
Data Driven Analytics for Personalized Healthcare

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19th May 2018

Agenda

- ✓ What is Real World Data?
- ✓ Difference between RCT and RWD
- ✓ ICDA - Data driven healthcare analytics platform
- ✓ Patient Similarity Analytics
- ✓ Data-Driven Visual Exploration of Similar Patients
- ✓ Data Driven Analytics Tools – Watson Advisor, HL7, FHIR
- ✓ Conclusion

What is Real Word Data (RWD)?

Real-World Data (RWD)

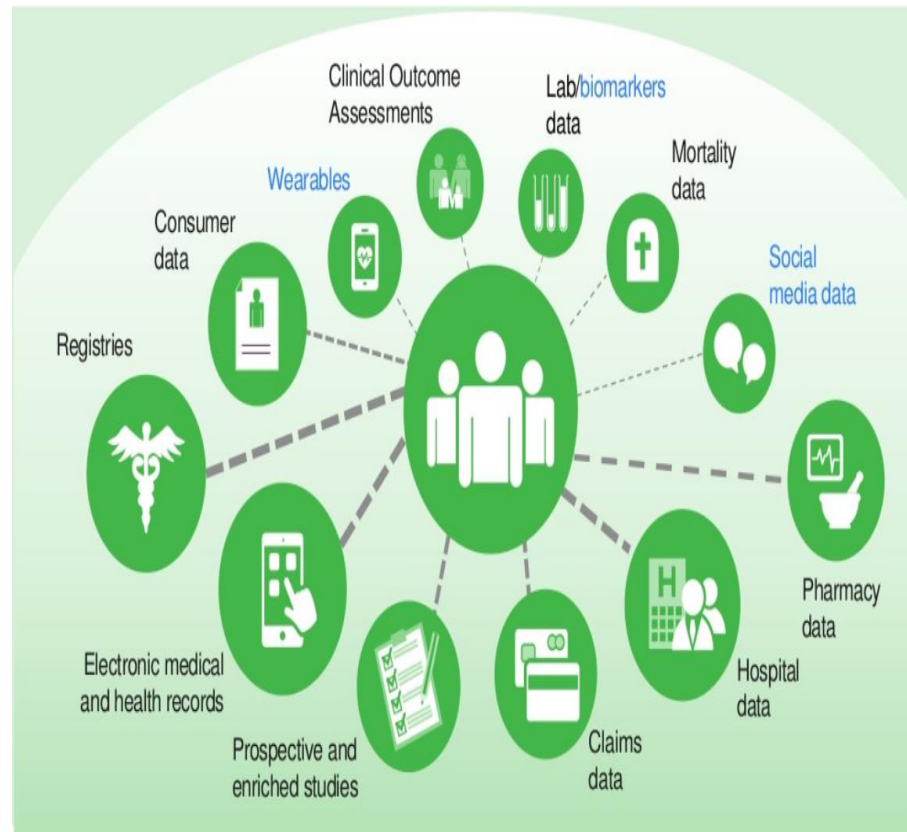
- Patient-level data not collected in conventional randomized controlled trials
- Examples: electronic medical records, claims data, mortality data, consumer data, registries, data collected in observational studies, chart reviews

Real-World Insights (RWI)

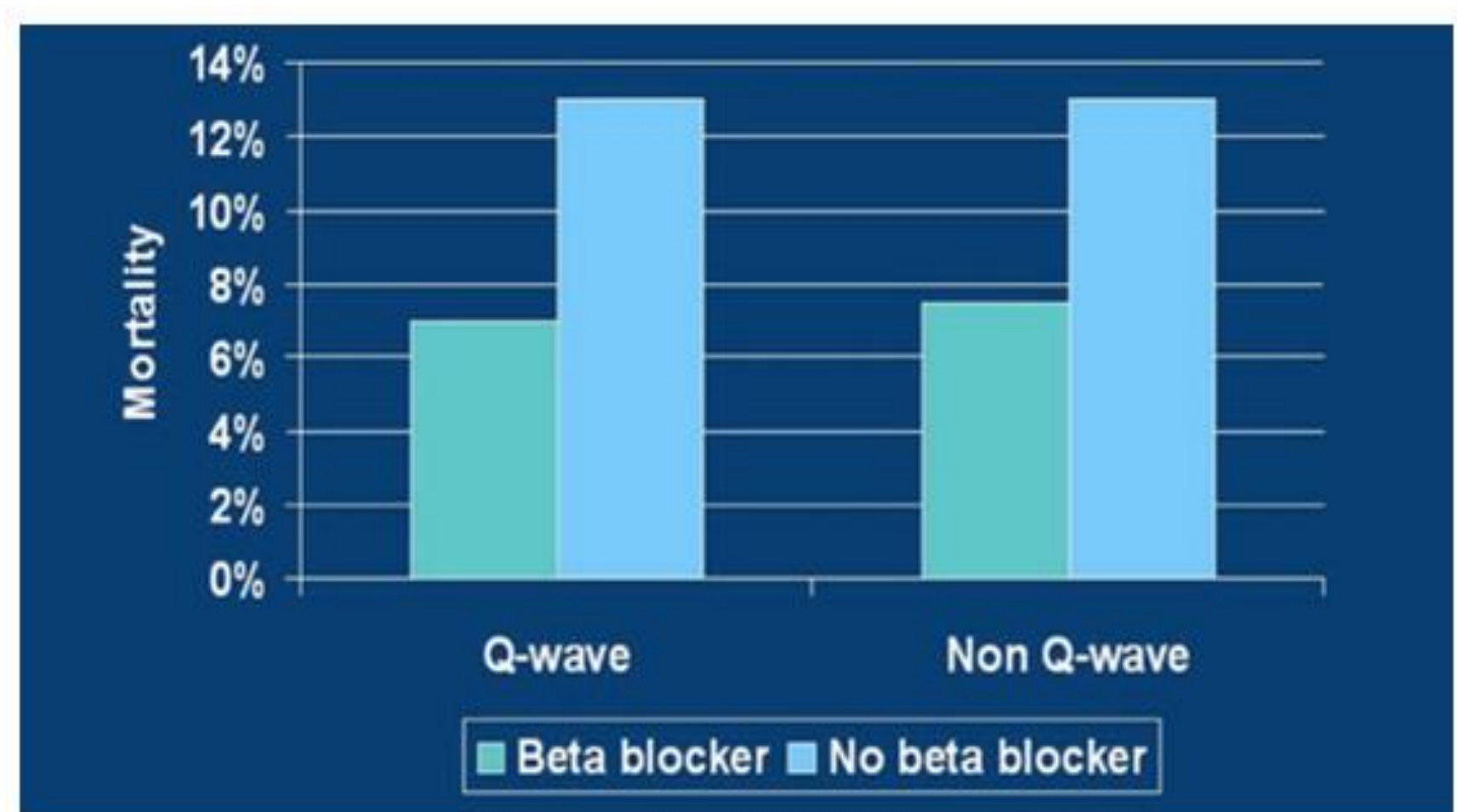
- Insights generated from RWD using appropriate scientific and/or generated commercial analytics

Real-World Evidence (RWE)

- Insights generated from RWD using appropriate scientific and/or generated commercial analytics with the intention to support a claim or belief to produce evidence for multiple stakeholders



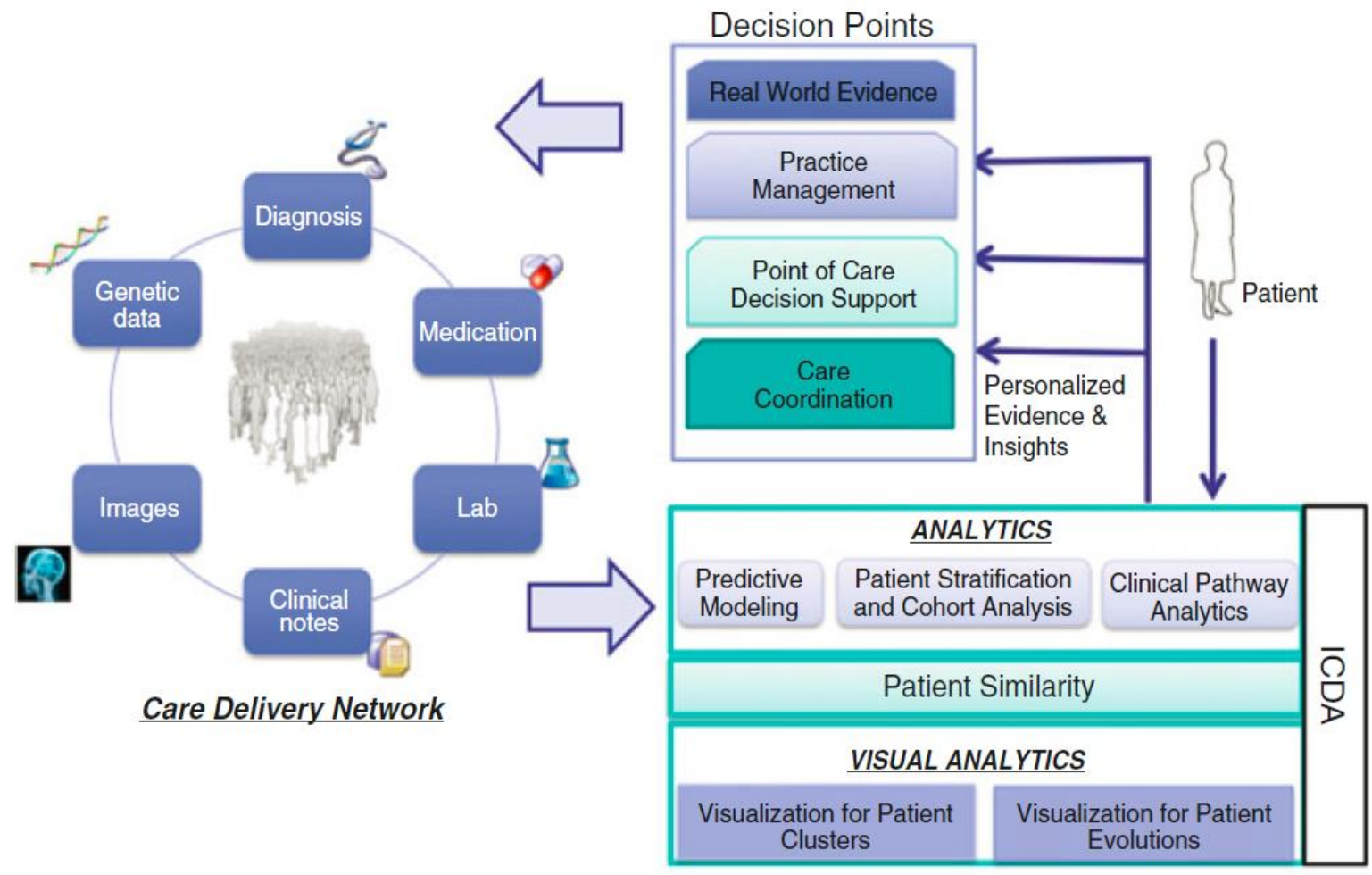
An early case study of Real World Data: Beta blockers



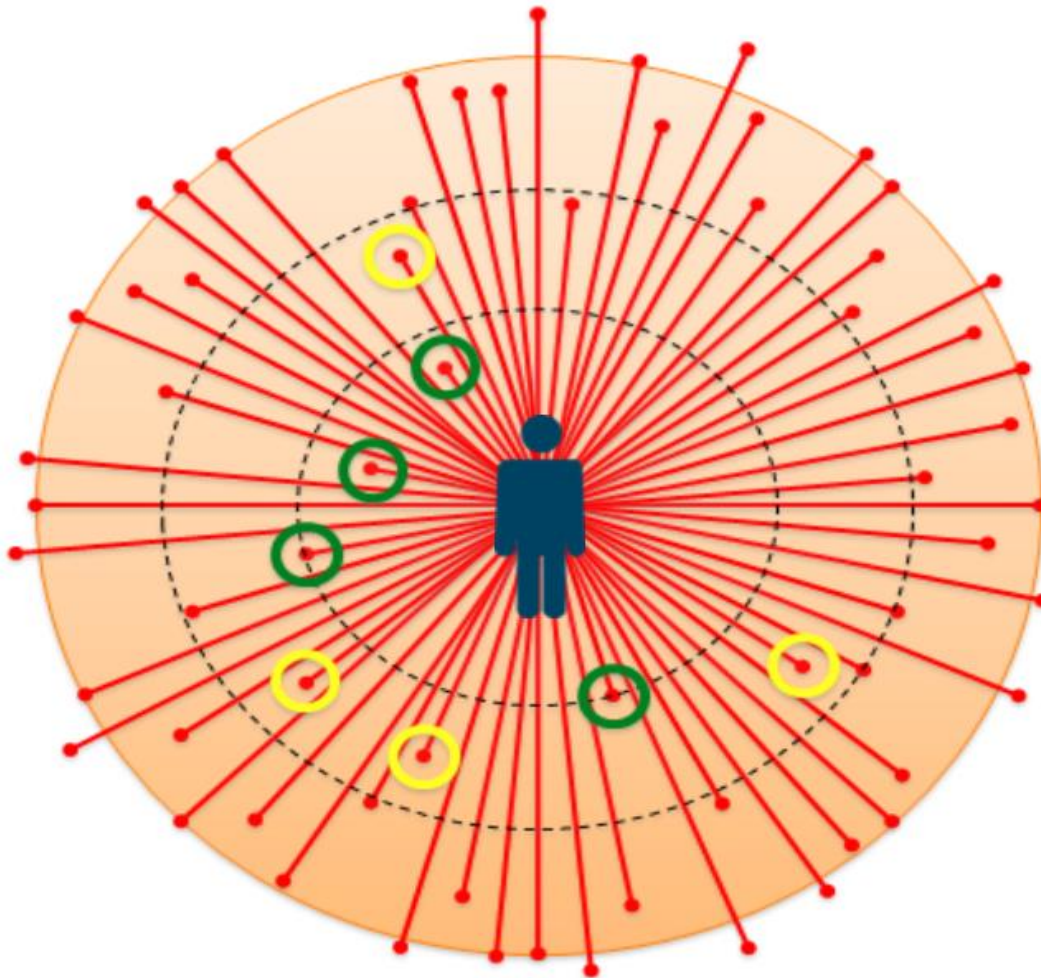
Difference between RCT and RWD

	RCTS	Real World Data
Type of Trial	Experimental	Observational
Primary focus	Efficacy, safety, and quality	Effectiveness
Patient population	Narrow and restricted	Wide and unrestricted
Monitoring	Intense	Not Required
Cost	High	Regularly less expensive
Randomization & Blinding	Yes	No

ICDA - Intelligent Care Delivery Analytics



Patient Similarity Analytics

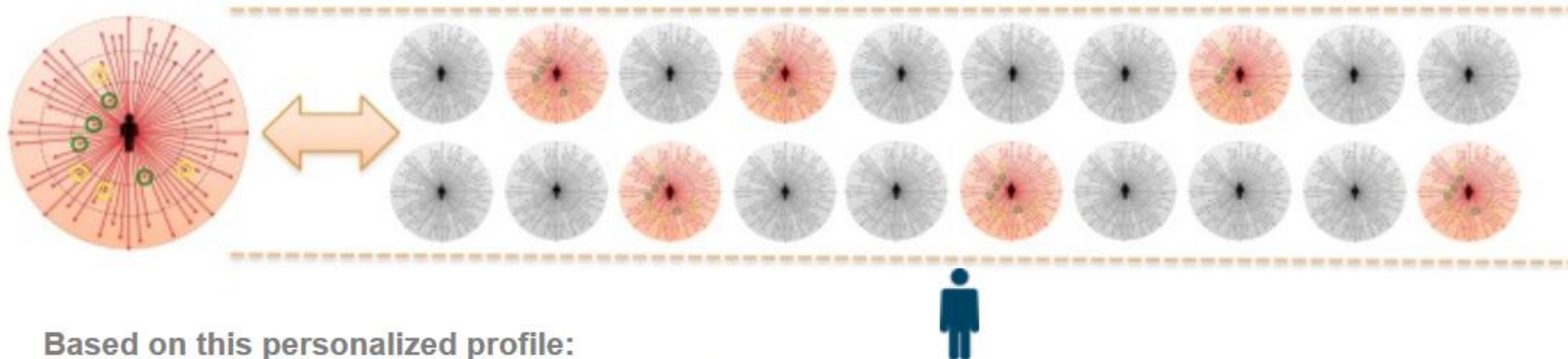


For this patient:

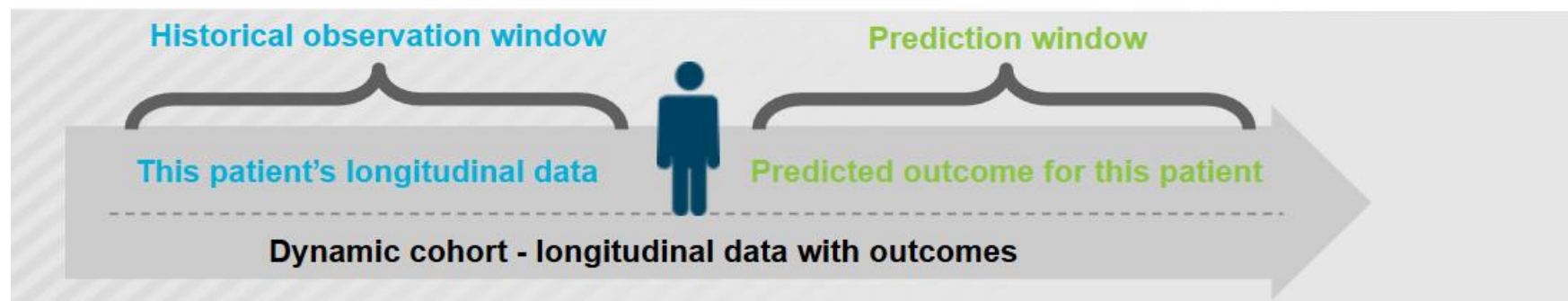
- **Analyze longitudinal data to develop a profile** across more than 30,000 possible points of comparison
- **Determine the individual risk factors** for this patient based on the desired outcome
- **Create an outcome based on the personalized profile** for this patient

-  Who is the individual most similar to?
-  Who is the individual least similar to?

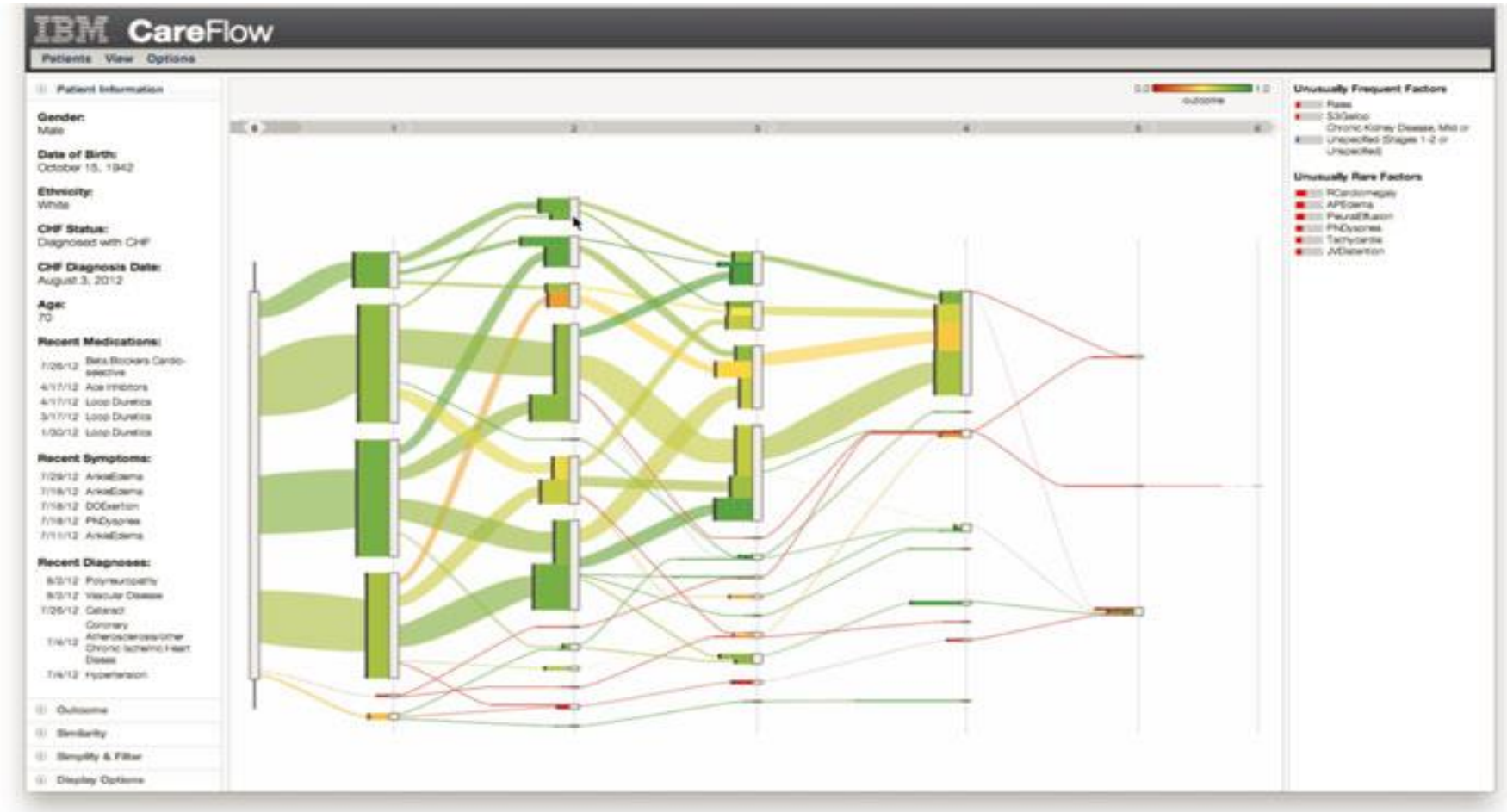
Patient Similarity Analytics



- **Find** the **most** similar patients (or *dynamic cohorts*) from the entire population
- **Analyze** the attributes and outcomes for this cohort (across more than 30,000 dimensions)
- **Predict** the probability of the desired outcome for the patient in question
- **Suggest** a personalized care plan based on the unique needs of this patient



CareFlow: Data-Driven Visual Exploration of Similar Patients



Data Driven – Analytics Tool

The screenshot displays the IBM Watson Analytics dashboard. The interface is divided into several sections: a left sidebar with a 'Hide panel' button and a 'Learn more about Watson Analytics' section with a 'Play Video' button; a central 'Explore' section with a circular icon and text about visualizations; a top right 'Predict' section with a target icon and text about predictive insights; and a bottom right 'Assemble' section with a dashboard icon and text about creating interactive dashboards. A 'WELCOME' header is at the top, and a 'Buy personal edition' link is in the top right. A search bar at the bottom left says 'Type in keywords to find assets', and buttons for 'Add', 'Filter', and 'Sort' are at the bottom right. Five blue callout boxes highlight specific features: 'Quick start intuitive interface' points to the top right; 'Key business driver insights' points to the 'Predict' section; 'Dashboard and storytelling authoring' points to the 'Assemble' section; 'Easy data upload and search capabilities' points to the search bar; and 'Natural language dialogue' points to the 'Add' button.

IBM Watson Analytics

WELCOME

Buy personal edition

Hide panel

Learn more about Watson Analytics

Play Video

Predict

Find predictive insights hidden in your data. Learn what drives each behavior and outcome - and take your next steps with confidence.

Explore

Explore powerful visualizations of your data and discover patterns and relationships that impact your business.

Assemble

Create interactive dashboards to monitor key details, and infographics that tell persuasive stories. Share and collaborate with others.

Type in keywords to find assets

Add

Filter

Sort

Quick start intuitive interface

Key business driver insights

Dashboard and storytelling authoring

Easy data upload and search capabilities

Natural language dialogue

<https://console.bluemix.net/catalog/?category=containers&search=label:lite>

Data Driven – Analytics Tool



Understanding HL7 Structure

```
MSH | ^~\& | ADT1 | MCM | LABADT | MCM | 198808181126 | SECURITY | ADT ^ A01 | MSG00001- | P | 2.4
EVN | A01 | 198808181123
PID | | PATID1234 ^ 5 ^ M11 | | JONES ^ WILLIAM ^ A ^ III | | 19610615 | M- | | C
PV1 | 1 | I | 2000 ^ 2012 ^ 01 | | | 004777 ^ LEBAUER ^ SIDNEY ^ J. | | | SUR | | - | | ADM | A0
AL1 | 1 | | ^ PENICILLIN | | PRODUCES HIVES ~ RASH ~ LOSS OF APPETITE
DG1 | 001 | I9 | 1550 | MAL NEO LIVER, PRIMARY | 19880501103005 | F
PR1 | 2234 | M11 | 111 ^ CODE151 | COMMON PROCEDURES | 198809081123
```

Segment ID

MSH Message Header
EVN Event Type
PID Patient Visit Information
AL1 Patient Allergy
Information
DG1 Diagnosis
PR1 Procedures

Fields: contain information
Related to the patient encounter
or event

FHIR – RESTful API

➤ **FHIR = Fast Health Interoperability Resource**

- HL7 V3 was too complex so decided
- HL7 needs to modernize
- Decided on how web applications are built

➤ **RESTful API**

- REST = Representational State Transfer -> Basis of HTTP
- Resource-oriented rather than RPC
- Easy for developers to understand and use

➤ **FHIR Resource**

- Well defined, simple snippets of data that capture core clinical entities



FHIR Resource Type

AdverseReaction	Group	Organization
Alert	ImagingStudy	Other
AllergyIntolerance	Immunization	Patient
(Binary)	ImmunizationRecommendation	Practitioner
CarePlan	List	Procedure
Composition	Location	Profile
ConceptMap (informative)	Media	Provenance
Condition	Medication	Query
Conformance	MedicationAdministration	Questionnaire
Device	MedicationDispense	RelatedPerson
DeviceObservationReport	MedicationPrescription	SecurityEvent
DiagnosticOrder	MedicationStatement	Specimen
DiagnosticReport	MessageHeader	Substance
DocumentReference	Observation	ValueSet
DocumentManifest	OperationOutcome	
Encounter	Order	
FamilyHistory	OrderResponse	

Example: Fetch a Systolic blood pressure

GET https://open-api.fhir.me/Observation/8567?_format=json

```
{
  "resourceType": "Observation",
  "text": {
    "status": "generated",
    "div": "<div>1999-07-02: Systolic blood pressure = 109 mm[Hg]</div>"
  },
  "name": {
    "coding": [
      {
        "system": "http://loinc.org",
        "code": "8480-6",
        "display": "Systolic blood pressure"
      }
    ]
  },
  "valueQuantity": {
    "value": 109.0,
    "units": "mm[Hg]",
    "code": "mm[Hg]"
  },
  "appliesDateTime": "1999-07-02",
  "status": "final",
  "subject": {
    "reference": "Patient/1186747"
  }
}
```

Resource (unique) ID

Resource Type

Semantics

Clinical Values

URL to Patient

Conclusion

- **Real-world medical data is challenging, but has great potential**
 - Better treatments
 - More efficient care
- **Many difficult challenges**
 - Large and Complex Data
 - Demanding Domain-Specific Requirements
- **Solutions require collaboration across many disciplines**
 - Data analytics and statistics
 - Visualization and user interaction
 - Systems
 - Medical domain experts





Thank you!!!

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