HEALTHCARE DATA ANALYTICS

TOM FISH | ALEX JANTZ

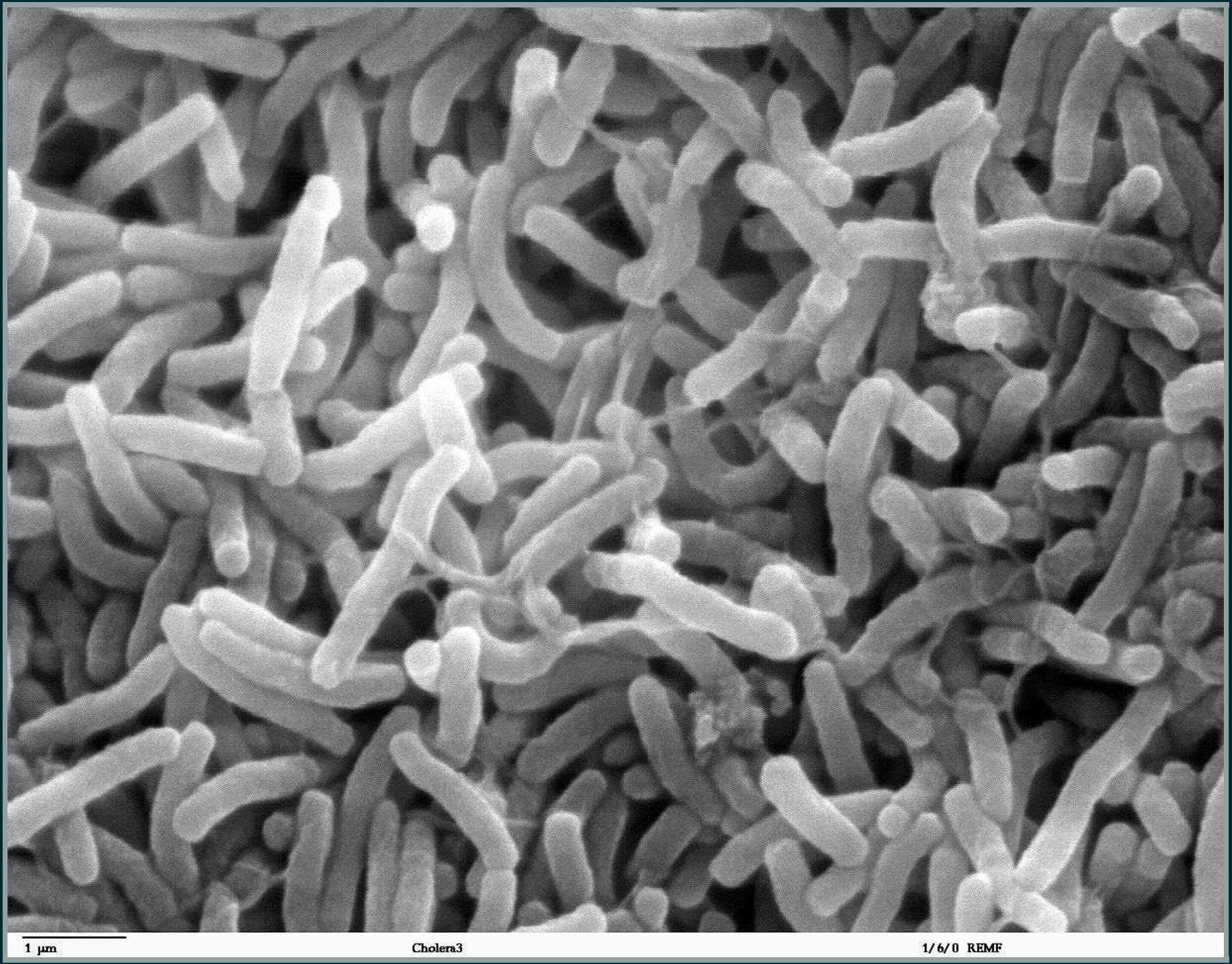
EPIC TRAINING

EPIC TRAINING

HISTORICAL CASE STUDY

1854 BROAD STREET CHOLERA OUTBREAK

CHOLERA

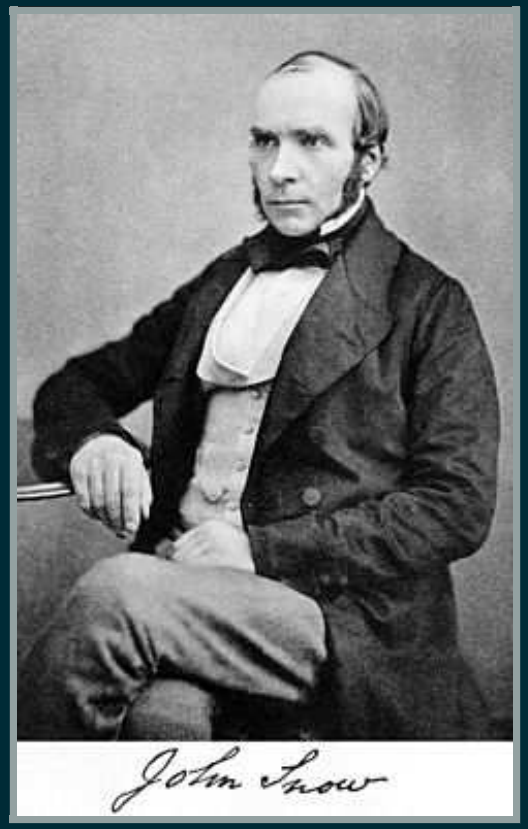

1 µm
Cholera3
1/6/0 REMF

WHAT DOES THIS TELL US?

Death Count	Location
3	-0.13793,51.513418
2	-0.137883,51.513361
1	-0.137853,51.513317
1	-0.137812,51.513262
4	-0.137767,51.513204
2	-0.137537,51.513184
2	-0.1382,51.513359
2	-0.138045,51.513328
3	-0.138276,51.513323

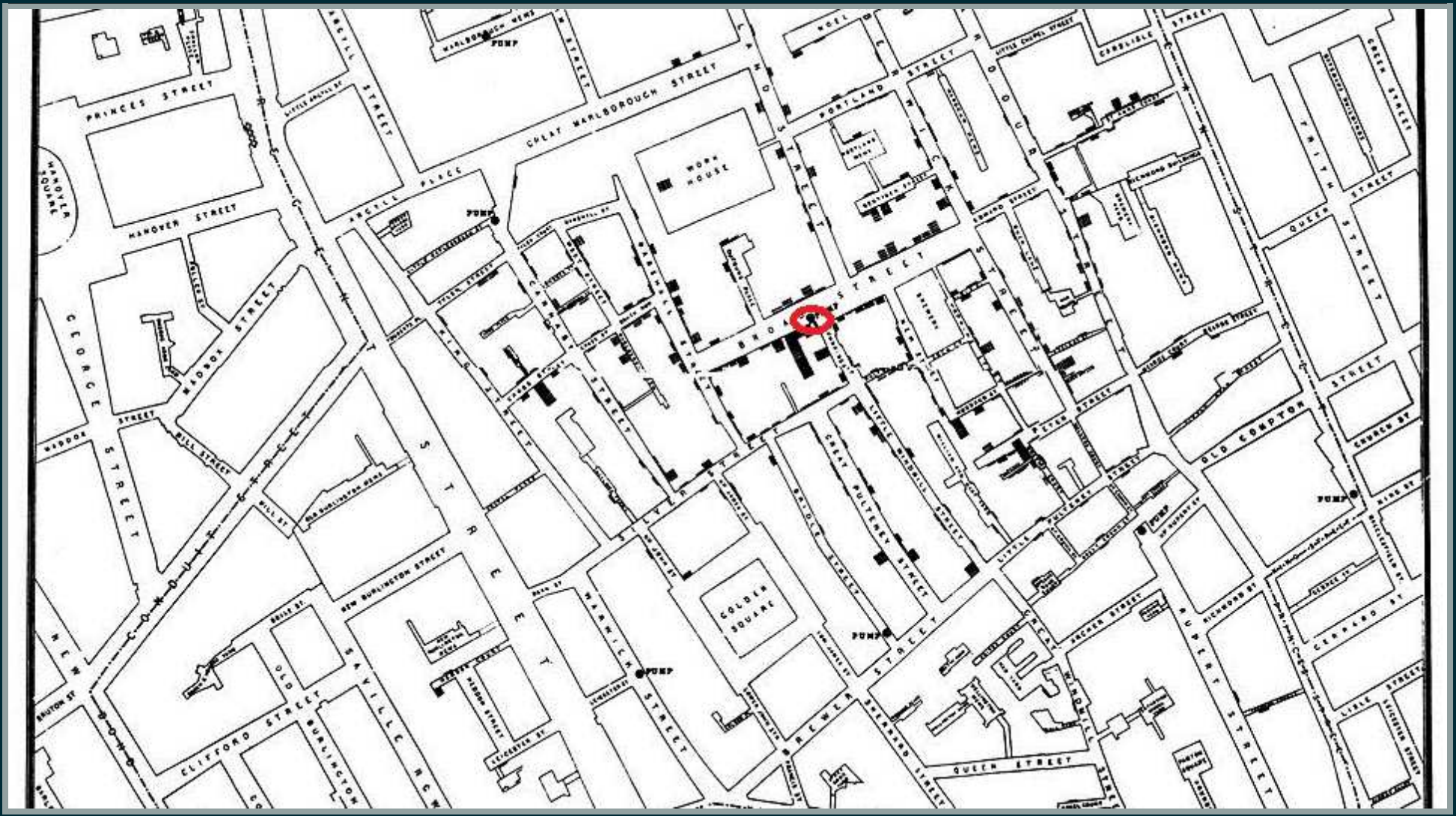
2	-0.138223,51.513427

JOHN SNOW

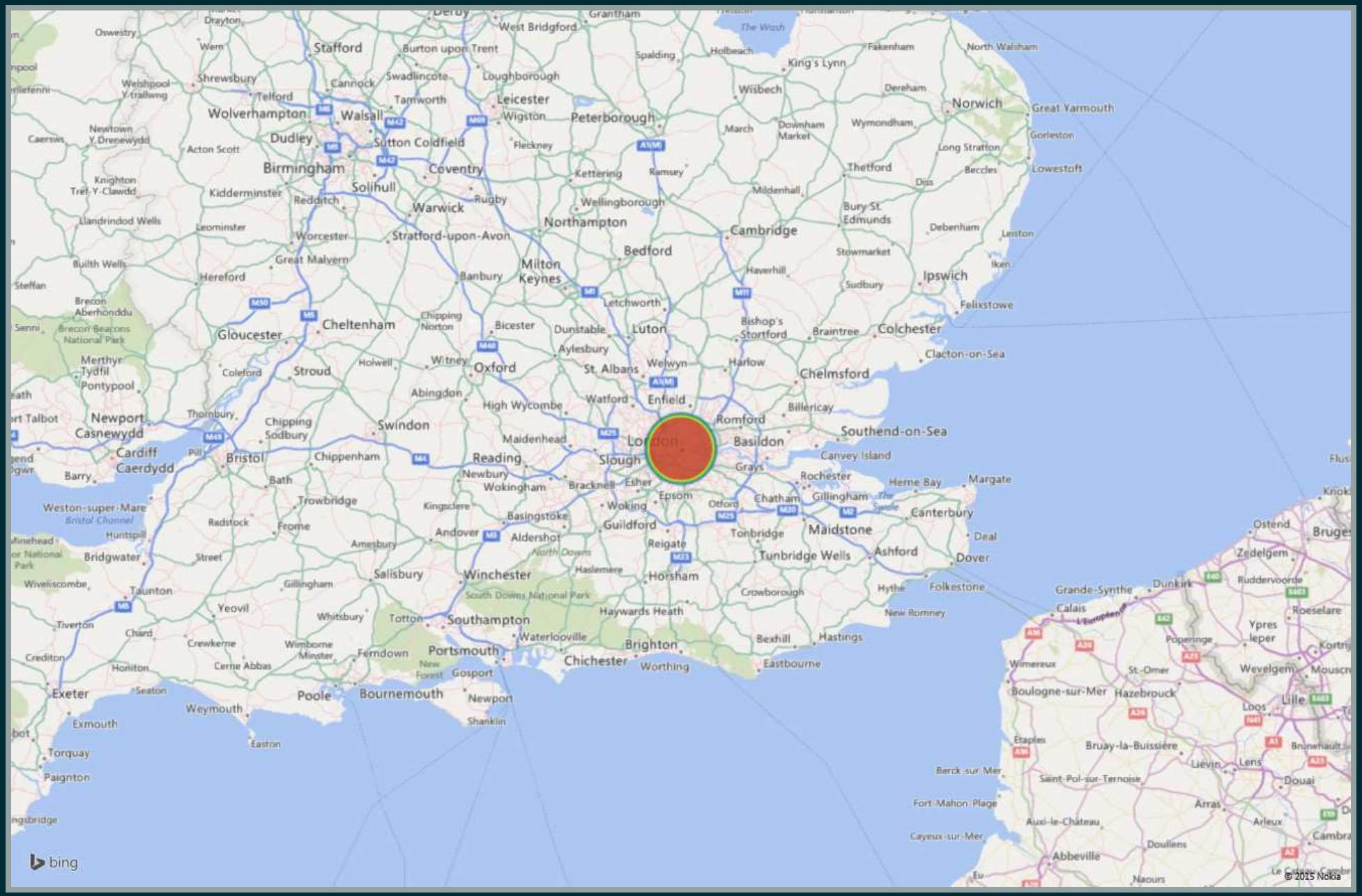


NOT HIM HIM

JOHN SNOW'S DATA VISUALIZATION



MODERN DATA VISUALIZATION


Stafford
Burton upon Trent
West Bridgford
Grantham
Spalding
Holbeach
King's Lynn
Fakenham
North Walsham
Norwich
Great Yarmouth
Gorleston
Lowestoft
Wisbech
Dereham
Wymondham
Downham Market
March
Peterborough
Leicester
Loughborough
Swadlincote
Cannock
Tamworth
Wigston
Fleckney
Shrewsbury
Telford
Wolverhampton
Walsall
Sutton Coldfield
Dudley
Birmingham
Coventry
Solihull
Kidderminster
Redditch
Warwick
Rugby
Kettering
Ramsey
Wellingborough
Northampton
Thetford
Long Stratton
Beccles
Diss
Mildenhall
Bury St. Edmunds
Cambridge
Debenham
Leiston
Stowmarket
Haverhill
Sudbury
Ipswich
Felixstowe
Iken
Bedford
Milton Keynes
Banbury
Worcester
Stratford-upon-Avon
Great Malvern
Hereford
Leominster
Acton Scott
Knighton
Tref-Y-Clawdd
Llandrindod Wells
Builth Wells
Brecon
Aberhonddu
Brecon Beacons National Park
Merthyr Tydfil
Pontypool
Newtown
Y Drenewydd
Caersws
Welshpool
Y Trallwng
Oswestry
Wem
Drayton
Cheltenham
Gloucester
Chipping Norton
Bicester
Dunstable
Luton
Letchworth
Aylesbury
Bishop's Stortford
Braintree
Colchester
Clacton-on-Sea
Harlow
Chelmsford
Witney
Oxford
Holwell
Stroud
Coleford
St. Albans
Welwyn
Abingdon
High Wycombe
Watford
Enfield
Billericay
Romford
Southend-on-Sea
Swindon
Chipping Sodbury
Thornbury
Newport
Casnewydd
Cardiff
Caerdydd
Barry
Bristol
Pill
Chippenham
Maidenhead
London
Basildon
Canvey Island
Reading
Slough
Grays
Rochester
Newbury
Wokingham
Bracknell
Esher
Epsom
Woking
Otford
Chatham
Gillingham
Herne Bay
Margate
Canterbury
Bath
Trowbridge
Kingsclere
Basingstoke
Guildford
Tonbridge
Maidstone
Deal
Weston-super-Mare
Bristol Channel
Radstock
Frome
Andover
Aldershot
North Downs
Reigate
Tunbridge Wells
Ashford
Dover
Bridgwater
Street
Amesbury
Salisbury
Winchester
Haslemere
Horsham
Crowborough
Hythe
Folkestone
New Romney
Taunton
Wiveliscombe
Gillingham
South Downs National Park
Haywards Heath
Yeovil
Whitsbury
Totton
Southampton
Waterlooville
Brighton
Bexhill
Hastings
Eastbourne
Tiverton
Chard
Crewkerne
Wimborne Minster
Ferndown
Portsmouth
Chichester
Worthing
Crediton
Honiton
Cerne Abbas
New Forest
Gosport
Exeter
Seaton
Poole
Bournemouth
Newport
Shanklin
Weymouth
Exmouth
Easton
Torquay
Paignton
Ostend
Bruges
Zedelgem
Ruddervoorde
Roeselare
Ypres
Ieper
Kortrijk
Mouscron
Wevelgem
Lille
Loos
Grande-Synthe
Dunkirk
Calais
Poperinge
Wimereux
St.-Omer
Boulogne-sur-Mer
Hazebrouck
Etaples
Bruay-la-Buissière
Lievin
Lens
Douai
Berck-sur-Mer
Saint-Pol-sur-Ternoise
Arras
Arleux
Fort-Mahon-Plage
Auxi-le-Château
Cayeux-sur-Mer
Doullens
Abbeville
Naours
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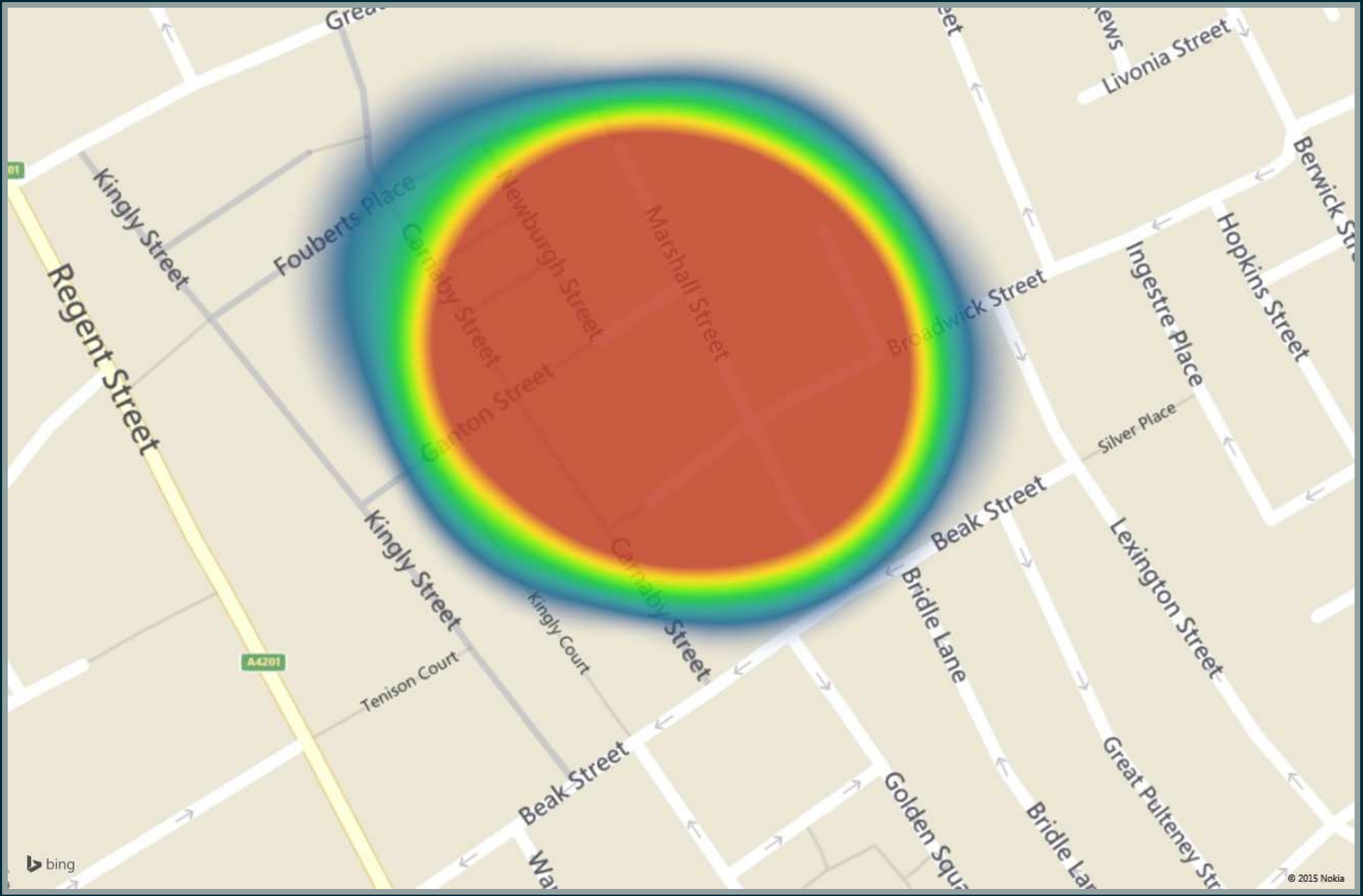
MODERN DATA VISUALIZATION


Livonia Street
Berwick Str
Hopkins Street
Ingestre Place
Broadwick Street
Silver Place
Beak Street
Lexington Street
Great Pulteney Str
Bridle Lane
Golden Squa
Bridle La
Marshall Street
Newburgh Street
Carnaby Street
Ganton Street
Fouberts Place
Kingly Street
Regent Street
A4201
Kingly Court
Tenison Court
Beak Street
bing
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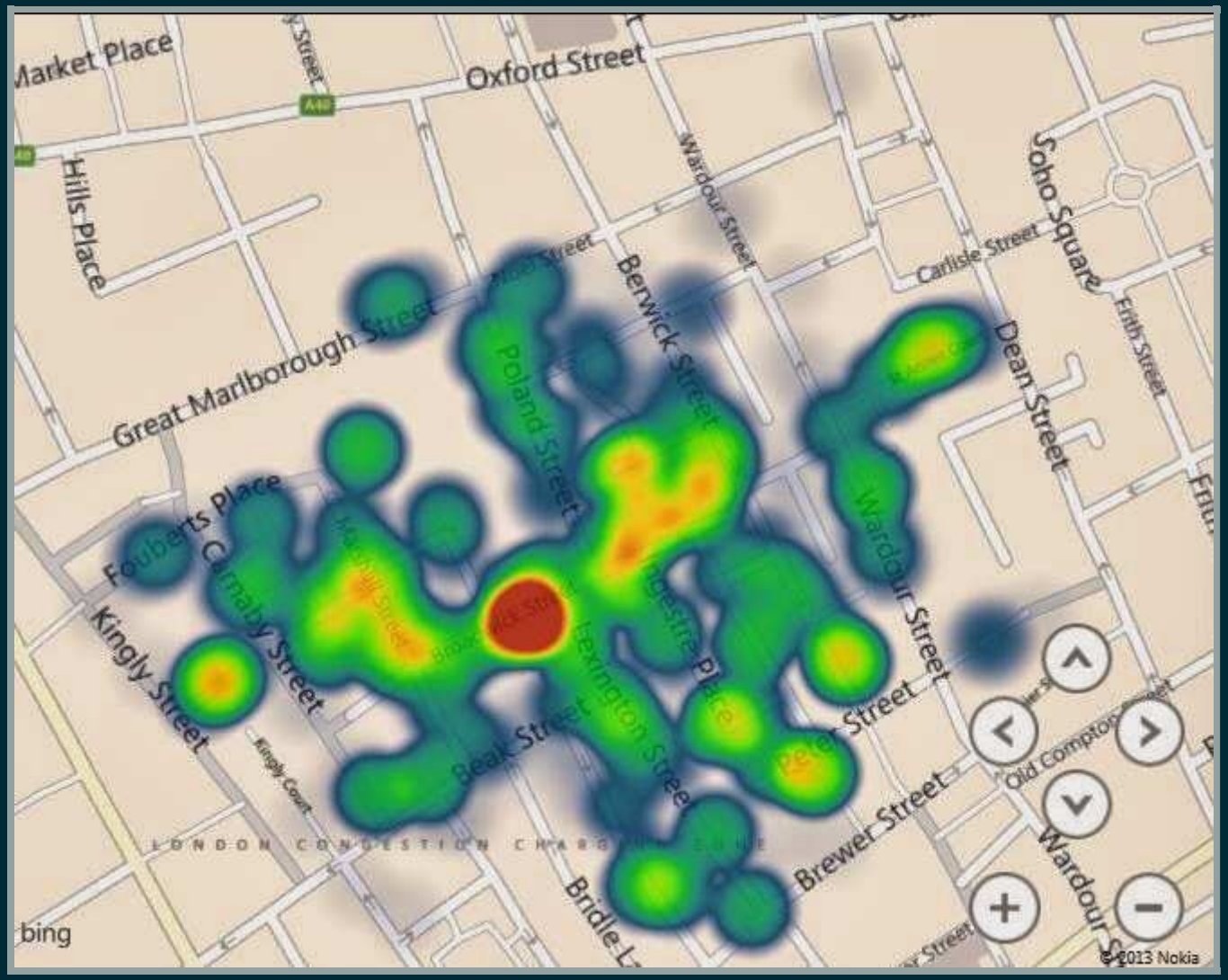
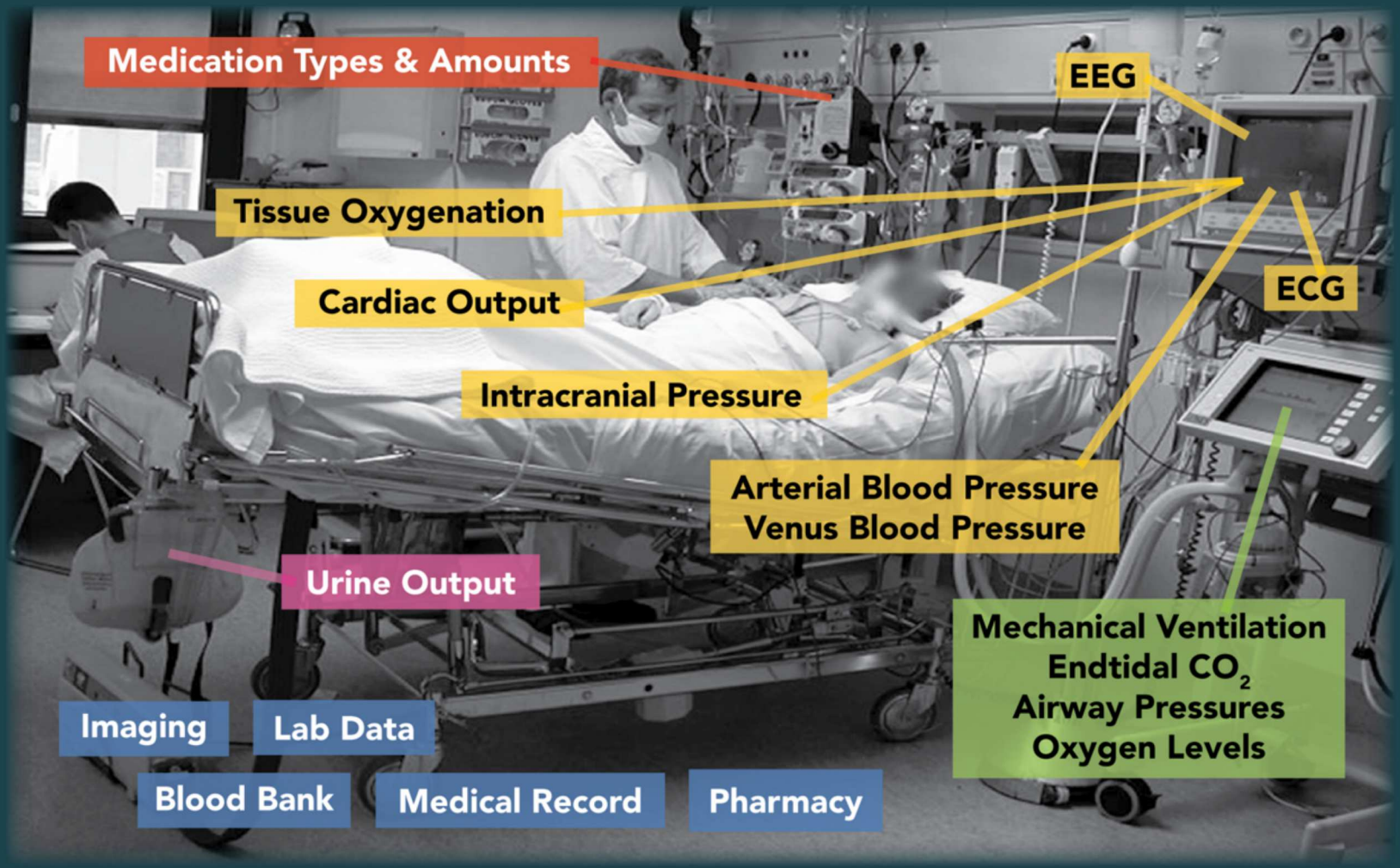
MODERN DATA VISUALIZATION



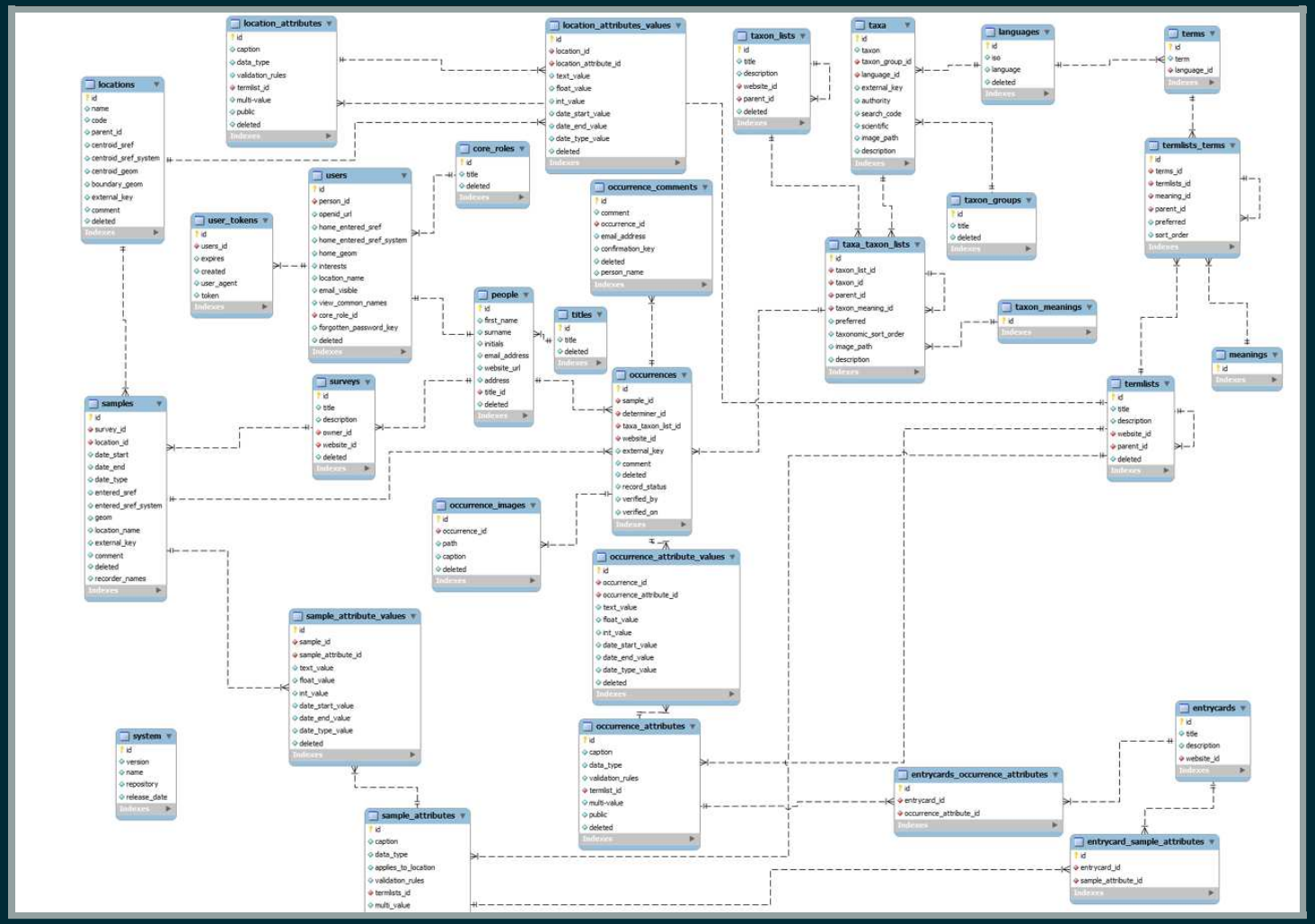
HEALTHCARE DATA

HEALTHCARE DATA

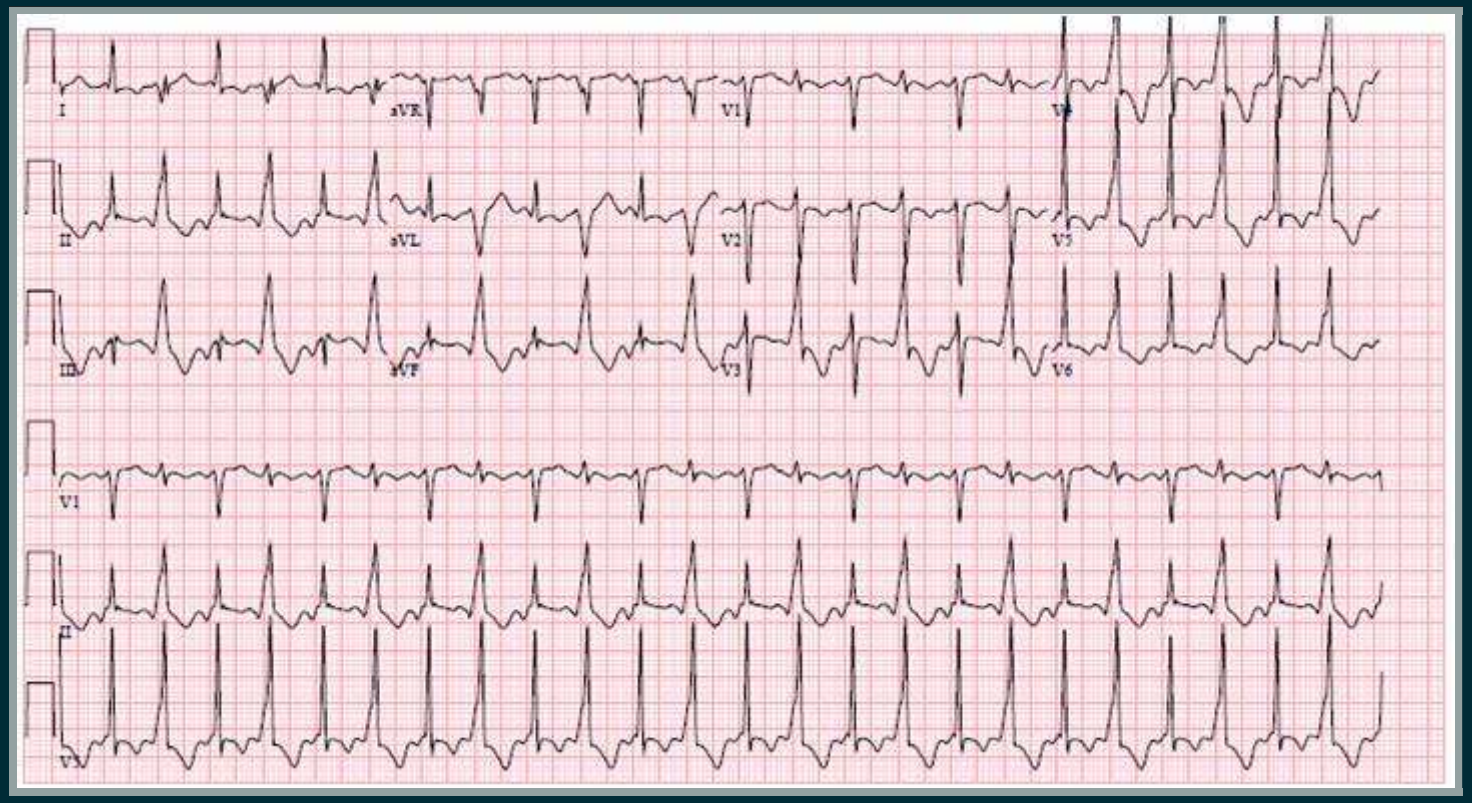


UNSTRUCTURED DATA

STRUCTURED DATA



MACHINE-GENERATED DATA



ELECTRONIC HEALTH RECORD

Mike Gonzoles Gender: M DOB: 01/04/1954 MRN: 00000673 FIN: 948847744990 Visit Reason: **Dyspnea/Chest Pain**

This page is not a complete source of visit information.

Inpatient Summary

- A + A Collapse All Summary Menu Results

Patient Information

Room/Bed:	3-18/1
Admitting Diagnosis:	Congestive Heart Failure (428.0)
Admit Date:	06/20/2009
Primary Physician:	Angela Brown, MD
Emergency Contact:	Carol Gonzoles
Emergency #:	(913) 123-4455
Code Status:	**Full Code**

Diagnosis (4) Active

- Acute Renal Failure (584.9)
- Congestive Cardiomyopathy (425.9)
- Congestive Heart Failure (428.0)
- Unstable Angina (411.1)

Problems (8) Active

- Alcoholism (303.90)
- Diabetes (249)
- Esophageal Reflux (530.81)
- Esophageal Varices (456.1)
- Hepatic Artery Embolism (902.22)
- Hypertension (997.91)
- Peripheral Vascular Disease (443.9)
- Site-specific Disorder of Skin (709.9)

Allergies (3) Active

	Reaction
ACE Inhibitors	**Lips Swelling**
Peanuts	**Rash**
Dust	Sneezing

Medications (15) Active

Scheduled (5)

Vitals Last 10 days

	Latest	within	Since 06/23 07:00 Min / Max	Previous 24 hours Min / Max
Temp. degC	↑39	15 min	↑36.5/39	37/37.5
Systolic BP mm/Hg	120	15 min	↑120/190	120/120
Diastolic BP mm/Hg	80	15 min	80/115	90/115
RR br/min	18	15 min	18/20	14/20
HR bpm	78	15 min	! 60/78	72/76
O_2Sat %	99	15 min	↓90/97	99/99
Glu (POC) mg/dL	--	Ordered	81/110	↑90/170

<Previous | Next>

Measurements and Weights Last 14 days

	Latest	within	Previous	within	Change
Weight kg	90	1h	91.4	2d	+1.4
Height cm	180	2d	180	2d	0
BMI	24.4	2d	24.4	2d	0

<Previous | Next>

Intake and Output 06/22/09 09:00 - Current

	Since 06/23 07:00	Previous 24 hours
Total Fluid Intake mL	201.2	1.135
- IV mL	72.5	140
Total Urine Output mL	50	200.4
- Urine mL/kg/hr	0.28	0.625
Stools	0	2
Last Diet Order	2000 kcal 1...	NPO

<Previous | Next>

Diagnostics (7) Last 10 days

	Latest	Status	Previous	Status
EKG (1)				
EKG 12-lead	1 hr	Completed	3 mo	Completed
Chest/Abd XR (1)				

Labs Last 10 days

	Latest	within	Previous	within
WBC x10(3)/mcL	6.5	15 min	↓4.0	16 h
Hemoglobin gm/dL	15	15 min	15	16 h
Hematocrit %	45	15 min	45	16 h
Platelets x10(3)/mcL	250	15 min	280	16 h
Sodium mEq/L	↑145	15 min	140	16 h
Potassium mEq/dL	4.0	15 min	3.9	16 h
CO2 mm/Hg	38	15 min	37	16 h
Chloride mEq/L	100	15 min	99	16 h
Creatinine g/24hr	1.0	15 min	1.0	16 h
BUN mg/dL	↓6.0	15 min	8.0	16 h
Glucose mg/dL	↓60	15 min	80	16 h
Magnesium mg/dL	2.0	15 min	1.6	16 h
Phosphorus mg/dl	3.0	15 min	3.0	16 h
Calcium mg/dL	9.2	15 min	10.0	16 h
PT s	13.0	15 min	13	16 h
INR	1.0	15 min	1.0	16 h
PTT s	22	15 min	24	16 h
Troponin ng/mL	--	Ordered	0.3	5 h
CK-MB ng/mL	--	Ordered	2	5 h
CK	--	Ordered	2	5 h

<Previous | Next>

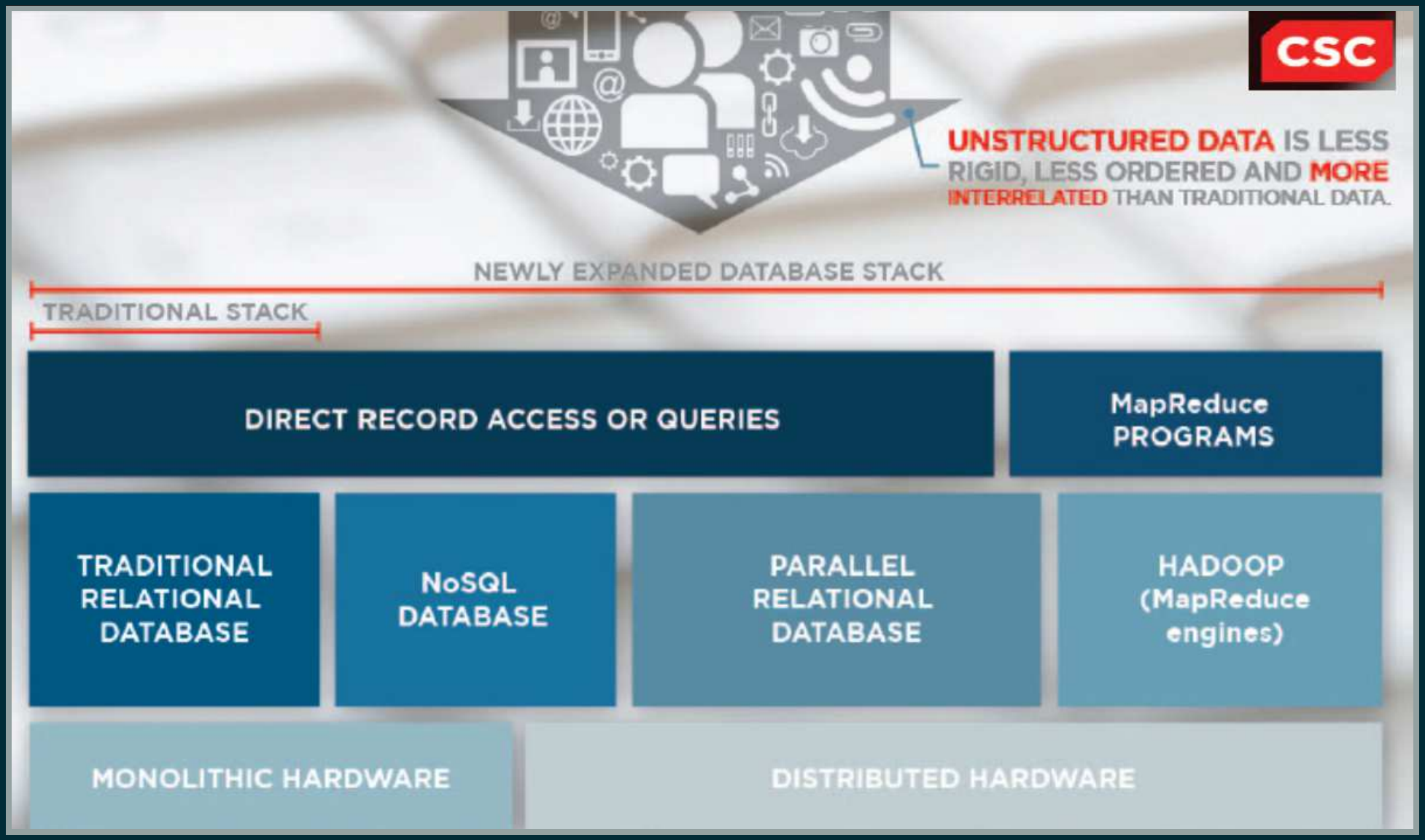
Microbiology (3)

Source/Site	Collected within	Normality	Status
Blood, Left Arm	2 d	**Growth**	**Final**
Blood, Right Arm	1 h	--	Pending
Urine	1 h	--	Pending

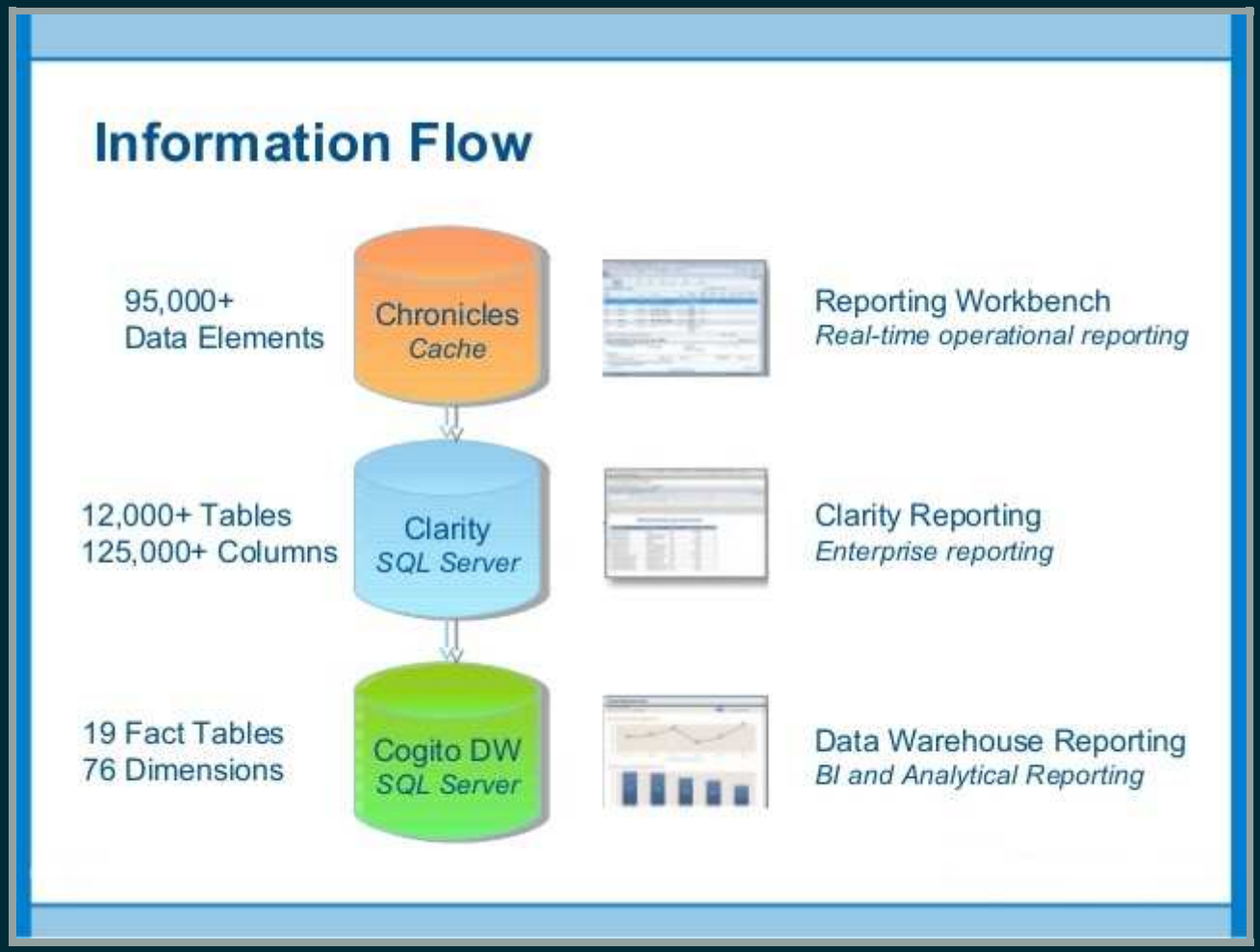
Pathology Last 5 results

	Verified Date
Surgical Pathology Report	04/23/09

HOW TO STORE THIS



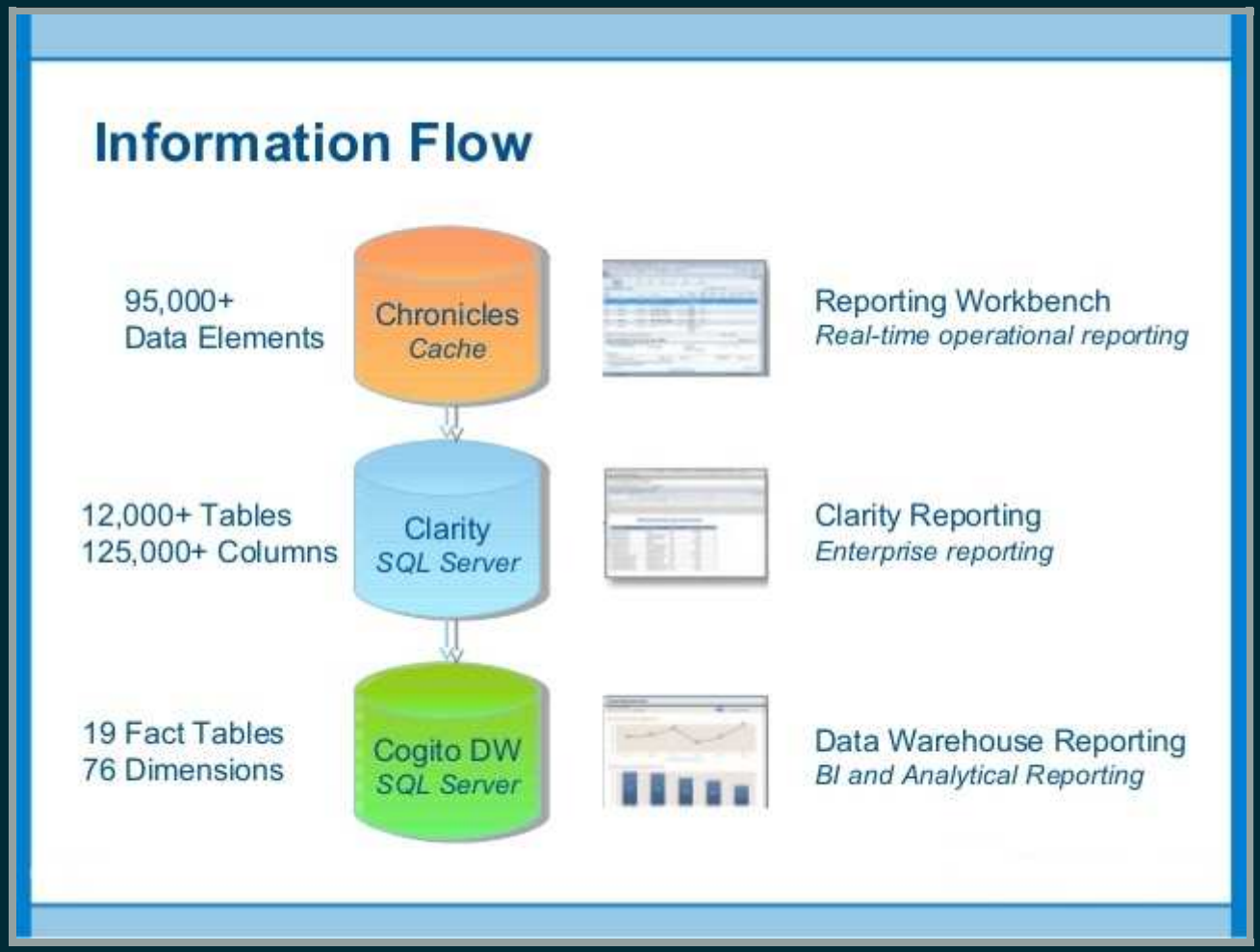
HOW TO STORE THIS (EPIC)



ANALYSIS

OR, WE HAVE ALL THIS DATA, NOW WHAT?

ANALYSIS EPIC



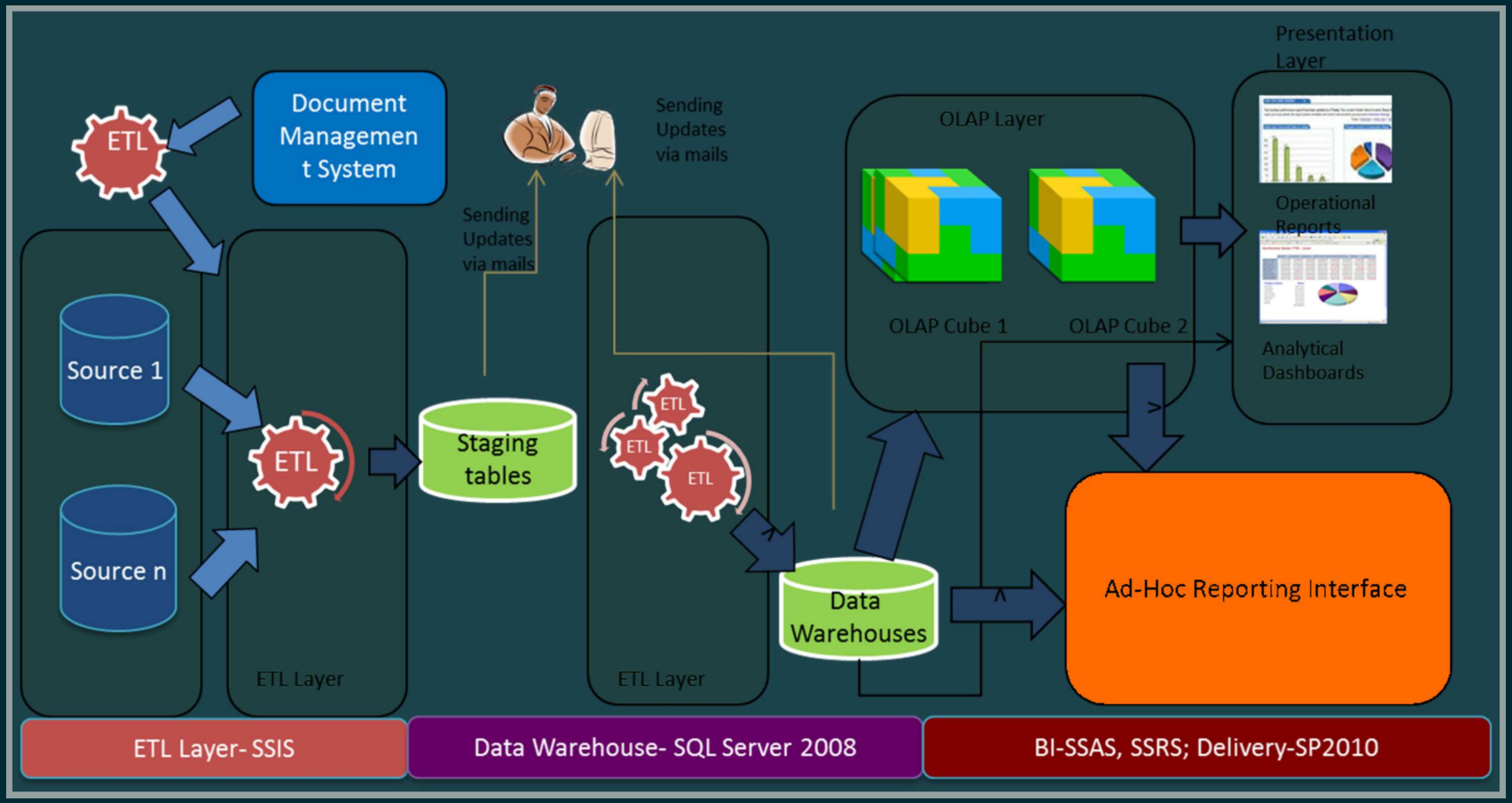
CLINICAL DECISION SUPPORT (CDS)

(REPORTING WORKBENCH)

- Basic
  - Clinical Calculators
  - Flowsheets
- Advanced
  - Alerts (drug, alergy, rules)
  - Reminders

TRADITIONAL REPORTING

(CLARITY REPORTING)



EXAMPLE: UNPLANNED SELF-EXTUBATION

Report User Department Name

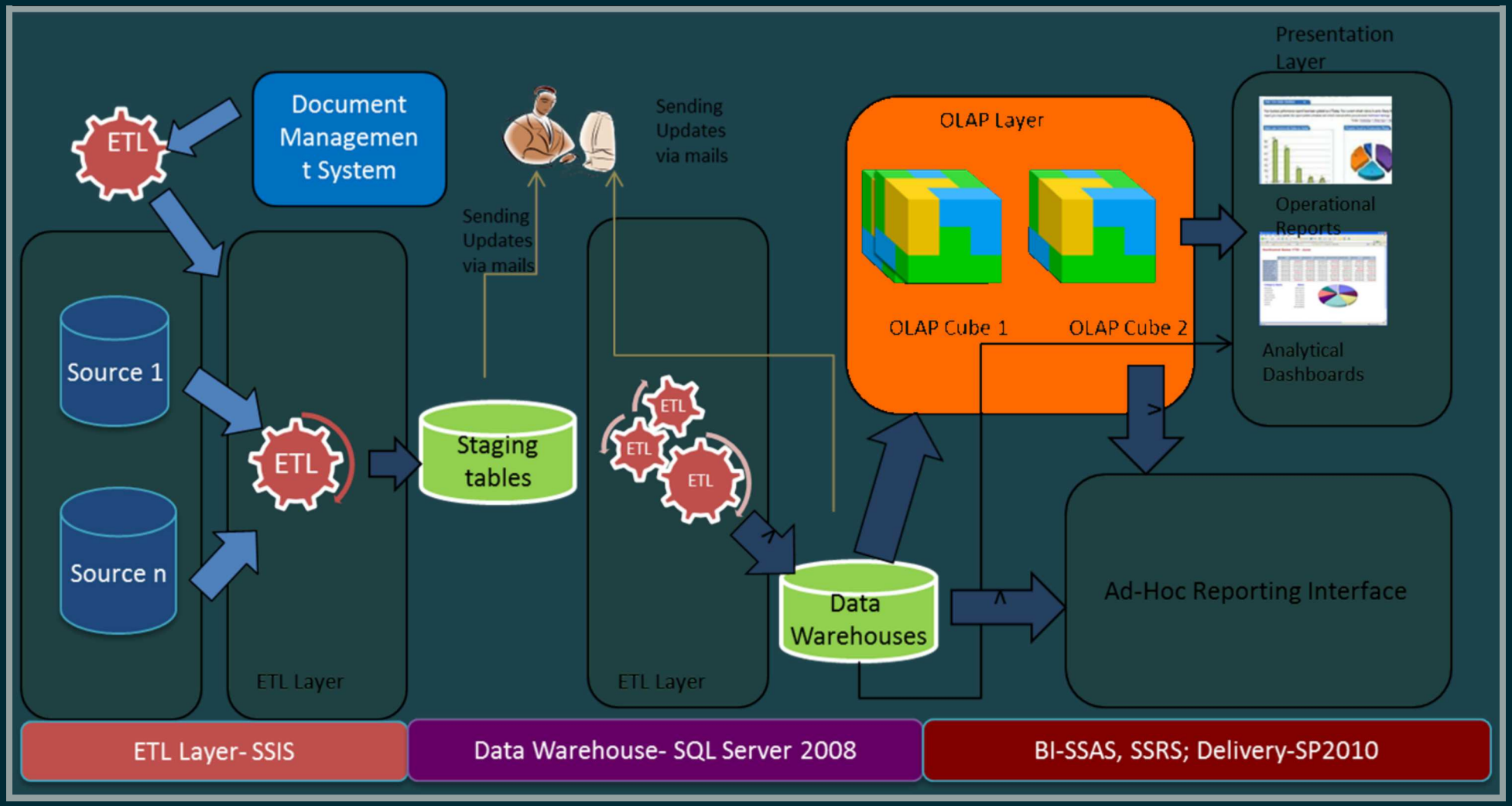
MetroHealth

Unplanned Extubation by Patient **Draft Version. For Internal Use Only.**

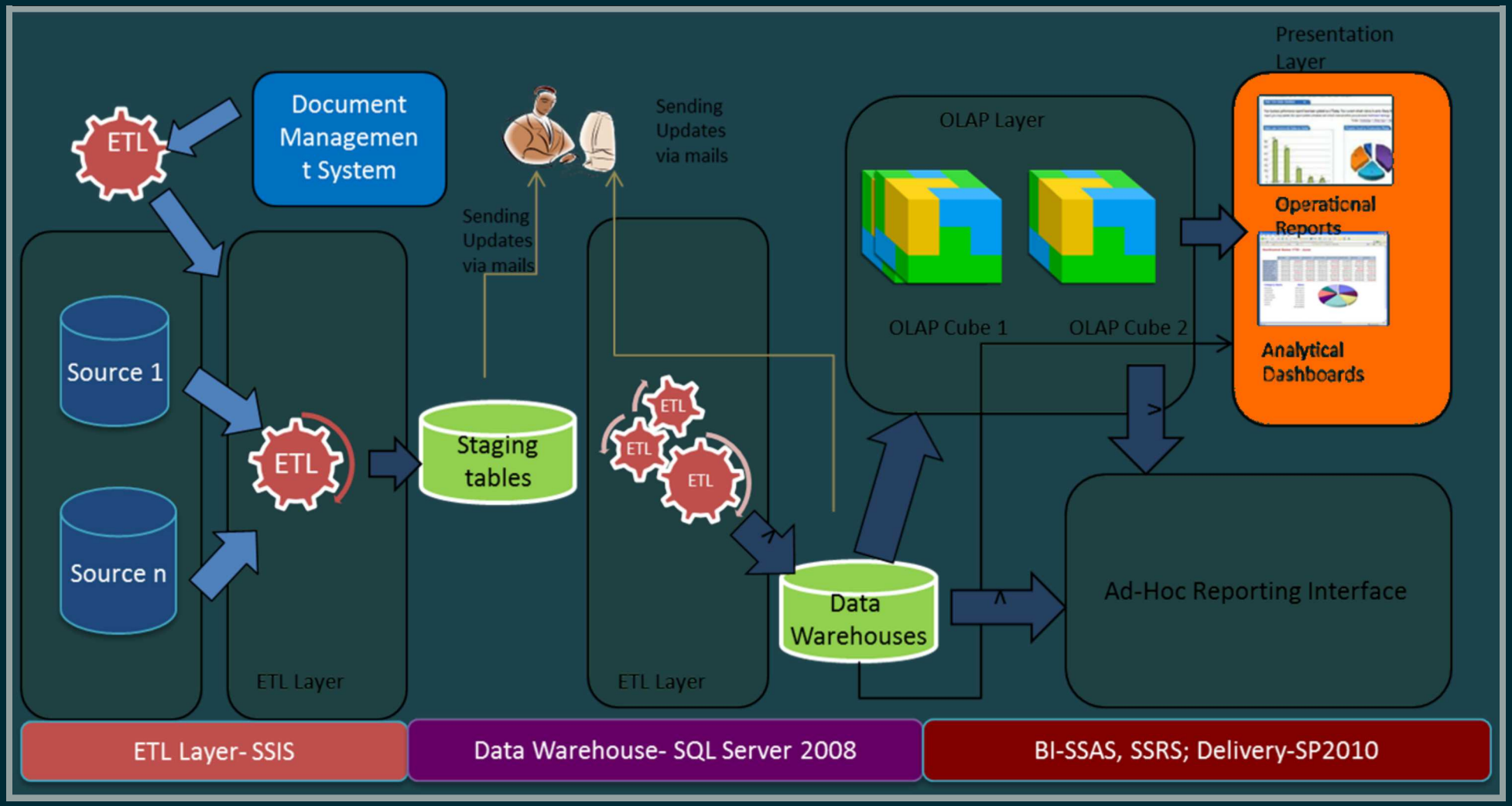
Selected Date Range: 03/04/14 to 09/03/14

Patient MRN	Date/Time of Extubation
[redacted]	4/28/2014 2:30:00AM
	Removal Date/Time: 04/28/14 0230 Placement Date/Time: 04/27/14 1500 Placed By: Licensed provider Airway Device: ETT- Cuffed Size (mm): 8 mm Not present on admission: Not present Removed By: Patient Removal Reason: Unplanned extubation
[redacted]	5/12/2014 7:21:00PM
	Removal Date/Time: 05/12/14 1921 Placement Date/Time: 05/12/14 1912 Present on Admission: Present Placed By: In place on arrival to facility Airway Device: Nasal pharyngeal airway Removed By: Patient Removal Reason: Unplanned extubation
[redacted]	5/23/2014 5:00:00AM
	Removal Date/Time: 05/23/14 0500 Placement Date/Time: 05/21/14 2223 Placed By: In ED Airway Device: ETT- Cuffed Size (mm): 8 mm Placement Verified By:: Auscultation;Chest X-ray Removed By: Patient Removal Reason: Unplanned extubation
[redacted]	8/13/2014 12:00:00AM
	Removal Date: 08/13/14 Placement Date/Time: 08/11/14 0419 Placed By: In ED Airway Device: ETT- Uncuffed Size (mm): (c) 8 mm Placement Verified By:: Auscultation Removed By: Patient Removal Reason: Unplanned extubation

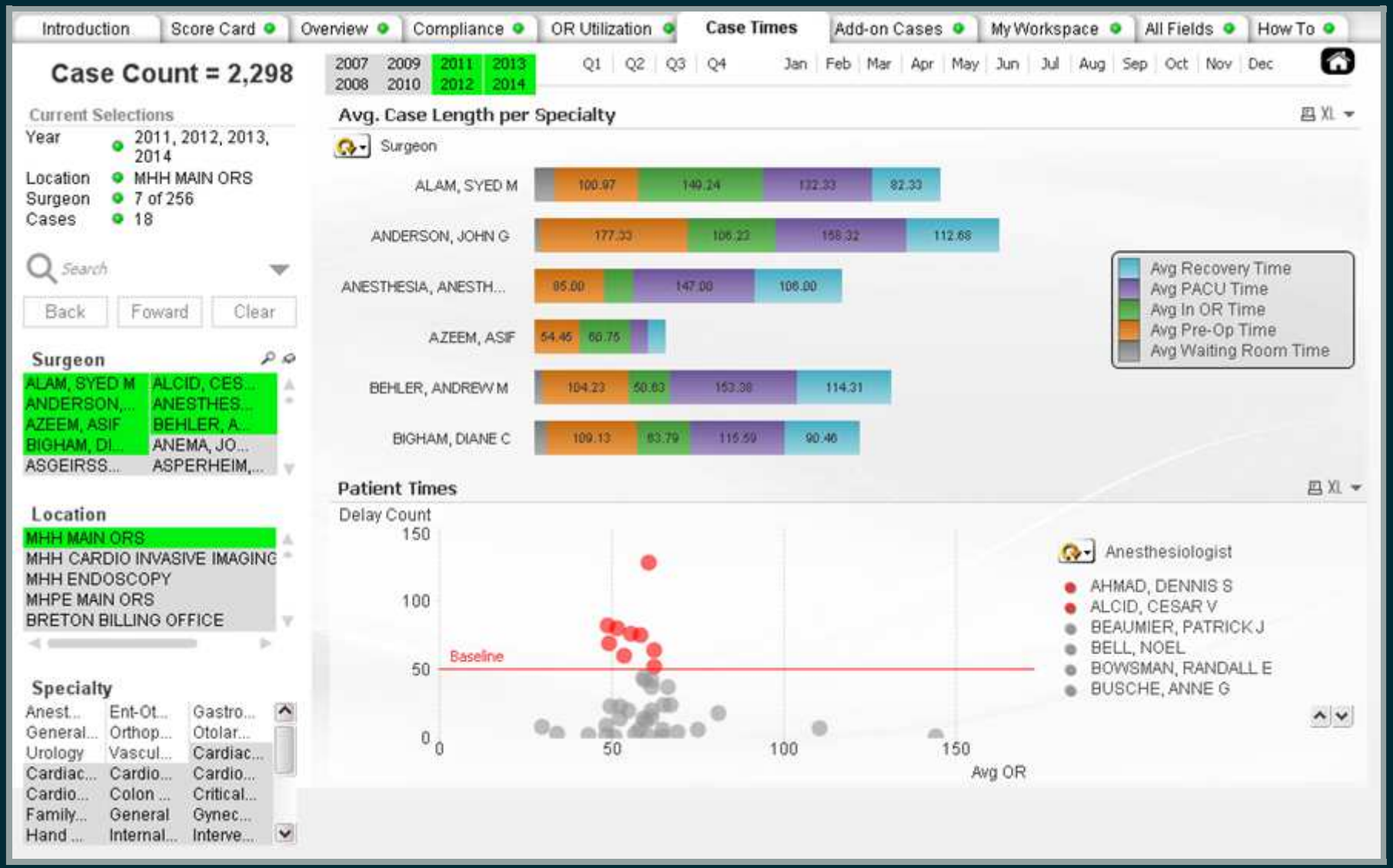
OLAP CUBES


Presentation Layer
ETL
Document Managemen t System
Sending Updates via mails
Sending Updates via mails
OLAP Layer
Operational Reports
OLAP Cube 1
OLAP Cube 2
Analytical Dashboards
Source 1
ETL
Staging tables
ETL
ETL
ETL
Source n
Data Warehouses
Ad-Hoc Reporting Interface
ETL Layer
ETL Layer
ETL Layer- SSIS
Data Warehouse- SQL Server 2008
BI-SSAS, SSRS; Delivery-SP2010

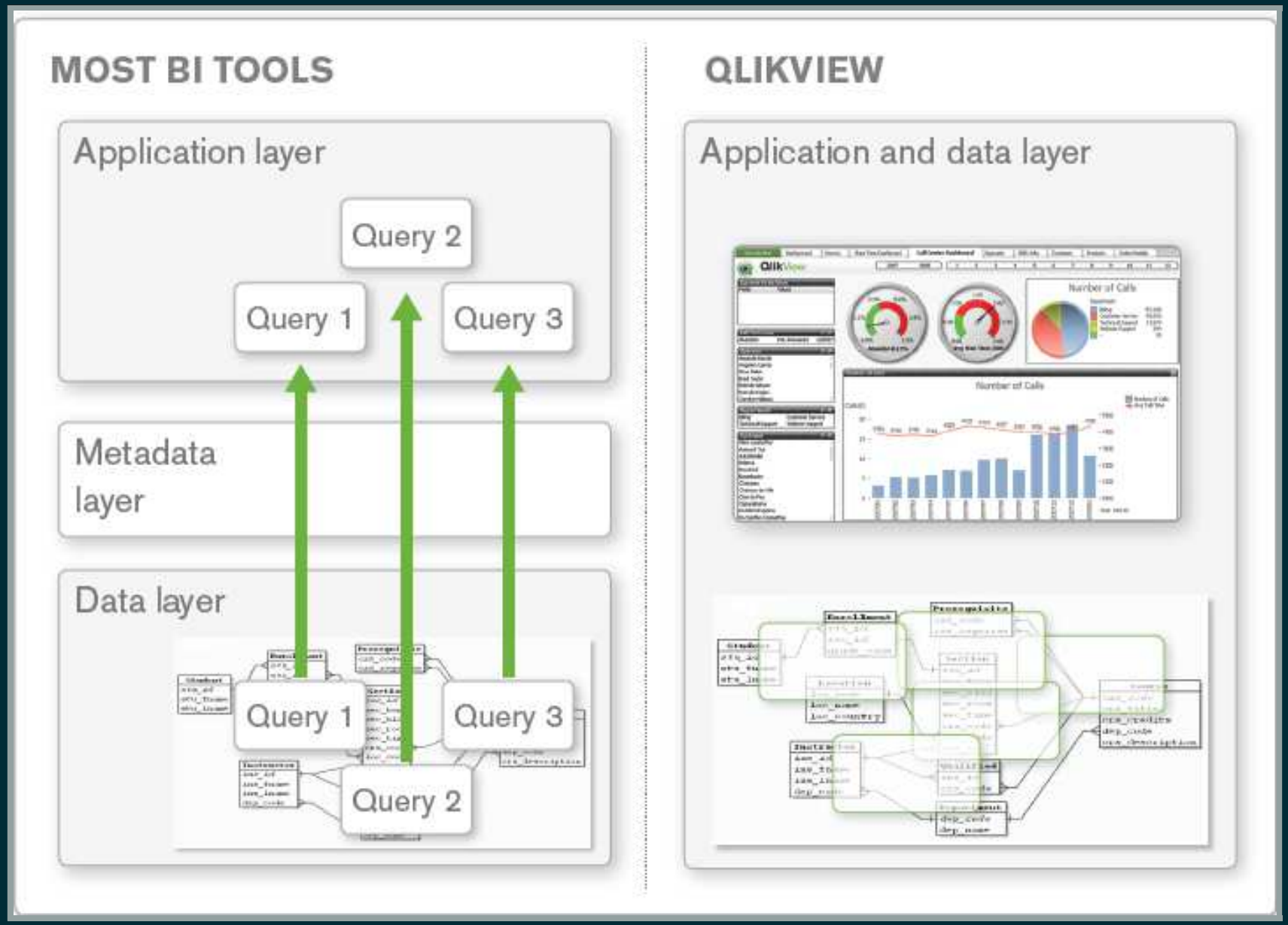
VISUALIZATION AND SELF DISCOVERY



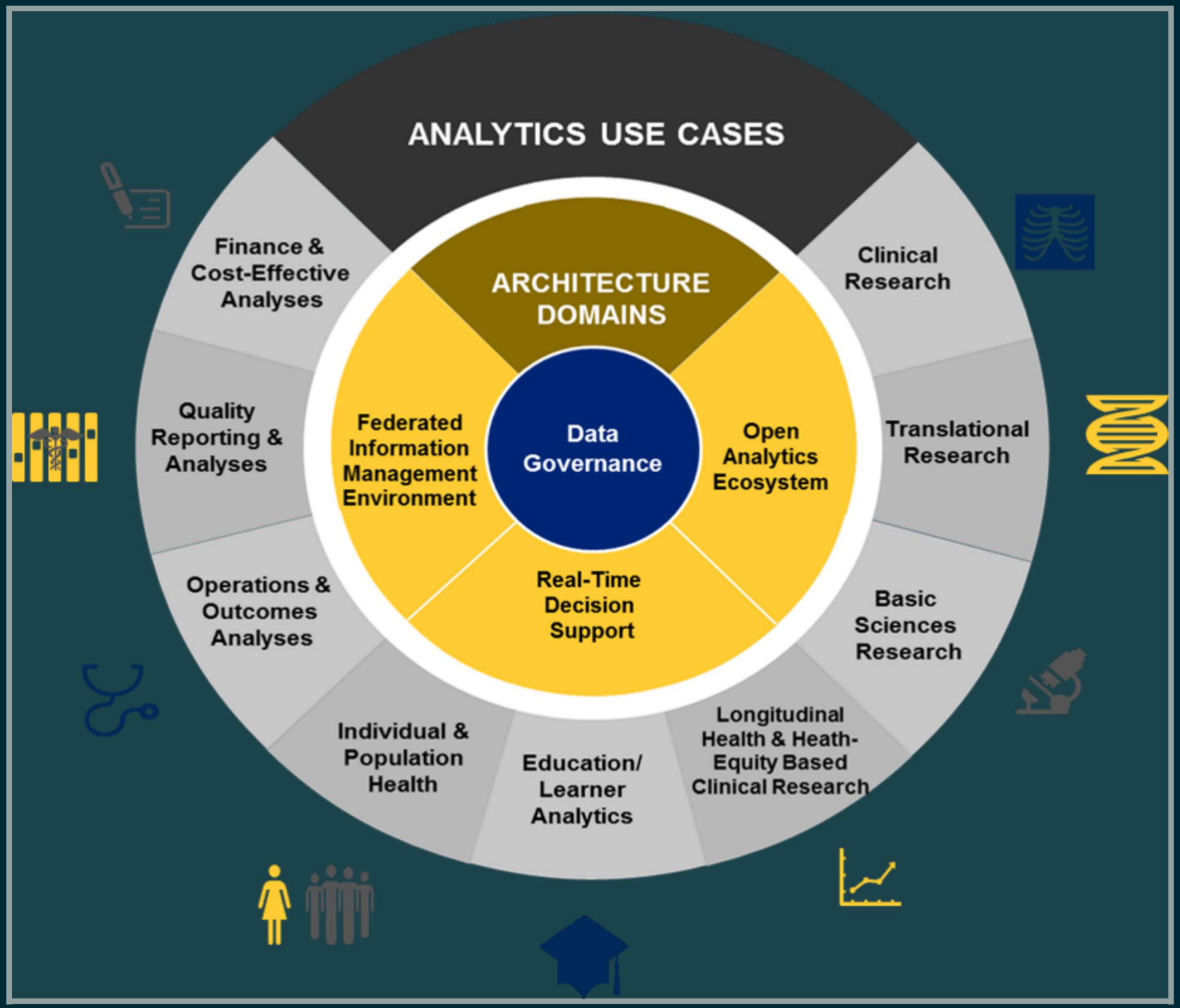
QLIKVIEW EXAMPLE



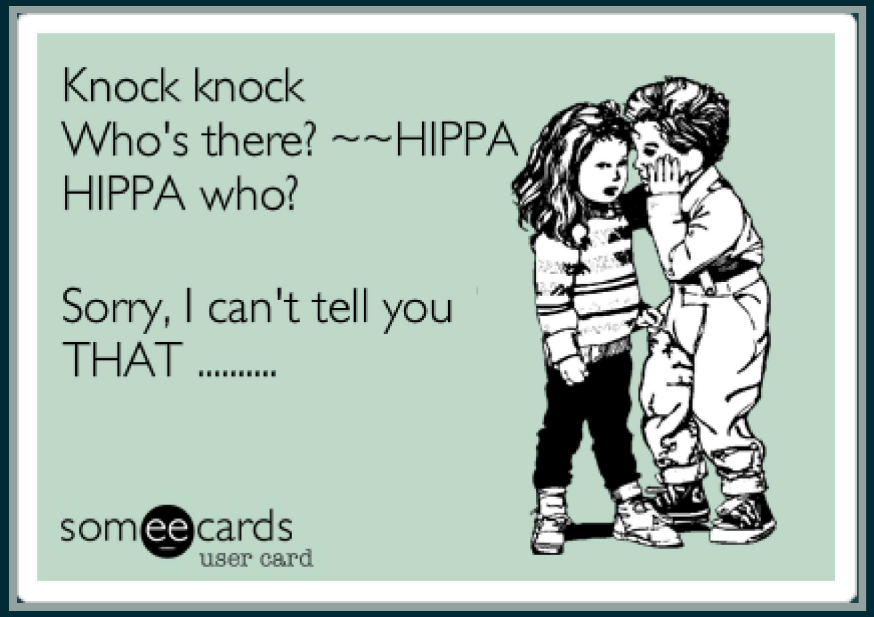
ASSOCIATIVE MODEL



GOVERNANCE


ANALYTICS USE CASES
ARCHITECTURE DOMAINS
Data Governance
Federated Information Management Environment
Open Analytics Ecosystem
Real-Time Decision Support
Finance & Cost-Effective Analyses
Clinical Research
Quality Reporting & Analyses
Translational Research
Operations & Outcomes Analyses
Basic Sciences Research
Individual & Population Health
Education/ Learner Analytics
Longitudinal Health & Heath-Equity Based Clinical Research

HIPAA


Knock knock
Who's there? ~~HIPPA
HIPPA who?
Sorry, I can't tell you
THAT .....
someecards
user card

HIPAA

(HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT)

- Whos Covered
  - Health care providers
  - Health plans
  - Healthcare clearinghousess

HIPAA

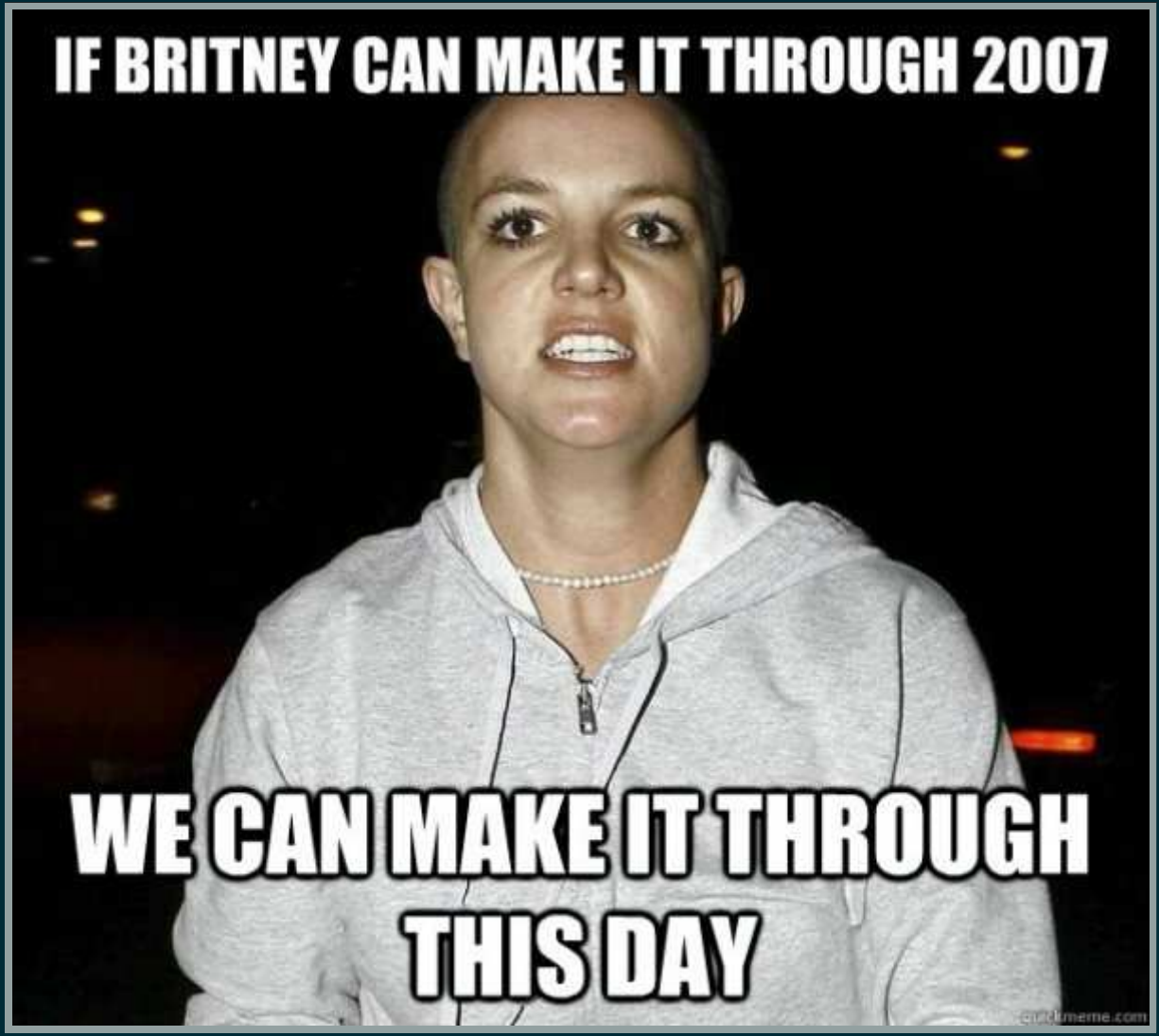
- HIPAA Patient Goals
  - Control information
  - Right to see their records and correct any mistakes on them
  - Right to know who has seen their information

HIPAA

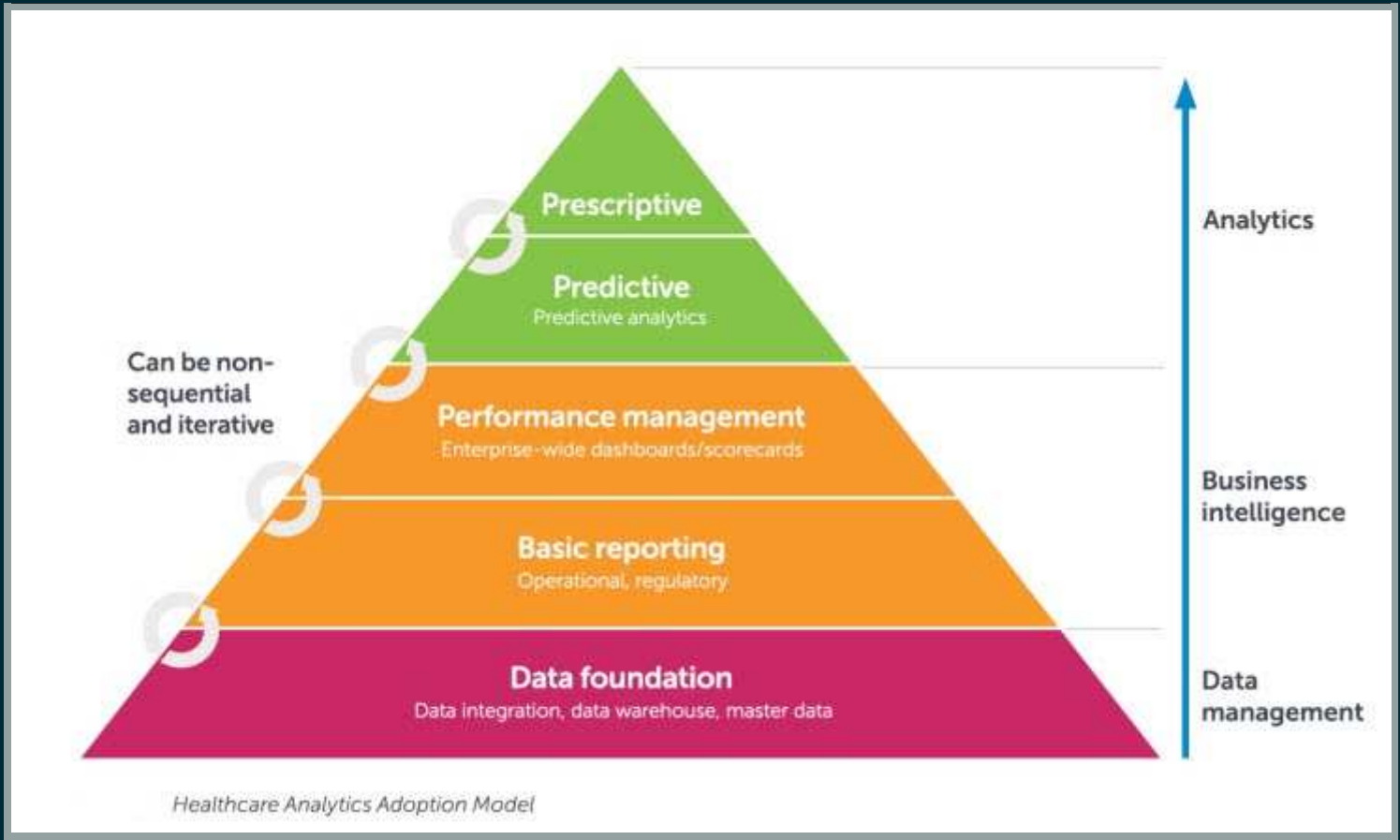
- HIPAA Institution Goals
  - Protect patient information
  - Limit use of patient information
  - Pentalize those who misuse information

HIPAA HAS TEETH

Violation Type	Each Violation	Repeat Violations
Did Not Know	$100 - $50,000	$1.5 Million
Reasonable Cause	$1,000 - $50,000	$1.5 Million
Willful Neglect - Corrected	$10,000 - $50,000	$1.5 Million
Willful Neglect - Not Corrected	$50,000	$1.5 Million


IF BRITNEY CAN MAKE IT THROUGH 2007
WE CAN MAKE IT THROUGH THIS DAY

WHAT'S NEXT?

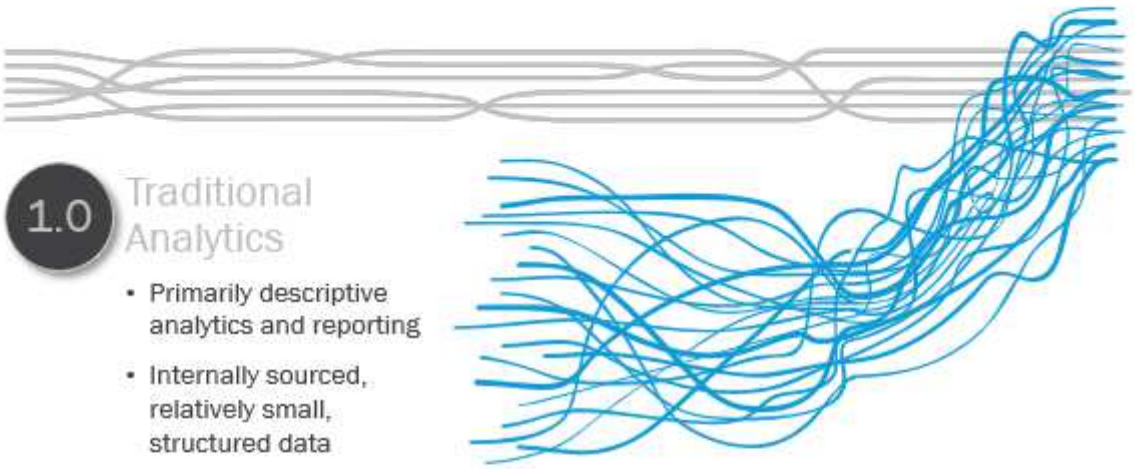

Prescriptive
Predictive
Predictive analytics
Performance management
Enterprise-wide dashboards/scorecards
Basic reporting
Operational, regulatory
Data foundation
Data integration, data warehouse, master data
Can be non-sequential and iterative
Analytics
Business intelligence
Data management
Healthcare Analytics Adoption Model

ANALYTICS 1.0 | TRADITIONAL ANALYTICS

1.0 Traditional Analytics

- Primarily descriptive analytics and reporting
- Internally sourced, relatively small, structured data
- "Back room" teams of analysts
- Internal decision support

ANALYTICS 2.0 | THE BIG DATA ERA



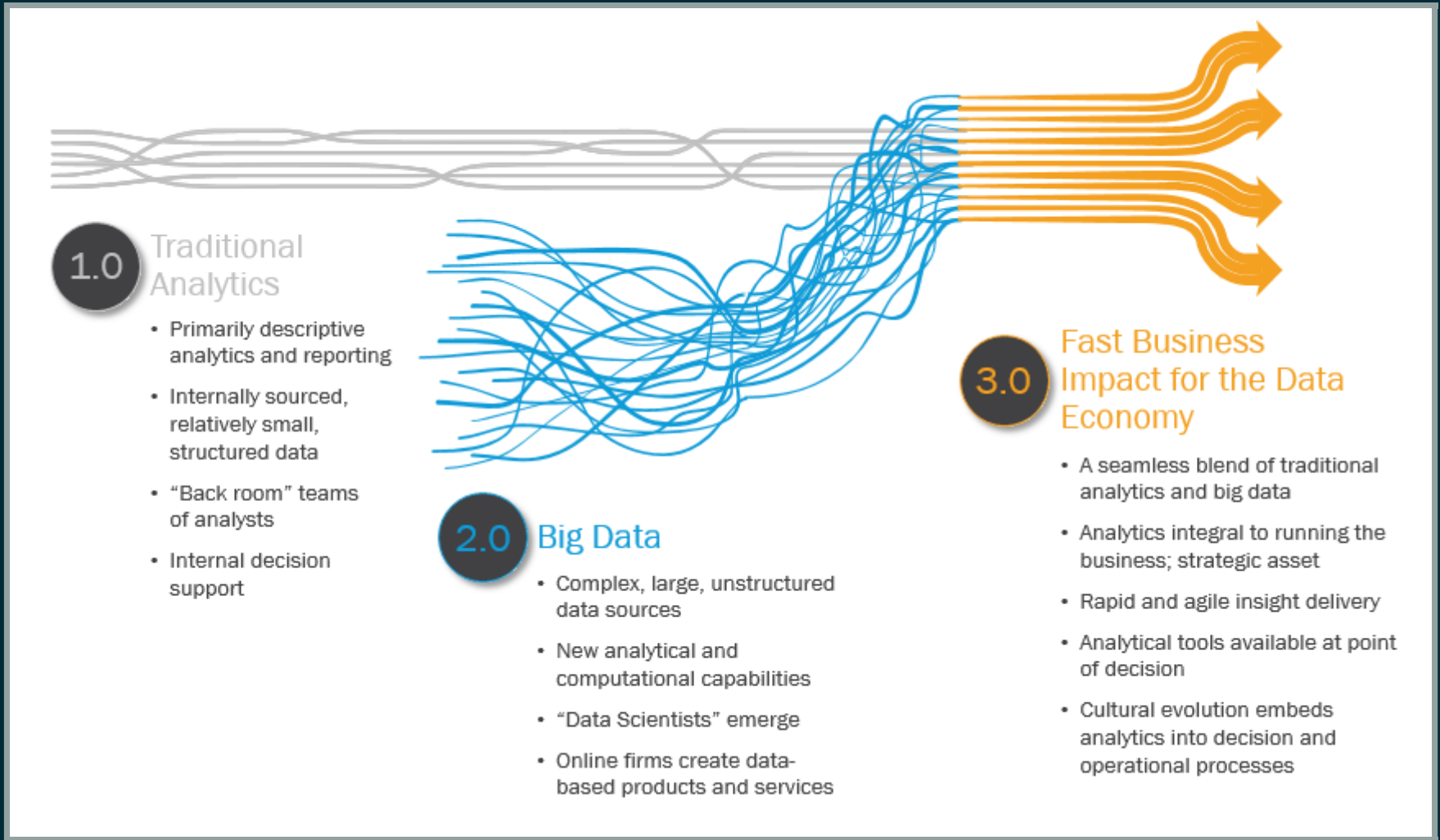
1.0 Traditional Analytics

- Primarily descriptive analytics and reporting
- Internally sourced, relatively small, structured data
- "Back room" teams of analysts
- Internal decision support

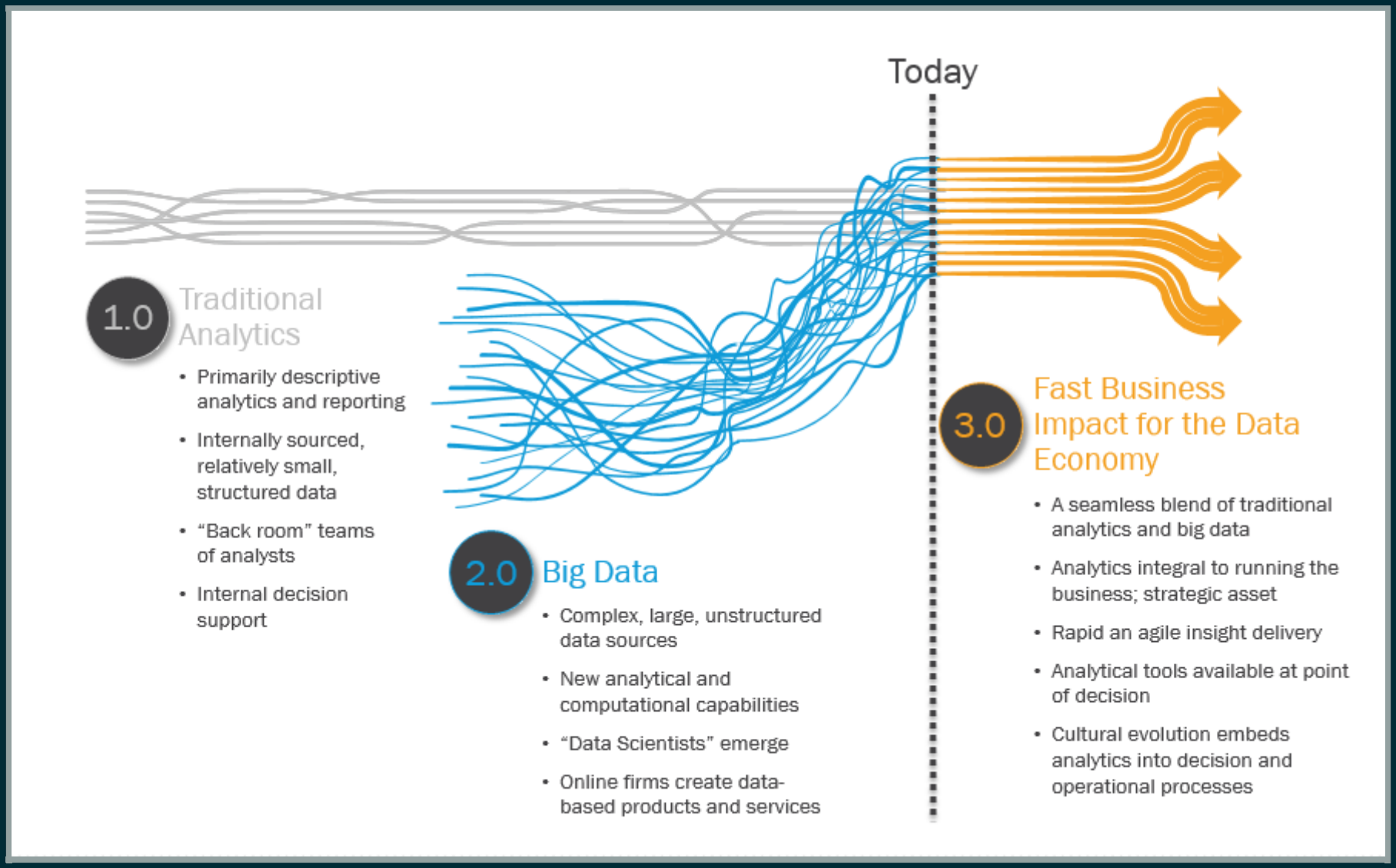
2.0 Big Data

- Complex, large, unstructured data sources
- New analytical and computational capabilities
- "Data Scientists" emerge
- Online firms create data-based products and services

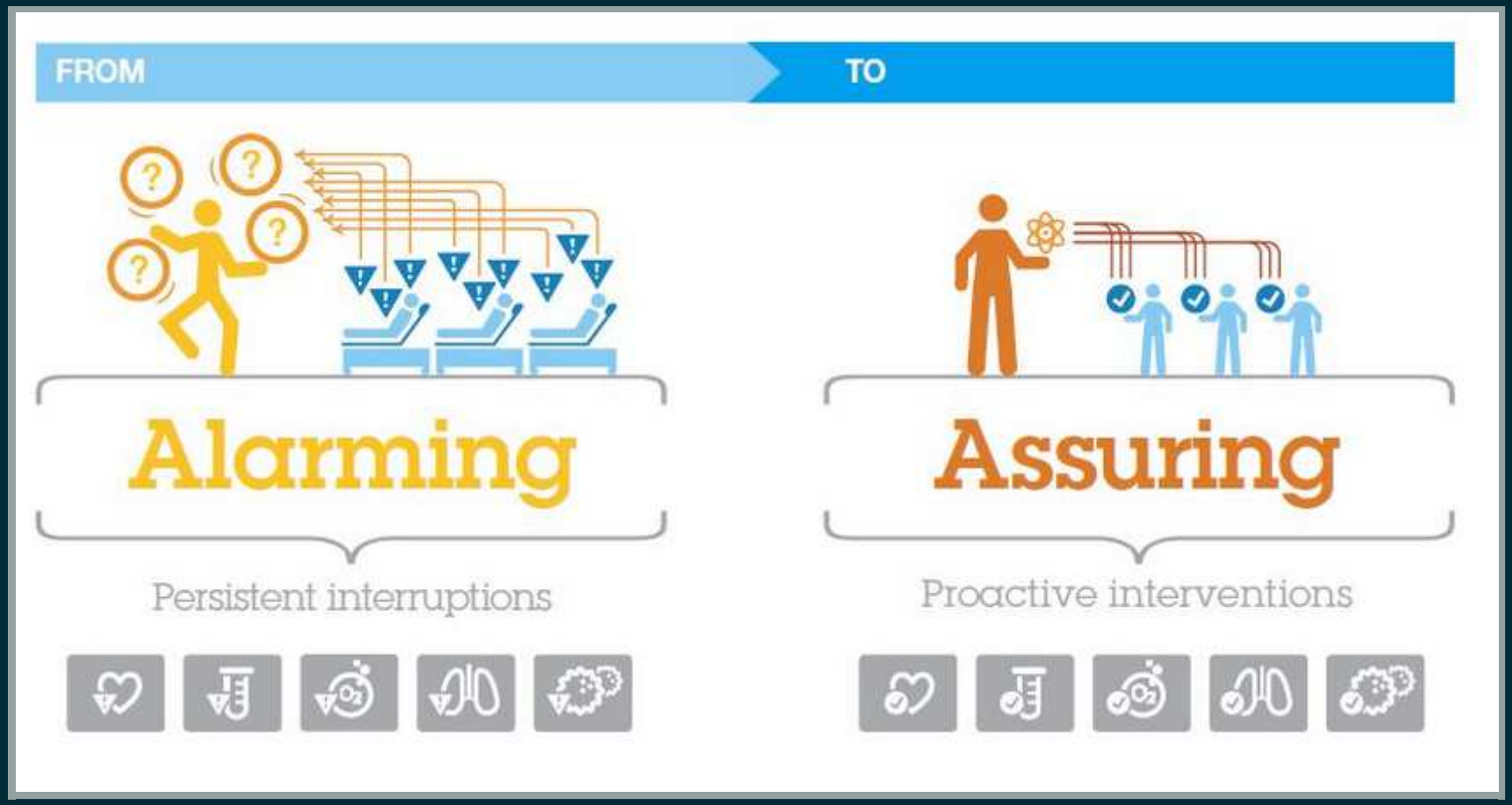
ANALYTICS 3.0 | DATA DRIVEN DECISIONS



ANALYTICS | TODAY

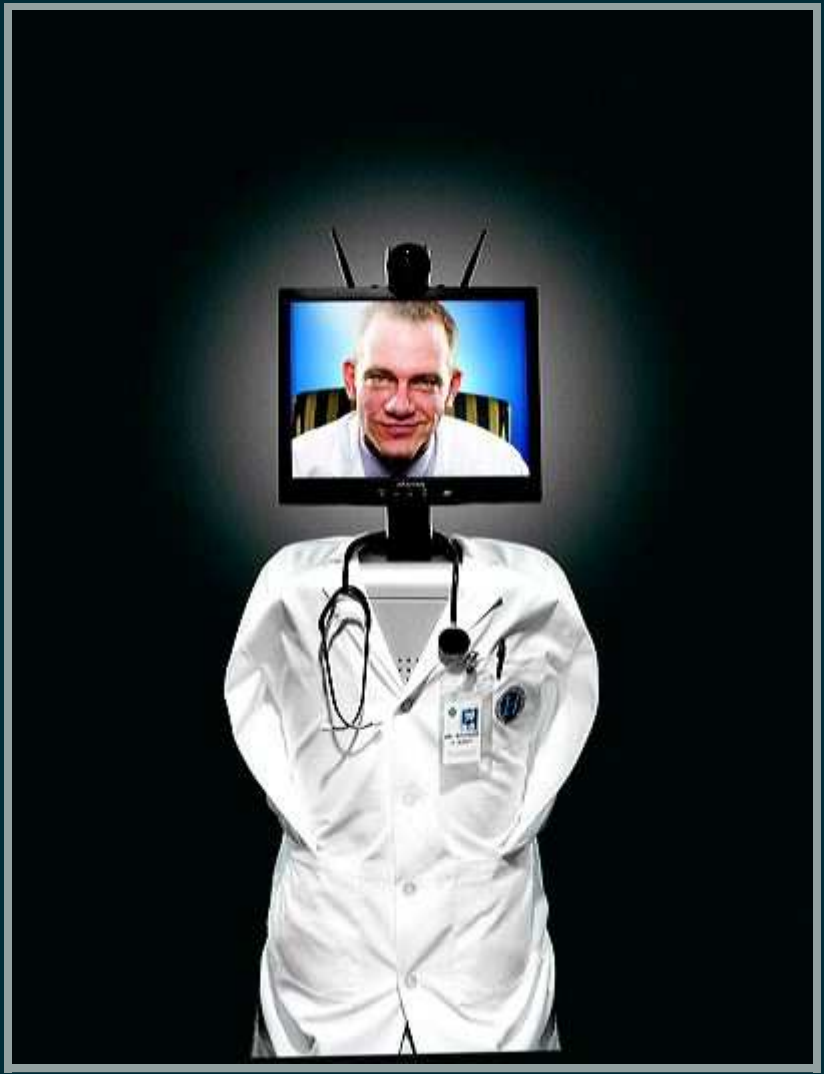


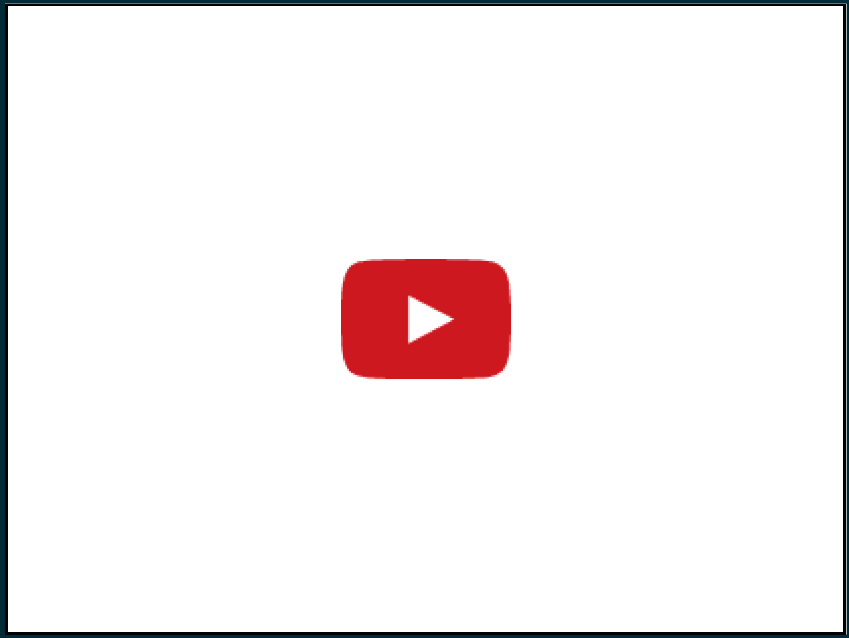
PROACTIVE INTERVENTION



PERSONAL TRACKING

TELEMEDICINE





QUESTIONS?