Utilizing Predictive Models to Target for Clinical and Diagnosis Gaps
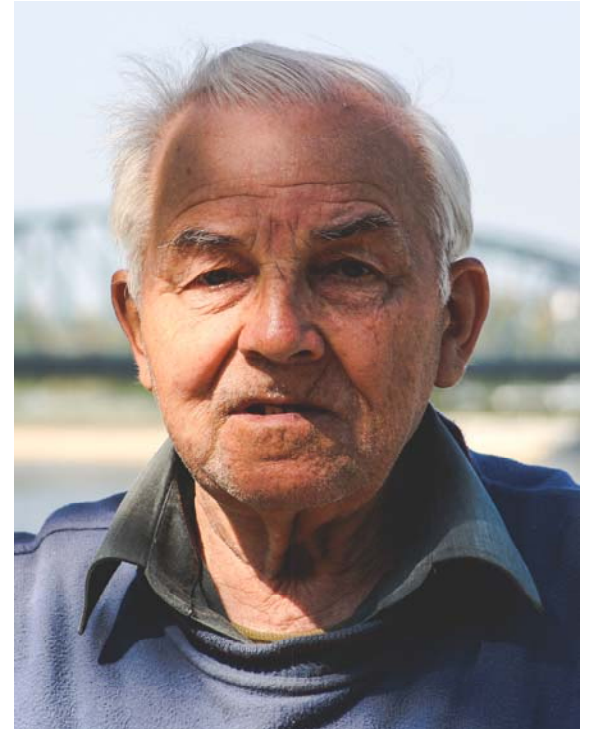
Stephanie Kreml, MD

Chief Medical Officer

Accordion Health

Predictive Modeling Summit
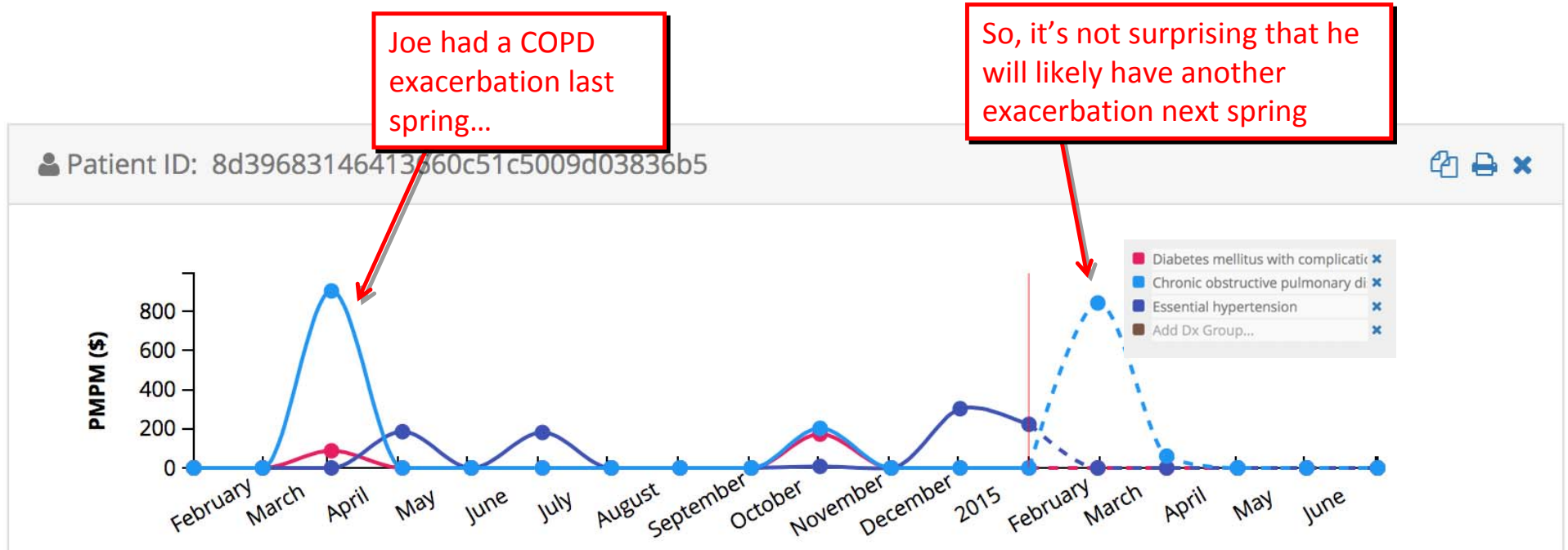
September 15, 2016

accordion

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Clinical Vignettes

Joe S.

- 69 y/o man with COPD & h/o acute exacerbations
  - Tend to occur annually with seasonal triggers
- Also has DM, HTN which are relatively well-controlled
- Doesn't always get annual influenza vaccine & sometimes forgets to fill his meds

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Joe S.

Joe had a COPD exacerbation last spring…

So, it's not surprising that he will likely have another exacerbation next spring

Patient ID: 8d39683146413660c51c5009d03836b5

Diabetes mellitus with complicatic ✕
Chronic obstructive pulmonary di ✕
Essential hypertension ✕
Add Dx Group... ✕

PMPM ($)

800
600
400
200
0

February March April May June July August September October November December 2015 February March April May June

4

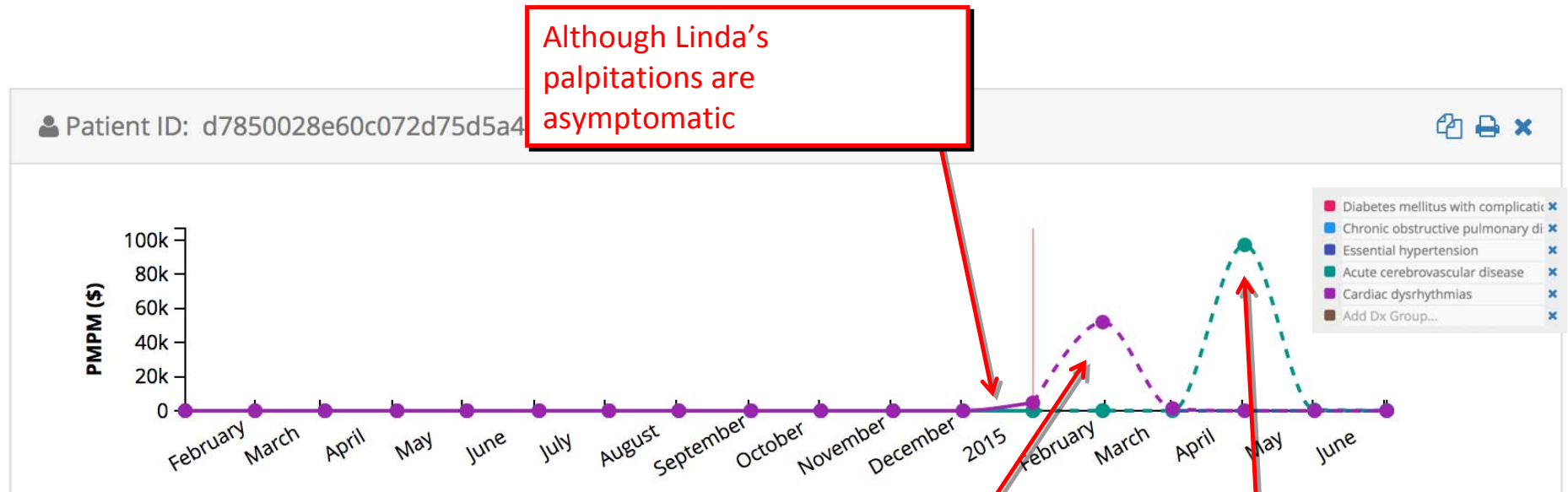Most case managers already know about patients like Joe…

What about the nonobvious cases?

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Linda R.

- 76 y/o woman with h/o of well-controlled HTN
- Family h/o CVD
- Recently seen for palpitations, but otherwise asymptomatic

Linda R.

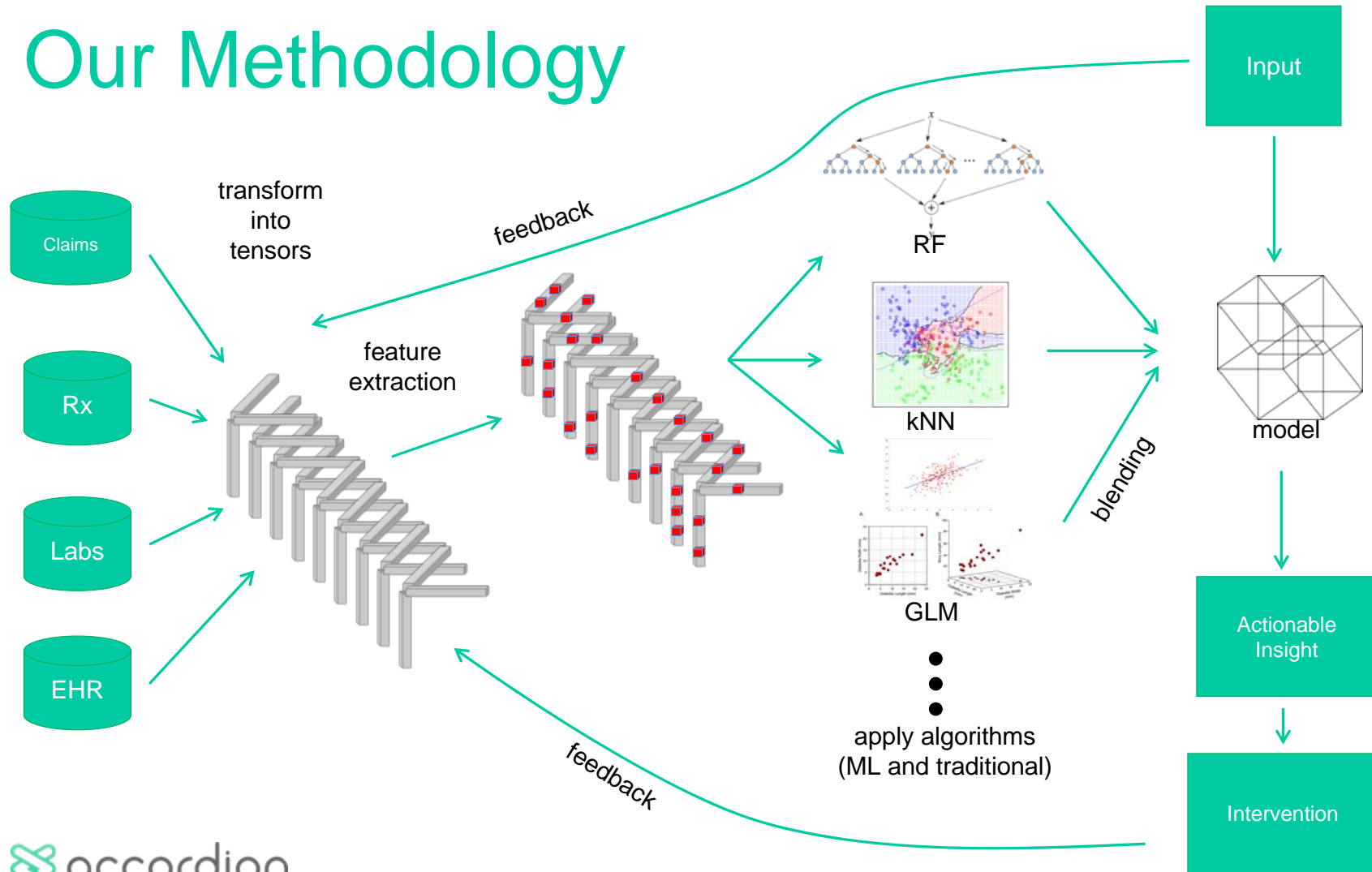Although Linda's palpitations are asymptomatic

Our model predicts that her palpitations may be indicative of a more severe cardiac dysrhythmia, like atrial fibrillation
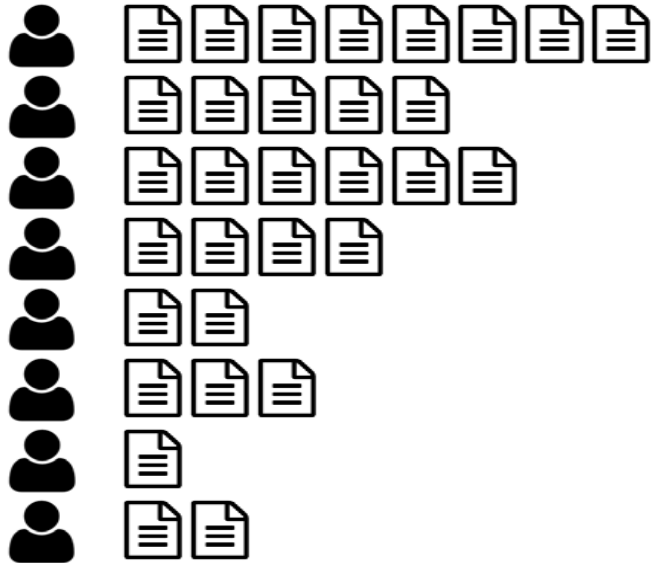
And the likelihood of a stroke is high

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7

How to apply Machine Learning

Our Methodology

Claims

Rx

Labs

EHR

transform into tensors

feature extraction

feedback

feedback

RF

kNN

GLM

blending

apply algorithms
(ML and traditional)

Input

model

Actionable Insight
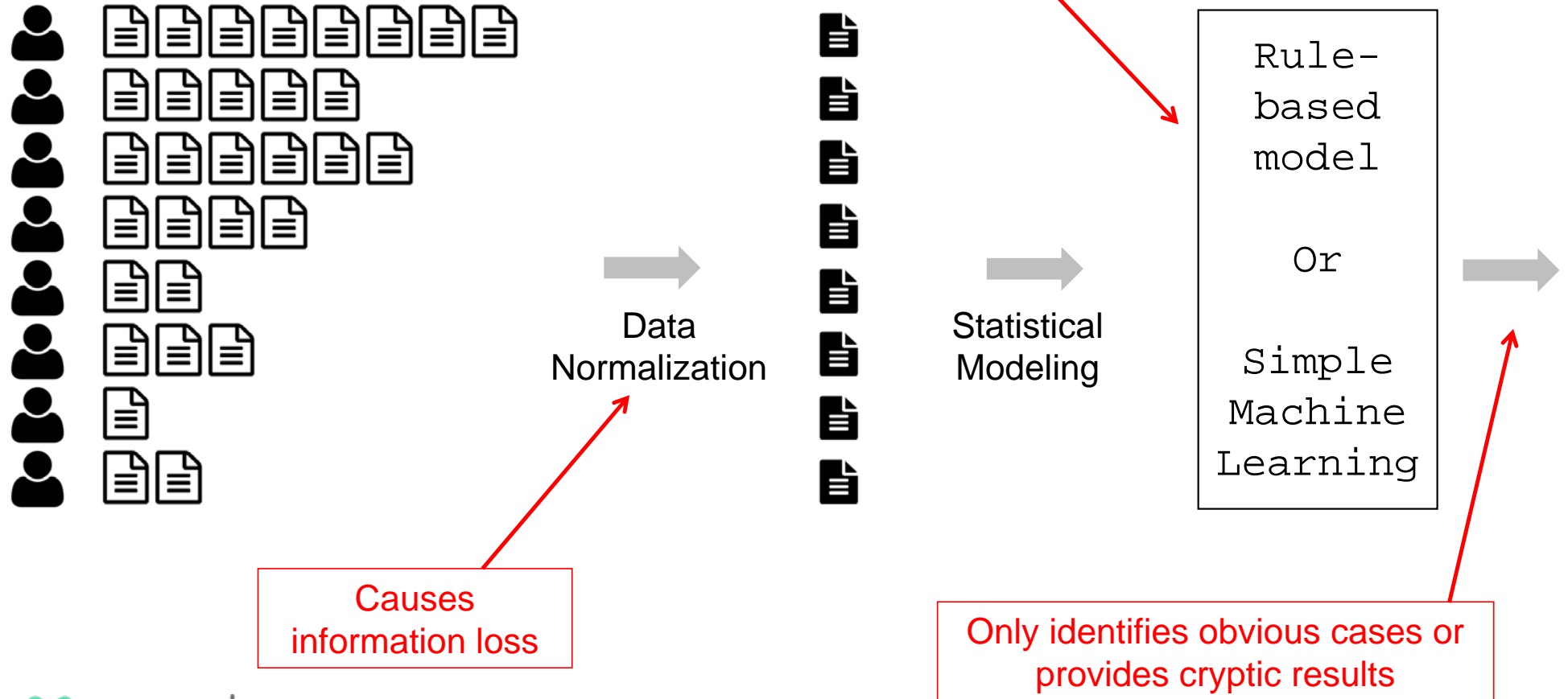
Intervention

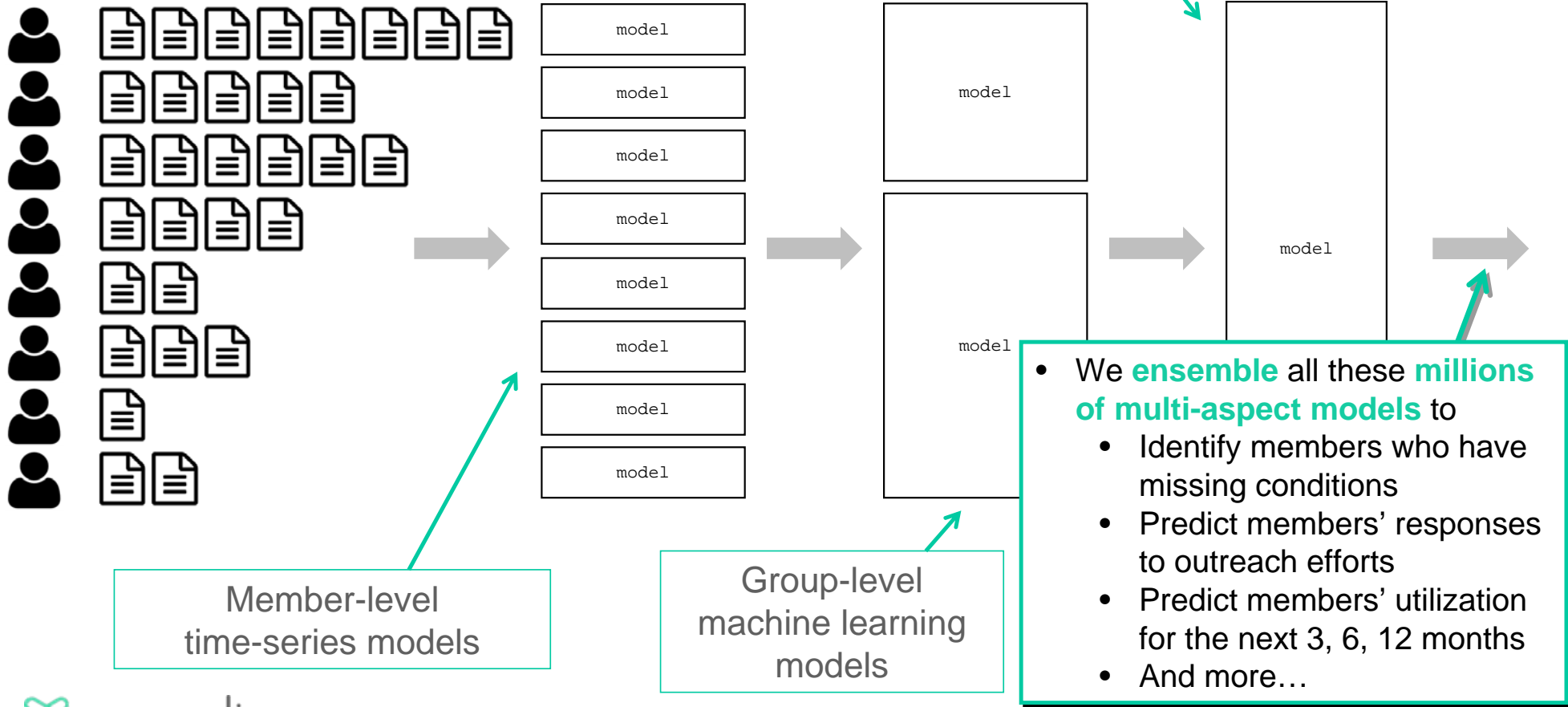accordion

Dealing with healthcare data

- Member data can be found in multiple sources e.g. claims, electronic health records, lab results, etc.
  - Each source of information has its own (dis)advantages
- Members have different amounts of data
  - Some members may have switched health plans
  - Some members may be sicker than others
- Service utilization can be quite different across regions and plan types
  - HMO vs. PPO
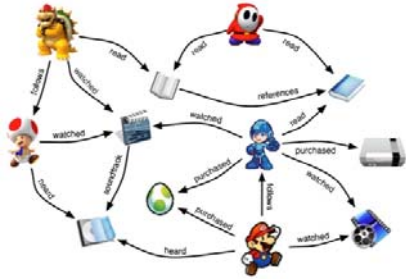 - Medicare Plans vs. Commercial Plans
  - California vs. Texas

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Current State-of-the-Art
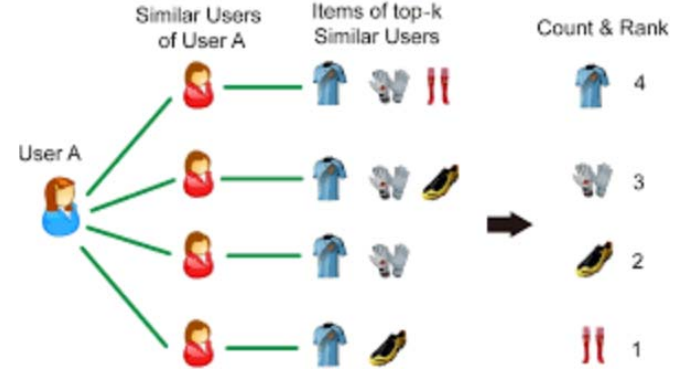
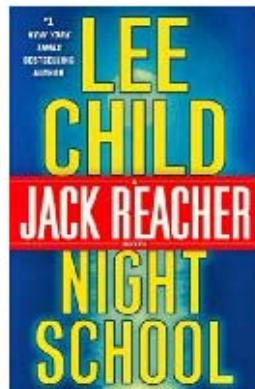Expert curated – time consuming & expensive to develop

Data Normalization

Statistical Modeling

Rule-based model

Or

Simple Machine Learning

Causes information loss

Only identifies obvious cases or provides cryptic results

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Accordion Health Approach

Population-level models

model

model

model

model

model

model

model

model

model

model

model

model

Member-level time-series models

Group-level machine learning models

- We **ensemble** all these **millions of multi-aspect models** to
  - Identify members who have missing conditions
  - Predict members' responses to outreach efforts
  - Predict members' utilization for the next 3, 6, 12 months
  - And more…

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Recommender Systems

New for you   See more
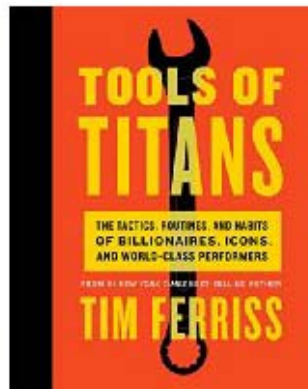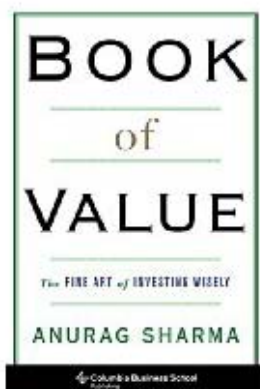
⊞ Suspected Condition Categories

Current Conditions

- [CC115] Myasthenia Gravis/Myoneural Disorders and Guillain-Barre Syndrome/Inflammatory and Toxic Neuropathy
- [CC3] Central Nervous System Infections, Except Viral Meningitis
- [CC56] Rheumatoid Arthritis and Specified Autoimmune Disorders
- [CC187] Chronic Kidney Disease, Stage 5
- [CC184] End Stage Renal Disease

Expected Conditions

- [CC183] Kidney Transplant Status

⚕ Surfaced Diagnoses (details)

[CC183] Kidney Transplant Status

Overview

- Dx Code: **9-V420**
- Dx Description: KIDNEY TRANSPLANT STATUS
- Likelihood of Dx: 0.4
- Likelihood of Dx in Chart: 0.2

Evidence from Patient History

- [Rx] Antimetabolite Immunosuppressant *(825.82)*
- [CC] 184: End Stage Renal Disease *(102.37)*
- [CC] 187: Chronic Kidney Disease, Stage 5 *(57.87)*
- [Dx] 9-5856: END STAGE RENAL DISEASE (Begin 2005) *(26.01)*
- [Pr] 83735: Assay of magnesium *(11.15)*
- [Pr] 80048: Metabolic panel total ca *(8.33)*
- [Pr] 84100: Assay of phosphorus *(5.84)*
- [Pr] 87186: Microbe susceptible mic *(5.77)*

Relevant Charts

1. Claim ID: ▒▒▒▒▒▒▒▒
   - Date: ▒▒▒▒
   - Provider NPI: ▒▒▒▒
2. Claim ID: ▒▒▒▒▒▒▒▒
   - Date: ▒▒▒▒▒▒
   - Provider NPI: ▒▒▒▒
3. Claim ID: ▒▒▒▒▒▒▒▒
   - Date: ▒▒▒▒▒▒
   - Provider NPI: ▒▒▒▒

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Suspected Condition Categories

Current Conditions
- 9: Lung, Brain, and Other Severe Cancers, Including Pediatric Acute Lymphoid Leukemia
- 88: Major Depressive and Bipolar Disorders

Expected Conditions
- 142: Specified Heart Arrhythmias
  - Expected Risk Gain: 0.2
- 156: Pulmonary Embolism and Deep Vein Thrombosis
  - Expected Risk Gain: 10.19

Suspected Diagnoses (details)

156: Pulmonary Embolism and Deep Vein Thrombosis
- Missing Code: 9-45340
- Likelihood: 0.6
- Risk gain 16.98
- Claim date: 20150327
- Provider ID: 1861466153

- Evidence found in Medical/Rx Claims
  - [dx] Administrative/social admission
  - [dx] Phlebitis; thrombophlebitis and thromboembolism
  - [dx] Other aftercare
  - [rx] Vitamin K Antagonist

Accepted
Rejected
N/A

142: Specified Heart Arrhythmias
- Missing Code: 9-42731
- Likelihood: 0.06
- Risk gain 3.11
- Claim date: 20150107
- Provider ID: 1871572818

- Evidence found in Medical/Rx Claims
  - [dx] Other aftercare
  - [rx] Vitamin K Antagonist

Accepted
Rejected
N/A

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Thank You!

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