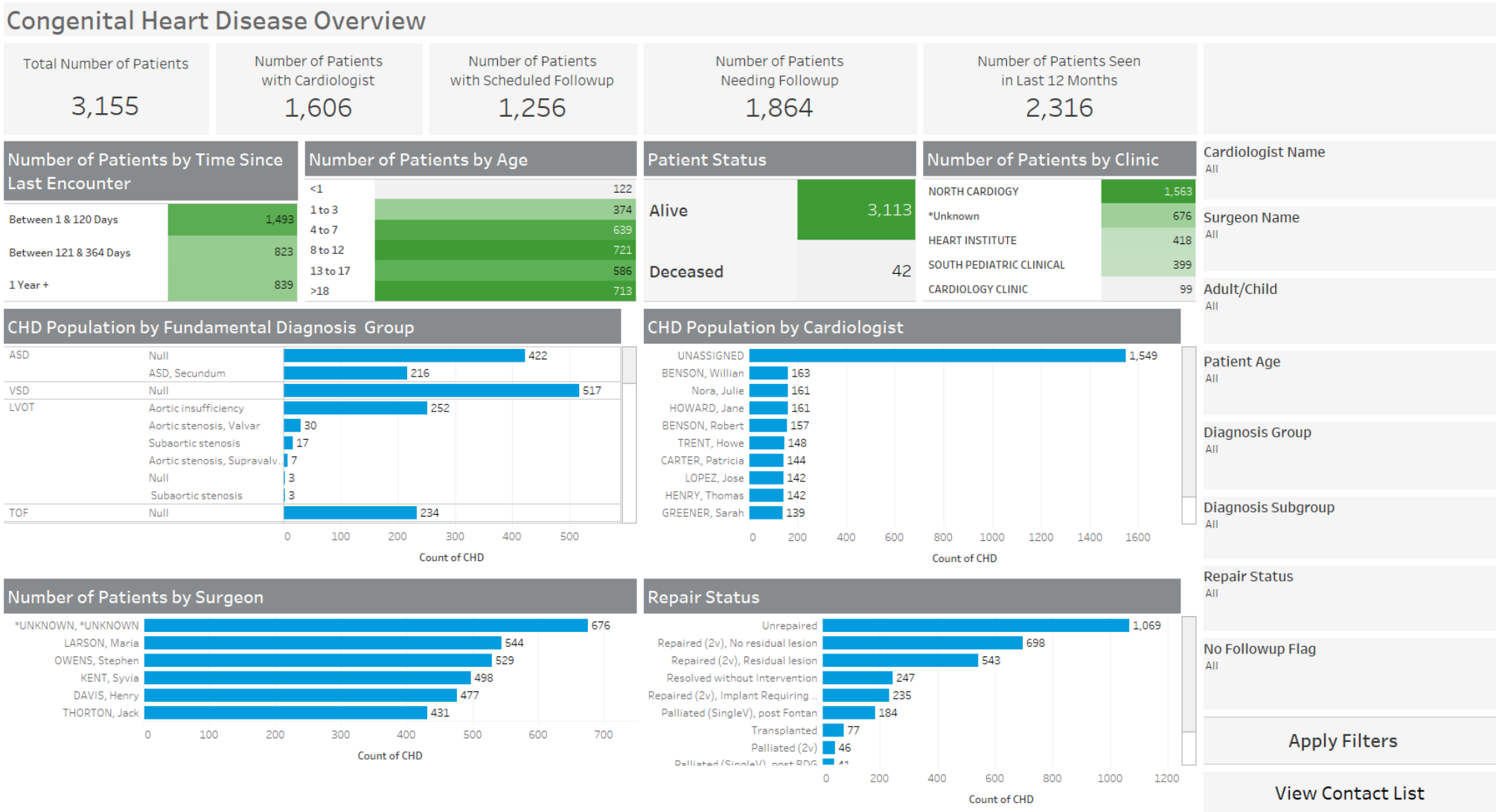
PUBLISHED:

- A Data Mining Tool and Process for Congenital Heart Defect Management in *American Medical Informatics Association*
- System to Identify, Classify and Manage Patients with Structural Heart Defects in *Quality and Productivity Research Conference 2019*

Can also be applied to:

- Any long-term chronic disease where patients may be overdue for assessment
- Adult structural heart defects

CASE STUDY:
Congenital Heart Defects (CHD)

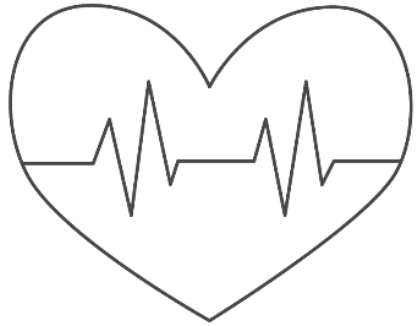


Supervised Learning for CHD

Supervised learning is the process of teaching a model by feeding it correct labeled output data.

Supervised learning can be used to improve algorithms, such as the CHD use case

1. Design workflows for following up identified patients
2. Allow providers to review the patient charts, prioritize and assign follow-up dates
3. For patients who come to cardiology follow-ups, track whether further intervention was ordered
4. Reprioritize identified patients based on learning feedback from #2 (how soon the chosen follow-up date was) and #3



Patient Engagement for care gaps

Lists of patients with care gaps can be integrated into outreach queues in CRMs, such as SalesForce and Microsoft Dynamics

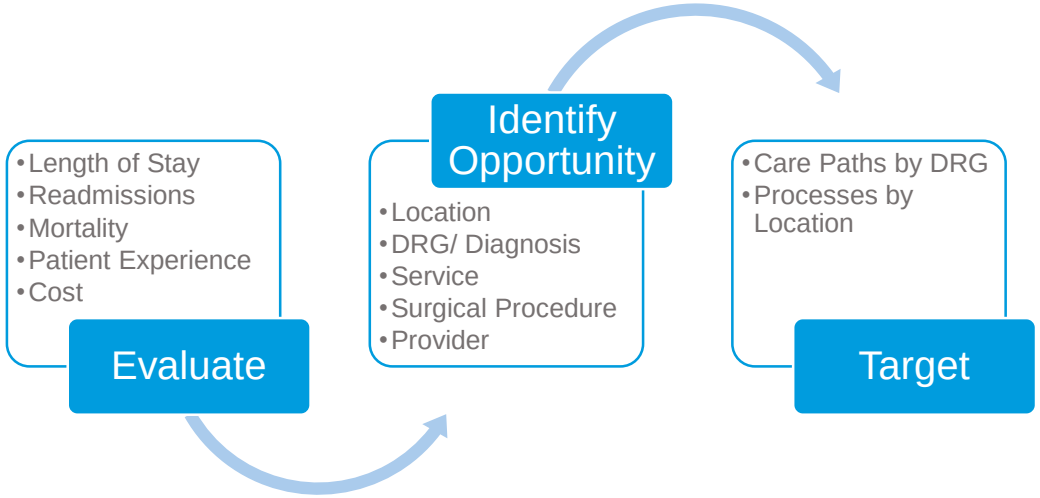
FOR EXAMPLE:
Tableau can be used to filter the types of encounters or patients you want to engage and then drive the engagement through SalesForce.

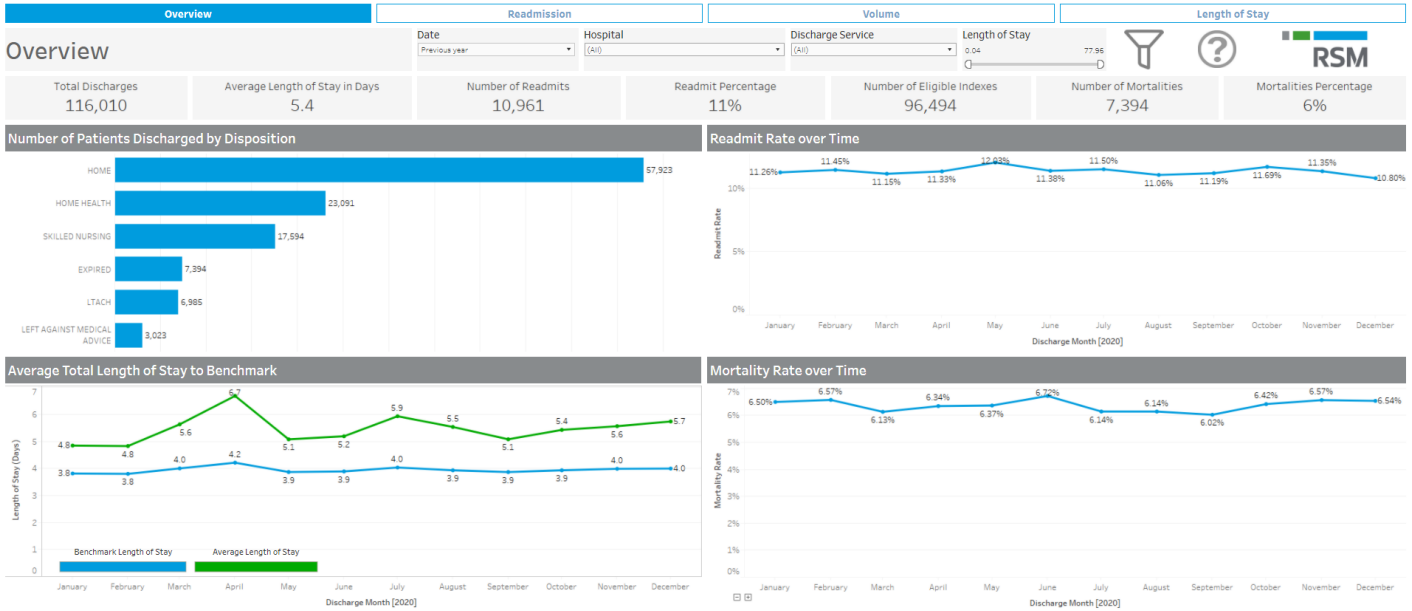
Examples:

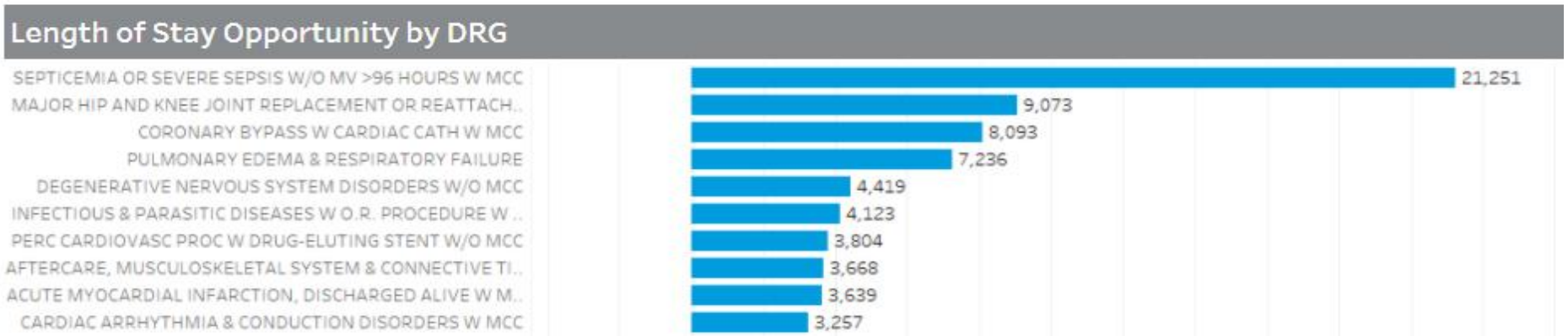
- ✓ Patients who cancelled appointments with this clinic and were not rescheduled
- ✓ Patients with identified care gaps
- ✓ Patients identified by CHD analytics as recommended for follow-up

INPATIENT QUALITY

Choosing a Project







Target Analytics by Care Path

A care path is a method for managing patient care based on clinical practice guidelines, with the main goals of improving quality of care, reducing variation in clinical practice and increasing the efficient use of health care.

Heart Failure	Sepsis	Sickle Cell Anemia
Stroke	Pneumonia	COVID-19
Acute Coronary Syndrome	Asthma	COPD
Colon Surgery	Preeclampsia	NICU Vent Weaning

CASE STUDY:
Congestive Heart Failure (CHF)

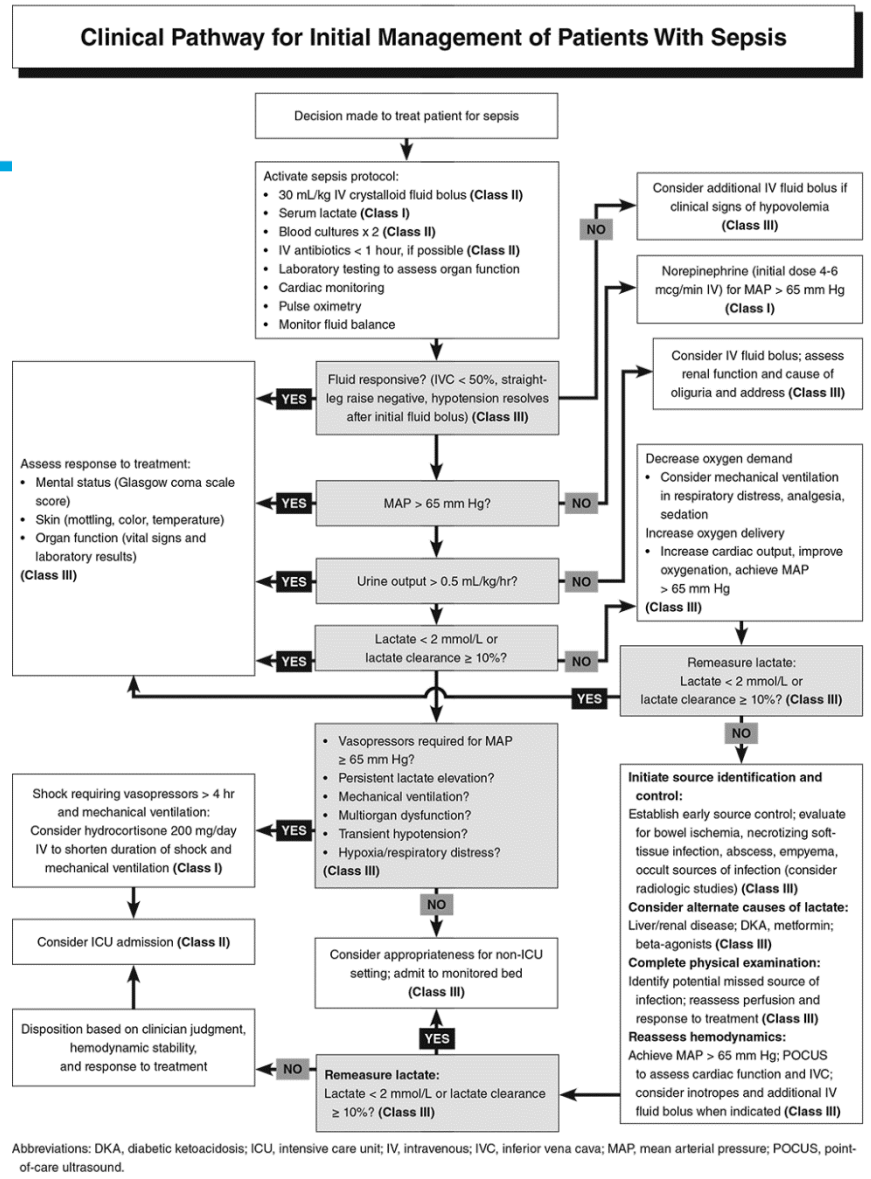
PROBLEM	GOAL	APPROACH	RESULTS
CHF is a very common hospital diagnosis associated with high mortality and readmissions	Improve care for CHF patients, reduce mortality, LOS, readmissions and cost	1. Choose best practice clinical pathways from literature including: 2. Profile data to identify most important metrics 3. Build workflow and analytics to track care path compliance 4. Track results and refine (what metrics most correlate to outcomes)	Reduced: LOS 1.5 days, Direct cost 16%, Readmission 22%, Mortality 60% Significant improvement was seen in second iteration

PUBLISHED:
Improving Patient Care Through Analytics in *International Symposium on Computational and Business Intelligence (ISCBI)*

Can also be applied to:
- Any disease with a treatment plan. There are more than 100 identified in literature and we have implemented 18 acute and 5 ambulatory

Standardized Care Paths

- Best practice care pathways can be found as flow charts and decision points in literature.
- Pathways are defined for both acute encounters and chronic disease treatment.
- Standardized analytics apply across all of the care pathways.
- These processes can be implemented and tracked and measured using standardized technology and process automation engines such as Abbyy Timeline.



PUBLISHED:
Accelerating Analytics for Clinical Pathways to Drive Cost Reduction and Quality Improvement in *IEEE International Conference on Information Reuse and Integration (IRI)*

Leveraging row level security

Row level security filters data based on values within the data.

EXAMPLES

- Show PHI only for patients who the provider discharged or wrote an order for
- Show only metrics for provider's specialty
- Show only DRGs treated by a provider
- Benchmark a provider against others in their service only
- Filter data based on user's role
- Anonymize data for other providers except for directors
- Anonymize cost data for other services except for leadership

USE CASE

We were able to create a single Tableau dashboard, which showed within Epic and was available to >600 physicians filtering based on physician role, specialty and relationship to patient

PUBLISHED:
Developing Enterprise-wide Provider Analytics in *12th International Conference on Health Informatics*

UTILIZATION

Clinical Variation

Clinical variation refers to medical practice pattern variation for similar patients.

Unwarranted clinical variation refers to medical practice pattern variation that cannot be explained by illness, medical need, or the dictates of evidence-based medicine. It is one of the causes of low value care often ignored by health systems.

Our challenge is to **identify clinical variation** and **analyze if it is warranted**.

Analytics for Clinical Variation

Track all orders
Imaging, Labs, Medications, Electrophysiology, Procedures, etc.

Stratify orders based on ordering information
Ordering provider, workflow, order set, service, location

Analyze orders based on patient
Diagnosis, DRG, comorbidity, age

Aggregate and quantify orders
- Antibiotics, opioids, x-rays, blood products, echocardiograms, procedures
- Per encounter, per patient, per calendar day, per service day

Cost Integration

PROBLEM	APPROACH
Most EMRs include only limited cost information. While hospitals track costs, often they are not tied back to orders and they are not communicated to providers.	• Integrate direct cost information with the orders creating the cost • Propagate costs from master lists to all orders and transactions • Analyze cost of treatment by disease, service, day and clinical event • Add cost details to orders analytics

CASE STUDY:
Congestive Heart Failure (CHF)

GOAL	APPROACH	RESULTS
Optimize CHF order set	1. Analyze all orders utilizing the CHF order set 2. Analyze all orders for CHF patients which do not utilize the CHF order set	As part of this analysis, we learned that a full narcotics screen was being ordered for 95% of CHF patients. Our data showed no clinical usage of the results of this lab, and we then verified this with providers. The cost of the narcotics screen was $309. We removed the narcotics screen from the default list of orders in the CHF order set.

Can also be applied to:
Any orders

CASE STUDY:
POKE-R

PROBLEM	GOAL	APPROACH	RESULTS
PICU patients receive lots of “pokes,” increasing cost, reducing patient experience and causing hospital acquired infections	Provide information to providers to allow reduction of poke	1. Define a poke Identify which orders count as “pokes” including blood labs, IV medications, radiology and invasive procedures. 2. Present poke information to providers – including: a. Past pokes and scheduled pokes b. Cost information c. Insure data is available during structured rounds	12.5% reduction in pokes 5 year savings $11,058,085 in 26 bed PICU

PUBLISHED:

- Avoiding Pain and Unnecessary Interventions and Reducing Cost in the PICU in *Critical Care Medicine*
- Poke-R - Using Analytics to Reduce Patient Harm in *10th International Conference on Health Informatics*

Can also be applied to other ICUs including:

- NICU
- SICU
- MICU

CASE STUDY:
Blood Utilization

PROBLEM	GOAL	APPROACH	RESULTS
Patients sometimes receive blood transfusions when not clinically required. This causes adverse outcomes.	Reduce unnecessary red blood cell transfusions, improve outcomes, reduce cost	1. Evaluate the clinical necessity of blood transfusions based on hemoglobin, base deficit, blood pressure, scvO2, lactate, blood loss, diagnosis 2. Analyze blood wastage and returns 3. Provide information for provider evaluation 4. Use supervised learning to adjust thresholds based on provider evaluations	• $3.3 million annual savings • 23% fewer units • 46% fewer non-indicated units

PUBLISHED:
Reducing Red Blood Cell Transfusions in *International Conference on Information Technology in Bio- and Medical Informatics (ITBAM)*

Can also be applied to other products including:
- Plasma
- Platelets

CAPACITY MANAGEMENT

Capacity Management and Patient Movement

- EMRs contain record of every time a patient physically moves or changes service or level of care.
- Moves can be initiated from a physician order, a bed request or a clinical event.

By combining this information in the data warehouse we can create analytics which show:

OCCUPANCY

- Not just midnight census but hourly occupancy
- Not just by unit but by level of care, patient class, and service
- Stratified by features, such as patient DRG or diagnoses, isolation, etc.

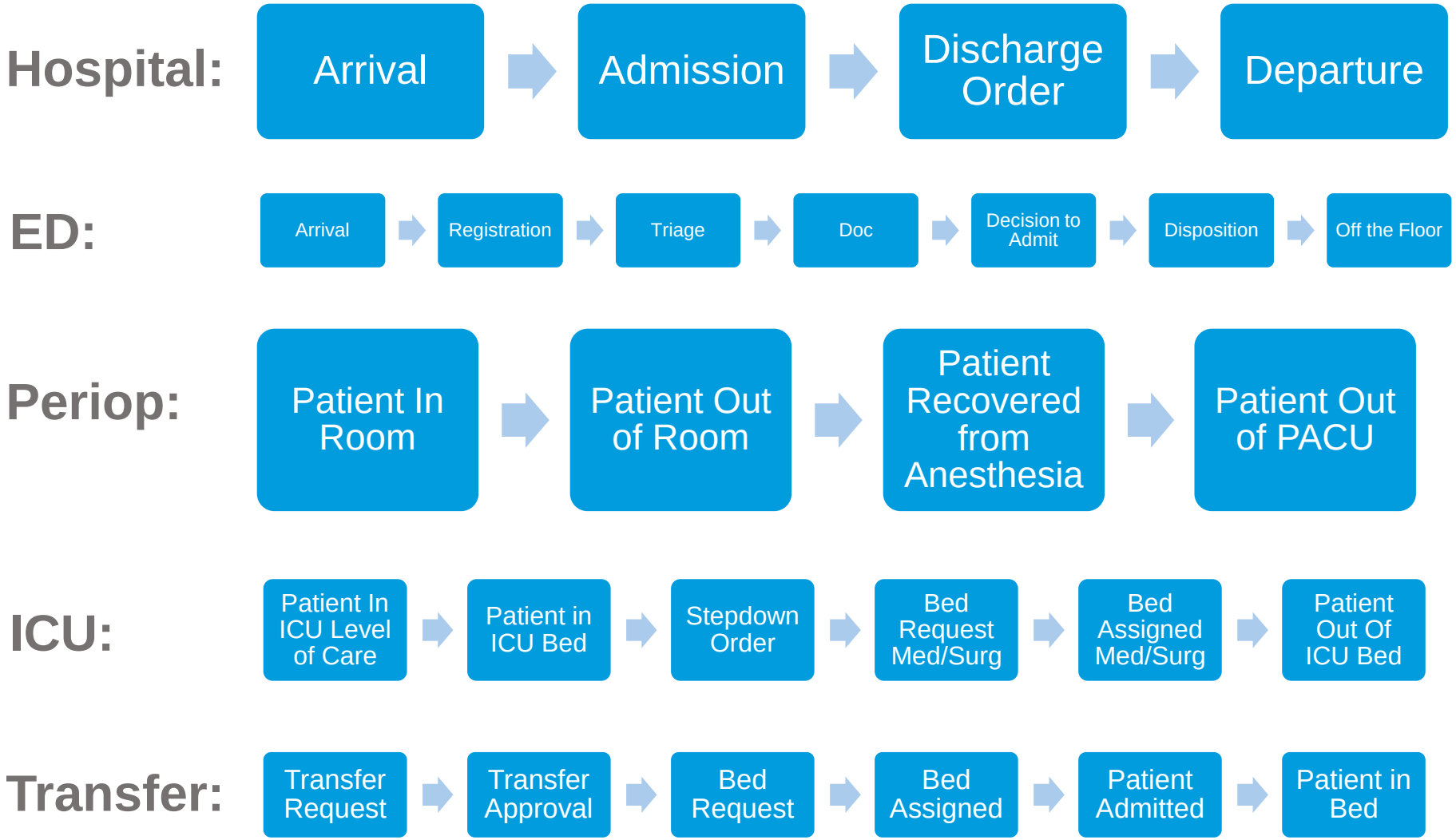
PATIENT MOVEMENT

- In and out flow for each unit, service, hospital, level of care

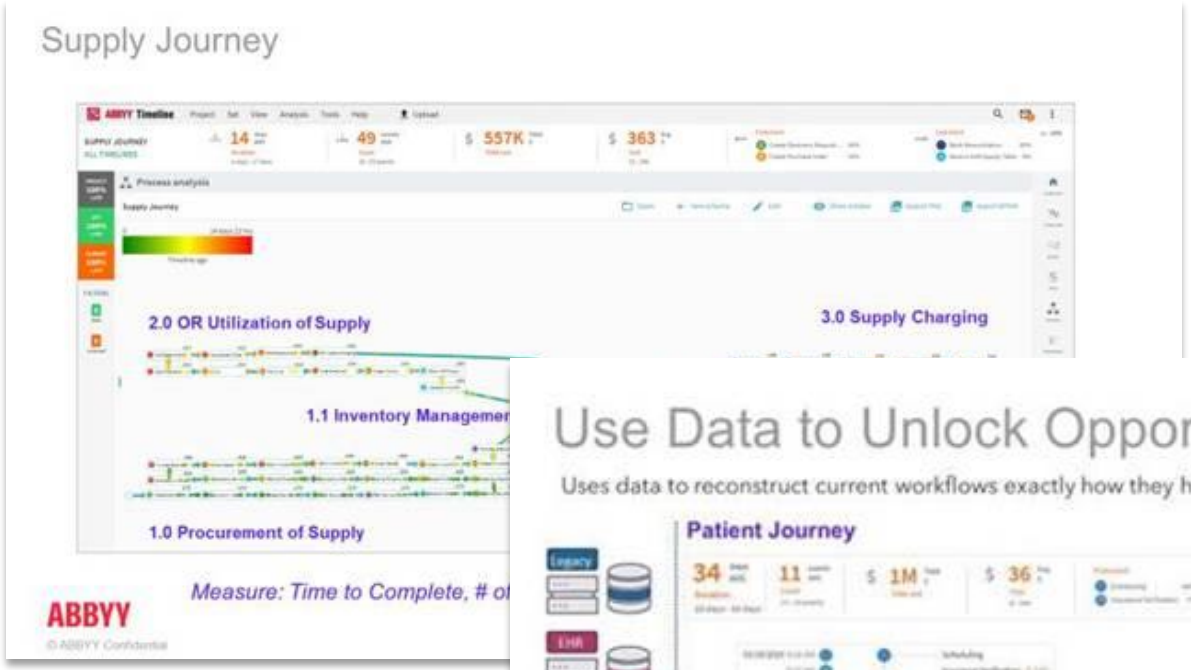
PATIENT DELAYS

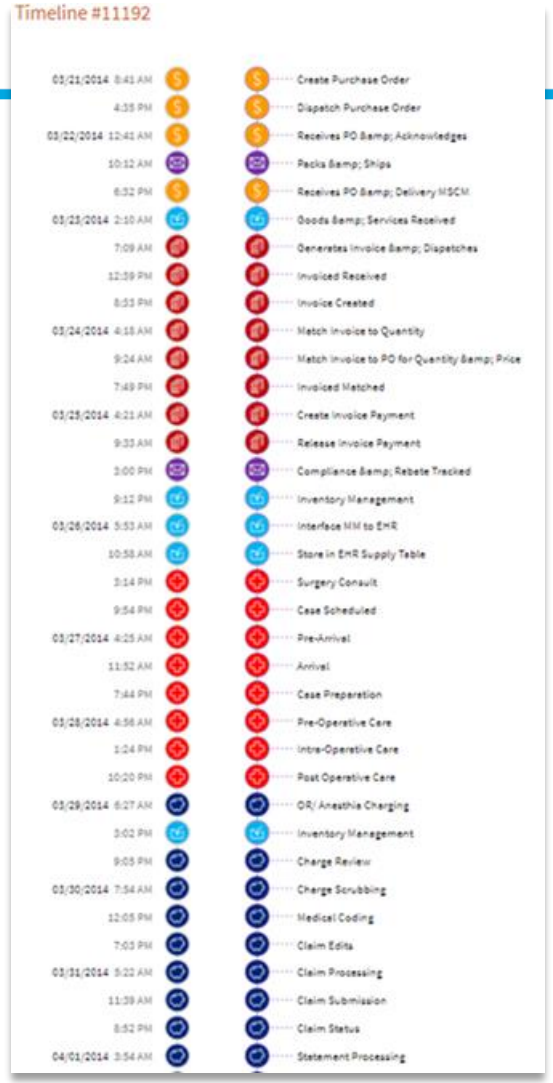
- Time from initiation to movement

Example Processes

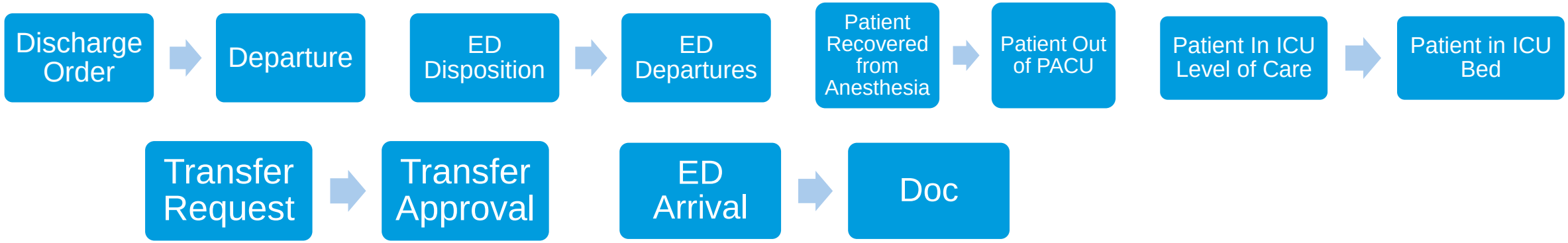


Process Visualization with Abbyy Timeline





Example Process Delays



IMPACT:

- Higher Length of Stay
- Reduced Occupancy
- Longer Wait Times
- Reduced Patient Experience
- Higher Left Without Being Soon or Against Medical Advice
- Cancelled Transfers
- More Delays

Examples of How to Reduce Delays

Emergency Department

- Identify faster
  - More point of care testing
- Treat faster
  - Acute response teams for HF, Sepsis, Stroke
- Separated long term observation (for example dehydration, overdose)
- Faster consult process
- Internal waiting rooms

Discharge

- Preorder durable medical equipment
- Perform dialysis outside of inpatient bed

Transfers

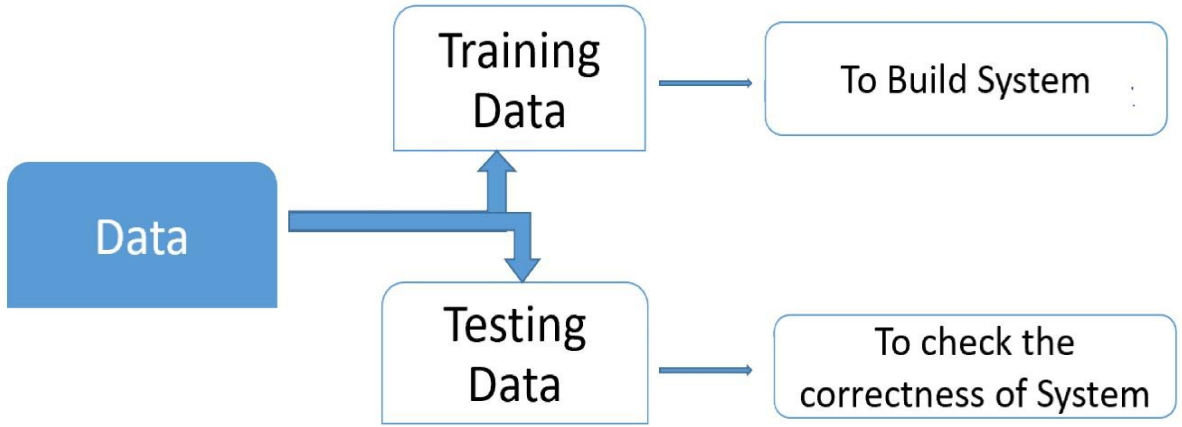
- Pre-assign beds and services
- Improve engagement and communication
- Accelerated registration process

What is predictive analytics

Predictive analytics is a broad term for many types of algorithms but the goal is always the same: to use past data and events to predict future data and events.

Not all healthcare events are predictable and often predictive analytics algorithms fail. The most important thing is to recognize if an algorithm works prior to relying on the results to make decisions.

Data, especially healthcare data, has many attributes and data points. The ones selected as “features” will be used in the predictive algorithm. We then “train” and “test” the algorithm.



CASE STUDY:
Predicting ED Arrivals and Occupancy

PROBLEM	GOAL	APPROACH	RESULTS
Emergency Department overfills causing long delays and emergency procedures to create occupancy	Predict high occupancy in the emergency room to allow mitigation efforts	1. Obtain historical data for emergency room patients 2. Augment data with local weather, holidays and events data 3. Predict ED arrivals • Evaluate and choose features and algorithms, train and test • Chosen features: day of week, time of day, date, temperature, relationship to holidays 4. Predict ED length of stay for patients in the ED using statistics Based on partial information from: service, date, time, diagnosis, ED events 5. Predict future occupancy This is a calculation using predicted ED arrivals, current occupancy and predicted ED length of stay for current patients	• Able to predict overflow as Yellow, Orange or Red (previous was just red) • Alerts up to 96 hours ahead • 78% accuracy at 72 hours

This can also be applied to: Urgent Care, Walk-In Clinics and the OR

CASE STUDY:
Digital Twin

PROBLEM	GOAL	APPROACH
Adding resources or demand in one area of a hospital can cause bottlenecks in other areas.	Analyze resource constraints and what-if scenarios to predict bottlenecks, occupancy and length of stay. Use this analysis to optimize resource allocation	1. Map the resources (beds, imaging machines, etc.) 2. Fill in what each resource can support (patient type, movement) through data profiling and manual review 3. Extract the clinical treatment plan from historical encounters 4. Randomly push patients/treatment plans through the hospital to test resource constraint usage, bottle necks, throughput 5. Allow resources to be edited to test what if scenarios

PUBLISHED:
Predicting Hospital Capacity and Efficiency in *11th International Conference on Health Informatics*

This can also be applied to:
- Beds
- Staffing
- Imaging resources
- Clinics
- Operating Rooms

PERIOPERATIVE AND PROCEDURAL ANALYTICS

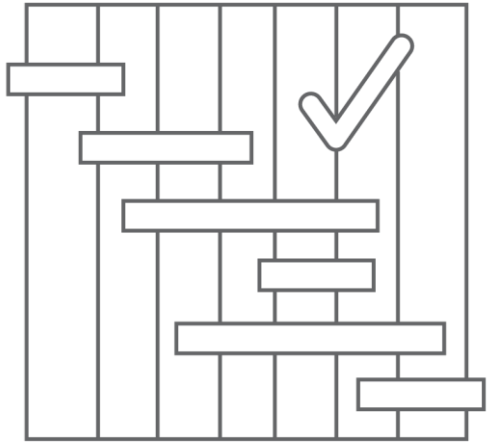
Efficiency

The perioperative suite is one of the busiest areas of the hospital, generates the most revenue and incurs the highest costs. Therefore, throughput and efficiency are vitally important.

SOME OF THE IMPORTANT KPIS TO TRACK EFFICIENCY INCLUDE:

- On-time starts
- Cancellations
- Add-ons
- Turnover and turnaround times
- PACU boarding times
- Case duration accuracy

Through analytics we can monitor the efficiency and also looks for causes of inefficiencies.



CASE STUDY:
Utilization

PROBLEM	GOAL	APPROACH	RESULTS
Operating rooms are sometimes empty and sometimes overbooked and open after hours. Some surgeons do not have enough operating room time available and others need more time. Disruption from COVID-19 has magnified these issues	Increase the amount of the operating room is full and decrease the amount of time the operating room is staffed and empty. Optimize block allocations to the changing needs of surgeon groups.	1. Track room utilization by hour to optimized staffed hours and volume. 2. Analyze anesthesia usage and out-of-room staff utilization across surgical and procedural suites to monitor resource constraints. 3. Analyze service and surgeon block utilization, including: block utilization, block releases, overbooks, unblocked utilization, scheduling patterns	• 12% higher service block utilization • 29% fewer empty staffed rooms • 25% lower out of block minutes

Can also be applied to:
- Endoscopy
- Cath Lab
- Electrophysiology
- Interventional Radiology
- Complex Imaging

OR Quality

Surgeries are both vital life saving interventions and dangerous.

THERE ARE MANY QUALITY MEASURES VITAL TO PERIOP, INCLUDING:

- Proper monitoring of blood sugar and insulin for diabetics to avoid complications while under anesthesia
- Pain management
- Blood loss
- Shock
- Surgical site infections
- Hemorrhage
- Deep vein thrombosis
- Pulmonary embolism
- Urinary retention

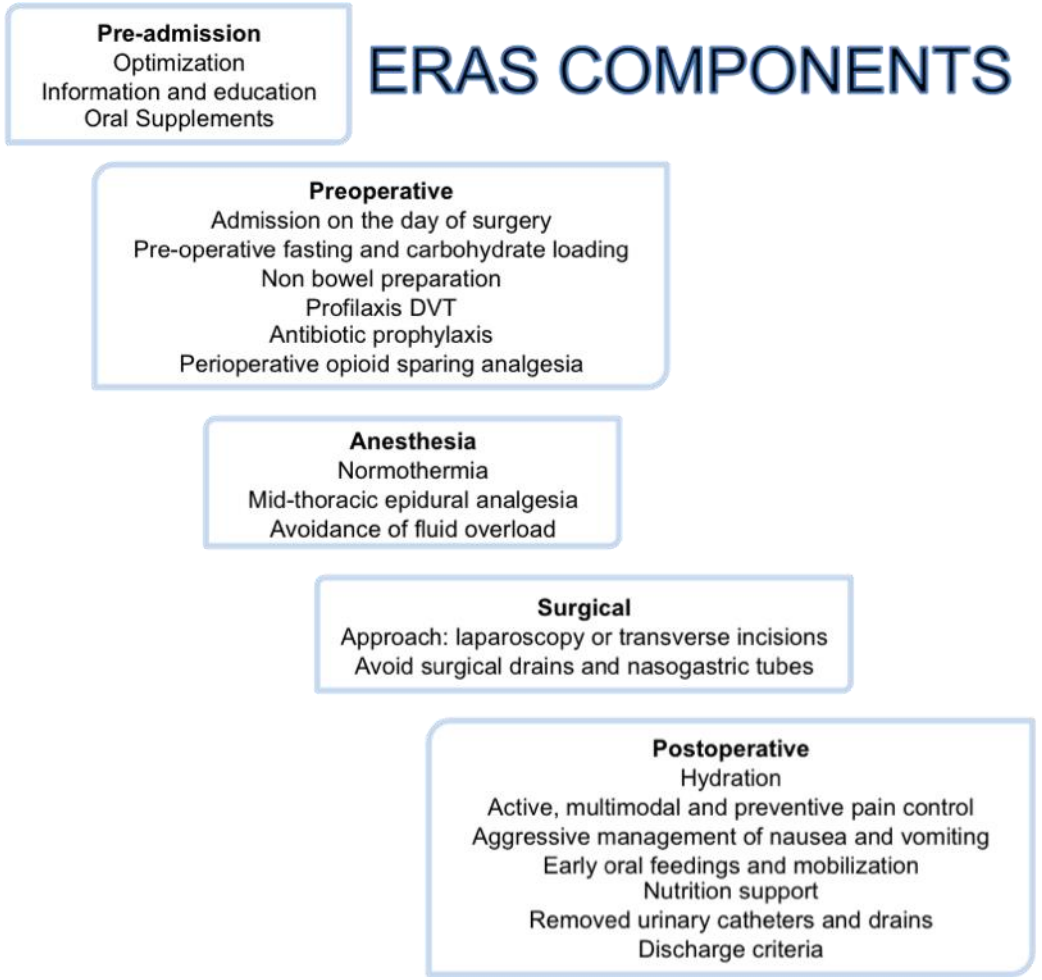
- Analytics can monitor these measures and analyze causes when they occur.
- Best practice care paths can be developed and implemented using insight from analytics combined with clinical expertise.

ERAS: Enhanced Recovery After Surgery

Enhanced recovery after surgery, or **ERAS**, is a set of **protocols** used by the surgical team to help ensure a patient has the best possible outcome from their surgery. Important components of these **protocols** occur before, during, and after a procedure.

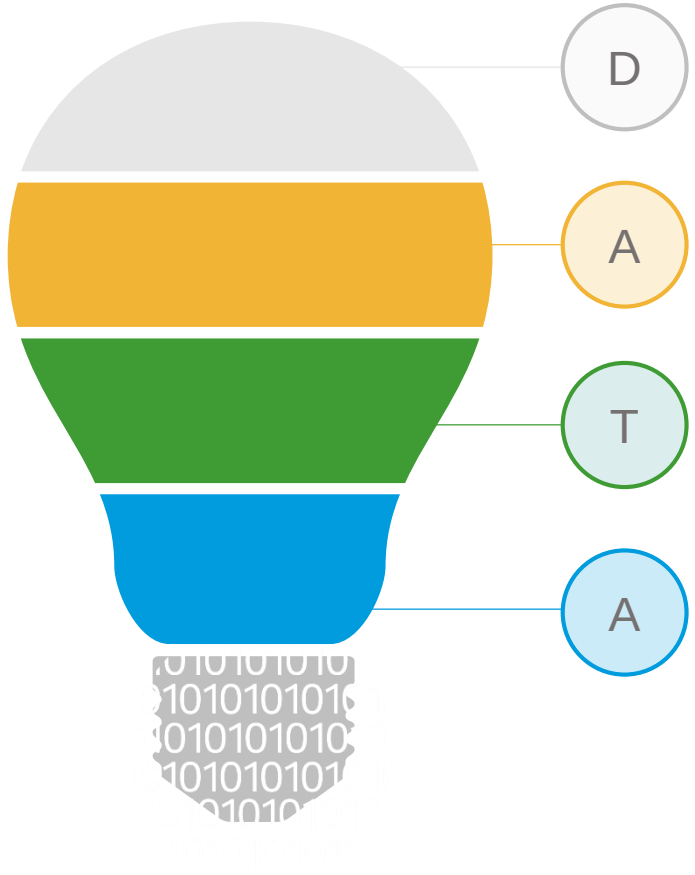
RESULTS

- 25% shorter care time
- 50% fewer complications
- 35% less opioids administered



REVIEW

ROI Review



QUALITY

- Decrease mortality
- Avoid readmissions
- Avoid ER visits
- Implement better care paths

- Reduce complications
- Enhance patient experience
- Improve quality metrics scores

- Reduce gaps in care
- Improve preventive care
- Manage chronic diseases
- Increase medication adherence

COST

- Decrease length of stay
- Avoid unnecessary tests and treatments
- Reduce clinical variation

- Optimize staffing levels
- Reduce supply costs
- Reduce risk

REVENUE

- Treat more patients
- Perform more surgeries
- Capture more revenue

- Minimize denials
- Accept more transfers
- Increase referrals

- Streamline authorization process
- Achieve financial incentives

EFFICIENCY

- Avoid delays
- Reduce wait times
- Accelerate throughput

- Increase productivity
- Avoid empty beds
- Optimize utilization

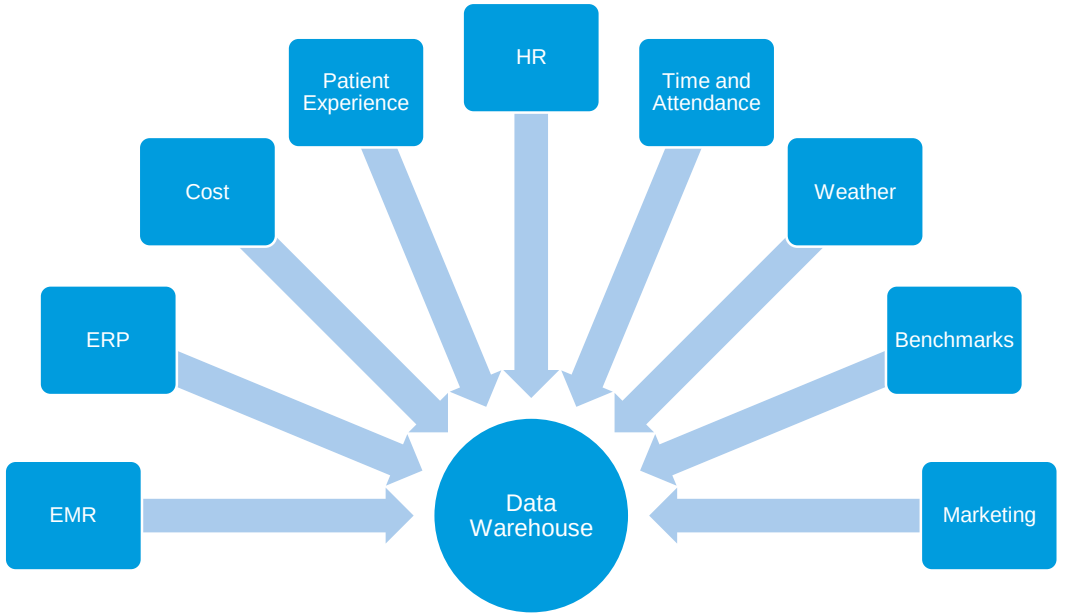
- Accelerate availability
- Reduce cancellations and bumps
- Improve care coordination

Outside Sources Review

One of the advantages of a data warehouse and enterprise analytics approach is the ability to join data sources which can augment each other.

The main data source is always the EMR for a health system.
Other valuable data sources discussed:

- Cost
- Patient Experience
- Time and Attendance
- ERP
- Weather
- Local holidays
- CRM
- Benchmarks



Advanced Analytics: Review

Supervised learning

- Using labels as feedback to improve classification algorithms
- Use Case: CHD

Row Level Security

- Filtering data and KPIs based on a user's relationship to the data.
- Useful to allow dashboards to be rolled out to large numbers of providers

Predictive Analytics

- Choosing features and training predictive algorithms with data points and outcomes. Then using the algorithms to predict future events.
- Use case: ED arrivals and occupancy

Discrete event modeling (digital twin)

- Modeling resources and flow and then using historical records to create digital simulations of patient treatment
- Useful to predict patient flow and bottlenecks and to evaluate what-if scenarios for resource allocation

QUESTIONS AND ANSWERS?

THANK YOU FOR YOUR TIME AND ATTENTION