The 12th Annual Healthcare Conference June 18, 2012

Western Canadian Summit: Bending the Cost Curve through Innovation

PANEL

BIG DATA: THE NEXT FRONTIER

Moderator: **Lindsay Kislock**
Assistant Deputy Minister of Health, Province of British Columbia

Speakers:

Dr. Tom Karson, M.D., Principal
Accenture Healthcare Solutions and Analytics

Julie Lockner, Vice President
Information Life Cycle Management BU, Informatica

Rachel Debes, Research Associate
Infectious Disease Insights, Cerner Corporation

BIG DATA: The New Frontier

Dr. Tom Karson, M.D., Principal
Accenture Healthcare Solutions and Analytics

June 18, 2012

WHAT'S THE DEFINITION OF BIG DATA?

BIG DATA: “Classic Definition”

The 3 Dimensions of “Big Data:”

1. Increasing **V**olume (amount of data)
2. **V**elocity (speed of data in and out)
3. **V**ariety (range of data types and sources)

2001 research report and related conference presentations,
META Group (now Gartner), Doug Laney (2001)

So, Is This Big Data?...
Increasing Volume: The Zettabyte Era

A **zettabyte (ZB)** is equal to one sextillion bytes

- 1,000,000,000,000,000,000,000 bytes = 1000^7 bytes = 10^{21} bytes
- As of April 2012 no storage system has achieved one zettabyte of information
- The combined space of all computer hard drives in the world was estimated at approximately 160 exabytes in 2006
- As of 2009, the entire World Wide Web was estimated to contain close to 500 exabytes. This is a half zettabyte

Comparisons to understand scale in context

- A zettabyte is equal to 1 billion terabytes
- The world's technological capacity to receive information through one-way broadcast networks was 0.432 zettabytes of (optimally compressed) information in 1986, 0.715 in 1993, 1.2 in 2000, and 1.9 (optimally compressed) zettabytes in 2007 (this is the informational equivalent to every person on earth receiving 174 newspapers per day)
- According to International Data Corporation, the total amount of global data is expected to grow to 2.7 zettabytes during 2012. This is 48% up from 2011
- Research from the University of California, San Diego reports that in 2008, Americans consumed 3.6 zettabytes of information

Or, Is This Big Data?...
Increasing Velocity: The Supercomputer

TOP500® 2012 20th Anniversary

SUPERMUC SUPERCOMPUTER, Leibniz

THE “K” SUPERCOMPUTER, Japan

OAK RIDGE NATIONAL LABS, USA

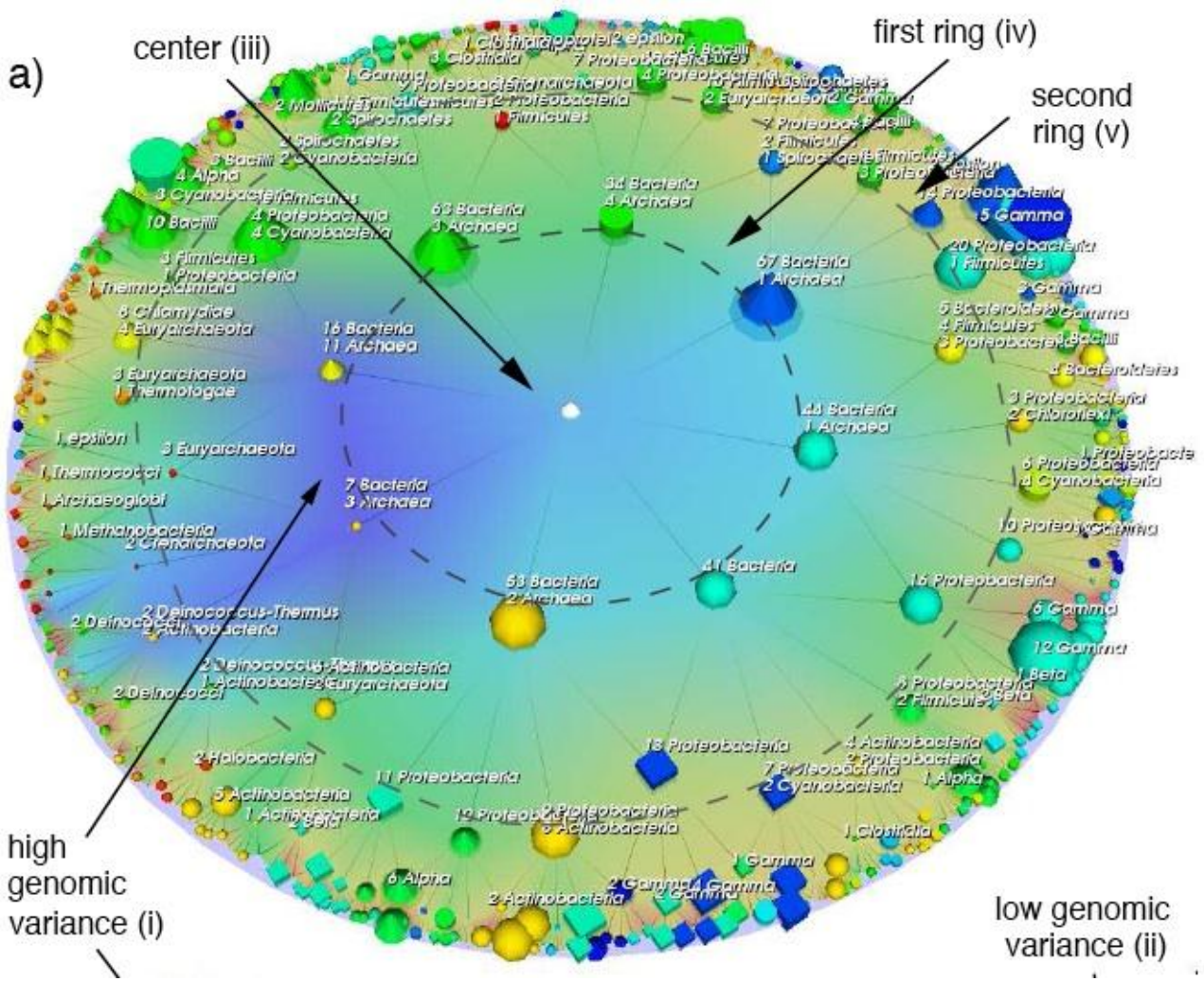
ARGONNE NATIONAL LABS, USA

The New Winner—June 14, 2012 Lawrence Livermore's Sequoia

US National Nuclear Security Administration uses Sequoia to research the safety, security and reliability of nuclear deterrent – replacing the need for underground testing

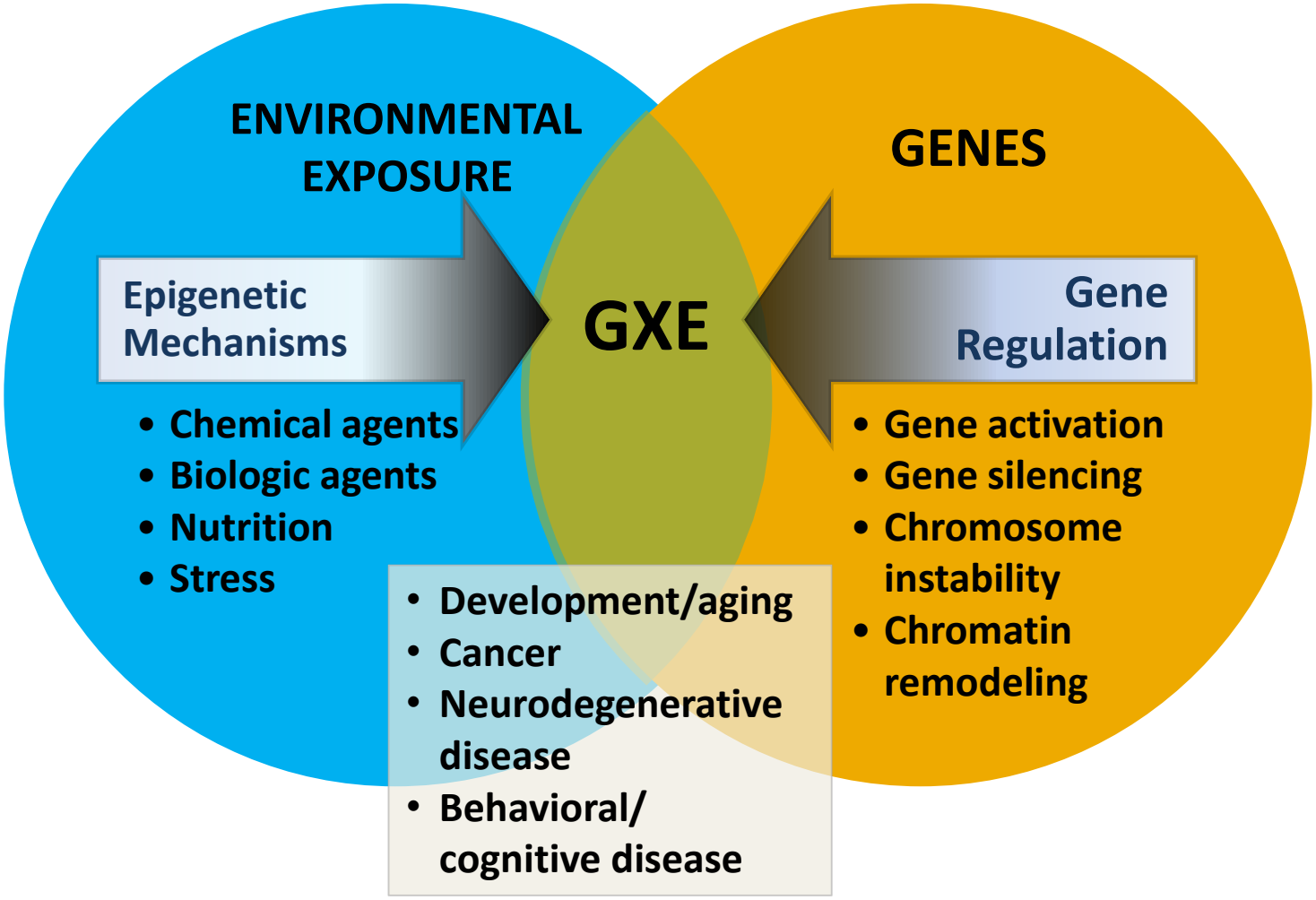
- Sequoia consists of 96 racks; 98,304 compute nodes,
- 1.6 million cores
- 1.6 petabytes of memory, and hit an impressive of
- 16.32 Petaflops—quadrillions of computations per second (a new record)
  - A quadrillion is one thousand million million
- Most energy efficient supercomputer as well

Or, Is This Big Data?...
Variety of Data: Range of Data Types



Variety of Data: Range of Data Sources

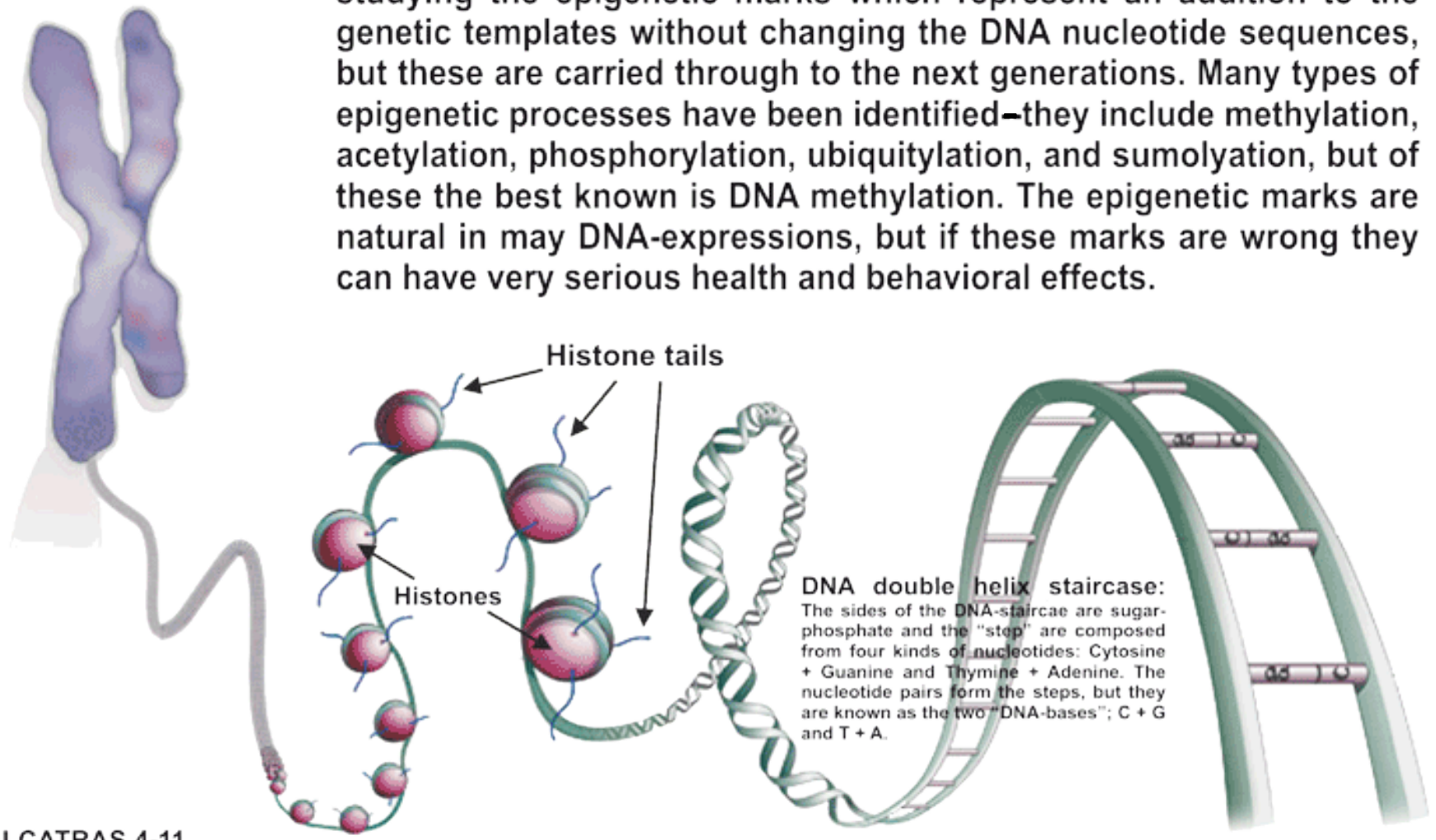
Epigenetic Mechanisms in Human Health and Disease



DNA-management through Epigenetic Marks.

Chromosome

Since 2002, particularly the last two years, biologists have turned to studying the epigenetic marks which represent an addition to the genetic templates without changing the DNA nucleotide sequences, but these are carried through to the next generations. Many types of epigenetic processes have been identified–they include methylation, acetylation, phosphorylation, ubiquitylation, and sumolyation, but of these the best known is DNA methylation. The epigenetic marks are natural in may DNA-expressions, but if these marks are wrong they can have very serious health and behavioral effects.



ALCATRAS 4-11

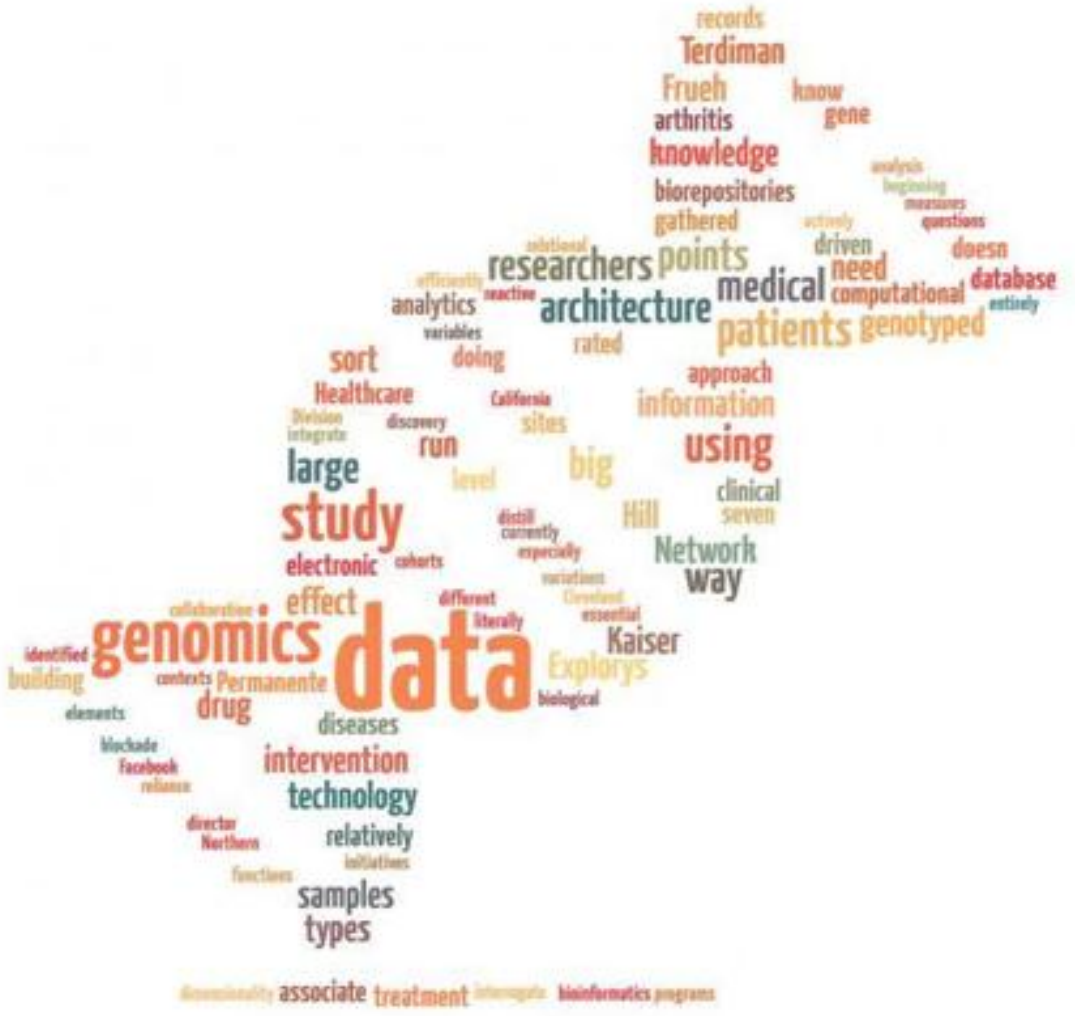
WHAT'S THE DEFINITION OF BIG DATA?

WHO CARES?!

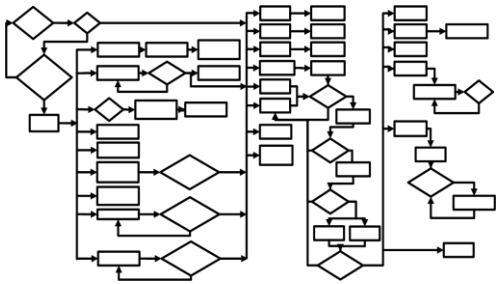
IT’S NOT ABOUT THE DATA…

IT IS ABOUT WHAT YOU DO WITH IT!

Use Big Data to Find Cause and Effect



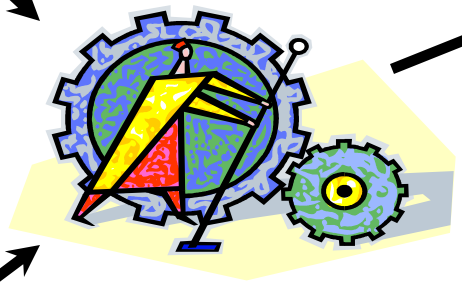
Use Big Data to Put the Pieces Together

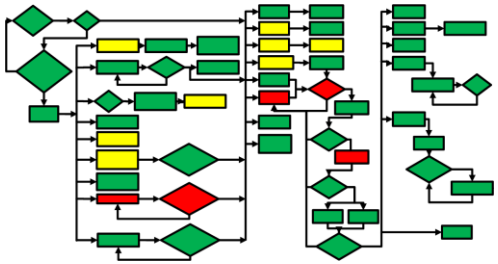


+

Clinical Events		
Type	Date/Time	Value
Vital	Data	Data
Lab	Data	Data
Order	Data	Data
Order	Data	Data
Eval	Data	Data
Lab	Data	Data
Lab	Data	Data
Order	Data	Data
Eval	Data	Data
Vital	Data	Data

Clinical Data Transformation





Best Practice Protocols

The result allows clinical analytics to be performed

Mortality (or progression, or resolution)					
		Compliance vs. Outcome			
	Step	Descrip	Variance impact (Death)	Variance impact (Progress)	Variance impact (Resolution)
Initial Eval	A.1		0.18	0.25	-0.01
	A.2		0.28	0.19	-0.21
	A.3		0.09	0.17	-0.07
	A.4		0.13	0.29	-0.14
Sepsis	B.1		0.30	0.23	-0.22
	B.2		0.27	0.19	-0.16
	B.3		0.07	0.10	-0.24
	B.4		0.13	0.07	-0.20
	B.5		0.10	0.10	-0.28
	B.6		0.03	0.04	-0.14
	B.7		0.10	0.12	-0.07
	B.8		0.15	0.02	-0.01
	B.9		0.24	0.02	-0.17
	B.10		0.03	0.15	-0.09
	B.11		0.06	0.06	-0.24
	B.12		0.05	0.19	-0.12
	B.13		0.07	0.12	-0.30
	B.14		0.18	0.07	-0.05
	B.15		0.30	0.16	-0.11

Population-level Outcomes Impact

Create Clinical Data Use Cases to Gain Insight

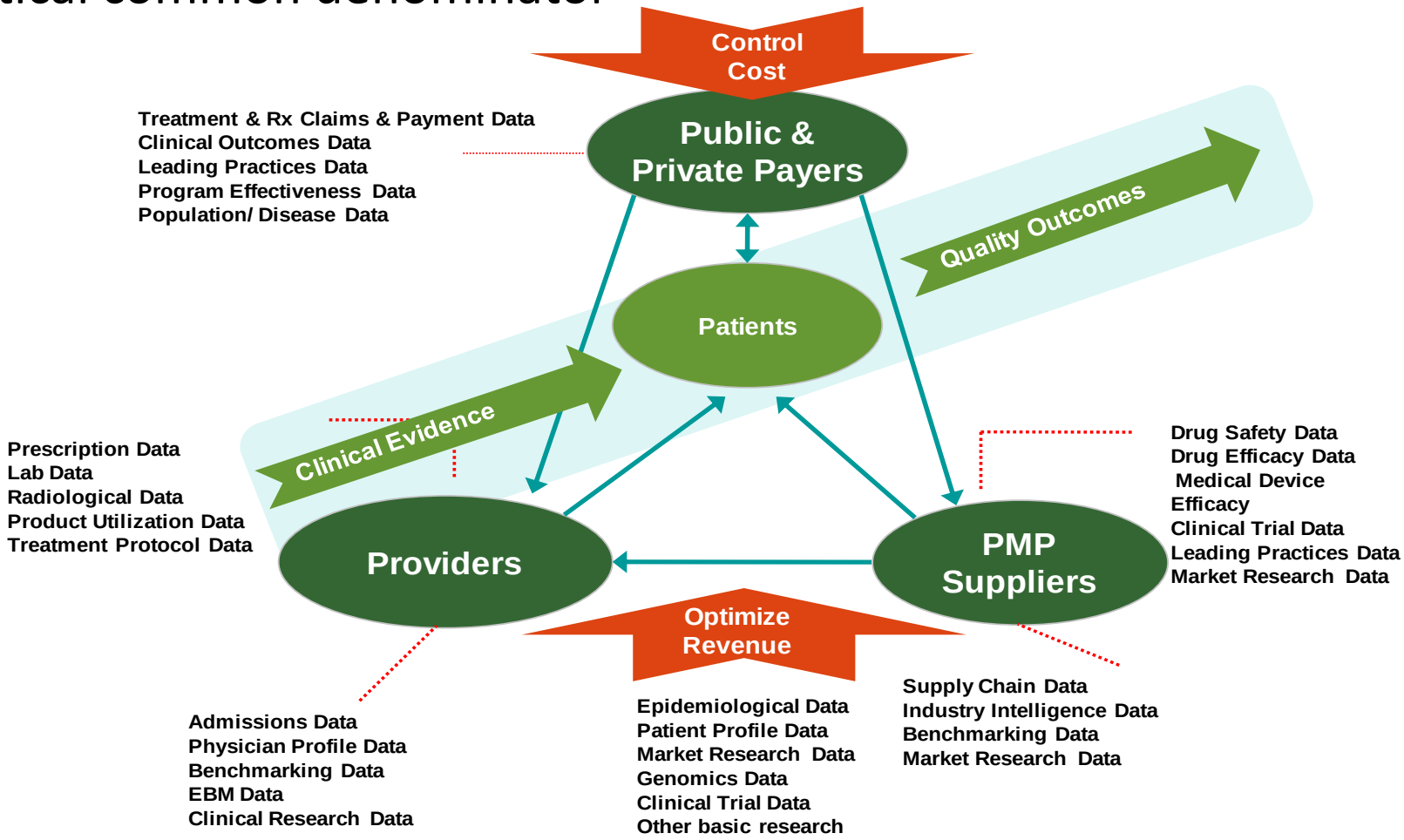
Clinical insight can be gained by creating clinical data use cases so that data repositories can satisfy the long term data needs of each opportunity for greater insight and improvement

Clinical Data Use Cases

- Care Management
- Quality Measurement
- Clinical Process Improvement
- Clinical Effectiveness & Outcomes Analysis
- Member / Patient Engagement
- Telemedicine / Remote Monitoring
- Data Integration
- Clinical Terminology

The Data Needed to Empower Health Analytics Is Distributed Throughout the Ecosystem

Patient insight based on both historical and current data is the critical common denominator



THE ANALYTIC JOURNEY

The Analytics Maturity of an Organization Can Be Defined Using the "DELTA" Model

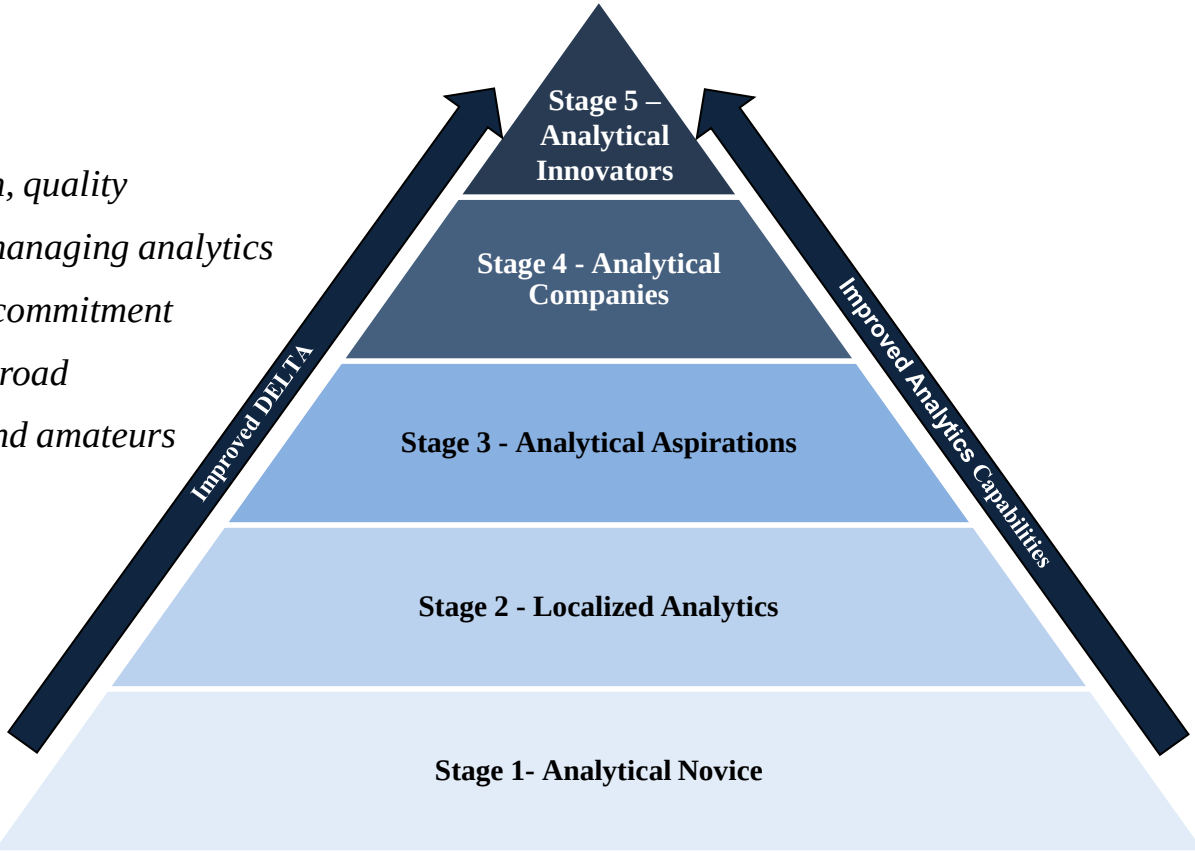
D ata**:** *breadth, integration, quality*

E nterprise*: approach to managing analytics*

L eadership**:** *passion and commitment*

T argets*: first deep, then broad*

A nalysts**:** *professionals and amateurs*

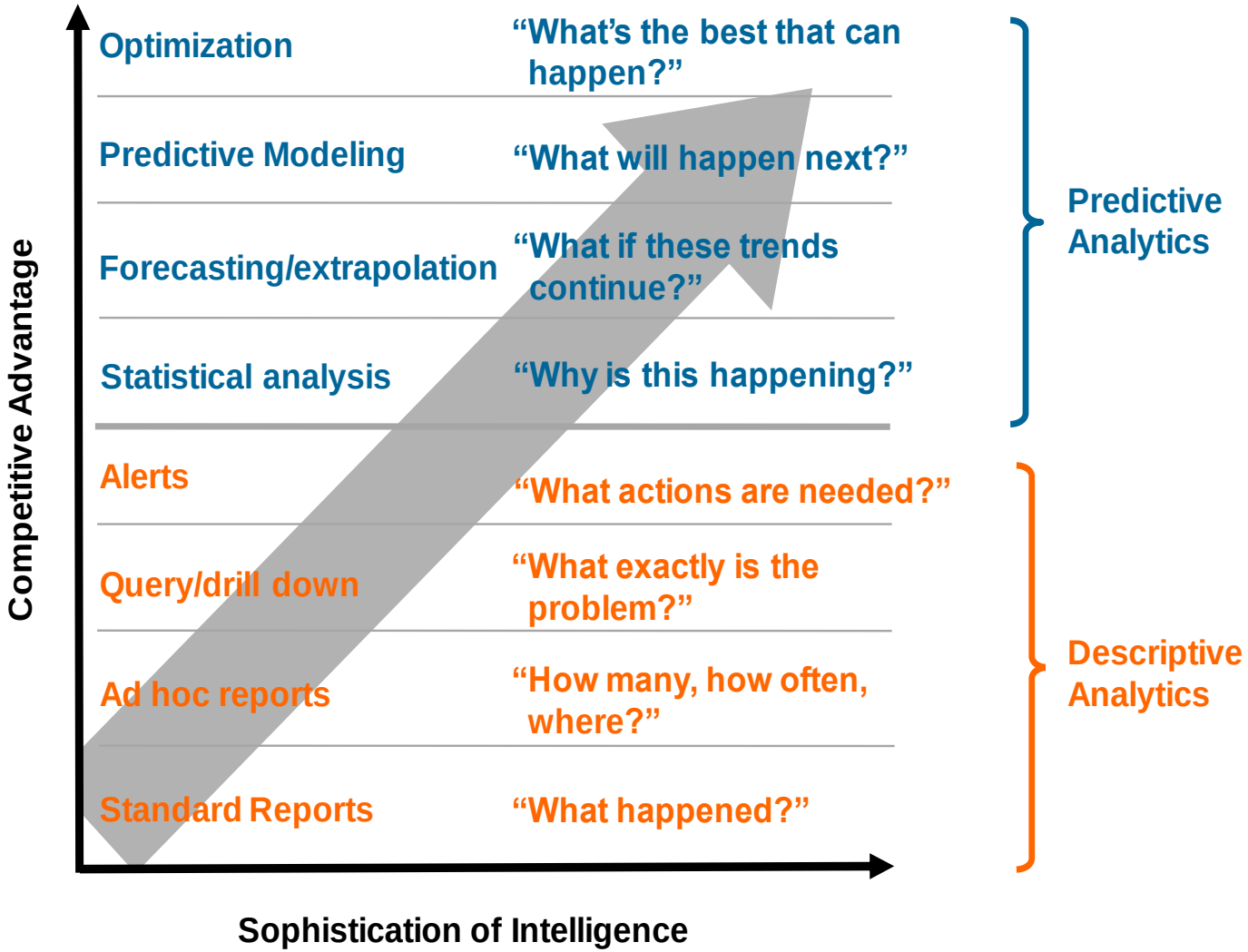


The Analytics Maturity Model evaluates 5 capabilities
Improved analytics capabilities are achieved by making improvements to one's DELTA

The Five Stages of the DELTA Model

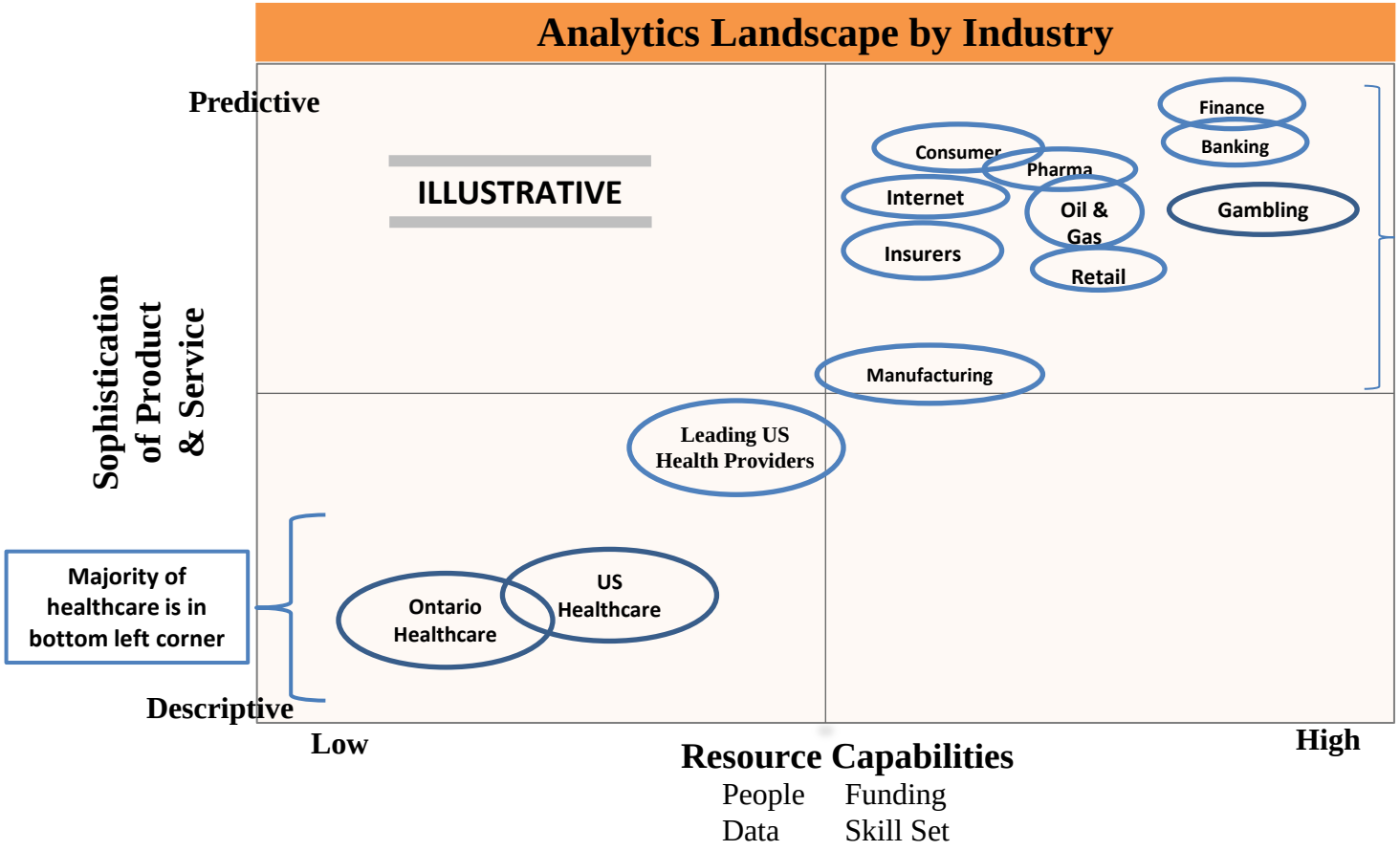
	Stage 1: Analytical Novice	Stage 2: Localized Analytics	Stage 3: Analytical Aspirations	Stage 4: Analytical Companies	Stage 5: Analytical Competitors
Data	• Inconsistent, poor quality & organization of data • Difficult to do substantial analysis • No groups with strong data orientation	• Much data useable • Functional/process silos • Limited data management • Isolated analytic efforts, un-integrated data; disconnected processes	• Identifying key data domains and creating central data repositories	• Integrated, accurate, common data in central warehouse; data still mainly an IT matter; little unique data • Few embedded processes	• Relentless search for new data and metrics • Organization separate from IT oversees info • Data as strategic asset • Fully integrated processes
Enterprise & Organization	• Analytics not a strategic priority • No enterprise perspective on data or analytics • Poorly integrated systems	• Analytics is functional priority; narrow focus • Islands of data, technology, and expertise deliver local value	• Analytics emerging as enterprise priority • Process/BU unit focus • Analytics infrastructure beginning to coalesce	• Key data, technology and analysts managed from an enterprise perspective • BI governance	• Key analytical resources focused on enterprise priorities & differentiation • Enterprise-wide BA/BI architecture implemented
Leadership & Culture	• Little awareness of or interest in analytics • Functional & tactical sponsors • Intuition-based decisions; knowledge averse	• Local leaders emerge, but have little connection • Desire for more objective data; success stories	• Senior leaders recognize importance of analytics / developing capabilities • Executive support for fact-based culture • Awareness of competitive possibilities	• Senior leaders developing analytical plans and building analytical capabilities • Fact-based, data driven culture • Broad C-suite support	• Strong leaders behaving analytically; Passion for analytical competition • Broad support for fact-based/testing/ learning culture • Strong commitment
Targets	• No targeting of opportunities	• Multiple disconnected targets, typically not of strategic importance	• Analytical efforts coalescing behind small set of important targets • Enterprise performance metrics	• Analytics centered on a few key business domains with explicit and ambitious outcomes	• Analytics integral to the company's distinctive capability and strategy
Analytical Talent	• Few analytical skills or roles • Attached to specific functions	• Unconnected pockets of analysts • Unmanaged mix of skills	• Analysts recognized as key talent and focused on important business areas • Limited interaction	• Highly capable analysts explicitly recruited, developed, deployed, and engaged	• World-class professional analysts; cultivation of analytical amateurs across the enterprise

The Analytics Progression



Source: Competing on Analytics: The New Science of Winning (Davenport / Harris)

In General, the Health Care Industry Lags Behind Other Industries in Use of Analytics



Banking - Barclays Bank
Consumer - P&G
Pharma - AstraZeneca
Retail - Walmart
Internet - Amazon
Gambling-Harrah's

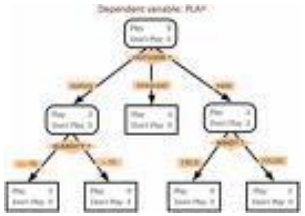
For Healthcare Organizations to Progress There Are Areas That Need to Evolve and Be Managed

- Governance
  - There is a spectrum of governance models that is right for a given organization based on its analytics maturity and environmental context
  - The appropriate model will allocate responsibility for data across those who use (own) the data and those who manage the data
- Skills and Talent Management
  - Leading organizations have talent management processes to define, discover, develop, and deploy analytic resources within the organization
  - Refining and/or expanding organizational skills requires planning and coordination to recruit and nurture resources
- Processes
  - Organizations re-organize processes to collect and analyze data, generate insights, and communicate results
  - Data becomes actionable

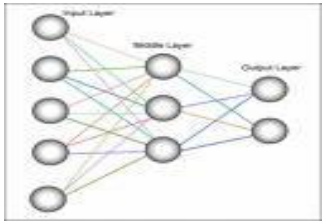
…and Analytics needs to bring value to the data

Statistical Analysis

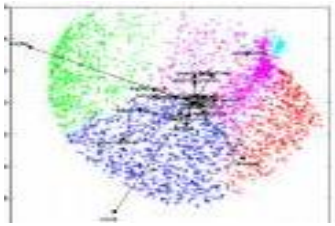
Root Cause Analysis



Link Analysis



Segmentation



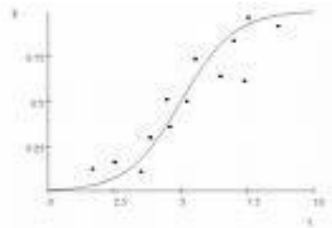
Text Mining

Optimization

Operations Research

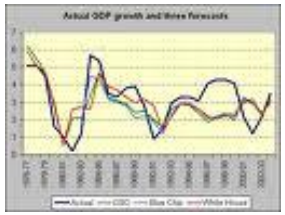
Modeling and Scoring

Propensity Analysis



Forecasting

Econometric Forecasting



IMPORTANT

Data is needed for:

- Providers on the front lines of medical care
- Healthcare officials managing the health of a population

HOW IS CANADA DOING?

Accenture Research Performed a Multinational Study Looking at a Wide Array of Data Sources

8
Countries

Germany
England
France
Spain

Canada
USA

160
Healthcare experts Interviewed

3700
Physicians surveyed

Singapore
Australia

10
In-depth case studies

Denmark **Hong Kong** **Kaiser Permanente** **Indiana HIE** **Intermountain Healthcare**

Scotland **Madrid, Spain** **Singapore's National EMR** **Lombardia Region** **Midi-Pyrénées, France**

17 Key Functionalities Identified for: Healthcare IT Adoption, Health Information Exchange and Insights from Patients and Analytics

The functionalities of connected health

Connected clinical practice
- Hospitals/physician offices use electronic tools to reduce the administrative burden of health care delivery (e.g. e-scheduling or e-billing)
- Physicians capture patient data electronically
- Physicians receive electronic alerts/reminders while seeing patients (e.g. prompts regarding contraindications or preventative care)
- Physicians use clinical decision support systems (CDSS) to help make correct diagnostic treatment decisions at the point of care

Connected to clinical practitioners in other organizations
- Physicians communicate electronically with clinicians in other organizations (e.g. via secure email)
- Physicians are notified electronically of patients' interactions with other health organizations (e.g. admission to hospital)
- Physicians send or receive referrals electronically to/from health professionals in other organizations (e.g. for specialist appointments)
- Physicians electronically access clinical data about a patient who has been seen by a different health organization (e.g. hospital, laboratory)
- Physicians send prescriptions electronically to pharmacies (e-prescribing)
- Physicians send order requests electronically (e.g. for tests)
- Physicians receive clinical results electronically that populate patients' electronic medical records

Connected to patients
- Patients can book/change/cancel appointments with their physicians online
- Patients can communicate with their physicians electronically via secure email or video conferencing
- Patients can electronically access their own medical information (e.g. lab results, medications, imaging results, etc)
- Patients can monitor and record their own health indicators and share information with their physicians or with other approved clinicians

Connected to analytics
- Healthcare organizations capture and analyze care data and use this to identify needs for improvement in clinical care protocols and clinical outcomes across the organization
- Public health agencies use system-wide clinical data for population health reporting, allowing them to carry out analysis to monitor trends and manage disease in the population

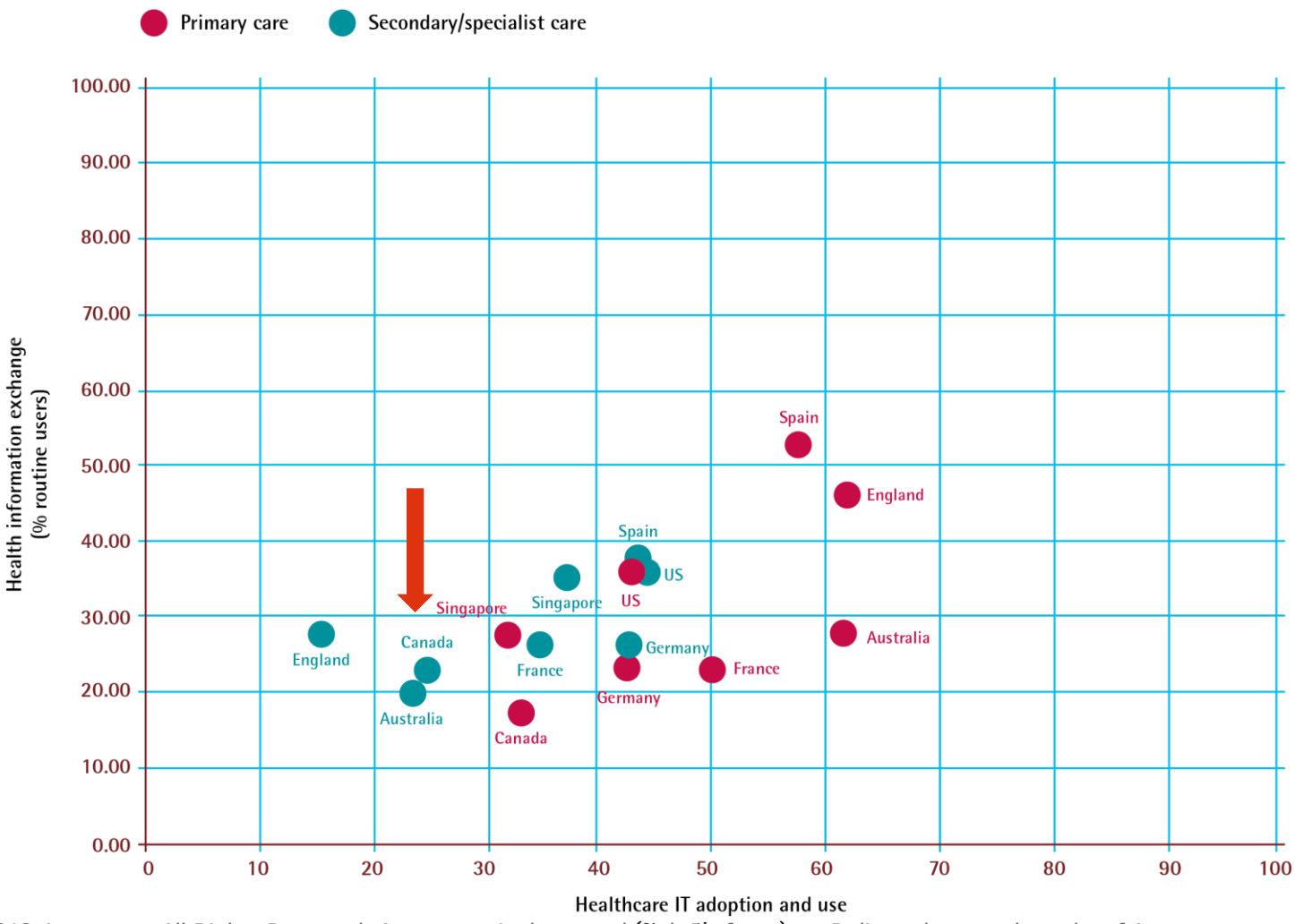
Healthcare IT Adoption

Health Information Exchange

Insight Driven Healthcare

Connected Health Maturity Index Is Based on Physicians' Use of Both Healthcare IT and HIE Functionalities

Connected health maturity index: primary care vs. secondary/specialist care



Findings
Stage 1: Healthcare IT adoption

Ability to generate registries and quality of care data

	Australia	Canada	England	France	Germany	Singapore	Spain	US	Survey Average
List of medications taken by patients (including those prescribed by other doctors)	59.7%	48.4%	65.5%	56.4%	64.3%	69.6%	74.7%	65.3%	62.5%
Lists of patients by specific condition/diagnosis	60.9%	42.2%	67.1%	46.2%	75.2%	61.8%	58.3%	57.4%	58.4%
List of patients by lab result	47.7%	35.2%	61.2%	30.7%	55.0%	59.8%	41.5%	42.4%	45.7%
Lists of patients who are due for tests (e.g. mammogram) or preventative care (e.g. vaccinations)	44.9%	24.2%	54.9%	31.5%	62.1%	59.3%	49.3%	40.6%	44.8%
Data relating to clinical quality of care measures	31.7%	18.2%	56.7%	21.3%	30.4%	52.0%	31.5%	42.4%	34.3%

N=3727

Findings
Stage 2: Health information Exchange

HIE functions used to connect with other practitioners

HIE functionalities	Australia		Canada		England		France		Germany		Singapore		Spain		US	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
I communicate electronically with clinicians in other organizations (e.g. secure email)	15%	35%	12%	28%	32%	47%	29%	35%	12%	36%	30%	35%	44%	43%	16%	34%
I am electronically notified of my patients' interactions with other health organizations (e.g. hospital admissions)	24%	6%	14%	11%	41%	9%	11%	13%	11%	12%	21%	25%	36%	22%	21%	18%
I electronically send or receive referrals to/from health professionals in other organizations (e.g. specialist appointments)	20%	12%	16%	16%	52%	19%	17%	21%	13%	9%	24%	28%	59%	34%	28%	27%
I have electronic access to clinical data about a patient who has been seen by a different health organization (e.g. hospital, laboratory)	24%	28%	27%	34%	51%	31%	23%	36%	20%	24%	26%	38%	56%	42%	38%	31%
I electronically send prescriptions to pharmacies (e-Prescribing)	6%	3%	10%	7%	11%	14%	5%	17%	5%	8%	33%	40%	32%	18%	54%	44%
I receive clinical results electronically that populate my patients' electronic medical record	84%	40%	35%	37%	90%	38%	61%	43%	48%	48%	30%	39%	66%	62%	47%	53%
I electronically send order requests (e.g. lab, radiology or diagnostic tests) to other health organizations	28%	17%	14%	22%	46%	43%	12%	21%	50%	48%	26%	38%	71%	47%	47%	48%
Health information exchange—average	29%	20%	18%	22%	46%	29%	23%	27%	23%	26%	27%	35%	52%	38%	36%	36%

Note: 1=Primary care; 2=Secondary care. Purple shows the lowest score, Green shows the hightest score across all eight countries for each of the functions

Findings
Stage 3: Insight Driven Healthcare

How patient data is currently entered in the system:
Accenture physician survey

In Summary

1. Although BIG DATA is classically defined by the "3-Vees:" Volume, Velocity and Variety
   - The value is not in size, but what you do with the data
   - Enough data and the right data is more important
2. Continue along the analytics journey, both in:
   - Maturity
   - Moving from descriptive to predictive
3. Identify, invest in and train the talent needed to understand and interpret the data, processes to collect and communicate results and evolve governance