Using patient data to electronically identify palliative care patients

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Background

There is growing evidence that timely integration of palliative care is needed in the acute care hospital setting. Intermountain Healthcare, in collaboration with Cerner Corporation, developed a hospital-based electronic palliative care identification algorithm. The algorithm leverages historical and near real time data to identify patients that would benefit from secondary level palliative care services[1] at the time of admission, along with an integrated clinical workflow solution to help providers decrease cost and improve quality of care.

Methods

This evaluation utilizes a non-randomized retrospective study design. A mixed-methods approach using qualitative and quantitative methods will help to triangulate the data and will offer a more in-depth look at palliative care solutions. We collected data in 2 iterations. We analyzed 60 days of clinical data from the Intermountain Healthcare system for patients who received palliative care consults, as well as for patients identified by the electronic algorithm. The 60 days were split up into the first 30 day period, after which we made changes the algorithm before collecting an additional 30 days of data. Key informant interviews were conducted after presenting the first 30-day results to the palliative care team. During the second 30-day data collection period, palliative care clinicians conducted chart reviews on a weekly basis for all the patients the algorithm triggered on. Clinicians decided "Yes" or "No" on an algorithm identified patient, determining if they were appropriate for a palliative care consult. If the answer was "No", then a reason was given for why that patient was determined an inappropriate patient for a palliative care consult. Positive Predictive Values and False Positive Probabilities were calculated for the modified algorithm results.

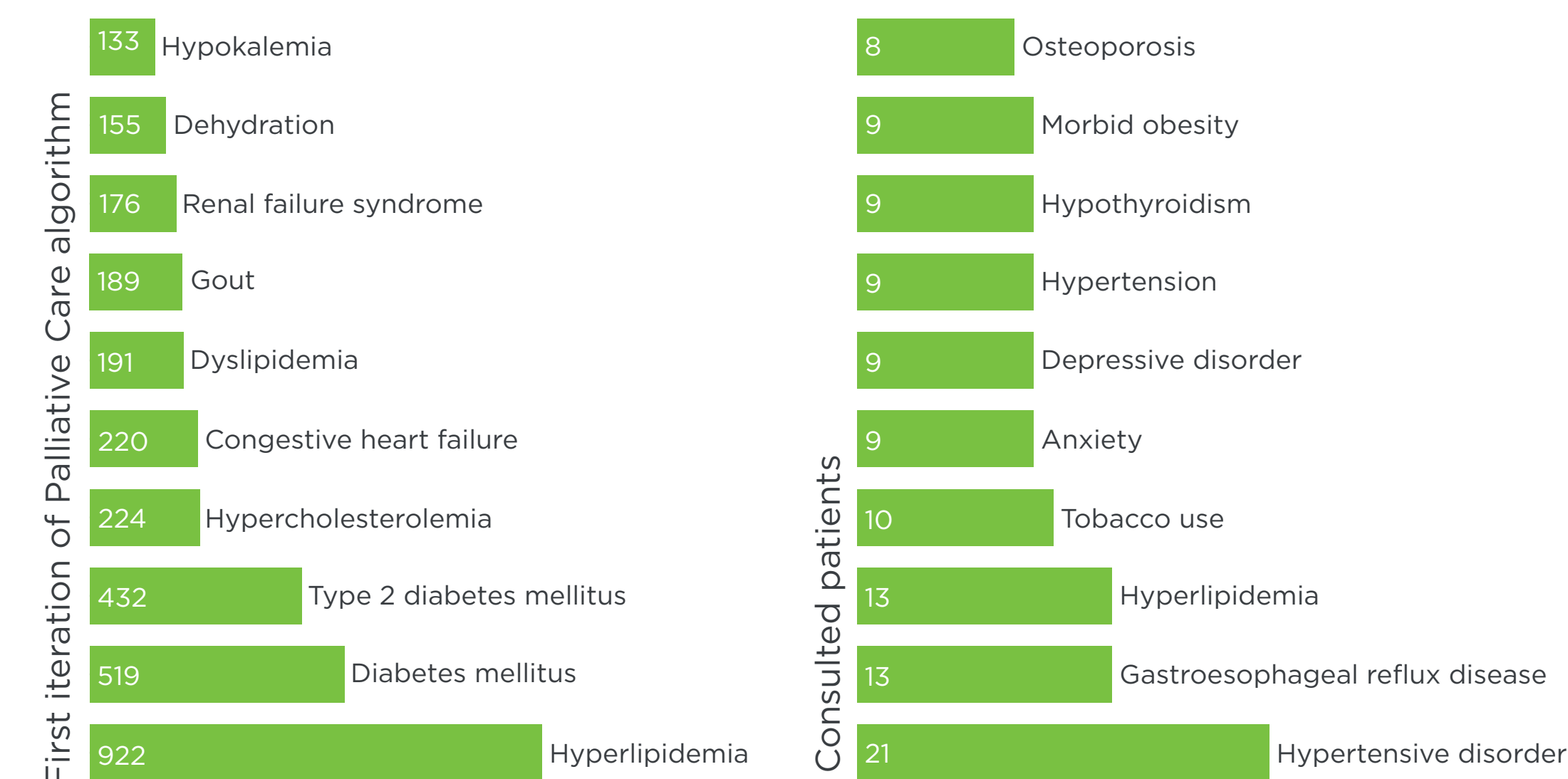### Electronic palliative care identification algorithm
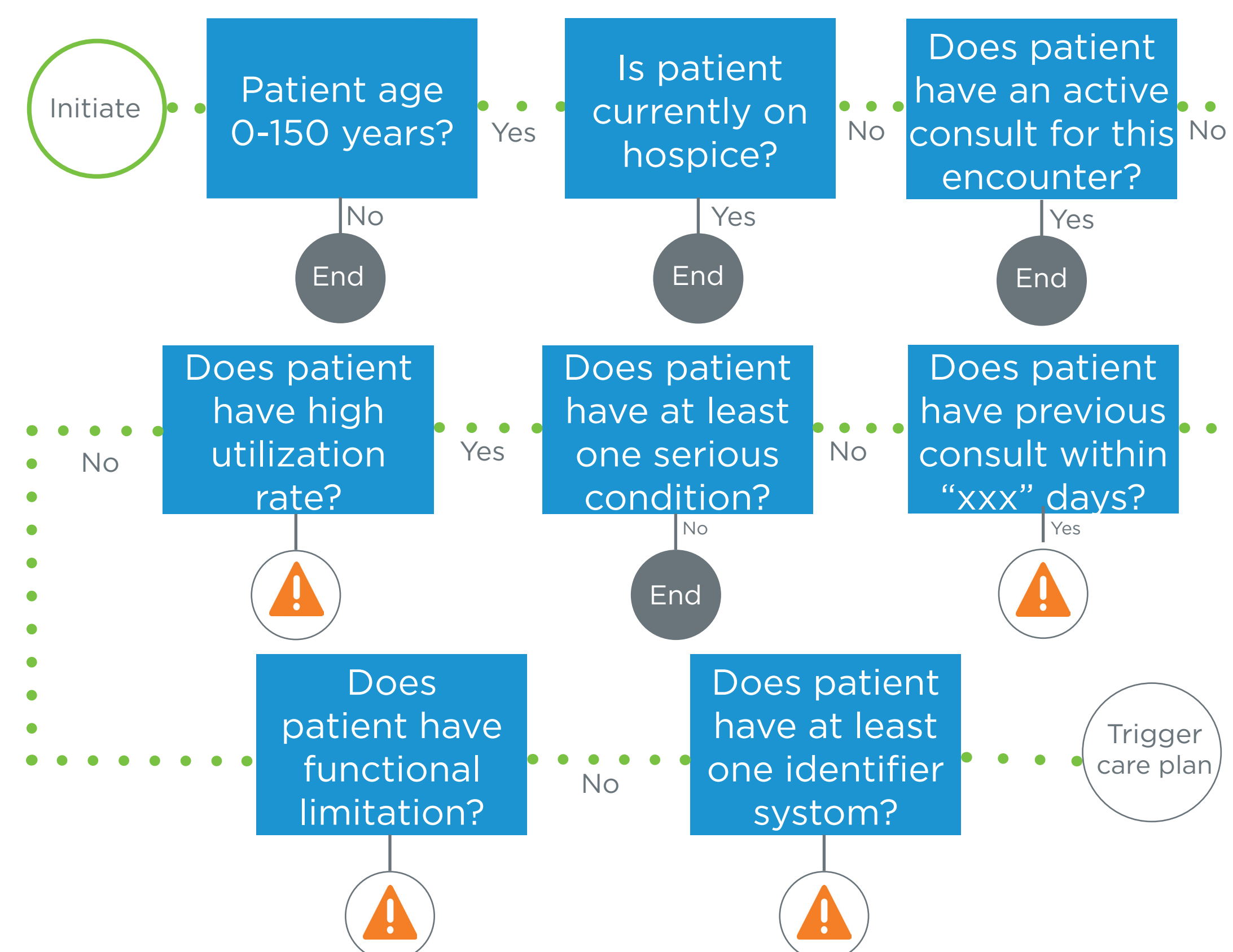
First 30-day results

The algorithm triggered 2,995 times on 1,384 unique patients, which was 70% of the total inpatient population during the 30 days. During this same time period, only 62 patients actually received palliative care consults, encompassing 3% of the total inpatient population. Qualifying criteria inclusive of diagnosis, hospital utilization, functional status and symptoms were reviewed.

Patient utilization triggering the algorithm before and after changes
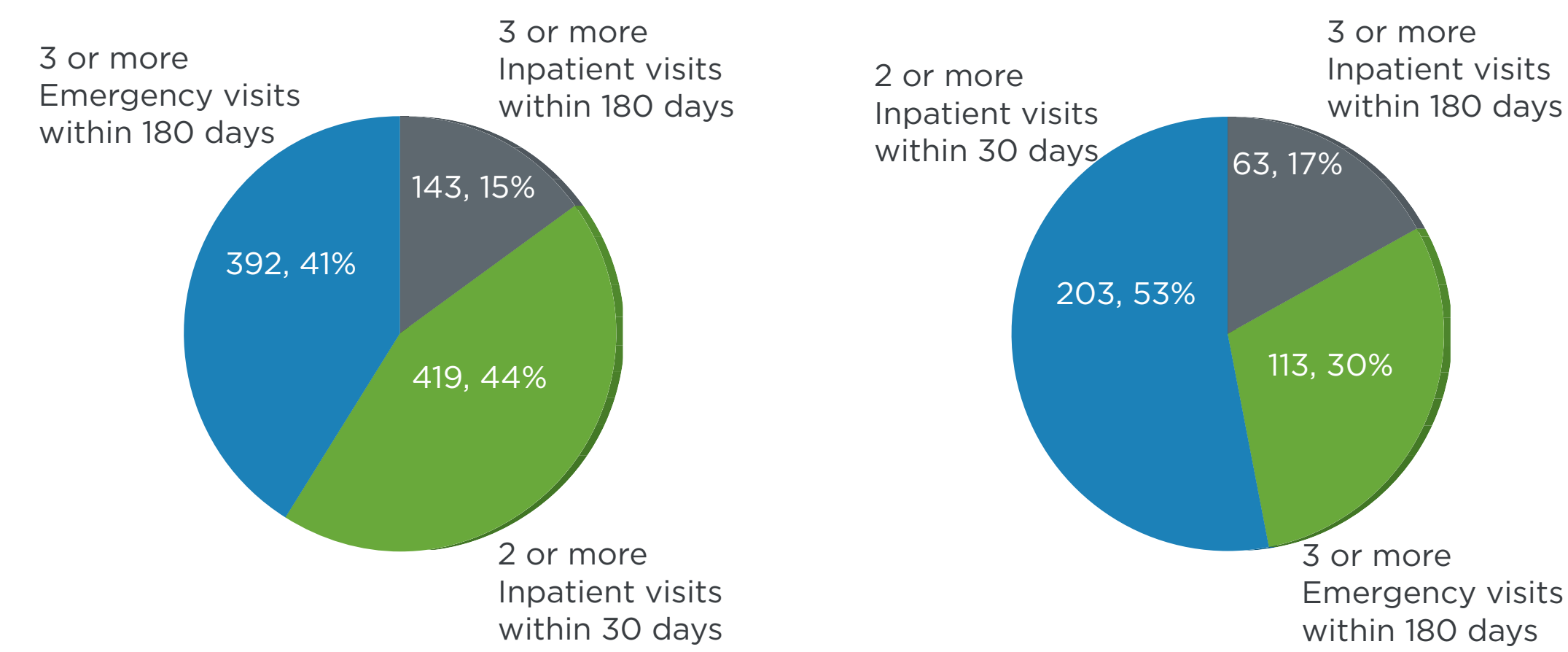
Interviews with the Intermountain palliative care teams provided the context and clinical expertise needed to understand what changes should be made to the algorithm to increase the accuracy of triggers.

Top 10 diagnosis or problems

	First iteration of Palliative Care algorithm		Consulted patients
133	Hypokalemia	8	Osteoporosis
155	Dehydration	9	Morbid obesity
176	Renal failure syndrome	9	Hypothyroidism
189	Gout	9	Hypertension
191	Dyslipidemia	9	Depressive disorder
220	Congestive heart failure	9	Anxiety
224	Hypercholesterolemia	10	Tobacco use
432	Type 2 diabetes mellitus	13	Hyperlipidemia
519	Diabetes mellitus	13	Gastroesophageal reflux disease
922	Hyperlipidemia	21	Hypertensive disorder

"What we don't want is for the trigger to turn on and identify every patient that is admitted to the hospital. [...] I meet a lot of people that have hyperlipidemia...but they don't need palliative care."
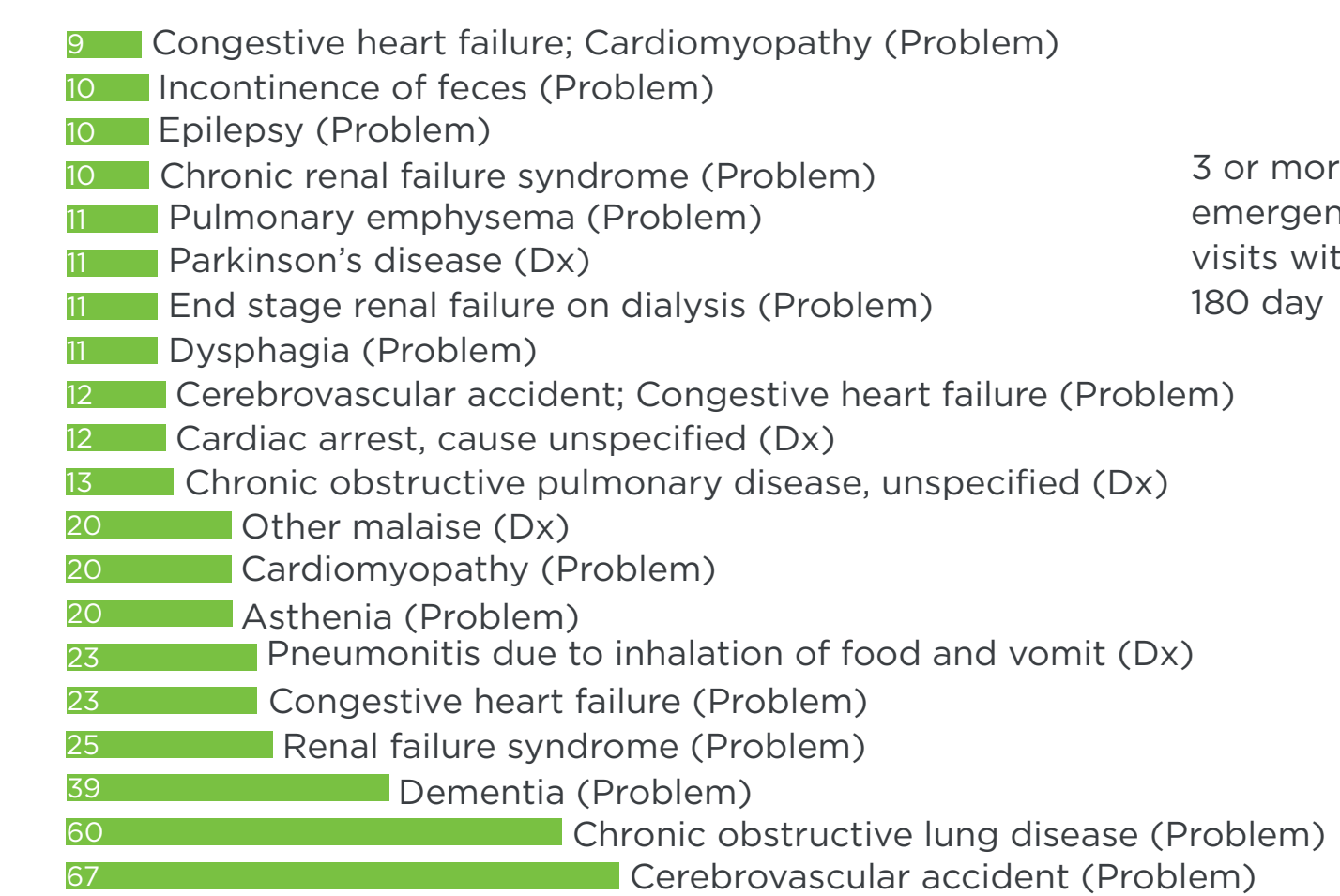- Palliative care provider

After making many of the proposed changes, we reanalyzed the same 30-day data. The number of times the algorithm triggered dropped to 992 on 425 unique patients, which was 21% of the total inpatient population.
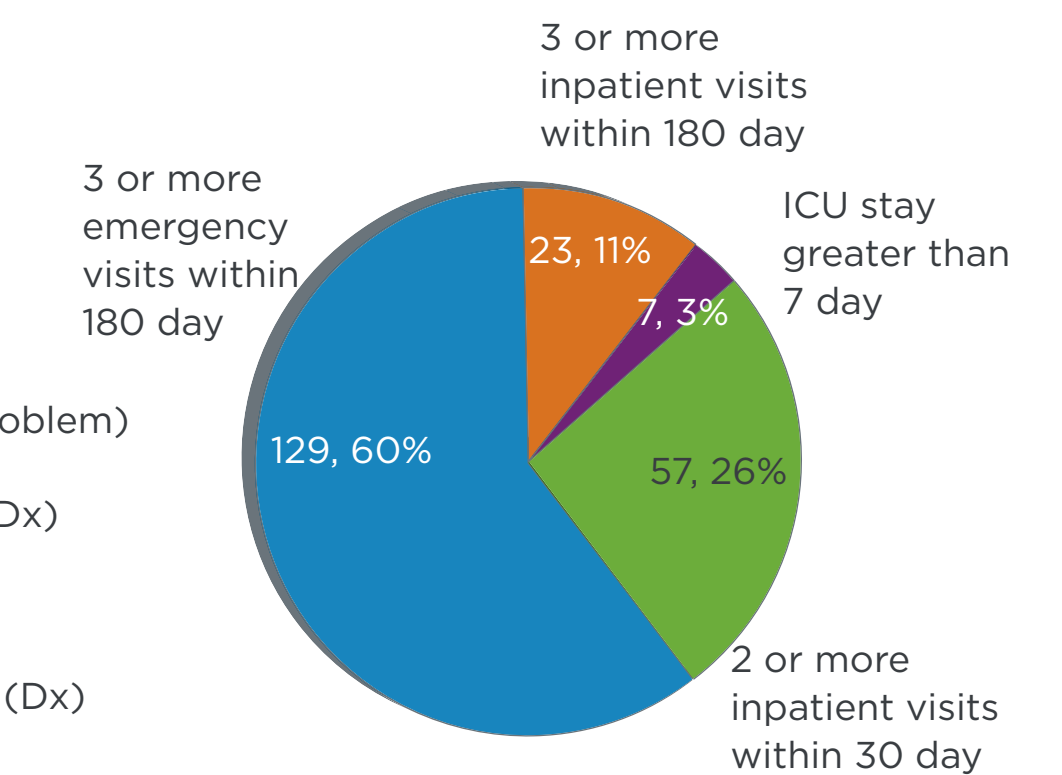
Second 30-day results

The algorithm triggered 851 times on 477 unique patient encounters which was 26% of the total inpatient population during the second 30 days. 706 chart reviews were completed on 461 unique patient encounters.

Top 10 diagnosis or problems

9	Congestive heart failure; Cardiomyopathy (Problem)
10	Incontinence of feces (Problem)
10	Epilepsy (Problem)
10	Chronic renal failure syndrome (Problem)
11	Pulmonary emphysema (Problem)
11	Parkinson's disease (Dx)
11	End stage renal failure on dialysis (Problem)
11	Dysphagia (Problem)
12	Cerebrovascular accident; Congestive heart failure (Problem)
12	Cardiac arrest, cause unspecified (Dx)
13	Chronic obstructive pulmonary disease, unspecified (Dx)
20	Other malaise (Dx)
20	Cardiomyopathy (Problem)
20	Asthenia (Problem)
23	Pneumonitis due to inhalation of food and vomit (Dx)
23	Congestive heart failure (Problem)
25	Renal failure syndrome (Problem)
39	Dementia (Problem)
60	Chronic obstructive lung disease (Problem)
67	Cerebrovascular accident (Problem)

Patient utilization triggering the algorithm

Of the 706 completed chart reviews, 474 (67%) were considered appropriate triggers for palliative care consults, and 232 (33%) were considered inappropriate triggers for palliative care consults. The positive predictive value (PPV) was 67% and the false positive probability was 33%.

Positive predictive value (PPV)

	Algorithm triggered
Appropriate	474 (67%)
Not appropriate	232 (33%)

Based on this PPV, for every 16 unique patients triggered per day, 11 of those patients would benefit from a palliative care consult. This suggests that approximately 16% of the total inpatient population may potentially benefit from palliative care consults.

Summary

A mixed-methods collaboration is successful for developing and optimizing a palliative care identification algorithm. Optimizing the identification algorithm is an iterative process involving data driven decisions as well as feedback and context from palliative care clinicians in order for the algorithm to function most accurately.

Future directions

Through continued collaboration we will evaluate and monitor the accuracy of the algorithm. Once Intermountain Healthcare turns the algorithm on in a live clinical setting, we can then begin to analyze the patient population that actually receives or does not receive palliative care consults as a result of the algorithm. An overall assessment will be conducted to demonstrate how electronically identifying patients for palliative care can improve workflow and outcomes for clinicians, patients and the families involved.

Clinical impact

The goal of this project is to enhance the Palliative Care Algorithm by bringing together the Cerner and Intermountain Healthcare development teams. This collaboration will bring alignment of both patient data and clinical experience to optimize the identification algorithm. The palliative care trigger will bring further awareness to providers regarding who is appropriate for an inpatient palliative care consult. The palliative care team is expecting an increase in the number of appropriate referrals to the inpatient service which in turn should impact patient quality of life and downstream resource utilization.

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[1] Von Gunten, C. F. (2002). Secondary and Tertiary Palliative Care in US Hospitals. JAMA, 287, 875-881.