Can we accurately identify chemotherapy-related acute care visits in administrative data?

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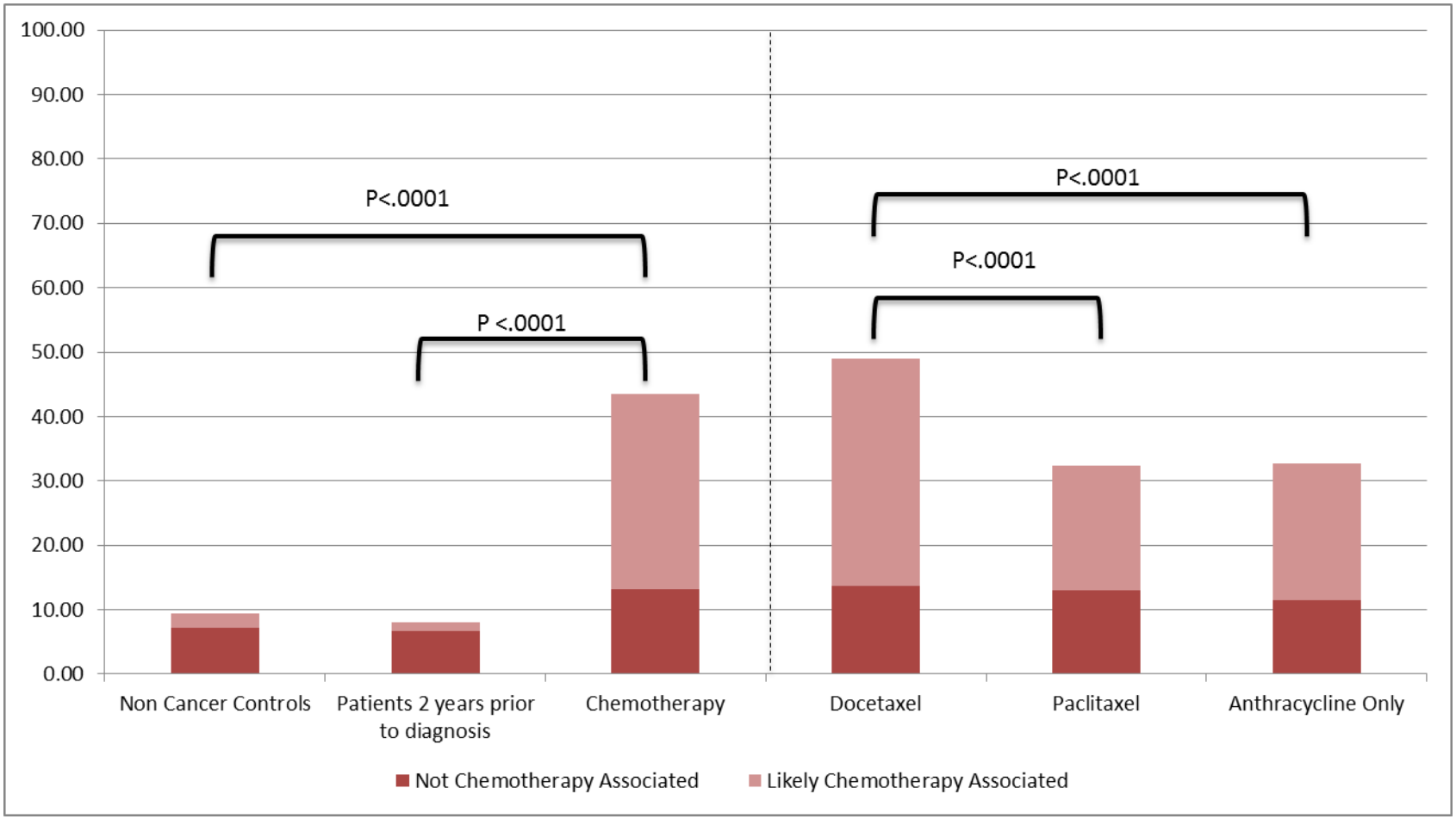
Background

- There is interest in using administrative data to evaluate complications related to cancer treatment.
- Visits to the Emergency Department (ED) and hospitalizations (H) have been used as a proxy measure for serious treatment related complications.
- While administrative data can reliably capture whether an acute care visit has taken place, less is known about the accuracy of billing codes for identifying treatment related visits.

Adjuvant Breast Cancer Toxicity (ABC-T) Study

- Population based cohort study of women with early stage breast cancer who received adjuvant chemotherapy in Ontario (2007-2009).
- Aims:
  1. To evaluate the frequency of ED+H in this cohort, identify predictive factors and compare rates to control populations;
  2. To determine the accuracy of administrative data for identifying chemotherapy related acute care visits;
  3. To evaluate primary care use during adjuvant chemotherapy.

ABC-T: Proportion of Patients with at Least One ED+H

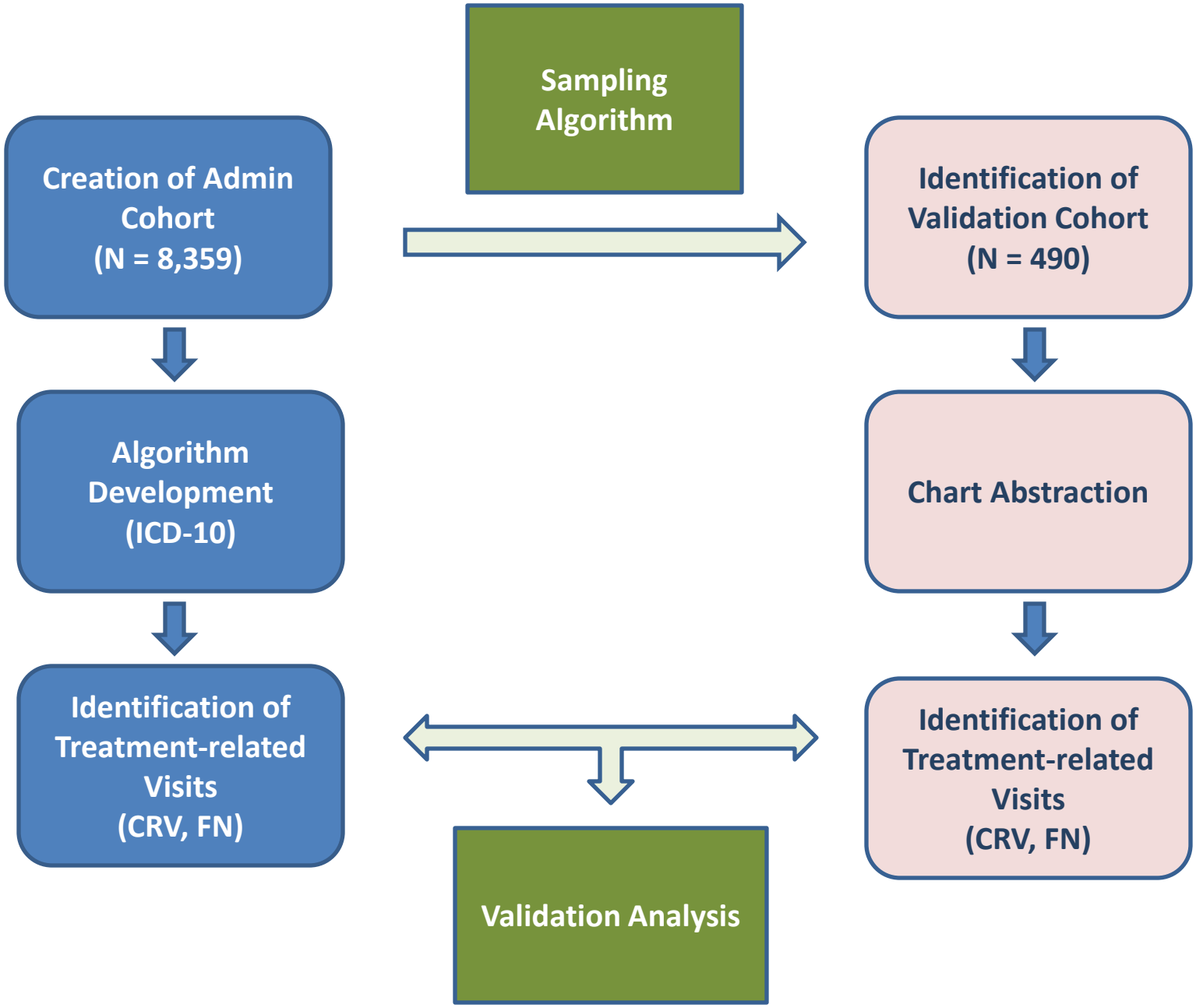


Aim 2

- To determine the accuracy of administrative data in identifying chemotherapy-related acute care visits:
  1. Any **C**hemotherapy **R**elated acute care **V**isits (**CRVs**)
  2. **F**ebrile **N**eutropenia (**FN**) related visits specifically

Methods: Overview

- Design: Validation study
- Setting: Ontario, Canada
- Population:
  - Women with early stage breast cancer (st 1-3)
  - Started adjuvant chemotherapy 2007-2009
- Data sources:
  - Case identification: Ontario Cancer Registry (OCR)
  - Chemotherapy identification: New Drug Funding Database (NDFP) and physician billing claims (OHIP)
  - Outcome identification:
    - ED Visits - National Ambulatory Care Reporting System (NACRS)
    - Hospitalizations – Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD)


Sampling Algorithm
Creation of Admin Cohort (N = 8,359)
Identification of Validation Cohort (N = 490)
Algorithm Development (ICD-10)
Chart Abstraction
Identification of Treatment-related Visits (CRV, FN)
Identification of Treatment-related Visits (CRV, FN)
Validation Analysis

Chemotherapy Related Visit (CRV) Algorithm

<u>Two scenarios:</u>

1. Most responsible diagnosis (MRD) field = one of the billing codes in the table
2. Any diagnosis (AD) field = one of the billing codes in the table

	Description	*ICD-10*
Neutropenia	Agranulocytosis Including drug induced	D70
Fever	Other Specified Fever	R508
	Chills with fever	
	Persistent fever	
	Fever with rigors	
	Fever unspecified	R509
	Fever NOS	
	FUO	
	Hyperpyrexia NOS	
	Pyrexia NOS	
	Pyrexia UO	
Infection	Infectious and parasitic diseases	A00-B99
	Bacteremia	
	Line associated Infection	T82.7
	Bronchitis	J20-J22
	Pneumonia	J12-J18
	Flu	J09-J11
	Kidney Infection	N10, N390
	Acute cystitis	N300
	Cellulitis	L00-L08
	Empyema	J86
	Abscess of lung/mediastium	J85
	Other septicaemia	A41
	Septicaemia unspecified	A419
	Septicaemia septic	
	Septicaemia other	A418
GI Toxicity	Diarrhea	K52
	Functional diarrhea	K59.1
	Nausea/emesis	R11
	Heartburn	R12
	Constipation	K59.0
	Obstruction	K56
	Stomatitis	K12
	Cachexia	R64.0
	Anorexia	R63.0
Other Systemic Treatment Related	Hyponatremia	E87.1
	Hypokalemia	E87.6
	Electrolyte disorder	E87.0, 2, 3, 4, 5, 7, 8
	Magnesium disorder	E834
	Dehydration/hypovolemia	E86
	Malaise/Fatigue	R53
	Syncope	R55
	Dizziness	R42
	Hypotension	I959
	Fe deficiency anaemia	D50
	Other deficiency anaemia	D51-D53
	Aplastic anemia	D60, D61
	Other and unspecified anemia	D62-D64
	Thrombocytopenia	D69.5, D69.6
	Other venous embolism and thrombosis	I82
	Rash and non specific skin eruptions	R21
	Hyperglycemia	R73
	Phlebitis	I808

Febrile Neutropenia (FN) Algorithm

Algorithm	Definition
General	MRD = Fever OR Infection OR Neutropenia
Moderate	MRD = Neutropenia *OR* "Strict"
Strict	MRD = (Fever OR Infection) PLUS additional code for Neutropenia

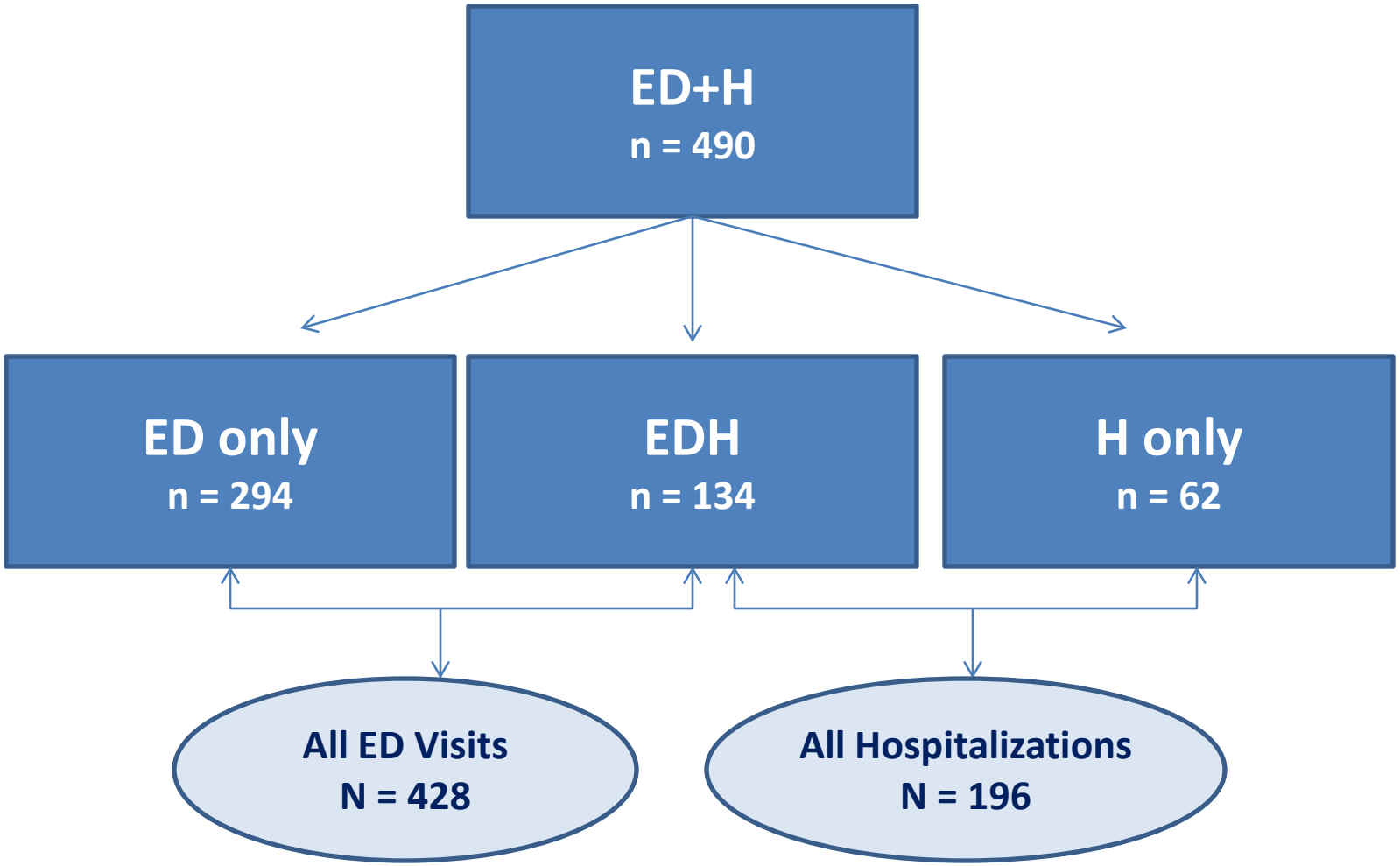
MRD = most responsible diagnosis

Validation Analysis

- For each of the two questions the following parameters were calculated stratified by type of visit (ED only, ED leading to H, or H only):
  - Sensitivity
  - Specificity
  - Positive predictive value
  - Negative predictive value
  - Accuracy

RESULTS

Types of Visits in Validation Cohort (VC)



Validation: CRVs

Admission Type	Algorithm	N	SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
ED only	MRD	294	65	80	89	48	69
	AD		69	79	89	50	71
EDH	MRD	134	90	100	100	32	90
	AD		94	100	100	43	93
All ED	MRD	428	75	81	94	46	76
	AD		78	80	94	50	79
H only	MRD	62	91	93	98	78	92
	AD		96	67	90	83	89
EDH	MRD	134	90	86	99	32	90
	AD		98	43	97	50	95
All H	MRD	196	90	91	99	80	90
	AD		97	59	95	72	93

ED = emergency department; H = hospitalization; MRD = most responsible diagnosis; AD = any diagnosis;
PPV = positive predictive value; NPV = negative predictive value;

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Validation: Febrile Neutropenia

Admission Type	N	Algorithm	SENSITIVITY %	SPECIFICITY %	PPV %	NPV %	ACCURACY %
ED only	294	General	94	80	21	100	81
		Moderate	69	98	65	95	96
		Strict	13	99	50	95	95
EDH	134	General	94	71	85	87	86
		Moderate	86	83	90	77	80
		Strict	50	88	88	49	63
All ED	428	General	94	79	58	98	82
		Moderate	83	96	86	95	93
		Strict	44	98	85	85	85
H only	62	General	96	74	74	96	84
		Moderate	96	97	96	97	97
		Strict	89	97	96	92	94
EDH	134	General	98	66	86	93	88
		Moderate	97	76	90	91	91
		Strict	89	78	90	77	86
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Limitations

- Lack of standard definition in the literature as to what constitutes a treatment related visit
- Suboptimal quality of documentation in the chart regarding visit details especially for ED visits
- Single jurisdiction
- Single clinical scenario

Summary

- **Chemotherapy Related Visits (CRVs):**
  - Algorithms based on the MRD had better performance characteristics than those based on all codes (similar sensitivity but improved specificity especially if visit involved hospitalization)
  - Visits that involved hospitalization had better performance characteristics than ED only visits
- **Febrile Neutropenia visits (FNs):**
  - There were significant differences in performance between the three different algorithms among ED visits, with substantial decrease in sensitivity with a STRICT algorithm
  - The MODERATE algorithm offered the best trade off between sensitivity and specificity

Conclusions

- Treatment related visits among patients receiving chemotherapy can be identified from administrative data with reasonable accuracy especially if visit involves a hospitalization.
- Optimal algorithm depends on intent of analysis to select best trade-off between sensitivity vs specificity.
- Validation of algorithm(s) in other cohorts and jurisdictions is warranted.

Acknowledgments

Funding for this project was provided by Cancer Care Ontario and the Ontario Institute for Cancer Research.

Chart Abstraction

- Definition of treatment related ED visit or hospitalization:
  - Single question based on review of chart details
- Definition of visit for febrile neutropenia:
  - ED visit: main reason for visit febrile neutropenia
  - Hospitalization: main reason for hospitalization febrile neutropenia

Prevalence of Treatment-Related Visits

Visit Type	Prevalence - Chart		Prevalence – Admin Data				
	Chemotherapy related visit	Febrile Neutropenia	MRD	AD	FN – G	FN – M	FN - S
ED only	71.4	5.4	52.4	55.1	23.8	5.8	1.4
EDH	95.5	64.2	85.8	89.6	70.9	61.2	36.6
All ED	79.0	23.8	62.9	65.9	38.6	23.1	12.4
H only	75.8	43.5	71.0	80.6	56.5	43.5	40.3
H admit	94.8	69.4	85.8	95.5	78.4	74.6	68.7
All H	88.8	61.2	81.1	90.8	71.4	64.8	59.7

Definitions

		GOLD STANDARD (Chart)		
		Related	Not Related	
ALGORITHM	Related	TP	FP	PPV
	Not Related	FN	TN	NPV
		SENSITIVITY	SPECIFICITY	ACCURACY

- Sensitivity = percentage of related visits that are correctly identified (TP/TP+FN)
- Specificity = percentage of visits that are *not* related that are correctly identified (TN/TN+FP)
- PPV = TP/TP+FP
- NPV = TN/TN+FN
- Accuracy = TP+TN/All