

Evaluation of Case-Finding Algorithm for Venous Thromboembolism Outcome



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33rd INTERNATIONAL CONFERENCE ON PHARMACOEPIDEMIOLOGY & THERAPEUTIC RISK MANAGEMENT (ICPE), Palais de Congres de Montreal, Montreal, Canada, August 26-30, 2017

BACKGROUND

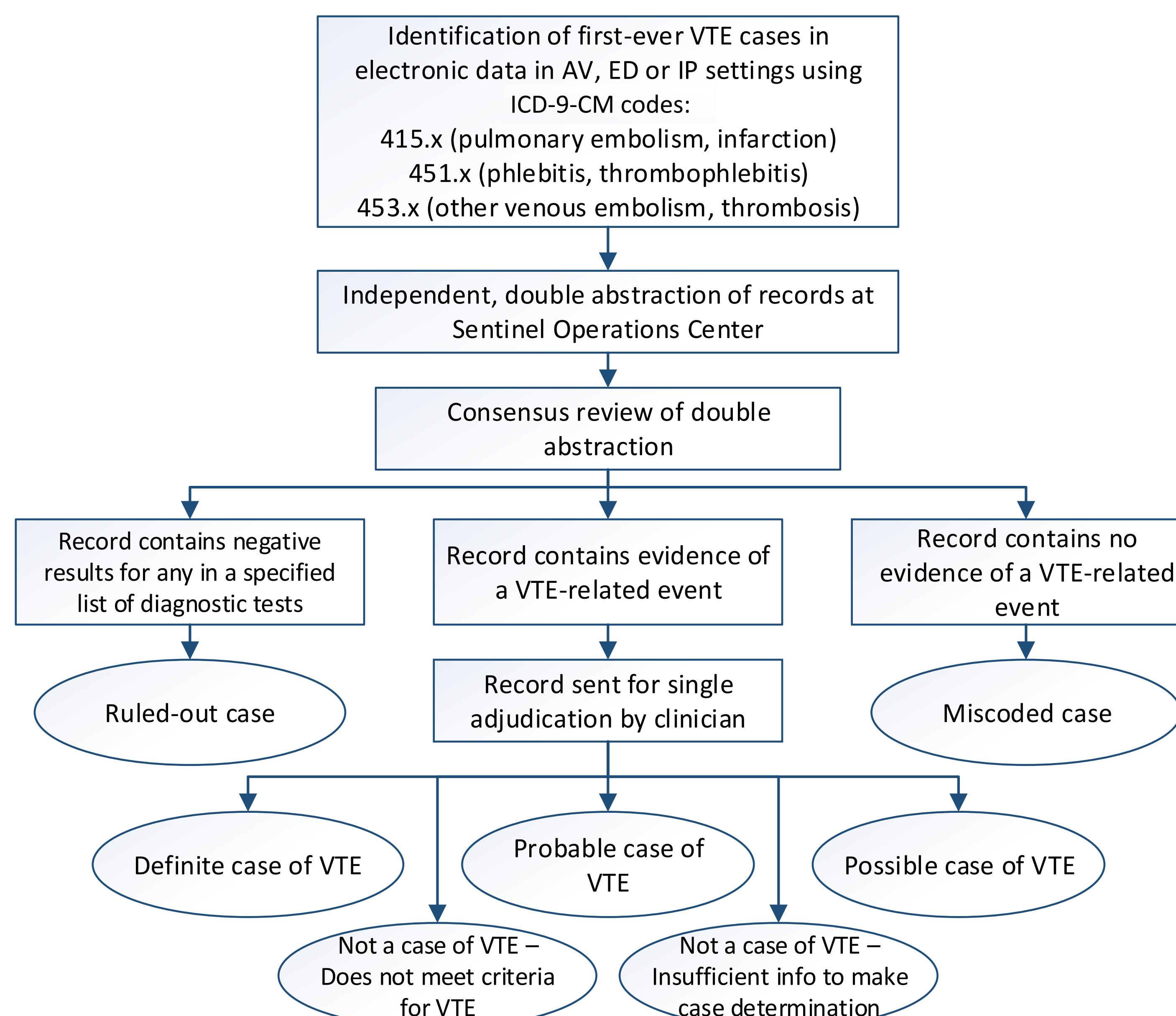
- In conducting medical product safety studies regarding pre-specified outcomes using administrative data, it is often desirable to use case-finding algorithms with high positive predictive value (PPV) in order to obviate the need for medical record review or at least to reduce its cost per confirmed case.
- As published PPVs are not available for many outcomes, evaluation of an algorithm for venous thromboembolism (VTE), a commonly studied outcome, will be useful for future studies.
- A Sentinel study was conducted to chart confirm first-ever VTE outcomes of pulmonary embolism (PE) and deep vein thrombosis (DVT).

METHODS

Study Population and Data Sources

- Females 9-26 years of age
- Members at 5 participating Sentinel Data Partners
- Study period June 2006 – June 2013
- Cases identified in the outpatient (AV), emergency department (ED), or inpatient (IP) settings using ICD-9-CM codes in electronic claims data at 5 Sentinel Data Partners
- Pre-specified case validation criteria used by clinician in adjudication of cases

Figure 1. Medical Record Review Process



Case Validation Criteria

Table 1. Rule Out Criteria

Pulmonary Embolism	Deep Vein Thrombosis
Pulmonary angiography, spiral CT scan or CT pulmonary angiography, MRI scan, or pathology	Venography, compression/duplex ultrasound, CT scan, or at autopsy

Miscode Criteria

- Record showed no diagnostic or blood test or symptom of possible VTE OR
- Record showed patient received a hematologic work-up and/or was evaluated for a risk factor specific to VTE due to familial history and/or initiating contraceptives

Table 2. Adjudication Case Criteria

	Pulmonary Embolism	Deep Vein Thrombosis
Definite	Confirmed by pulmonary angiography, spiral CT scan or CT pulmonary angiography, MRI scan, or pathology	Confirmed by venography, compression/duplex ultrasound, CT scan, or at autopsy
Probable*	If above tests not performed or were indeterminate, but ventilation-perfusion scan findings were of high probability	If above tests not performed or were indeterminate, but impedance plethysmography, radionuclide venography, or radiolabeled fibrinogen scan test results were reported as positive
Possible*	If all of the above tests were not performed or were indeterminate and 2 of the following criteria were satisfied: medical record indicates physician-diagnosed PE, signs or symptoms of PE were documented and the patient underwent therapy with anticoagulants, or an IVC filter was placed	If all of the above tests were not performed or were indeterminate and 2 of the following criteria were satisfied: medical record indicates physician-diagnosed DVT, signs or symptoms of DVT were documented and the patient underwent therapy with anticoagulants, or an IVC filter was placed

*Possible and probable cases were reviewed by a 2nd clinician. The 2nd clinician also consulted on specific questions and to confirm the overall case determination on a case-by-case basis.

Not-a-Case-of-VTE Categorization

- Cases that did not fit definite, probable, or possible criteria were categorized as:
 - Not a case of VTE – Does not meet criteria for VTE
 - Not a case of VTE – Insufficient information to make case determination

PPV and "Cost" Analysis

- PPV was calculated as the number of definite first-ever VTE cases divided by the number of potential cases for which VTE-related medical records were obtained
- The "cost" of record review is expressed as the number of potential cases reviewed for every case confirmed (the reciprocal of the PPV)

ACKNOWLEDGEMENTS

Many thanks are due to Data Partners who provided data and medical records used in the analysis.

FUNDING SOURCE

Funded by FDA contracts HHSF223200910006I. The authors have no conflicts to disclose.

OBJECTIVE

To evaluate the PPV of the components of the VTE case-finding algorithm used in a Sentinel study.

RESULTS

Figure 2. Disposition of Potential Incident VTE Cases

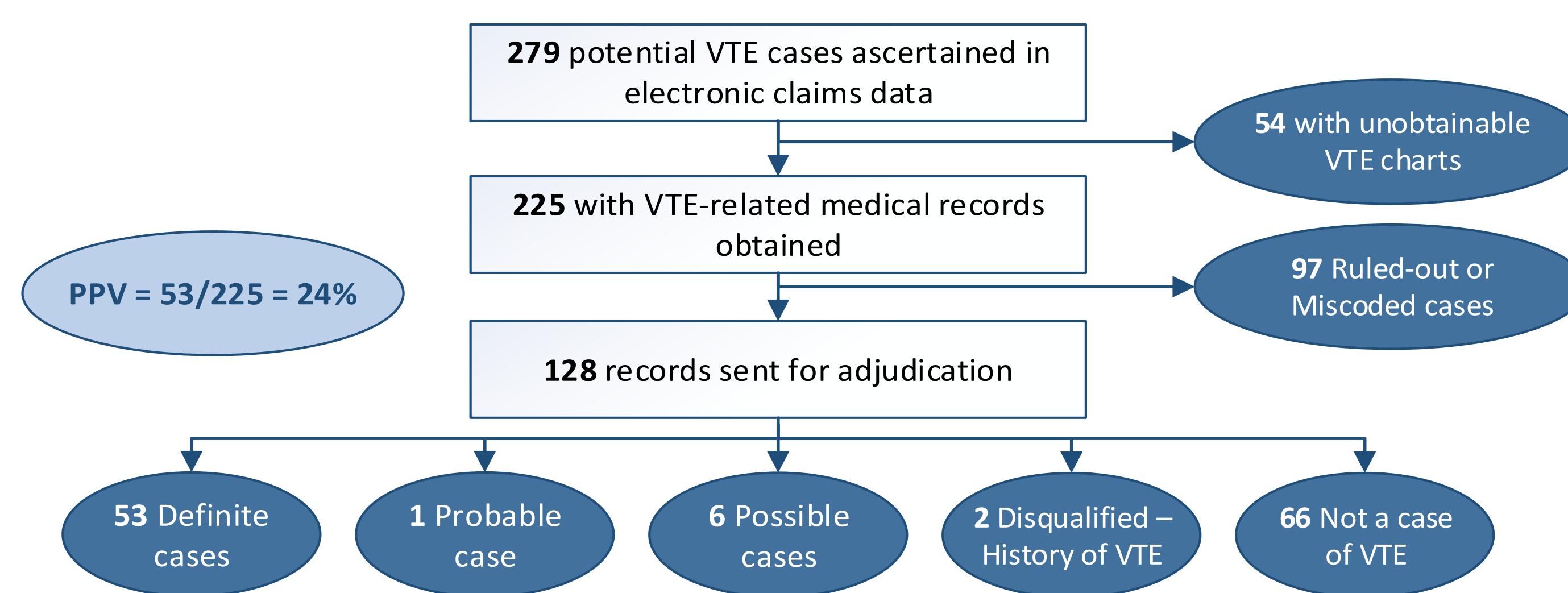


Table 3. PPVs by Setting

	AV	ED	IP	Total
Definite	8	10	35	53
Possible/Probable	2	2	3	7
Excluded	126	22	17	165
Total cases	136	34	55	225
PPV	6%	29%	64%	24%
PPV, IP & ED				51%

- "Excluded" includes ruled-out, miscoded, not-a-case-of-VTE, and history-of-VTE cases.
- The PPV would have increased from 24% to 51% if the algorithm had excluded the outpatient setting.
- 8 of the 53 definite cases would have been missed if the outpatient setting had been excluded.

Table 4. PPVs by Code Combination and Setting

	415.1x only			415.1x + 453.x			451.x only		
	AV	ED	IP	AV	ED	IP	AV	ED	IP
Definite	0	4	11	0	0	8	3	1	1
Possible/Probable	0	1	3	0	1	0	0	0	0
Excluded	13	3	2	0	0	0	55	13	8
PPV, all settings	41%			89%			6%		
PPV, IP & ED	63%			89%			9%		
	451.x + 453.x			453.x only			415.1x + 451.x + 453.x		
	AV	ED	IP	AV	ED	IP	AV	ED	IP
Definite	0	1	5	5	4	6	0	0	4
Possible/Probable	0	0	0	2	0	0	0	0	0
Excluded	3	0	2	54	6	5	1	0	0
PPV, all settings	55%			18%			80%		
PPV, IP & ED	75%			48%			100%		

*415.1x (pulmonary embolism, infarction), 451.x (phlebitis and thrombophlebitis), 453.x (other venous embolism, thrombosis)

Table 5. PPVs Excluding 451.x from Algorithm

	AV	ED	IP	Total
Definite	5	9	34	48
Possible/Probable	2	2	3	7
Excluded	71	9	9	89
Total cases	78	20	46	144
PPV	6%	45%	74%	33%
PPV, IP & ED				65%

- 451.x (phlebitis/thrombophlebitis) had the lowest PPV of the 3 codes used in the algorithm (see Table 4).
- The PPV would have increased from 24% to 33% if the algorithm had excluded code 451.x (see Table 5).
- 5 of the 53 definite cases would have been missed if 451.x had been excluded.

Table 6. Summary of Performance of Alternative Algorithms Compared With Original

Algorithm	PPV	Amount of chart review that would be saved	No. of definite cases that would be missed	Proportion of definite cases that would be missed	"Cost" of retaining respective element (code 451.x or AV setting) in algorithm—no. of charts to review for every confirmed case
Original algorithm: 415.x, 451.x, 453.x, all settings	53/225 = 24%	N/A	N/A	N/A	N/A
Alternative Algorithm 1: No outpatient setting	45/89 = 51%	136	8	8/53 = 15%	136/8 = 17 charts in ambulatory setting
Alternative Algorithm 2: 48/144 = 33% No 451.x code	81	5	5/53 = 9%	81/5 = 16 charts with code 451.x	
Alternative Algorithm 3: 43/66 = 65% No outpatient setting or 451 code	159	10	10/53 = 19%	159/10 = 16 charts in ambulatory setting or with code 451.x	

- The PPV would have increased from 24% to 65% if the algorithm had excluded the outpatient setting and code 451.x (Table 5, last row; Table 6, Alternative Algorithm 3)
- 10 of the 53 definite cases would have been missed if the algorithm had excluded outpatient setting and code 451.x
- The outpatient setting and 451.x code were each associated with a "cost" of 16-17 cases, where "cost" refers to the number of cases that had to be chart-reviewed for every definite case obtained

CONCLUSION

- The outpatient setting and phlebitis code (451.x) decreased the specificity of the VTE algorithm. However, omitting both would have caused us to miss 19% of the definite cases.
- These results are relevant in both the ICD-9 and ICD-10 era, as ICD-10 codes exist for the same diagnoses.
- Researchers studying the VTE outcome in administrative data should consider these PPV findings in light of the relative importance to their study of sensitivity vs. specificity of the VTE case-finding algorithm.