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Avoidable Utilization of the Chest Pain Observation Unit: Evaluation of Very-Low-Risk Patients

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Abstract

Background—Very-low-risk patients treated in a chest pain observation unit (CPOU) may threaten efficient care delivery. To optimize the efficiency of CPOU evaluations, it is necessary to quantify the avoidable CPOU utilization rate, examine physician variability, and determine patient and physician characteristics associated with avoidable CPOU utilization.

Methods—Consecutive chest pain patients were evaluated in an Emergency Department-based CPOU. Patients were risk stratified based on the American College of Cardiology/American Heart Association framework, age, and electrocardiogram findings. Very-low-risk was defined as age <35, physician assessment of low-risk, and normal or nondiagnostic electrocardiogram. Patients identified as very-low-risk were considered avoidable CPOU evaluations. Individual physicians' avoidable CPOU utilization rates were calculated. Patients were followed for 30-day major adverse cardiac events, defined as the composite of death, acute myocardial infarction, and coronary revascularization.

Results—Over 33 months, the registry included 1731 chest pain patients. The study definition of avoidable CPOU evaluations was met by 174 patients (10.1%, 95% confidence interval: 8.7–11.6%). The median rate of physician's avoidable CPOU utilization was 10% (interquartile range: 5.9–13.6%) and varied from 1.9% to 18.4%. None of the patients with an avoidable CPOU evaluation had a major adverse cardiac events within 30 days. Physician predictors of avoidable CPOU utilization included recent residency graduation (<5 years), part-time status, and moderate or high rates of CPOU use.

Conclusions—Approximately 10% of CPOU evaluations were avoidable. Wide variability exists among physicians regarding their individual rates of avoidable CPOU utilization. This variability could represent an opportunity to improve the efficiency of CPOU care delivery.

Keywords

chest pain; risk stratification; observation unit; acute coronary syndrome

Chest pain observation units (CPOUs) have become a popular way of facilitating medical assessments, mitigating risk, and avoiding inpatient admissions for chest pain patients with diagnostic uncertainty. CPOUs offer highly protocolized, evidence-based care that includes comprehensive chest pain evaluations: serial electrocardiograms (ECGs) and troponins followed by stress testing or cardiac imaging accomplished in an outpatient setting. Several studies have documented that completing comprehensive cardiac evaluations in the CPOU setting is safe and decreases length of stay and costs relative to an inpatient strategy.¹⁻⁶

Patients at low- to intermediate-risk for acute coronary syndrome (ACS) are typically targeted for CPOU care. In these patients, the American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend comprehensive cardiac evaluations, including stress testing or cardiac imaging.^{7,8} However, very-low-risk patients (corresponding to a 30-day risk for ACS of less than 1%) are unlikely to benefit from a comprehensive cardiac evaluation and CPOU care.^{9,10} Physicians evaluating very-low-risk patients in the CPOU may threaten the efficiency and efficacy of care delivery. In addition to consuming valuable bed capacity, use of CPOU resources in very-low-risk patients exposes patients to unnecessary testing. Some stress testing and cardiac imaging modalities expose patients to radiation, which may increase their lifetime risk of cancer. In addition, stress testing and cardiac imaging in patients with very low pretest probabilities are likely to result in false positives, which may lead to invasive testing such as coronary angiography. At the patient level, this manifests as increased cost of medical bills and anxiety. In summary, use of CPOU beds for very-low-risk patients consumes resources that could be used more appropriately for patients at low- to intermediate-risk for ACS.

In many CPOUs, clear objective criteria such as elevated troponin results or diagnostic ECG changes prevent the placement of patients with excessively high risk into these units. However, similar objective criteria do not exist on the low end of the risk spectrum. Therefore, in order to optimize the efficiency of CPOU evaluations, it is necessary to quantify the proportion of CPOU evaluations that are for patients at very-low-risk for ACS, determine physician variability in their rates of appropriate (low- and intermediate-risk patients) or avoidable (very-low-risk patients) utilization of the CPOU, and investigate patient and physician factors associated with avoidable CPOU utilization. With greater understanding of these issues, interventions can be designed and tested to limit use of CPOU care for very-low-risk patients. The objective of this study is to quantify avoidable CPOU utilization for patients at very low pretest probability for ACS and determine the amount of variability between individual Emergency Department (ED) physicians in their rates of avoidable CPOU utilization. In addition, we will examine physician and patient factors associated with CPOU utilization for patients at very-low-risk for ACS.

METHODS

Study Design

We performed a retrospective cohort study of consecutive patients included in the ED-based CPOU Registry at Wake Forest Baptist Medical Center from July 2008 to March 2011. Registry data elements include a combination of prospectively collected cross-sectional data and retrospective follow-up data. The registry and this analysis were approved by the Internal Review Board of the sponsoring organization with a waiver of consent.

Study Setting and Population

Wake Forest Baptist Medical Center is a tertiary referral center with an annual ED volume of approximately 104,000 patients per year. Patients with chest pain suggestive of a cardiac etiology and determined by the ED physician to be at low-risk for ACS based on the ACC/AHA framework for global risk assessment and who are admitted to the CPOU are included in the CPOU registry.¹¹ Physicians are encouraged to use a Thrombosis In Myocardial Infarction risk score to aid in their risk assessment.^{12,13} Inclusion criteria for the CPOU include a negative first troponin I and ECG without ST segment depression or elevation obtained in the ED.

The CPOU cares for over 600 chest pain patients annually and is open 7 days a week, with 24-hour nursing, advanced practice clinician, and physician coverage. Patients placed in the CPOU receive serial ECGs, serial cardiac biomarkers, and objective cardiac testing before discharge. The objective cardiac testing modality selected is at the discretion of the treating physician and can consist of exercise stress echocardiogram, dobutamine stress echocardiogram, coronary computed tomography angiography, single-photon emission computed tomography, or stress cardiac magnetic resonance. ECG stress tests without imaging are not performed within the CPOU protocol.

Study Protocol and Definitions

Patients were classified as very-low-risk or at-risk based on the physician's global risk assessment using the ACC/AHA framework, the patient's age, and ECG findings. Very-low-risk was defined as age less than 35 years, a physician determination of low-risk, and a normal or nondiagnostic ECG. This definition is supported by prior studies able to identify young chest pain patients with less than 1% risk for ACS at 30 days, who do not require a comprehensive cardiac evaluation.^{14–17} All CPOU patients identified as very-low-risk for ACS were considered an avoidable CPOU admission. Each encounter in the registry is associated with a board certified attending emergency physician allowing calculation of physicians' appropriate and avoidable CPOU utilization rates.

Major adverse cardiac events (MACE) were assessed to ensure that patients identified as very-low-risk could have safely avoided CPOU utilization. MACE was defined as a composite endpoint of all-cause mortality, myocardial infarction, or coronary revascularization during the index visit or within 30 days. Acute myocardial infarction was determined based on the "universal definition": a gradual rise and fall of troponin with a cutoff of 0.04 ng/mL (TnI-Ultra assay, Siemens, Munich, Germany), which represents the

99th percentile reference value with a coefficient of variation less than 10%.¹⁸ Coronary revascularization was defined as emergent or non-emergent revascularization procedures including angioplasty with or without stent placement, or coronary artery bypass surgery. All patients in the CPOU registry received a structured record review to determine MACE within 30 days.

Data Analysis

The proportion of CPOU evaluations with very-low-risk chest pain was calculated and a 95% confidence interval (CI) was reported. In addition, this proportion was examined at each 6-month period of patient accrual to investigate time-trends. The MACE rate for very-low-risk patients and at-risk patients was determined and 95% CIs of those proportions were reported.

To determine the variability among ED physicians in their rates of avoidable CPOU utilization, the proportions of patients evaluated in the CPOU qualifying as very-low-risk were calculated for physicians that placed at least 20 patients into the CPOU. Descriptive statistics (median, interquartile range [IQR], and range) were used to describe the frequency distribution of avoidable CPOU utilization. A frequency distribution histogram was used to graphically depict physician variability in avoidable CPOU utilization. The presence of greater than expected variability was assessed using Pearson Goodness-of-Fit Statistic for binomial overdispersion. A sensitivity analysis was performed using only physicians placing at least 40 patients in the CPOU. To determine the sensitivity of our findings to the definition of very-low-risk, an analysis was performed using an alternate definition of very-low-risk: of age less than 40 (18–39) with a physician determination of low-risk for ACS and a normal or nondiagnostic ECG.

Physician and patient attributes associated with CPOU utilization for patients at very-low-risk for ACS were examined first with separate logistic regression models. Full models included all potentially clinically relevant covariates and were reduced using manual backward elimination with an α threshold of 0.05 for retention in the model. Time, using 6-month blocks, was included as a covariate in both full models to investigate potential secular trends. The patient attribute logistic model included potential patient-level confounders as covariates including gender, race, chest pain characteristics (left-sided chest pain, chest pain at rest, multiple episodes of pain, pain on arrival, pain worse than prior episodes, pressure pain, sharp pain, burning pain, aching pain, and pleuritic pain), associated symptoms (nausea, vomiting, dyspnea, lightheaded, diaphoresis, and palpitations), risk factors (smoker, hypertension, hyperlipidemia, diabetes, family history, and cocaine use), and time. The physicians attribute logistic regression model included physician-level covariates including time since residency graduation (<5 years, 5–10 years, and >10 years), presence or absence of fellowship training, full-time (0.85 full-time equivalent (FTE) or non-full-time status, frequency of CPOU utilization (low utilizers 0–49 patients placed in the CPOU, moderate utilizers 50–99 patients, and high utilizers 100 patients), and time. To determine if patient factors confounded the physician model and vice-versa, a full model including all of the patient and physician covariates was fit and reduced as above. This model reduced to the same covariates as the separate patient and physician models demonstrating no confounding.

Therefore, the full model including patient and physician attributes will be reported. Statistical analysis was performed using SAS 9.2 and SAS Enterprise Guide 4.3 (SAS Institute, Cary, NC).

RESULTS

From July 2008 to March 2011, 1731 patients were included in the CPOU Registry. Over the study period, 174 of 1731 (10.1%, 95% CI: 8.7–11.6%) patients evaluated in the CPOU met the study definition of very-low-risk for ACS and represented avoidable utilization. Characteristics of the cohort are summarized in Table 1. Follow-up data for index MACE was available for the entire cohort. Complete follow-up data was accumulated for nonindex MACE (from discharge to 30 days) on 73% of patients, who had a return visit to the study institution. None of the patients with complete follow-up data had MACE after the index visit. MACE was present in 28 of 1731 (1.6%, 95% CI: 1.1–2.3%) CPOU, of which all were identified at the index visit. Among the very-low-risk patients, the MACE rate was 0 of 174 (0%, 95% CI: 0–2.6%). Rates of objective cardiac testing and adverse events are summarized in Table 2.

Twenty-seven physicians placed at least 20 patients in the CPOU and accounted for 1679 of 1731 (97%, 95% CI: 96.1–97.7%) CPOU evaluations. Characteristics of the physicians are summarized in Table 3. The median rate of physician's avoidable CPOU utilization was 10% (IQR: 5.9–13.6%), and the rate varied from a low of 1.9% to a high of 18.4%. Pearson Goodness-of-Fit Statistic for overdispersion was significant ($P = 0.011$) indicating greater variability in physician's avoidable CPOU utilization compared with the expected variability from a binomial distribution. A frequency distribution histogram of physician's avoidable CPOU utilization rates is presented in Figure 1.

The rate of avoidable utilization did not significantly differ across the 6-month time blocks. Significant patient-level predictors of avoidable CPOU utilization included male sex, chest pressure, sharp chest pain, vomiting, lightheadedness, and the absence of hypertension and hyperlipidemia. Significant physician-level predictors of avoidable CPOU admission included less than 5 years since residency graduation, part-time status, and moderate or high CPOU utilization. Odds ratios for the reduced model of patient and physician covariates are presented in Table 4.

A sensitivity analysis changing the definition of very-low-risk to age less than 40 (18–39) with a physician determination of low-risk for ACS and a normal or nondiagnostic ECG increased the number of patients classified as very-low-risk to 382 of 1731 (22.1%, 95% CI: 20.2–24.1%). MACE occurred in 1 of 382 (0.3%, 95% CI 0–1.6%) very-low-risk patients. The median rate of physician's avoidable CPOU utilization was 20.3% (IQR: 17.4–28.0%), and the rate varied from a low of 11.5% to a high of 40.4%. Pearson Goodness-of-Fit Statistic for overdispersion was significant ($P < 0.048$) indicating greater than expected physician variability. A frequency distribution histogram of physician's avoidable CPOU utilization rates is presented in Figure 2. Limiting the analysis to include only physicians placing 40 or more patients into the CPOU did not change the results.

DISCUSSION

This study demonstrates that approximately 10% of patients placed in the CPOU at an academic medical center are very-low-risk for ACS and represent avoidable utilization. This represents a clinically significant percentage of patients that could have avoided a CPOU evaluation. High utilization of the CPOU for very-low-risk patients may threaten the efficiency of CPOU care. Hospitals often have limited ED and CPOU bed capacity, and the use of CPOU beds for avoidable patient assessments consumes resources that could be used more appropriately for patients at greater risk for ACS. In addition, applying a CPOU chest pain care pathway to patients with extremely low pretest probabilities for ACS exposes them to unnecessary testing, which may lead to patient harm and increased costs. Nearly a third of very-low-risk patients placed in the CPOU received coronary computed tomography angiography, which exposed them to radiation possibly increasing their lifetime risk of cancer. Furthermore, stress testing and cardiac imaging in very-low-risk patients may result in false positives, which could lead to invasive testing.

None of the patients identified as very-low-risk based on an age less than 35 years, a physician determination of low-risk, and a normal or nondiagnostic ECG had a MACE event within 30 days of their index visit. This confirms that these patients could have safely avoided a comprehensive cardiac evaluation including stress testing or cardiac imaging. A sensitivity analysis changing the definition of very-low-risk to age less than 40 years, a physician determination of low-risk, and a normal or nondiagnostic ECG resulted in a much larger rate of avoidable CPOU utilization (over 22%). One 36-year-old very-low-risk patient did have a 30-day MACE event (index acute myocardial infarction), resulting in a missed MACE rate of 0.3%.

Wide variability exists among physicians regarding their individual rate of inappropriate CPOU utilization. Avoidable CPOU utilization rates ranged from less than 2% to over 18%. High physician variability suggests that interventions designed to limit use of the CPOU for very-low-risk patients are warranted. Furthermore, these interventions should be developed in a way that targets physicians with high rates of avoidable CPOU utilization, while ensuring appropriate education for all physicians to enhance patient selection and appropriate care process selection.

Rates of avoidable utilization rates were similar across the 6-month time blocks suggesting an absence of significant time-trends. Patient factors associated with avoidable CPOU utilization included male sex, chest pressure, sharp chest pain, associated vomiting or lightheadedness, and absence of hypertension or hypercholesterolemia. Because female patients are more likely to present with atypical symptoms of ACS, we expected that female sex, rather than male sex, would be associated with avoidable CPOU utilization.^{19–21} However, our findings are consistent with a large body of literature demonstrating that men are more likely than women to receive testing for ACS.^{22–26} Chest pressure, vomiting, and lightheadedness may be associated with increased avoidable CPOU placement because physicians may consider these features concerning for ACS and therefore increasing their likelihood of CPOU utilization. The significance of sharp chest pain and the absence of hypertension and hyperlipidemia may be due to confounding from age because younger

patients are less likely to have developed these cardiac risk factors and are more likely to present with atypical chest pain. Physician-level predictors associated with avoidable CPOU utilization included being within 5 years of residency graduation, part-time status, and having a moderate or high frequency of CPOU utilization. These findings suggest that targeting education or interventions to physicians with these attributes may present an opportunity to reduce avoidable CPOU utilization.

Limitations

This study has several limitations. This analysis included patients and physicians from a single academic medical center using site-specific CPOU entry criteria and objective cardiac testing protocols. Although we suspect many academic centers have similar CPOUs, physicians, and patient populations, the results of this study may not be generalizable to all medical centers. The decision to place a patient in the CPOU was at the discretion of the emergency physician and therefore this cohort, by design, is a highly selected group. In addition, 27% of patients had index data for MACE, but lacked complete 30-day follow-up data. This could have resulted in a misclassification bias and underestimation of MACE. However, the likelihood of MACE occurring shortly after discharge in this cohort seems low. Nearly all patients received objective cardiac testing, and of the patients with complete 30-day follow-up data, none had MACE that was not identified during the index visit. This is consistent with the literature, which has demonstrated that short-term occurrence of ACS after discharge has been very low in patients receiving objective cardiac testing.² It is also possible that CPOU care resulted in changes to patients' medical management, which may have reduced the 30-day event rate in a way that is not accounted for in this analysis.

CONCLUSIONS

Approximately 10% of patients placed in a CPOU at an academic medical center were very-low-risk for ACS and represented avoidable observation evaluations. Wide variability exists among physicians regarding their individual rate of avoidable CPOU utilization. High rates of avoidable observation evaluations offer an important opportunity for future interventions designed at improving the efficiency of EDs and CPOUs, by facilitating the discharge of very-low-risk patients. Patient and physician characteristics associated with avoidable CPOU utilization suggest that interventions designed to decrease avoidable CPOU evaluations could be targeted at patients or physicians with these attributes. These interventions could include the use of objective tools such as clinical decision aids. Future studies are needed to determine whether interventions can successfully decrease avoidable CPOU utilization.

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FIGURE 1.

Frequency distribution for the rate of avoidable CPOU utilization. Very-low-risk defined as age <35, with a physician determination of low-risk for ACS and a normal or nondiagnostic ECG.

FIGURE 2.

Frequency distribution for the rate of avoidable CPOU utilization. Very-low-risk defined as age <40, with a physician determination of low-risk for ACS and a normal or nondiagnostic ECG.

TABLE 1

Cohort Patient Characteristics

Patient Characteristics	Very-Low-Risk	At-Risk	Total Cohort	<i>P</i> Value for Comparison of Very-Low-Risk and At-Risk
	n (%)	n (%)	n (%)	
	n = 174	n = 1557	n = 1731	
Age, mean $\pm$ standard deviation	30.7 $\pm$ 3.7	48.1 $\pm$ 8.3	46.4 $\pm$ 9.6	<0.001
Gender				0.007
Male	86 (49.4)	604 (38.8)	690 (39.9)	
Race				0.714
Caucasian	97 (55.7)	874 (56.1)	971 (56.1)	
African American	63 (36.2)	587 (37.7)	650 (37.6)	
Asian	2 (1.1)	30 (1.9)	32 (1.8)	
Other	8 (4.6)	39 (2.5)	47 (2.7)	
Unknown	4 (2.3)	27 (1.7)	31 (1.8)	
CPOU disposition				0.014
Admitted	5 (2.9)	122 (7.8)	127 (7.3)	
Discharged	169 (97.1)	1434 (92.1)	1603 (92.6)	
Unknown	0 (0)	1 (0.1)	1 (0.15)	
Chest pain description*				
Pressure/tightness	113 (64.9)	849 (54.5)	962 (55.6)	0.085
Sharp	60 (31.0)	468 (30.1)	528 (30.5)	0.226
Ache	10 (5.7)	170 (10.9)	180 (10.4)	0.035
Burning	5 (2.9)	78 (5.0)	83 (4.8)	0.263
None/not Specified	18 (10.3)	175 (11.2)	193 (11.1)	0.800
Location				
Left chest	127 (73.0)	1003 (64.4)	1130 (65.3)	0.029
Other	29 (16.7)	377 (24.2)	406 (23.5)	0.030
Not specified	18 (10.3)	177 (11.4)	195 (11.3)	0.705
Risk factors				
Hypertension	47 (27.0)	639 (41.0)	686 (39.6)	<0.001
Smoking	71 (40.8)	552 (35.5)	623 (36.0)	0.183
Family history	57 (32.8)	475 (30.5)	532 (30.7)	0.545
Hyperlipidemia	22 (12.6)	364 (23.4)	386 (22.3)	0.001
Diabetes	13 (7.5)	144 (9.2)	157 (9.1)	0.490
ECG (initial)				0.807
Normal	135 (77.6)	1224 (78.6)	1359 (78.5)	0.770
Nondiagnostic	39 (22.4)	272 (17.5)	311 (18.0)	0.118
Ischemic changes	0 (0)	61 (3.9)	61 (3.5)	0.002
Thrombosis In Myocardial Infarction Score				0.048
0	95 (54.6)	679 (43.6)	774 (44.7)	0.006
1	67 (38.5)	766 (49.2)	833 (48.1)	0.008

	Very-Low-Risk	At-Risk	Total Cohort	
	n (%)	n (%)	n (%)	<i>P</i> Value for Comparison of Very-Low-Risk and At-Risk
Patient Characteristics	n = 174	n = 1557	n = 1731	
>2	12 (6.9)	112 (7.2)	124 (7.2)	1

* Chest pain descriptions were not mutually exclusive.

Bold *P* values are statistically significant.

TABLE 2

Objective Cardiac Testing and Adverse Events of Very-Low-Risk and At-Risk Patients at 30 Days

Outcome	Very-Low-Risk n,% (95% CI) n = 174	At-Risk n,% (95% CI) n = 1557	Total Cohort n,% (95% CI) n = 1731
Objective cardiac testing			
CCTA	57, 32.8 (26.2–40.0%)	457, 29.4 (27.1–31.7%)	514, 29.7 (27.6–31.9%)
ESE	98, 56.3 (48.9–63.5%)	835, 53.6 (51.2–56.1%)	933, 53.9 (51.6–56.2%)
DSE	0, 0 (0–2.6%)	6, 0.4 (0.2–0.9%)	6, 0.3 (0.1–0.8%)
CMR	1, 0.6 (0–3.5%)	6, 0.4 (0.2–0.9%)	7, 0.4 (0.2–0.9%)
Nuclear imaging	0, 0 (0–2.6%)	2, 0.1 (0–0.5%)	2, 0.1 (0–0.5%)
Cardiac catheterization	2, 1.1 (0.1–4.4%)	31, 2.0 (1.4–2.8%)	33, 1.9 (1.4–2.7%)
None	16, 9.2 (5.7–14.5%)	108, 6.9 (5.8–8.3%)	124, 7.2 (6.0–8.5%)
Unknown	0, 0 (0–2.6%)	1, 0.1 (0–0.4%)	1, 0.1 (0–0.4%)
MACE	0, 0 (0–2.6%)	28, 1.8 (1.2–2.6%)	28, 1.6 (1.1–2.3%)
Death	0, 0 (0–2.6%)	1, 0.1 (0–0.4%)	1, 0.1 (0–0.4%)
Acute myocardial infarction	0, 0 (0–2.6%)	23, 1.5 (1.0–2.2%)	23, 1.3 (0.9–2.0%)
Revascularization	0, 0 (0–2.6%)	4, 0.3 (0.1–0.7%)	4, 0.2 (0.1–0.6%)

CCTA indicates coronary computed tomography angiography; CMR, cardiac magnetic resonance; DSE, dobutamine stress echocardiogram; ESE, exercise stress echocardiogram.

TABLE 3

Physician Characteristics

Physician Characteristics	Number	
	(n = 27)	Percent
Gender		
Male	21	77.8
Female	6	22.2
Time since residency graduation		
<5 years	13	48.1
5–10 years	5	18.5
>10 years	9	33.3
Fellowship training		
Yes	8	29.6
No	19	70.4
Full-time status		
Full-time clinical	15	55.5
<85% clinical	12	45.5

TABLE 4

Patient and Physician Characteristics Associated With Avoidable CPOU Utilization

Patient Characteristic	Odds Ratio (95% CI)	P
Gender		
Male	1.53 (1.20–1.95)	0.001
Chest pain		
Pressure	2.14 (1.37–3.33)	0.001
Sharp	1.76 (1.23–2.52)	0.002
Associated symptoms		
Vomiting	3.61 (1.40–9.30)	0.008
Lightheaded	2.42 (1.16–5.04)	0.018
Risk factors		
Hypertension	0.63 (0.42–0.93)	0.021
Hypercholesterolemia	0.47 (0.26–0.82)	0.01
Physician characteristic		
Time since residency graduation		
<5 years*	1.78 (1.20–2.64)	0.004
Full-time status		
Non–full time	1.82 (1.17–2.83)	0.008
CPOU utilization		
Low <50 patients placed in the CPOU	Reference	—
Moderate 50–100 patients	1.56 (1.01–2.38)	0.043
High >100 patients	1.58 (1.11–2.24)	0.011

Full model variables: gender, race, left-sided chest pain, chest pain at rest, multiple episodes of pain, pain on arrival, pain worse than prior episodes, pressure pain, sharp pain, burning pain, aching pain, pleuritic pain, nausea, vomiting, dyspnea, lightheaded, diaphoresis, palpitations, smoker, hypertension, hyperlipidemia, diabetes, family history, cocaine use, time since residency graduation (<5 years, 5–10 years, and >10 years), presence or absence of fellowship training, full-time (>0.85 full-time equivalent [FTE]) or non–full-time status, frequency of CPOU utilization (low utilizers 0–49 patients placed in the CPOU, moderate utilizers 50–99 patients placed in the CPOU, and high utilizers >100 patients placed in the CPOU), and time (6-month time blocks).

* More than 10 years since residency graduation used as reference, 5–10 years since residency graduation was not significant.