New Cancer Diagnoses among Patients with Iron Deficiency Anemia

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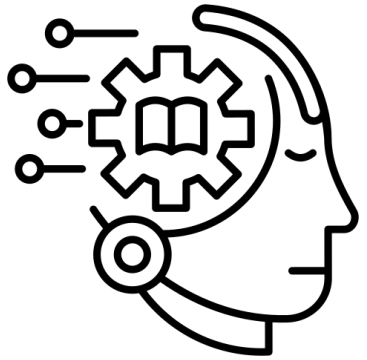
DISCLOSURE INFORMATION

I have no relevant financial relationships to disclose

Iron deficiency anemia is very common

- Iron deficiency anemia (IDA) impacts **2.9%** individuals in North America
- Patients with IDA are more likely to have an underlying **gastrointestinal malignancy** than the general population
- **Machine learning** advances can enable the efficient deployment of safety nets for maximizing guideline compliance



Kassebaum et al 2010
Ko et al 2020

AGA 2020 Guidelines

In asymptomatic postmenopausal women and men with iron-deficiency anemia, the AGA recommends bidirectional endoscopy over no endoscopy

Ko et al 2020

How well do we comply with these guidelines?

How many patients are going on to develop a GI malignancy?

Halo Solutions

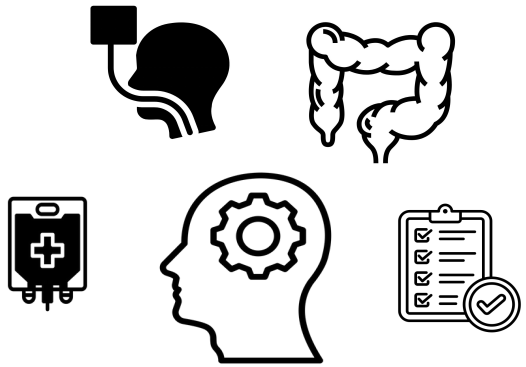
Machine Learning Algorithm

Software		Reports	Machine Learning	Data
webOMR		Scheduling, Labs		Endoscopy Visits, Labs
gGastro		Procedure PDFs	OCR NLP	Endoscopy Findings
webOMR		Patient Letters	NLP	Endoscopy Findings
SoftPath		Pathology Reports	NLP	Pathology Findings

OCR = Optical Character Recognition

NLP = Natural Language Processing

Methods



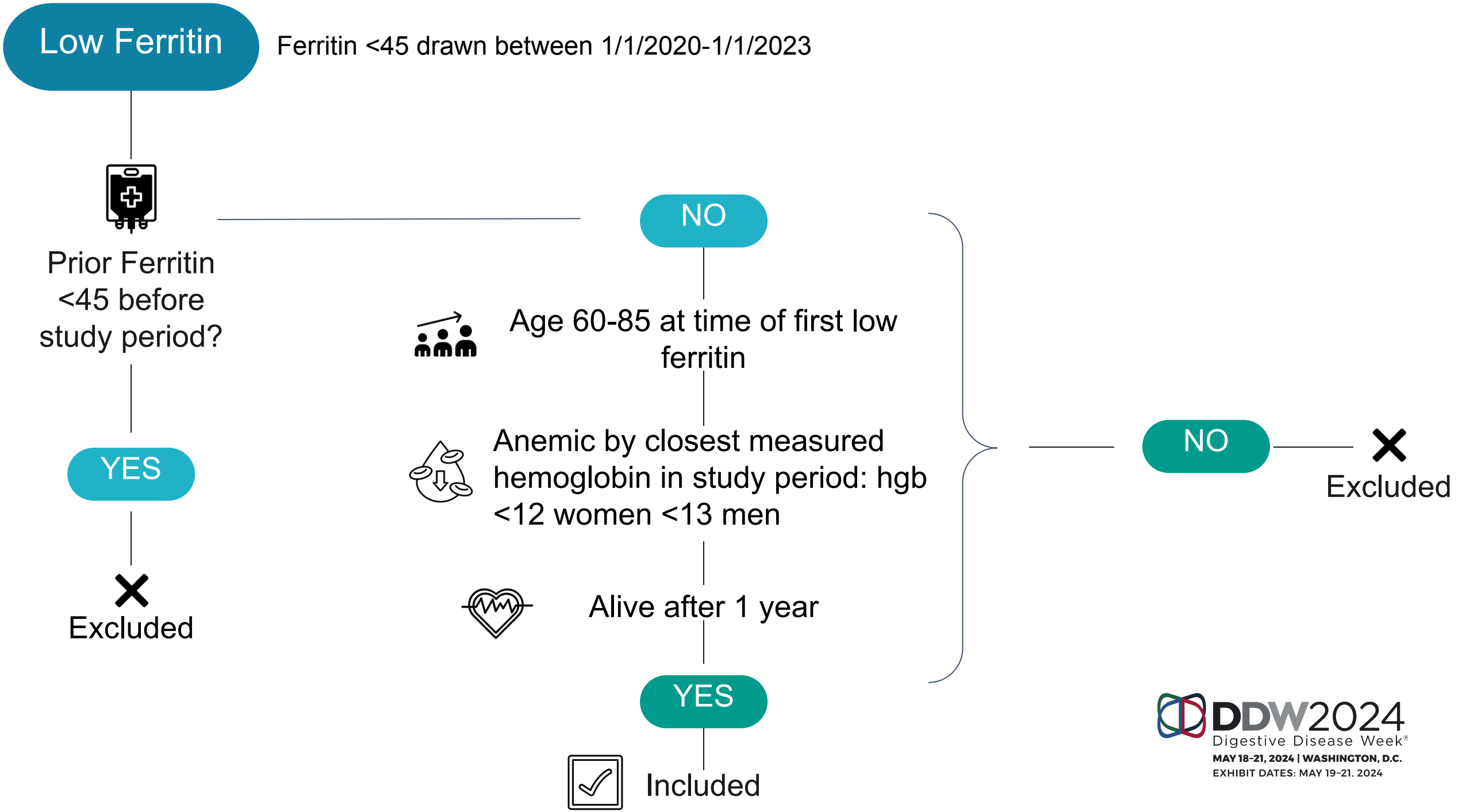
Machine Learning Algorithm

Retrospective Cohort

2020-2023

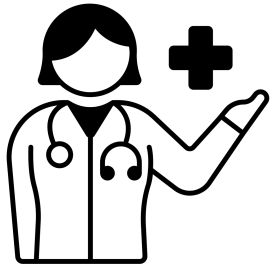
Prospective Cohort

2024-present



Demographics- Retrospective Cohort

Total Clinic Patient Population: ~43,000

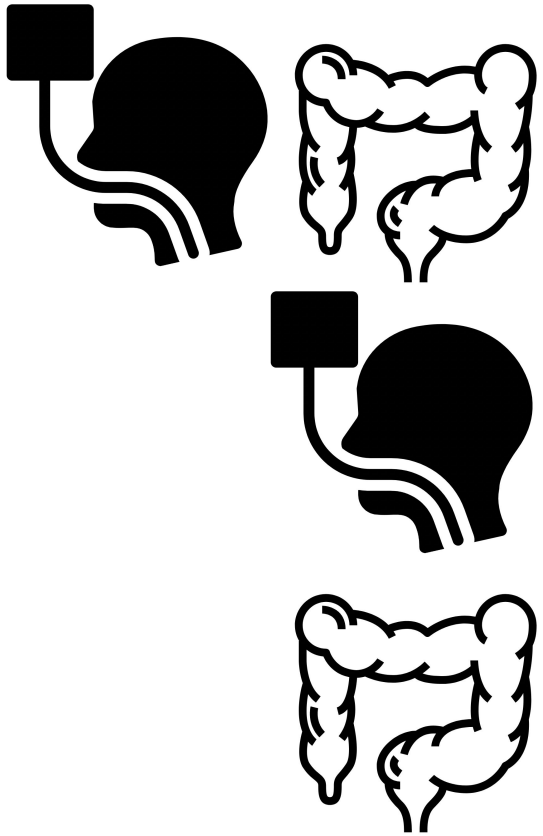


Number of Primary Care Physicians: 99

2020-2023

Total population with IDA (n)	2,068
Median Age (years)	71.0 (60-85)
Female (%)	57.8
Median Hemoglobin (g/dL)	11.1 (2.7-12.9)
Median Ferritin (ng/mL)	27 (0.7-44)

Endoscopic Compliance



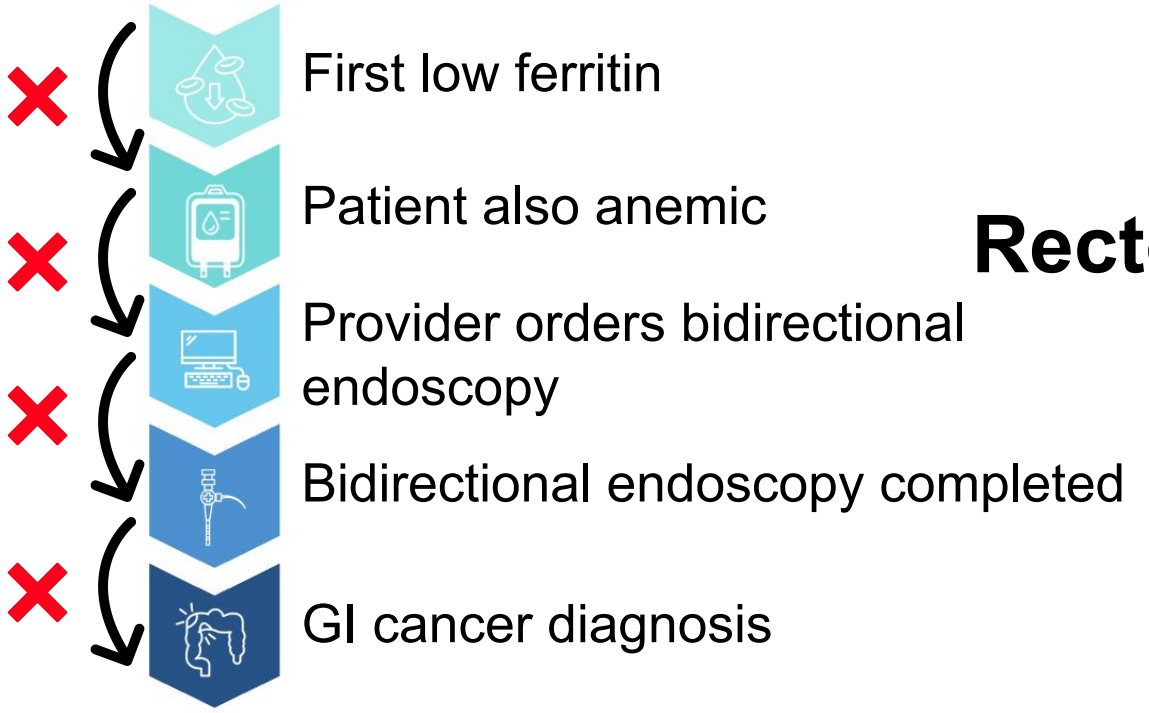
Bidirectional Endoscopy Compliance: **20.8%**

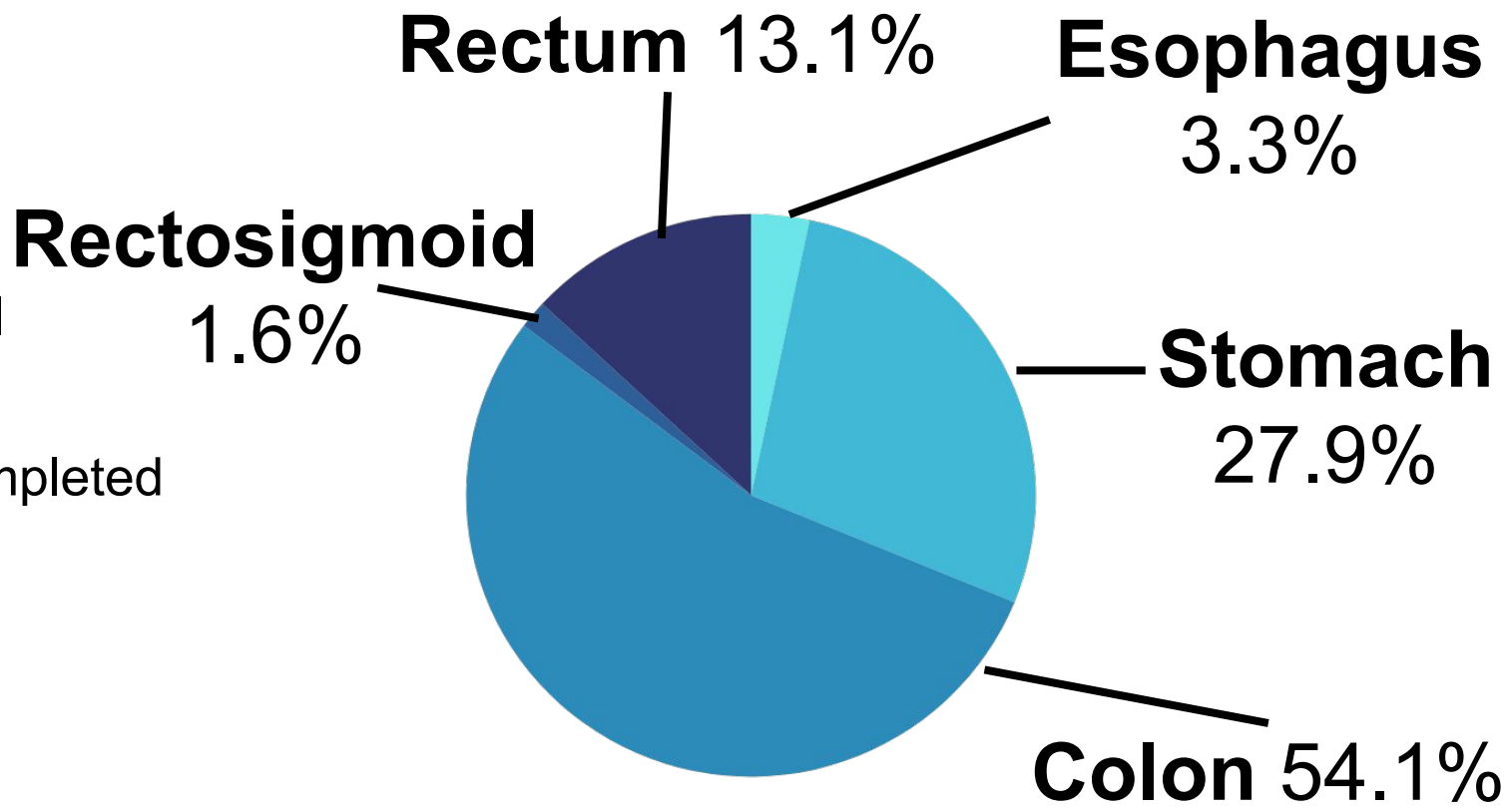
EGD Compliance: **31.7%**

Colonoscopy Compliance: **29.8%**

New Cancer Diagnoses

- **61 (2.9%)** of patients went on to develop GI malignancy within 2 years of IDA
- Lower GI tract cancers were roughly **twice** as common as upper GI cancers





Are there differences in compliance between subgroups of our population?

Subgroup Analysis

Bidirectional Endoscopy Compliance by Race

	Caucasian	Asian	Black	Hispanic	Other	Unknown
Odds Ratio	1.0	0.79	0.79	1.10	0.66	0.82
P-value	1.0	0.37	0.20	0.69	0.16	0.18

Bidirectional Endoscopy Compliance by Gender

	Female	Male
Odds Ratio	0.78	1.0
P-value	**0.027***	1.0

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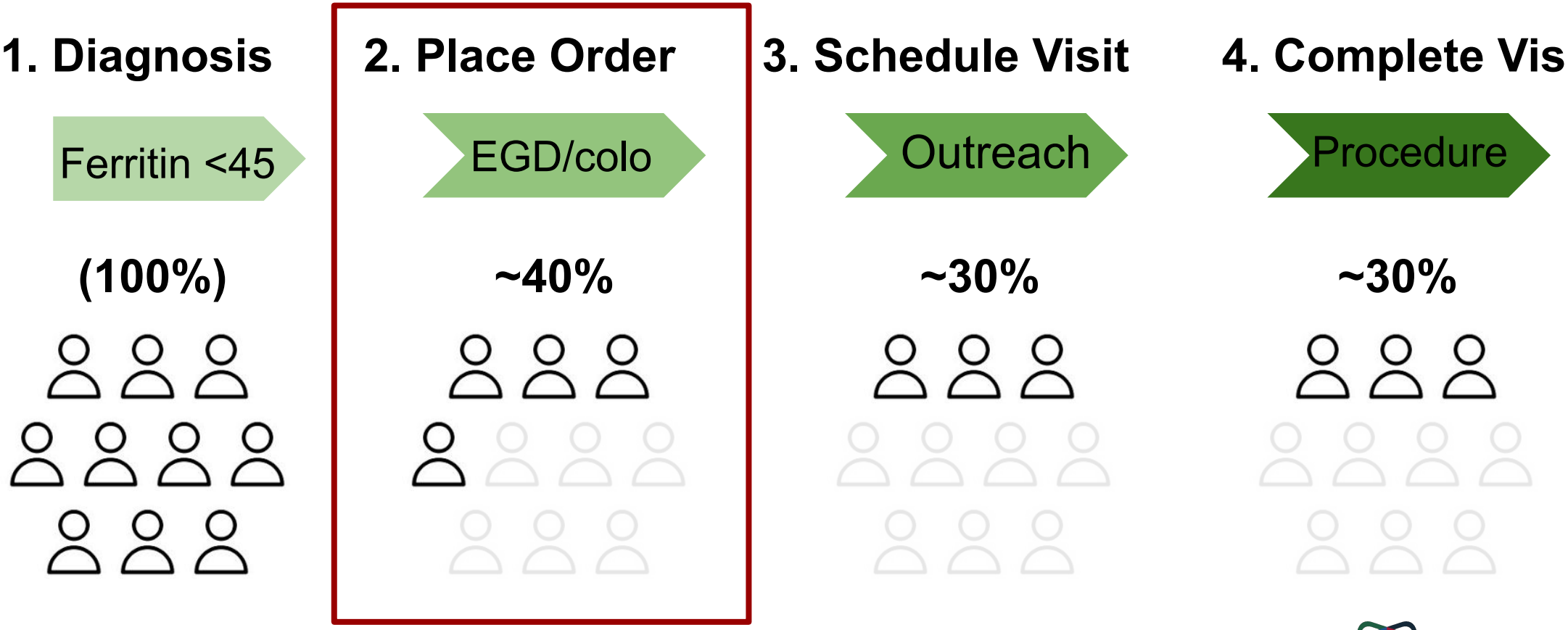
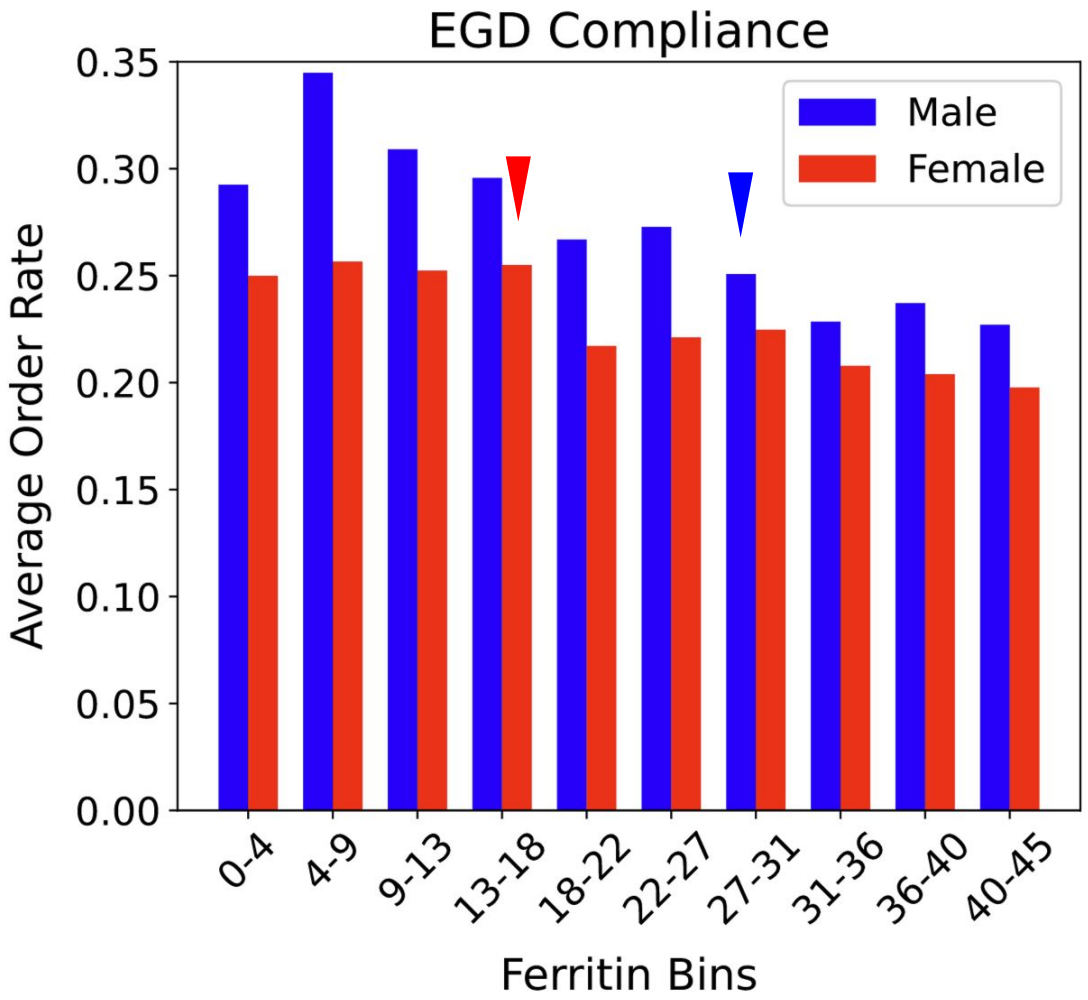
Root Cause Analysis for Low Compliance



Ordering Discrepancy



Ferritin laboratory threshold:

Women: 13

Men: 30

Clinician behavior correlates with EHR lab display color (abnormal = black, normal = red; $p<0.05$)

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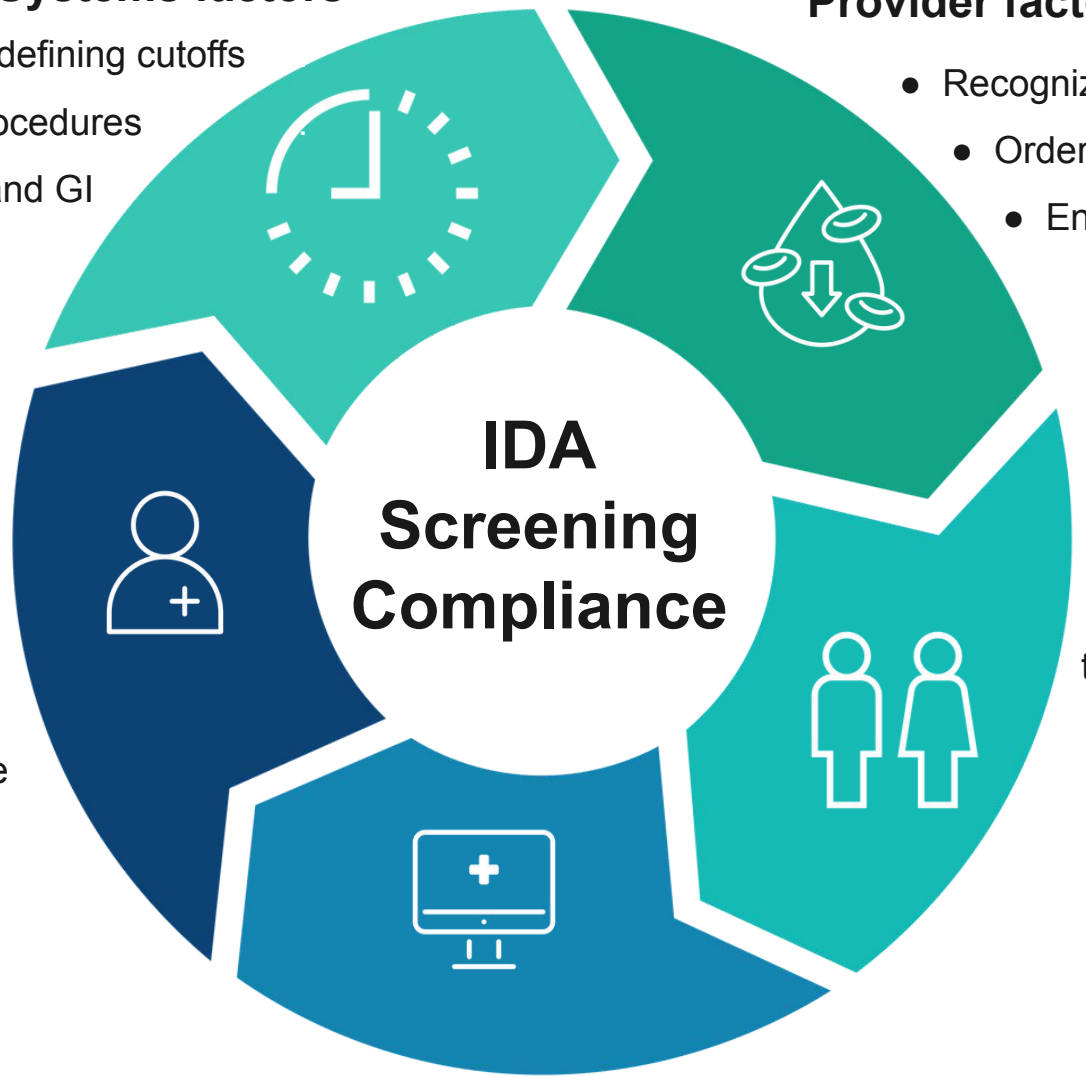

Systems factors

- Lab protocols for defining cutoffs
- Wait times for procedures
- Coordination between PCP and GI

Provider factors

- Recognizing diagnosis of IDA
- Ordering appropriate studies
- Ensuring study completion

Patient factors

- Concerns about invasive procedures
- Lost to follow up
- Language barriers
- Insurance

Biological factors

- Variation in ferritin across the lifecourse that influences the “normal” range

Technological factors

- Electronic medical record
- Lack of reminder tools for physicians
- Cut off for iron deficiency

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Conclusions

- Using **machine learning**, we were able able to rapidly assess cohorts of data to identify those at risk of malignancy
- **Multiple malignancies** were identified within 2 years of a diagnosis of iron deficiency anemia
- Adherence to AGA guidelines may **reduce** the risk of iron deficiency anemia associated malignancy
- Compliance rates may be **reduced** due to diagnostic anchoring on lab reported normal vs abnormal results

References

Kassebaum NJ, Jasrasaria R, Naghavi M, et al. A systematic analysis of global anemia burden from 1990 to 2010. Blood 2014;123:615–624. https://doi.org/10.1182/blood-2013-06-508325

Ko, Cynthia W., Shazia M. Siddique, Amit Patel, Andrew Harris, Shahnaz Sultan, Osama Altayar, and Yngve Falck-Ytter. “AGA Clinical Practice Guidelines on the Gastrointestinal Evaluation of Iron Deficiency Anemia.” *Gastroenterology* 159, no. 3 (September 2020): 1085–94. https://doi.org/10.1053/j.gastro.2020.06.046.