

Deep Care Management at Duke

Lessons in Using ML in a Medicare Population

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65 years old. History of myocardial infarction, status post CABG, congestive heart failure, drug dependency

Admitted via Emergency Department with chest pain and pulmonary edema

Betty C. Discharged and lost to follow-up

Betty C. is *lost in the shuffle*

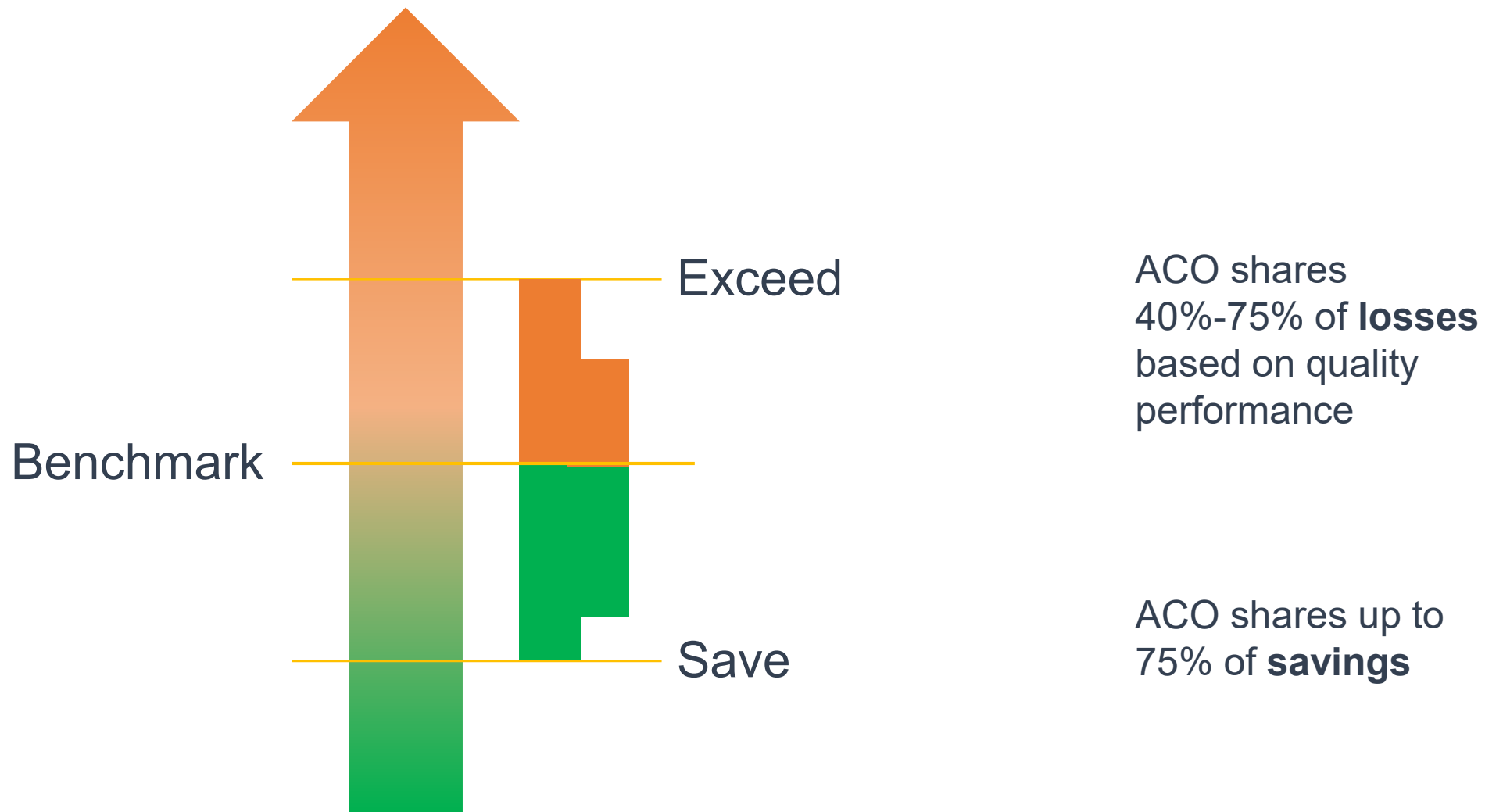
Medical tradition



Duke Connected Care

Duke Connected Care

Medicare Shared Savings Program **Track 3**



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Being “at risk” requires being able to **quantify risk**



Hospitalizations

30%

admission rate 7/17-7/18

15%

readmission rate 7/17-7/18

Can we risk stratify 52K
patients by hospitalization?





Can we “see” 52K patients?

Can we predict their trajectories?

Can we change their trajectories?

Effectively managing a precious resource—
intensive care management

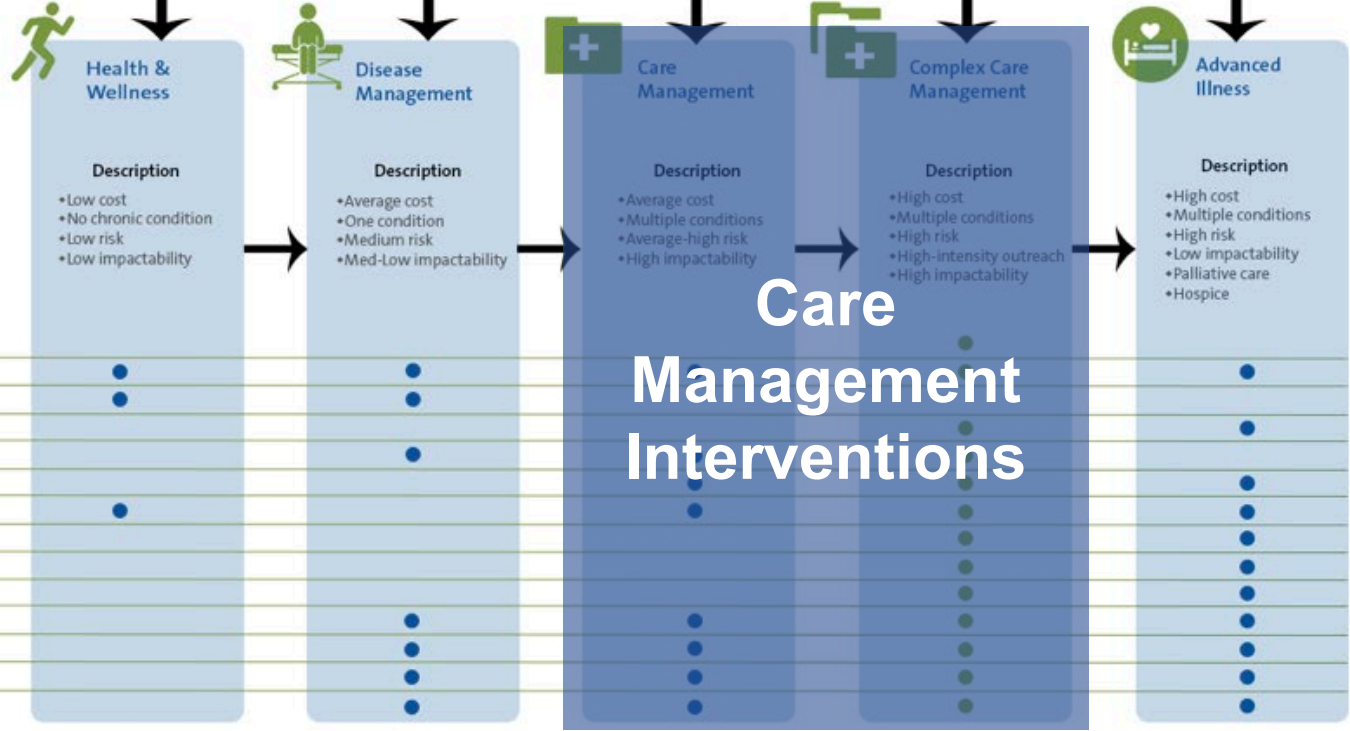


Identification

- Patient Identification**
- Duke Health referrals
 - Community provider referrals
 - Intra-program referrals
 - Self-referrals

Stratification

- Patient Stratification**
- Risk
 - Impactability



- Service**
- Comprehensive health assessment
 - Condition-specific education
 - Health coaching
 - Coordination of transitions in care
 - Services utilization education
 - Pharmacy & medication support
 - Resource coordination
 - Face-to-face consultation
 - Shared decision making support
 - Advanced care planning
 - Symptom management
 - Appointment coordination
 - Quality gap closure
 - Specialty / disease-specific rounds

Health & Wellness

Description

- Low cost
- No chronic condition
- Low risk
- Low impactability

Disease Management

Description

- Average cost
- One condition
- Medium risk
- Med-Low impactability

Care Management

Description

- Average cost
- Multiple conditions
- Average-high risk
- High impactability

Complex Care Management

Description

- High cost
- Multiple conditions
- High risk
- High-intensity outreach
- High impactability

Advanced Illness

Description

- High cost
- Multiple conditions
- High risk
- Low impactability
- Palliative care
- Hospice

Identification



Stratification



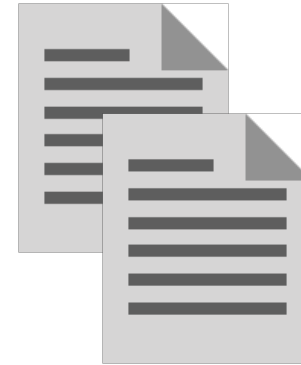
**Care
Management
Interventions**

See

Predict

Change

See



flat claims files



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common data model



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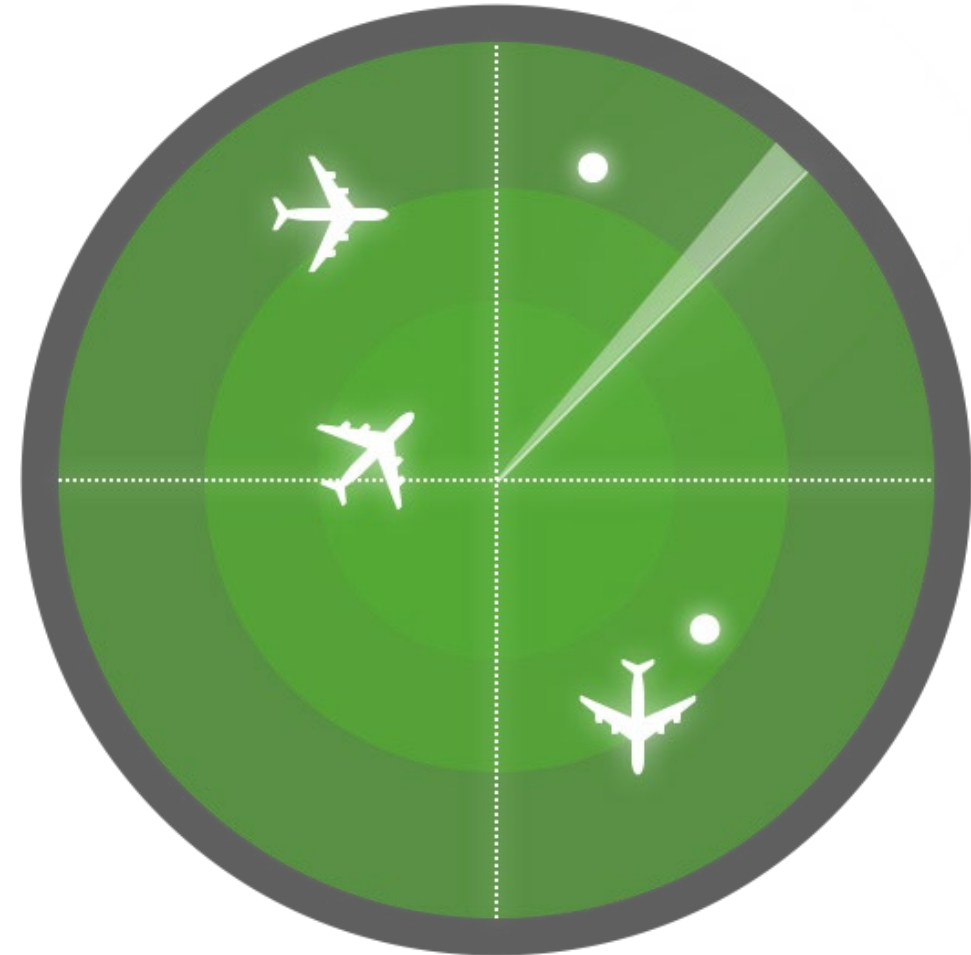
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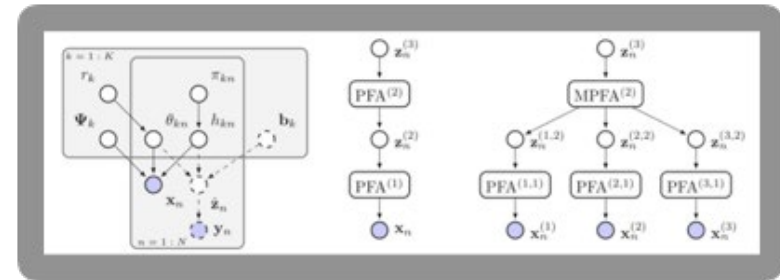
Predict



flat claims files



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common data model



Poisson Deep Factor Network

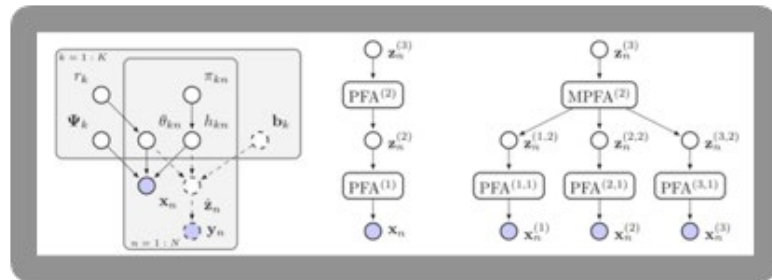
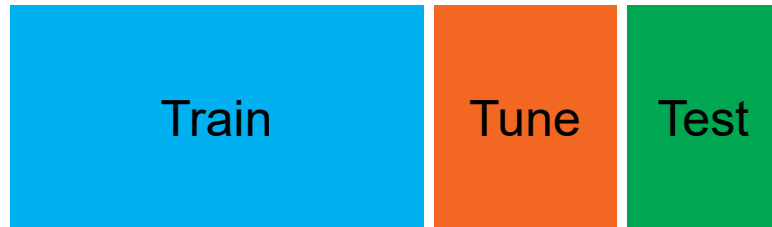


<https://www.physiciansweekly.com/how-much-would-you-pay-for-a-nap/>

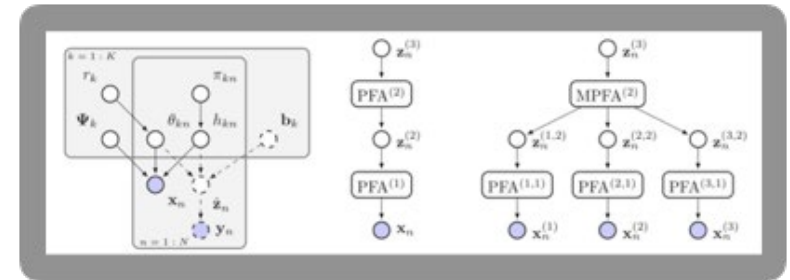
52K x 32 Diagnostic Categories

Month

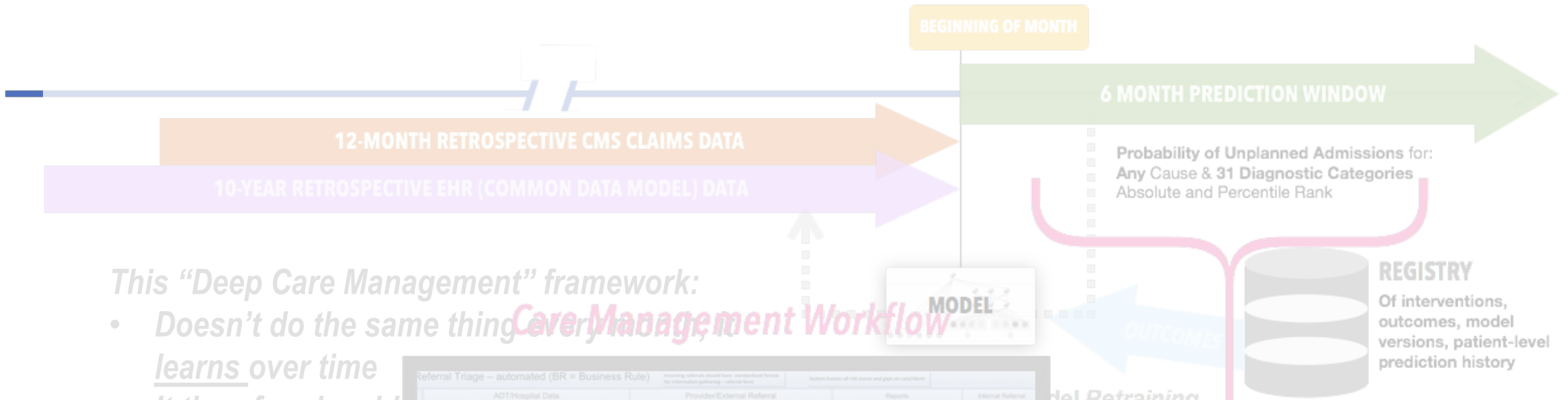
Historical Data



Poisson Deep Factor Network



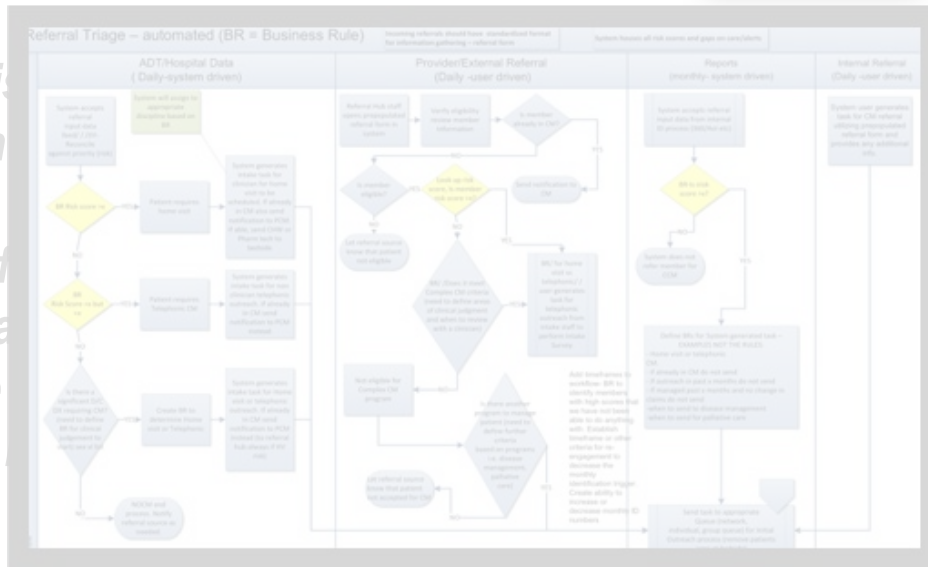
Poisson Deep Factor Network



This “Deep Care Management” framework:

- Doesn't do the same thing every time, it learns over time
- It therefore has high capacity to adjust as interventions and outcomes change
- We can integrate feedback loops to influence its learning
- Regardless of the interventions, we can track the metric with which we are trying to improve

Care Management Workflow



change

A pharmacy technician
visits Betty at her home

Helps her understand her
medications

Links her to resources for
financial support



Betty C.