"Data Overload" and "Dirty Data"

"a 70 page C-CDA is probably 68 pages too long for a physician to read"
- Keith Boone, Interoperability Guru

"If I get 7 CCDs from my HIE, I look at zero of them."
- Partners Healthcare ER Physician

"Our biggest challenge is Badly Behaving Data."
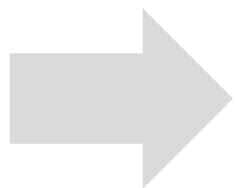– Healthcare Information Exchange CEO

Data, Data everywhere...

"Water, water everywhere, nor any drop to drink."

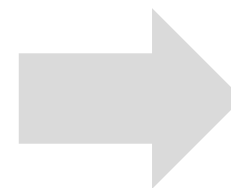- The Rime of the Ancient Mariner, Samuel Taylor Coleridge
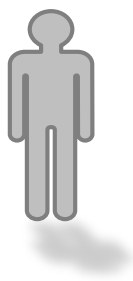
Fragmented Healthcare Information

~40%
Medicare patients with 7+ chronic conditions

➡

11
Median number of physicians, across 5+ practices

➡

20
Top EHRs hold 70% of fragmented market

One patient, multiple problems

Epic	Allscripts	eClinical Works	Practice Fusion
NextGen	GE	Cerner	McKesson
atehena health	Amazing Charts	Greenway	MedPlus
eMDs	MEDITECH	Office Ally	Sage
CCS	BioMedix	AdvanceMD	NexTech

Sources:
1. Care patterns in Medicare and their implications for pay for performance. NEJM 2007.
2. EHR Product Market Shares Rankings, EMR & EHR website, 2014

Fragmented Clinical Care

High-cost patients see 10+ providers annually with data spread across care settings

Unified, Normalized Clinical Data Ready for Analytics
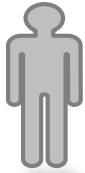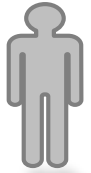
Office Visit

Specialist Referral

Ambulatory Center

Hospital Stay

Post-Acute Care

McKESSON

Allscripts

Epic

Cerner

MEDITECH

What We Do
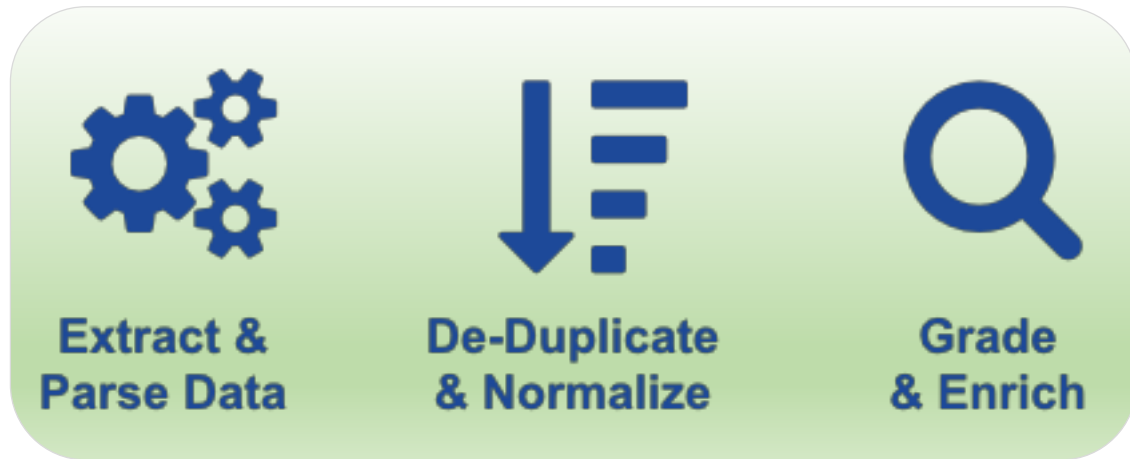
Enhance Data Quality & Usability

Extract & Parse Data · De-Duplicate & Normalize · Grade & Enrich
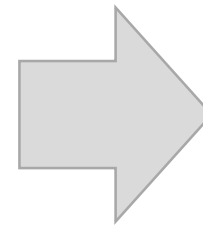
Automated & Actionable Analytics

- Aggregated Longitudinal Clinical View of the Patient
- Identify Patients at Risk
- Improve Clinical Documentation
- Provide Quality Measures

Improve Patient Safety and Clinical & Business Outcomes

The Continuity of Care Document (CCD)

A Single Clinical View:

Key Value:

- Integrate with **any** certified EHR

- No custom extracts

- Rich clinical detail & normalization

- Actionable **before** patient billing/discharge

Clean and Enrich

Distilling Medical Concepts

Allergies

115
Concepts
COVERS 80+%

Problems

282
Concepts
COVER 98+%

Meds

3,411
Concepts
COVER 98+%

Results

351
Concepts
COVER 75+%

Procedures

252
Concepts
COVER 80+%

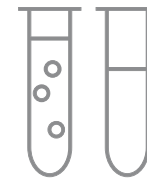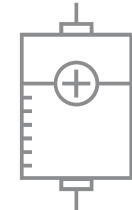# Normalizing Medications…

Normalizing codes from different code systems that represent generic and branded meds with various dosage/route/package/precise ingredients information

Meds

Problems

Allergies

Results

Procedures

RxNorm:
597970	atorvastatin 10 MG
597966	atorvastatin 20 MG
597983	atorvastatin 40 MG
329299	atorvastatin 80 MG
617312	atorvastatin 10 MG Oral Tablet
617310	atorvastatin 20 MG Oral Tablet
617311	atorvastatin 40 MG Oral Tablet
259255	atorvastatin 80 MG Oral Tablet
153165	Lipitor
617314	Lipitor 10MG Oral Tablet
617318	Lipitor 20MG Oral Tablet
617320	Lipitor 40MG Oral Tablet
262095	Lipitor 80MG Oral Tablet
83366	atorvastatin calcium
1483793	atorvastatin calcium propylene glycol solvate
1297766	atorvastatin calcium trihydrate

NDC (sample)
42291-143	atorvastatin calcium 10 mg Oral Tablet
63629-3366	Lipitor 80 mg Oral Tablet
63629-3366-1	Lipitor 80 mg Oral Tablet ,30 tablet, film coated in 1 bottle

Multum (sample)
97157	atorvastatin

AND unstructured text such as "Lipitor Oral"

atorvastatin

Normalizing Problems...

Normalizing codes from various code systems that represent detailed clinical conditions, and consolidating them to higher level concepts

Meds

Problems

Allergies

Results

Procedures

91 Codes, ICD-9, ICD-10, SNOMED

Code	Description
10091002	High output heart failure (disorder)
10335000	Chronic right-sided heart failure (disorder)
10633002	Acute congestive heart failure (disorder)
111283005	Chronic left-sided heart failure (disorder)
128404006	Right heart failure (disorder)
194767001	Benign hypertensive heart disease with congestive cardiac failure (disorder)
194779001	Hypertensive heart and renal disease with (congestive) heart failure (disorder)
194781004	Hypertensive heart and renal disease with both (congestive) heart failure and renal failure (disorder)
195111005	Decompensated cardiac failure (disorder)
195112003	Compensated cardiac failure (disorder)
195114002	Acute left ventricular failure (disorder)
206586007	Congenital cardiac failure (disorder)
233924009	Heart failure as a complication of care (disorder)
25544003	Low output heart failure (disorder)
277639002	Sepsis-associated right ventricular failure (disorder)
314206003	Refractory heart failure (disorder)
359617009	Acute right-sided heart failure (disorder)
359620001	Acute right heart failure (disorder)
364006	Acute left-sided heart failure (disorder)
367363000	Right ventricular failure (disorder)
410431009	Cardiorespiratory failure (disorder)
417996009	Systolic heart failure (disorder)
418304008	Diastolic heart failure (disorder)
42343007	Congestive heart failure (disorder)
424404003	Decompensated chronic heart failure (disorder)
426012001	Right heart failure due to pulmonary hypertension (disorder)
426263006	Congestive heart failure due to left ventricular systolic dysfunction (disorder)
426611007	Congestive heart failure due to valvular disease (disorder)
43736008	Rheumatic left ventricular failure (disorder)
441481004	Chronic systolic heart failure (disorder)
441530006	Chronic diastolic heart failure (disorder)
44313006	Right heart failure secondary to left heart failure (disorder)
46113002	Hypertensive heart failure (disorder)
48447003	Chronic heart failure (disorder)
5053004	Cardiac insufficiency due to prosthesis (disorder)
5148006	Hypertensive heart disease with congestive heart failure (disorder)
5375005	Chronic left-sided congestive heart failure (disorder)
56675007	Acute heart failure (disorder)
60856006	Cardiac insufficiency following cardiac surgery (disorder)
66989003	Chronic right-sided congestive heart failure (disorder)
82523003	Congestive rheumatic heart failure (disorder)
83105008	Malignant hypertensive heart disease with congestive heart failure (disorder)
84114007	Heart failure (disorder)
85232009	Left heart failure (disorder)
88805009	Chronic congestive heart failure (disorder)
90727007	Pleural effusion due to congestive heart failure (disorder)
92506005	Biventricular congestive heart failure (disorder)
74960003	Acute left-sided congestive heart failure (disorder)
77737007	Benign hypertensive heart disease with congestive heart failure (disorder)
80479009	Acute right-sided congestive heart failure (disorder)

Code	Description
I11.0	Hypertensive heart disease with heart failure
I13.0	Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
I13.2	Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease
I50.1	Left ventricular failure
I50.20	Unspecified systolic (congestive) heart failure
I50.21	Acute systolic (congestive) heart failure
I50.22	Chronic systolic (congestive) heart failure
I50.23	Acute on chronic systolic (congestive) heart failure
I50.30	Unspecified diastolic (congestive) heart failure
I50.31	Acute diastolic (congestive) heart failure
I50.32	Chronic diastolic (congestive) heart failure
I50.33	Acute on chronic diastolic (congestive) heart failure
I50.40	Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
I50.41	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I50.42	Chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.43	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50.9	Heart failure, unspecified
402.01	Malignant hypertensive heart disease with heart failure
402.11	Benign hypertensive heart disease with heart failure
402.91	Unspecified hypertensive heart disease with heart failure
404.01	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.03	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V or end stage renal disease
404.11	Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.13	Hypertensive heart and chronic kidney disease, benign, with heart failure and chronic kidney disease stage V or end stage renal disease
404.91	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.93	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and chronic kidney disease stage V or end stage renal disease
428.0	Congestive heart failure, unspecified
428.1	Left heart failure
428.20	Systolic heart failure, unspecified
428.21	Acute systolic heart failure
428.22	Chronic systolic heart failure
428.23	Acute on chronic systolic heart failure
428.30	Diastolic heart failure, unspecified
428.31	Acute diastolic heart failure
428.32	Chronic diastolic heart failure
428.33	Acute on chronic diastolic heart failure
428.40	Combined systolic and diastolic heart failure, unspecified
428.41	Acute combined systolic and diastolic heart failure
428.42	Chronic combined systolic and diastolic heart failure
428.43	Acute on chronic combined systolic and diastolic heart failure
428.9	Heart failure, unspecified

Heart Failure

Normalizing Allergies…

Normalizing codes from various code systems that represent allergens of various forms and concept levels

Meds

Problems

Allergies

Results

Procedures

SNOMED:
59255006	Sulfonamide (class of antibiotic)
387406002	Sulfonamide (substance)
38191006	Combined sulfonamides
72398005	Ophthalmic sulfonamide preparation
91939003	Allergy to Sulfonamides
429239002	Allergy to Sulfonamide antibiotic

RxNorm (sample)
9793	Silver sulfadiazine
10169	Sulfacetamide
10171	Sulfadiazine
…	Others not shown

NDF-RT
N0000008034	Sulfanilamides [Chemical/Ingredient]
N0000008048	Sulfonamides [Chemical/Ingredient]
N0000175503	Sulfonamide Antibacterial [EPC]
N0000175504	Sulfonamide Antimicrobial [EPC]
N0000175511	Methylated Sulfonamide Antibacterial [EPC]
N0000175512	Methylated Sulfonamides [Chemical/Ingredient]
N0000175880	Sulfonamide [EPC]

Sulfonamides (antibiotics)

Normalizing Results...

Normalizing LOINC codes as well as free-texted lab names representing diverse synonyms and abbreviations

Meds

Problems

Allergies

Results

Procedures

LOINC:
777-3   Platelets [#/Volume] In Blood By Automated Count
26515-7   Platelets [#/volume] in Blood
778-1   Platelets [#/volume] in Blood BY Manual Count

Free-text:
Platelet
Platelets
PLT
Plt count
Platelet #bld
Platelet #bld auto
Platelet count
Platelet estimate
Platelets in blood
Platelets in blood by automated count
(and many others…)

Platelet count

Normalizing Procedures...

Normalizing codes from various code systems and consolidating them to higher-level concepts when applicable

Meds

Problems

Allergies

Results

Procedures

CPT/HCPCS
27125	Partial hip replacement
27130	Total hip arthroplasty
27132	Total hip arthroplasty

ICD-9
81.51	Total hip replacement
81.52	Partial hip replacement

ICD-10
0SR90J9	Replacement of right hip joint with synthetic substitute, cemented, open approach
0SR90JA	Replacement of right hip joint with synthetic substitute, uncemented, open approach
0SR90JZ	Replacement of right hip joint with synthetic substitute, open approach
0SRB0J9	Replacement of left hip joint with synthetic substitute, cemented, open approach
0SRB0JA	Replacement of left hip joint with synthetic substitute, uncemented, open approach
0SRB0JZ	Replacement of left hip joint with synthetic substitute, open approach

SNOMED (sample):
397956004	Hip replacement
307814001	Arthroplasty of hip joint using cement
307815000	Arthroplasty of hip without cement
57589001	Arthroplasty, acetabular and proximal femoral prosthetic replacement, with allograft
53081006	Arthroplasty, acetabular and proximal femoral, prosthetic replacement
339905004	Cup arthroplasty of hip
47596009	Cup arthroplasty of hip with use of methyl methacrylate
179326003	Primary uncemented hemiarthroplasty of hip
430688009	Prosthetic arthroplasty of left hip
430694001	Prosthetic arthroplasty of right hip
52734007	Total replacement of hip

Hip Replacement

Client Profile

Accurate Risk Stratification– Individualized Action

Action Required
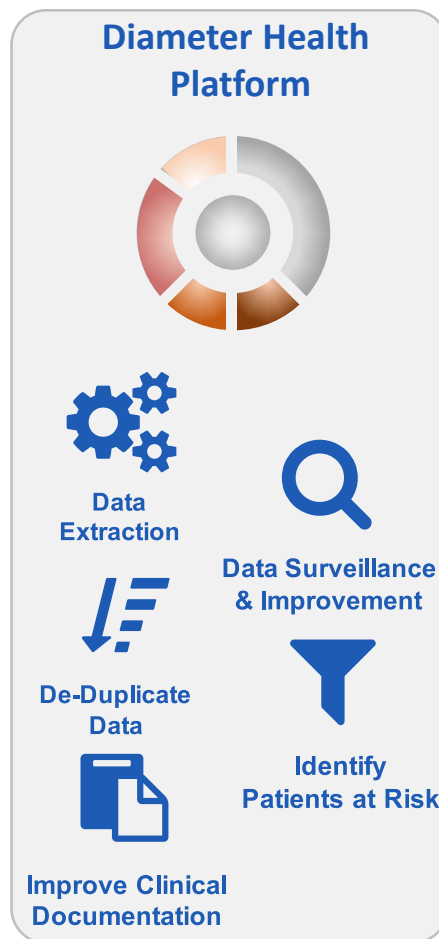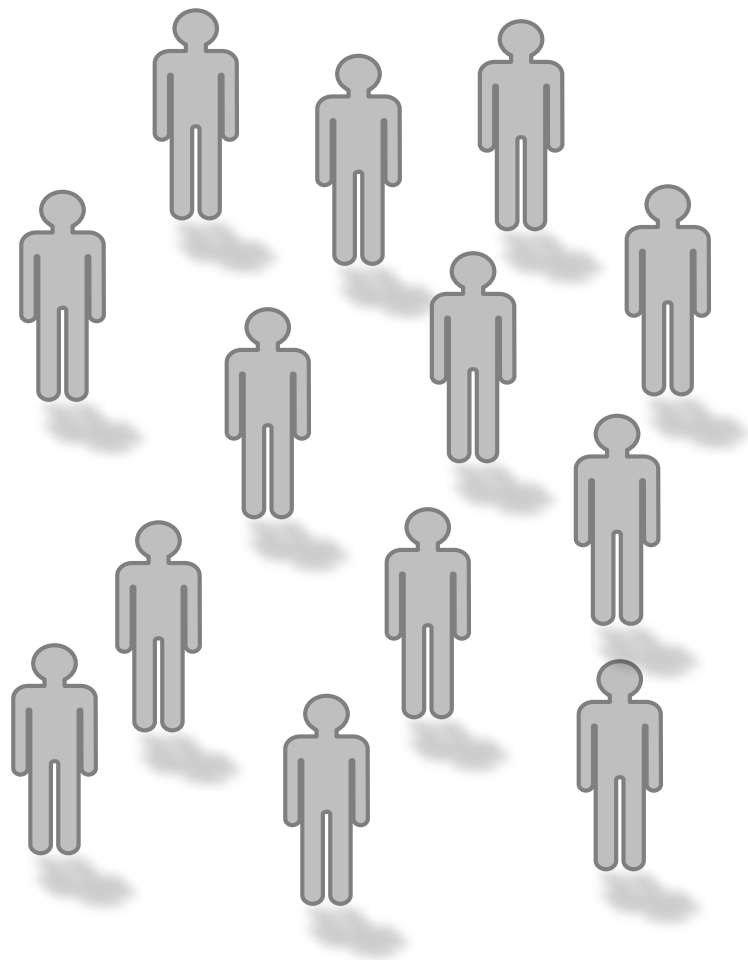
Action Merited

Standard of Care

Diameter Health Platform

Data Extraction

Data Surveillance & Improvement

De-Duplicate Data

Improve Clinical Documentation

Identify Patients at Risk

Case Study of a High-Risk Patient

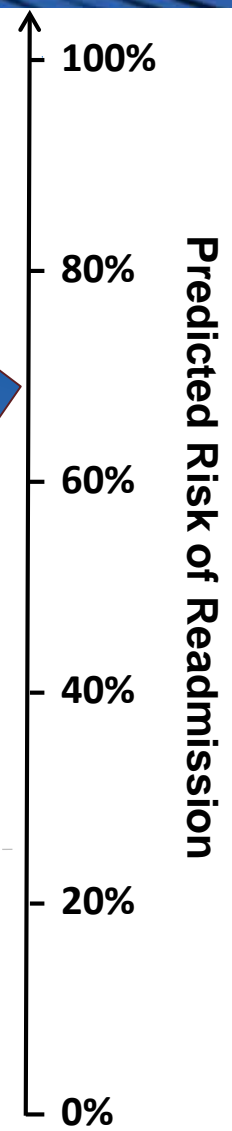**Admitted Multiple Times in Past Year**

Discharged to a Rehab Center

Long Length of Stay (> 5 days)

Majority of BMP Abnormal

High Polypharmacy

Has CHF, COPD, CKD, and acute presentation of pneumonia

READMITTED

Predicted Risk of Readmission
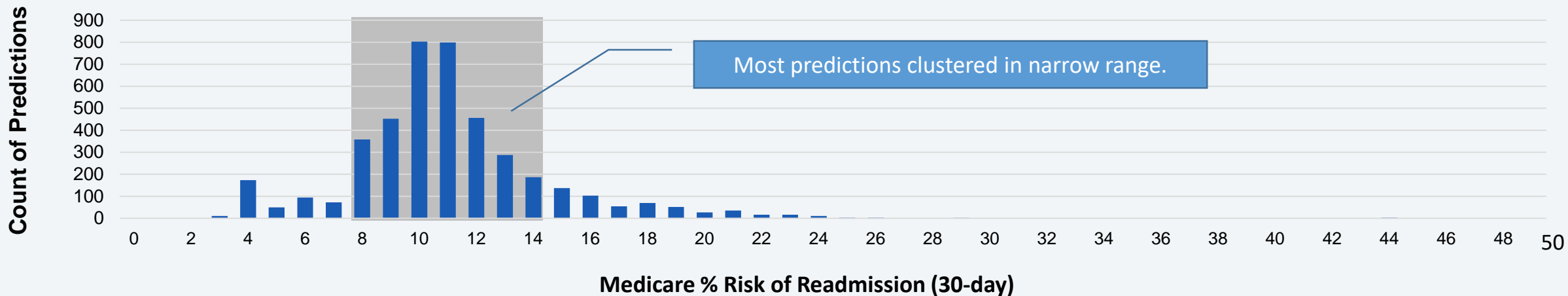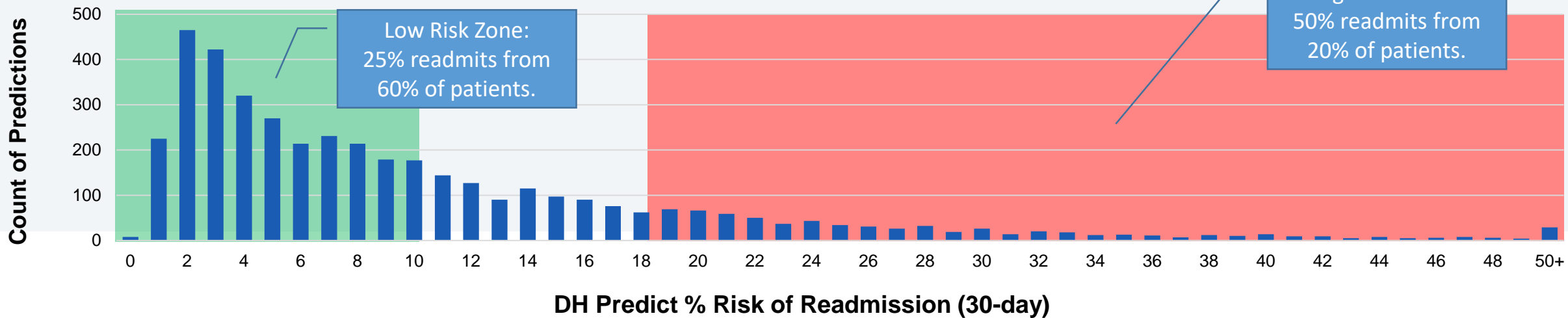
100%
80%
60%
40%
20%
0%

Readmission Risk Distribution

Better discrimination to identify & allocate resources on high-risk patients.

Distribution of Medicare Readmission Risks

Most predictions clustered in narrow range.

Medicare % Risk of Readmission (30-day)

Distribution of Diameter Health Readmission Risks

Low Risk Zone:
25% readmits from 60% of patients.

High Risk Zone:
50% readmits from 20% of patients.

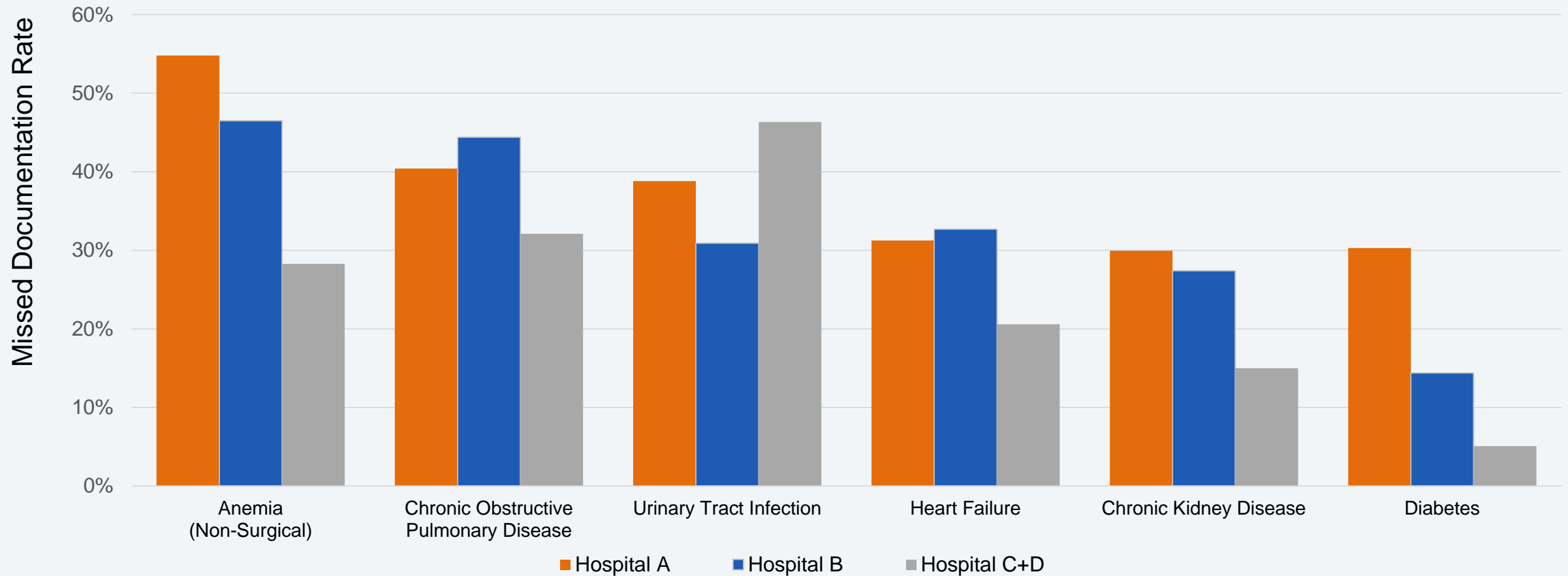DH Predict % Risk of Readmission (30-day)

Documentation Opportunities

Significant documentation improvement opportunities for common comorbidities across different hospitals.

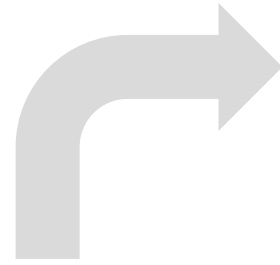Documentation Opportunities across Clinical Categories

Return on Investment

~30%
Patients Missing Documentation

1 in 6
Results in higher Medicare payment

$2,500
Avg. Incremental Reimbursement per case

$500,000
(Annually for 250 bed hospital)

Thank You!

Contact Information & Resources

- **Eric Rosow, CEO:**
  - ✉ erosow@diameterhealth.com
  - 🌐 www.diameterhealth.com

- **White Papers:**
  - [Semantic Interoperability](#)
  - [Predictive Strategies for Readmission Reduction](#)

- **ROI Calculator:** http://diameterhealth.com/roi-calculator/