Our study confirms that selected patients with PE can be treated as outpatients with favorable short-term outcomes.

Margaret C. Fang, MD, MPH
Dongjie Fan, MSPH
Sue Hee Sung, MPH
Daniel M. Witt, PharmD
Steven H. Yale, MD
Steven R. Steinhubl, MD, MS
Alan S. Go, MD

Author Affiliations: Division of Hospital Medicine, University of California, San Francisco (Fang); Division of Research, Kaiser Permanente Northern California, Oakland (Fan, Sung, Go); Department of Pharmacotherapy, University of Utah College of Pharmacy, Salt Lake City (Witt); Office for Health Services, Marshfield Clinic Research Foundation, Marshfield, Wisconsin (Yale); Geisinger Health System, Danville, Pennsylvania (Steinhubl).

Corresponding Author: Margaret C. Fang, MD, MPH, Division of Hospital Medicine, University of California, San Francisco, 533 Parnassus Ave, PO Box 0131, San Francisco, CA 94143 (mfang@medicine.ucsf.edu).

Published Online: April 20, 2015. doi:10.1001/jamainternmed.2015.0936.

Author Contributions: Dr Fang had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Fang, Go.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Fang, Witt.
Critical revision of the manuscript for important intellectual content: Fan, Sung, Witt, Yale, Steinhubl, Go.
Statistical analysis: Fang, Fan.
Obtained funding: Fang, Go.
Administrative, technical, or material support: Sung, Witt, Yale, Go.
Study supervision: Go.

Conflict of Interest Disclosures: Dr Go reports receiving a research grant from CSL Behring. No other disclosures were reported.

Funding/Support: This study was funded by grant R01HL103820 from the National Heart, Lung, and Blood Institute of the National Institutes of Health (Dr Fang).

Role of the Funder/Sponsor: The funding source had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Additional Contributions: John R. Schmelzer, PhD, Marshfield Clinic Research Foundation, contributed to the initial conception and design of the study and acquisition and interpretation of the data and provided critical revisions to the final manuscript. He was not financially compensated.

1. Vinson DR, Zehtabchi S, Yealy DM. Can selected patients with newly diagnosed pulmonary embolism be safely treated without hospitalization? a systematic review. *Ann Emerg Med*. 2012;60(5):651-662.e654.

2. Aujesky D, Obrosky DS, Stone RA, et al. A prediction rule to identify low-risk patients with pulmonary embolism. *Arch Intern Med*. 2006;166(2):169-175.

3. Aujesky D, Roy PM, Verschuren F, et al. Outpatient versus inpatient treatment for patients with acute pulmonary embolism: an international, open-label, randomised, non-inferiority trial. *Lancet*. 2011;378(9785):41-48.

4. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. *J Clin Epidemiol*. 1994;47(11):1245-1251.

5. Mahan CE, Borrego ME, Woersching AL, et al. Venous thromboembolism: annualised United States models for total, hospital-acquired and preventable costs utilising long-term attack rates. *Thromb Haemost*. 2012;108(2):291-302.

LESS IS MORE

Oral Anticoagulant Prescription in Patients With Atrial Fibrillation and a Low Risk of Thromboembolism: Insights From the NCDR PINNACLE Registry

In patients with atrial fibrillation (AF) who are at risk for thromboembolism, anticoagulation therapy with warfarin or the newer novel anticoagulants reduces morbidity and mortality.[1,2] Because oral anticoagulant use carries a risk of bleeding, the drugs are not recommended in patients with AF who are at a particularly low risk for stroke. Specifically, previous AF guidelines recommend against the use of oral anticoagulation in patients younger than 60 years without heart disease or other known risk factors for thromboembolism,[3] and more recently updated guidelines do not recommend the use of oral anticoagulation in patients with AF without any established risk factor for stroke.[4] We sought to examine the prevalence of oral anticoagulant prescription that does not adhere to the guidelines in young and healthy patients with AF who were at the lowest risk for thromboembolism, as well as the clinical predictors of this practice.

Methods | Of 1 711 326 patients enrolled in the National Cardiovascular Data Registry's PINNACLE (Practice Innovation and Clinical Excellence) Registry between January 1, 2008, and December 30, 2012, a total of 359 315 (21.0%) had received a diagnosis of AF. Our final study cohort, derived from 76 cardiology practices from 287 different geographic office sites in 33 states, comprised 10 995 young (<60 years) and healthy patients with AF and no structural heart disease who were at low risk for thromboembolism. While all these patients by definition had a $CHADS_2$ (defined as 1 point each for congestive heart failure, hypertension, age ≥75 years, and diabetes mellitus, and 2 points for prior stroke, transient ischemic attack, or thromboembolism) score[5] of 0, we also performed a secondary analysis restricted to those with a CHA_2DS_2-VASc (defined as 1 point each for congestive heart failure, hypertension, age 65-74 years, diabetes mellitus, vascular disease, and female sex, and 2 points each for prior stroke, transient ischemic attack, or thromboembolism and age ≥75 years) score[6] of 0. To investigate the independent associations of various characteristics with the outcome of oral anticoagulant prescription, we constructed hierarchical modified Poisson regression models adjusted for patient demographics and clinical characteristics. Certification to use these deidentified data was obtained from the University of California, San Francisco, Committee on Human Research.

Results | In the cohort of patients with a $CHADS_2$ score of 0 and the cohort of those with a CHA_2DS_2-VASc score of 0, a total of 2561 (23.3%) and 1787 (26.6%) patients with AF, respectively, were prescribed an oral anticoagulant. Demographics and clinical characteristics of patients in each cohort stratified by prescription of oral anticoagulants are shown in the **Table**. In both the cohort of patients with a $CHADS_2$ score of 0 and the cohort of those with a CHA_2DS_2-VASc score of 0, patients with AF who were prescribed oral anticoagulants were older and more frequently insured by Medicare or were uninsured. Patients in both cohorts who were prescribed oral anticoagulation had a higher body mass index, and a greater proportion of patients received anticoagulation than not in the Northeast and West. Patients prescribed oral anticoagulants were less likely to have paroxysmal AF or to be current smokers. In only the cohort of patients with a $CHADS_2$ score of 0, patients who were prescribed oral anticoagulants were more likely to be male and have dyslipidemia. In multivari-

Table. Baseline Characteristics of Patients With Atrial Fibrillation at Low Stroke Risk With No Structural Heart Disease

Characteristic	Cohort					
	$CHADS_2$ Score = 0 (n = 10 995)[a]			CHA_2DS_2-VASc Score = 0 (n = 6730)[a]		
	Prescribed Oral Anticoagulant (n = 2561)	No Oral Anticoagulant (n = 8434)	*P* Value	Prescribed Oral Anticoagulant (n = 1787)	No Oral Anticoagulant (n = 4943)	*P* Value
Age, mean (SD), y	50.9 (7.6)	46.3 (10.4)	<.001	50.7 (7.7)	46.6 (10.1)	<.001
Male sex	1811 (70.8)[b]	5020 (59.6)[b]	<.001	0	0	
Race						
White	1100/1190 (92.4)	3614/3904 (92.6)	.11	770/825 (93.3)	2162/2301 (94.0)	.56
Black	61/1190 (5.1)	228/3904 (5.8)		37/825 (4.5)	102/2301 (4.4)	
Other	29/1190 (2.4)	62/3904 (1.6)		18/825 (2.2)	37/2301 (1.6)	
Hispanic ethnicity[b]	25 (2.3)	78 (2.4)	.87	13 (1.8)	40 (2.1)	.60
Insurance						
Private	1845/2270 (81.3)	5896/7159 (82.4)	.002	1314/1581 (83.1)	3631/4282 (84.8)	.002
Medicare	160/2270 (7.0)	373/7159 (5.2)		101/1581 (6.4)	180/4282 (4.2)	
Medicaid	54/2270 (2.4)	237/7159 (3.3)		24/1581 (1.5)	91/4282 (2.1)	
Other	60/2270 (2.6)	220/7159 (3.1)		42/1581 (2.7)	144/4282 (3.4)	
Uninsured	151/2270 (6.7)	433/7159 (6.0)		100/1581 (6.3)	236/4282 (5.5)	
Region						
Northeast	361/2561 (14.1)	874/8434 (10.4)	<.001	266/1787 (14.9)	540/4943 (10.9)	<.001
Midwest	662/2561 (25.8)	2127/8434 (25.2)		452/1787 (25.3)	1354/4943 (27.4)	
South	906/2561 (35.4)	3823/8434 (45.3)		615/1787 (34.4)	2064/4943 (41.8)	
West	632/2561 (24.7)	1610/8434 (19.1)		454/1787 (25.4)	985/4943 (19.9)	
Body mass index, mean (SD)[c]	31.6 (7.3)	29.0 (6.3)	<.001	31.5 (6.7)	29.3 (5.7)	<.001
Atrial fibrillation classification						
First episode detected	413/891 (46.4)	1156/2901 (39.8)	.003	272/594 (45.8)	758/1770 (42.8)	.002
Paroxysmal	385/891 (43.2)	1405/2901 (48.4)		254/594 (42.8)	863/1770 (48.8)	
Persistent	93/891 (10.4)	340/2901 (11.7)		68/594 (11.4)	149/1770 (8.4)	
Comorbidities						
Peripheral arterial disease	12 (0.5)	43 (0.5)	.80	0	0	
Dyslipidemia	503 (19.6)	1505 (17.8)	.04	349 (19.5)	918 (18.6)	.38
Tobacco use						
Never	802/1522 (52.7)	2938/5546 (53.0)	<.001	521/1051 (49.6)	1723/3290 (52.5)	<.001
Current	273/1522 (17.9)	1250/5546 (22.5)		206/1051 (19.6)	761/3290 (23.2)	
Quit <12 mo ago	75/1522 (4.9)	195/5546 (3.5)		50/1051 (4.8)	113/3290 (3.4)	
Quit >12 mo ago	372/1522 (24.4)	1163/5546 (21.0)		274/1051 (26.1)	693/3290 (20.8)	

Abbreviations: $CHADS_2$, 1 point each for congestive heart failure, hypertension, age 75 years or older, and diabetes mellitus, and 2 points for prior stroke, transient ischemic attack, or thromboembolism; CHA_2DS_2-VASc, 1 point each for congestive heart failure, hypertension, age 65 to 74 years, diabetes mellitus, vascular disease, and female sex, and 2 points each for prior stroke, transient ischemic attack, or thromboembolism and age 75 years or older.

[a] Data are given as number/total number (percentage) unless otherwise noted. Where values do not total the number in the cohort, this is owing to missing values. Some percentages within a category do not total 100% due to rounding.

[b] Missing data for each category are not shown; percentages are calculated based on the denominator of participants with known values for each variable.

[c] Calculated as weight in kilograms divided by height in meters squared.

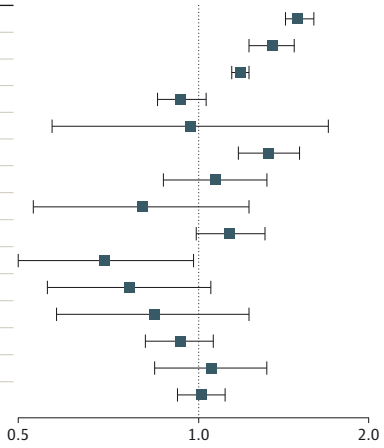
able analysis of the cohort of patients with a $CHADS_2$ score of 0 that assessed clinical predictors of oral anticoagulant prescription adjusted for clustering of patients within sites, older age (adjusted relative risk [RR], 1.48 per 10 years; 95% CI, 1.41-1.56, *P* < .001), male sex (adjusted RR, 1.34; 95% CI, 1.22-1.46, *P* < .001), higher body mass index (adjusted RR, 1.18 per 5 kg/m^2; 95% CI, 1.14-1.22, *P* < .001), and Medicare compared with private insurance (adjusted RR, 1.32; 95% CI, 1.17-1.49, *P* < .001) were associated with a higher likelihood of being prescribed oral anticoagulants, whereas treatment in the South compared with the Northeast of the United States was associated with a lower likelihood of being prescribed oral anticoagulants (adjusted RR, 0.69; 95% CI, 0.49-0.98, *P* = .04) (**Figure**, A).

In multivariable analysis of the cohort of patients with a CHA_2DS_2-VASc score of 0, older age (adjusted RR, 1.44 per 10 years; 95% CI, 1.36-1.54, *P* < .001), higher body mass index (adjusted RR, 1.19 per 5 kg/m^2; 95% CI, 1.15-1.23, *P* < .001), Medicare compared with private insurance (adjusted RR, 1.29; 95% CI, 1.13-1.47, *P* < .001), and no insurance compared with private insurance (adjusted RR, 1.19; 95% CI, 1.03-1.37, *P* = .02) were associated with a higher likelihood of being pre-

Figure. Relative Risk of Oral Anticoagulant Prescription in Patients With Atrial Fibrillation Who Have Low Stroke Risk

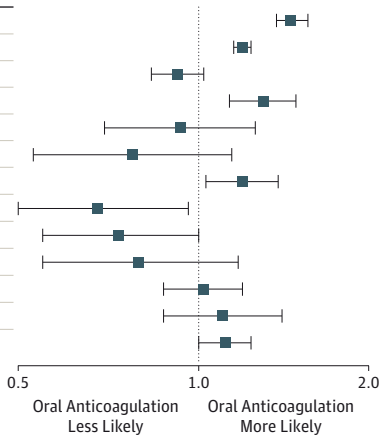
A $CHADS_2$ Cohort

Characteristic	Adjusted RR (95% CI)
Age (per 10 years)	1.48 (1.41-1.56)
Male sex	1.34 (1.22-1.46)
Body mass index (per 5 kg/m^2)	1.18 (1.14-1.22)
Dyslipidemia	0.93 (0.85-1.03)
Peripheral arterial disease	0.97 (0.56-1.67)
Insurance: Medicare vs private	1.32 (1.17-1.49)
Insurance: Medicaid vs private	1.07 (0.87-1.31)
Insurance: other vs private	0.80 (0.52-1.22)
Insurance: no insurance vs private	1.13 (0.99-1.30)
Region: South vs Northeast	0.69 (0.49-0.98)
Region: West vs Northeast	0.76 (0.55-1.05)
Region: Midwest vs Northeast	0.84 (0.57-1.22)
Tobacco: current vs never	0.93 (0.81-1.06)
Tobacco: quit <12 months vs never	1.05 (0.84-1.31)
Tobacco: quit >12 months vs never	1.01 (0.92-1.11)



B CHA_2DS_2-VASc Cohort

Characteristic	Adjusted RR (95% CI)
Age (per 10 years)	1.44 (1.36-1.54)
Body mass index (per 5 kg/m^2)	1.19 (1.15-1.23)
Dyslipidemia	0.92 (0.83-1.02)
Insurance: Medicare vs private	1.29 (1.13-1.47)
Insurance: Medicaid vs private	0.93 (0.69-1.25)
Insurance: other vs private	0.77 (0.52-1.14)
Insurance: no insurance vs private	1.19 (1.03-1.37)
Region: South vs Northeast	0.67 (0.47-0.96)
Region: West vs Northeast	0.73 (0.54-1.00)
Region: Midwest vs Northeast	0.79 (0.54-1.17)
Tobacco: current vs never	1.02 (0.87-1.19)
Tobacco: quit <12 months vs never	1.10 (0.87-1.39)
Tobacco: quit >12 months vs never	1.11 (1.00-1.23)



Characteristics associated with oral anticoagulant prescription after multivariable adjustment in patients with atrial fibrillation and low thromboembolic risk, as defined by a $CHADS_2$ (defined as 1 point each for congestive heart failure, hypertension, age 75 years or older, and diabetes mellitus, and 2 points for prior stroke, transient ischemic attack, or thromboembolism) score of 0 (A) and those with a CHA_2DS_2-VAS_c (defined as 1 point each for congestive heart failure, hypertension, age 65 to 74 years, diabetes mellitus, vascular disease, and female sex, and 2 points each for prior stroke, transient ischemic attack, or thromboembolism and age 75 years or older) score of 0 (B). Error bars denote 95% CIs. Body mass index is calculated as weight in kilograms divided by height in meters squared. RR indicates relative risk.

scribed oral anticoagulants, whereas treatment in the South compared with the Northeast of the United States was associated with a lower likelihood of being prescribed oral anticoagulants (adjusted RR, 0.67; 95% CI, 0.47-0.96, P = .03) (Figure, B).

Discussion | In a large, nationally representative sample of young (<60 years) and healthy outpatients with AF who were at the lowest risk of stroke treated by cardiovascular specialists, approximately 25% of patients were prescribed oral anticoagulant therapy, contrary to contemporary guideline recommendations. Specific patient characteristics predicted an increased likelihood of oral anticoagulant prescription. These findings may have important public health implications since young and healthy patients with AF who are at the lowest risk of stroke have an unfavorable risk-benefit profile when prescribed oral anticoagulants.

Our study has limitations. First, the PINNACLE Registry did not capture data on certain diagnoses, such as previous pulmonary embolism or deep vein thrombosis, which may have warranted use of oral anticoagulation independent of AF. Second, the PINNACLE Registry did not include procedural data regarding electrical cardioversion or catheter ablation for AF. Since oral anticoagulation is often administered for 1 to 2 months after these procedures, patients who recently underwent these procedures may have been categorized as taking oral anticoagulants despite the actual intention for the treatment to be only transient.

Because oral anticoagulants have the potential for substantial benefit and harm, decision making for health care professionals regarding stroke prophylaxis in patients with AF presents a unique clinical challenge. Prescription of oral anticoagulants by cardiovascular specialists in a significant proportion of patients at the lowest thrombotic risk suggests

that these health care professionals may not be fully aware of the potential risks associated with oral anticoagulation or the particularly low risk of stroke in this population.

Jonathan C. Hsu, MD, MAS
Paul S. Chan, MD, MSc
Fengming Tang, MS
Thomas M. Maddox, MD, MSc
Gregory M. Marcus, MD, MAS

Author Affiliations: Cardiac Electrophysiology Section, Division of Cardiology, Department of Medicine, University of California, San Diego (Hsu); Mid America Heart Institute, Kansas City, Missouri (Chan, Tang); Department of Internal Medicine, University of Missouri, Kansas City (Chan); Veterans Affairs Eastern Colorado Health Care System, Denver (Maddox); Division of Cardiology, University of Colorado School of Medicine, Denver (Maddox); Cardiac Electrophysiology Section, Division of Cardiology, Department of Medicine, University of California, San Francisco (Marcus).

Corresponding Author: Gregory M. Marcus, MD, MAS, Cardiac Electrophysiology Section, Division of Cardiology, Department of Medicine, University of California, San Francisco, 505 Parnassus Ave, Room M1180B, San Francisco, CA 94143 (marcusg@medicine.ucsf.edu).

Published Online: April 13, 2015.
doi:10.1001/jamainternmed.2015.0920.

Author Contributions: Drs Hsu and Marcus had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Hsu, Marcus.
Acquisition, analysis, or interpretation of data: Hsu, Chan, Tang, Maddox.
Drafting of the manuscript: Hsu, Marcus.
Critical revision of the manuscript for important intellectual content: Hsu, Chan, Tang, Maddox.
Statistical analysis: Tang.
Study supervision: Hsu, Marcus.

Conflict of Interest Disclosures: Dr Hsu reported receiving honoraria from Medtronic. Dr Chan reported receiving a Career Development Grant Award K23HL102224 from the National Heart, Lung, and Blood Institute. Dr Maddox reported receiving a Health Services Research and Development Career Development Award from the US Department of Veterans Affairs. Dr Marcus reported receiving research support from Medtronic and SentreHeart Inc. No other disclosures were reported.

Funding/Support: This research was supported by the American College of Cardiology Foundation's National Cardiovascular Data Registry (NCDR).

Role of the Funder/Sponsor: The PINNACLE (Practice Innovation and Clinical Excellence) Registry is an initiative of the American College of Cardiology Foundation. Bristol-Myers Squibb and Pfizer Inc are founding sponsors of the PINNACLE Registry. The PINNACLE Registry and the NCDR had no role in the design and conduct of the study and management, analysis, or interpretation of the data. The manuscript was approved with minor editorial suggestions by the PINNACLE Registry Research and Publications Committee prior to submission.

Disclaimer: The views expressed in this article represent those of the authors and do not necessarily represent the official views of the NCDR or its associated professional societies identified at http://www.ncdr.com.

1. Hart RG, Pearce LA, Aguilar MI. Meta-analysis: antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. *Ann Intern Med*. 2007;146(12):857-867.

2. Ruff CT, Giugliano RP, Braunwald E, et al. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. *Lancet*. 2014;383(9921):955-962.

3. Fuster V, Rydén LE, Cannom DS, et al; European Heart Rhythm Association; Heart Rhythm Society; American College of Cardiology; American Heart Association Task Force on Practice Guidelines; European Society of Cardiology Committee for Practice Guidelines; Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation—executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation). *J Am Coll Cardiol*. 2006;48(4):854-906.

4. January CT, Wann LS, Alpert JS, et al; ACC/AHA Task Force Members. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. *Circulation*. 2014;130(23):2071-2104.

5. Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. *JAMA*. 2001;285(22):2864-2870.

6. Lip GY, Nieuwlaat R, Pisters R, Lane DA, Crijns HJ. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro Heart Survey on atrial fibrillation. *Chest*. 2010;137(2):263-272.

LESS IS MORE

Unnecessary Hospitalization and Related Harm for Patients With Low-Risk Syncope

Testing in patients admitted for syncope rarely identifies an underlying cause.[1,2] The San Francisco Syncope Rule (SFSR) was developed to identify patients with syncope at low risk for short-term serious outcomes who were unlikely to benefit from hospital admission.[3] During hospitalization, many patients experience adverse events.[4] Admission and testing can also lead to incidental findings of unclear clinical significance ("incidentalomas") that can trigger clinical cascades of further testing.[5] We performed a retrospective cohort study examining outcomes of patients who presented with low-risk syncope and were unnecessarily admitted to the hospital.

Methods | From January 1, 2010, to December 31, 2012, all patients with an *International Classification of Disease, Ninth Revision* (*ICD-9*) diagnosis of syncope (codes 780.2, 780.0, 458.0, or 780.4) were reviewed by internal medicine physicians (J.V.C., E.A., H.H., and C.K.). Hospitalizations were excluded if there was an obvious alternative reason for admission on presentation; the admission involved drug intoxication, alcohol intoxication, or trauma; patients were directly admitted or transferred; or determinants of SFSR were not available.

We focused on patients with SFSR ratings of 0 (systolic blood pressure >90 mm Hg on triage, hematocrit >30% [to convert to proportion of 1.0, multiply by 0.01], no history of congestive heart failure, no shortness of breath, and no nonsinus rhythm or new electrocardiographic changes) because they are at low risk for bad outcomes and likely did not require admission.[5,6] Data abstraction included length of stay, laboratory testing, imaging testing, procedures, and consultations (**Table 1**). Adverse events were determined using the Institute for Healthcare Improvement tool.[4] Reviewers also noted unexpected incidental findings during patient evaluation.

Descriptive statistics were computed using Microsoft Excel (Microsoft Corp). This study was approved by the institutional review board of the University of Maryland, Baltimore. The need for informed consent was waived by the institutional review board. Data were not deidentified because it would not have been possible to access medical records without the information.

Results | A total of 507 admissions were identified by *ICD-9* codes, of which 213 met inclusion criteria. Of 213 admissions