Serious Cardiac Outcomes and Physician Estimation of Risk in Emergency Department Patients With Presyncope Versus Syncope

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Study objective: Previous research suggests that the short-term incidence of adverse events is similar in emergency department (ED) patients with presyncope and syncope. However, admission rates for presyncope are lower, which could imply clinicians underestimate its risk. We sought to compare physician risk estimates and the 30-day rate of serious cardiac outcomes between patients with syncope and presyncope.

Methods: We conducted a secondary analysis of a prospective, observational, multicenter study of patients aged ≥40 years presenting to ED with presyncope or syncope. Patients with serious ED diagnoses were excluded. Descriptive statistics and multivariable regression analyses were used to compare the physician-estimated risk, ED disposition, and 30-day rate of adverse outcomes.

Results: Of the 1,263 patients analyzed, 721 (57%) had syncope and 542 (43%) had presyncope. Baseline characteristics were similar between groups. At 30 days, 34 (4.7%) syncope patients and 28 (5.2%) presyncope patients experienced a serious cardiac outcome; logistic regression showed no difference in the odds (odds ratio 1.13; 95% confidence interval 0.66 to 1.79) of serious cardiac outcomes between syncope and presyncope patients. The mean physician-estimated risk of serious cardiac outcomes was 7.6% in syncope, versus 5.3% in presyncope (risk difference 2.3% [0.89%, 3.7%]); this difference remained significant after adjustment for clinical characteristics. Admission rate was lower in presyncope, 38.2% versus 49.5% (risk difference 11.3% [1.2%, 21.5%]).

Conclusion: Patients with unexplained presyncope and syncope had similar rates of 30-day serious cardiac outcomes after ED visit. Patients with presyncope were less likely to be admitted and had a lower mean physician-estimated risk of adverse outcomes. [Ann Emerg Med. 2026;87:69-78.]

Please see page 70 for the Editor's Capsule Summary of this article.

Keywords: Syncope, Presyncope, Near syncope, Risk stratification, Physician risk estimation.

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INTRODUCTION

Background

Syncope is a transient loss of consciousness followed by spontaneous recovery caused by a sudden and temporary decrease of cerebral blood flow.[1] Syncope is common and usually has a benign cause, but it is occasionally caused by a serious underlying medical condition. The assessment and risk stratification of patients who present to the emergency department (ED) with syncope is an active area of research.[2,3] Presyncope (used in this study synonymously with "near-syncope") can be defined as the phenomenon experienced when decreased cerebral blood flow causes a sensation of imminent syncope but is not of sufficient severity or duration to produce a complete loss of consciousness.[4] Because these sensations can be manifold, vague, and difficult to differentiate from other phenomena described as dizziness or lightheadedness, there has been less study of the associated short-term risks.

Many studies comparing ED patients with presyncope and syncope have found similar rates of serious outcomes between the two groups,[5] but other reports have found presyncope to confer a lower risk.[6] There is also evidence to suggest that typical presyncope symptoms such as "weakness," "lightheadedness," or "a warm sensation" in the

Editor's Capsule Summary

What is already known on this topic

Adult patients with presyncope or syncope can have serious cardiovascular outcomes.

What question this study addressed

What are the differential physician assessments, admission rate, and incidence of serious cardiac outcomes within 30 days of an emergency department (ED) visit for presyncope or syncope?

What this study adds to our knowledge

This retrospective study of 1,263 patients ages ≥40 years observed that presyncope patients were less often admitted, and both groups had an approximate 5% risk of serious outcomes. Physicians mildly overestimated risk, particularly for syncope patients.

How this is relevant to clinical practice

Older ED presyncope and syncope patients have similar risk profiles and adverse outcomes, though the mechanisms of adverse outcomes may differ.

prodrome of a full syncopal event is associated with lower probability of a serious cause.[7-9] Unsurprisingly, previous studies have reported that physicians consider presyncope to confer a lower risk than syncope,[10] underestimate the risk of serious outcomes following presyncope,[11] and are less likely to admit patients with presyncope.[12]

Importance

Characterizing the differences between current clinical approaches to presyncope versus syncope and the incidence of short-term serious outcomes will inform implementation of risk-stratification approaches to optimize allocation of health care resources and improve patient safety.

Goals of This Investigation

We sought to compare the rate of 30-day serious cardiac outcomes in ED patients with presyncope versus syncope without a serious ED diagnosis, and to evaluate differences in unstructured physician-estimated risks and ED disposition between the two groups.

MATERIALS AND METHODS

Study Design and Setting

We conducted a preplanned secondary analysis of the Practical Approaches to Care in Emergency Syncope (PACES) study, a multicenter, prospective, observational cohort study conducted at 6 urban EDs across the United States between September 2020 and September 2024.[13] Five of these EDs were located at academic hospitals, and one was in a community hospital. The primary objective of the PACES study was to externally validate two ED syncope risk-stratification tools (the FAINT score and the Canadian Syncope Risk Score) in older patients, with the overall goal of improving health care resource utilization in those who did not have serious diagnoses made during their ED evaluation.[2,3] Approval for the study was obtained from the institutional review boards of the participating centers and from a central institutional review board. Our report follows the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cohort studies.

Selection of Participants

Our study enrolled adults aged ≥40 years presenting with syncope or presyncope who did not have a serious acute diagnosis made during the ED visit. Syncope was defined as a brief loss of consciousness with spontaneous return to baseline neurologic function. Presyncope was defined as the sensation of an impending loss of consciousness without an actual loss of consciousness. Patients who described isolated vertigo, lightheadedness, or a sensation of imbalance without a loss of consciousness or the sensation of an impending loss of consciousness were not included, which is consistent with the approach used in the original Canadian Syncope Risk Score and FAINT score derivation studies. Patients whose symptoms were suspected to be caused by intoxication, seizure, stroke, significant head trauma, or hypoglycemia were excluded, as were patients with pregnancy, confusion, and a prolonged loss of consciousness (≥5 minutes), those who required intervention to restore mental status, those who had a ventricular assist device, those who were unable to communicate in English or Spanish, or those who were otherwise unable to consent and had no legally authorized representative who could provide consent. Trained research associates monitored the ED track board to screen for potentially eligible patients between 8 AM and 10 PM, 5 to 7 days a week, with some variability between study sites. They engaged ED clinicians caring for the patient to confirm that the patient met eligibility criteria and was suitable for approach. The goal of the primary study was to evaluate approaches to syncope/presyncope in patients who had no serious, acute diagnosis made in ED. Patients were therefore excluded after consent if any of the following were diagnosed before admission or discharge from the ED: significant cardiac arrhythmia, acute

myocardial infarction, new significant structural heart disease, pulmonary embolism, aortic dissection, significant hemorrhage or anemia requiring blood transfusion, acute pulmonary edema, pneumonia, sepsis, acute renal failure, intracranial bleeding, major traumatic injury requiring inpatient management, acute surgical illness, or death.

Measurements

After clinical workup (including initial laboratories and imaging) was completed, the research associate queried the ED attending physician to collect the estimate of their patient's risk of a serious adverse clinical outcome. This physician estimation of risk was collected as an unstructured estimate of the chance of a serious cardiac outcome occurring within 30 days, expressed as a percentage from 0% to 100%. Only attending physicians performed risk estimates; residents and advanced practice providers were not eligible. Baseline clinical and demographic variables were later abstracted from the chart by a research associate, including age, sex, presenting symptoms, past medical history, vital signs, ECG findings, and laboratory test results. Research associates were extensively trained on chart abstraction by the principal investigator in 3 2-hour sessions over a period of 2 to 3 weeks, using training charts and actual clinical data; research associate abstractions were closely reviewed by the project manager for the first month after training to identify any deficiencies. Chart abstraction was performed using a standardized instrument with an easily accessible data dictionary of variable definitions. Regular quality control was performed by the principal investigator and project manager, who met weekly throughout the data collection period. Disposition was dichotomized as hospital admission (including observation unit stays, at sites that had this capacity) versus discharge directly from ED. Clinical evaluation and management was left to the discretion of the treating physicians; participants who enrolled had blood samples taken for N-terminal pro B-type natriuretic peptide and high-sensitivity cardiac troponin T analysis at an external research laboratory (CER Lab).

Outcomes

Our primary outcome was a serious cardiac event within 30 days of the index visit (including adverse outcomes occurring during the index hospitalization and after discharge). This composite outcome included death from any cause, significant cardiac arrhythmia, myocardial infarction, new diagnosis of significant structural heart disease, cardiac arrest requiring cardiopulmonary resuscitation, or major cardiac interventions (defined in the below section). Significant cardiac arrhythmias were defined as ventricular fibrillation, ventricular tachycardia, sick sinus disease, Mobitz II atrioventricular heart block, complete heart block, symptomatic supraventricular tachycardia, symptomatic bradycardia, and pacemaker malfunction. Major cardiac interventions included permanent pacemaker or implantable cardiac defibrillator placement, coronary artery bypass graft, percutaneous transluminal coronary angioplasty, or valvular surgery. Cardiac devices implanted for monitoring purposes only were not classified as major interventions.

Outcomes were determined by electronic chart review and telephone calls. Chart review for adverse outcomes was conducted by physician investigators at each site using standardized outcome definitions and an electronic abstraction form. Participants or their legally authorized representatives were then contacted through telephone between 30 and 44 days after the index visit by research associates blinded to baseline data to identify outcomes not captured in the available medical records. Study team members were not blinded to the primary study hypothesis (risk score validation), but research associates were not informed about this secondary analysis. To assess the interrater reliability of chart review for detection of serious outcomes at 30 days, records of the first 25 to 50 sequentially enrolled patients at each of the 6 sites were independently reviewed by 2 investigators, with disagreements resolved by discussion with a third member of the research team. Ambiguous serious outcomes that were identified by phone follow-up or chart review had adjudication performed by a second physician investigator at the main study site.

Data Analysis

We calculated descriptive statistics for baseline characteristics, physician-estimated risks, resource utilization, and 30-day serious cardiac outcomes of the participants stratified based on presyncope versus syncope. Continuous variables were summarized using means and standard deviations and, if skewed, also by medians with interquartile ranges; categoric variables were tabulated as counts and proportions. Differences between presyncope and syncope patients were calculated as differences in means or proportions with 95% confidence intervals. We accounted for clustering within sites using the design effect detailed in the Appendix E1 (available at http://www.annemergmed.com). Missing biomarker data (owing to significant hemolysis in the research and clinical specimens) were addressed with multiple imputation in the regression

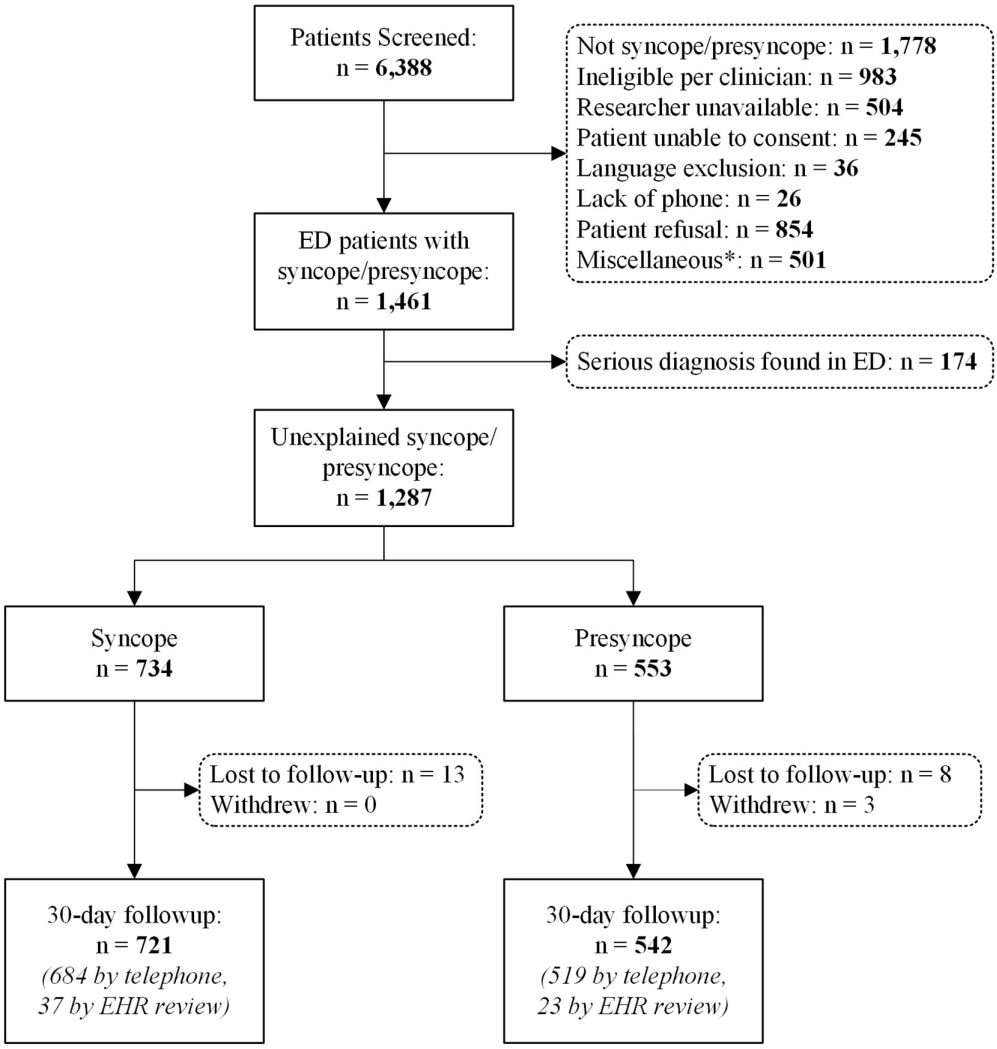

Figure 1. Patient flow through study. *Miscellaneous reasons for nonenrollment include blood unable to be obtained (n=29), EKG not obtained (n=7), presence of left ventricular assist device (n=7), previously enrolled (n=6), provider request (n=15), and other (n=437). *EHR*, electronic health record.

analyses. Patients who were entirely lost to follow-up or withdrew were excluded from the analysis. We used Bayesian multivariable logistic regression of serious cardiac outcomes on syncope/presyncope and adjusted for demographic variables, clinical characteristics, and study sites. Propensity score adjustment, which condenses the same variables to a single covariate,[14] was conducted as a sensitivity analysis and is available in the supplemental material (Appendix E2, available at http://www.annemergmed.com). Similarly, we compared the difference in mean physician-estimated risks using linear regression to adjust for differences in clinical characteristics between syncope and presyncope groups. As an unplanned exploratory analysis, we sought to evaluate the concordance of physician-estimated risks with the empirical risk of serious cardiac outcomes for individual participants. We performed logistic regression of serious cardiac outcomes with physician-estimated risk as the main predictor and applied locally estimated scatterplot smoother analysis to visualize this relationship.[15] We logit transformed physician-estimated risk as it was skewed, with significant clustering at the lower range of values. We used κ statistics to assess the interrater agreement for physician chart reviews to determine 30-day serious cardiac outcomes. All statistical analyses were conducted in R version 4.4.3. (R Foundation for Statistical Computing, Vienna, Austria)[16]

RESULTS

Characteristics of Study Participants

Patient flow through screening, enrollment, and follow-up is provided in Figure 1. A total of 1,287 patients were enrolled and 1,263 were analyzed, 721 (57%) with syncope and 542 (43%) with presyncope. Characteristics of the study population are presented in Table 1. The syncope and presyncope groups were broadly similar in age, sex, race/ethnicity, and past medical history. Enrollment based on site is presented in Table E1 (available at http://www.annemergmed.com).

Main Results

A total of 28 (5.2%) patients with presyncope had a 30-day serious cardiac outcome, compared with 34 (4.7%) patients with syncope, a risk difference (RD) of -0.45% (95% confidence interval -5.6% to 4.1%). Similar proportions of patients experienced arrhythmia, 19 (3.5%) in presyncope versus 18 (2.5%) in syncope. More patients with symptomatic supraventricular tachycardias were in the presyncope group (12 in presyncope versus 5 in syncope) and more bradydysrhythmia and ventricular arrhythmias were in the syncope group (13 in syncope versus 6 in presyncope). A full tabulation of all serious cardiac outcomes is provided in Table 2. Unadjusted and adjusted logistic regression using both the propensity score approach and individual baseline characteristics also did not show an association of serious cardiac outcomes with presyncope/syncope, with an odds ratio (OR) of 1.13 (0.66, 1.79) in unadjusted and 1.17 (0.66, 1.92) in adjusted analysis (Table 3; Tables E2 and E3, available at http://www.annemergmed.com). There was high interrater agreement for detection of serious cardiac outcomes, with κ statistics at each site ranging from 0.81 to 1.0 (median 1.0).

The mean physician-estimated risk for syncope was 7.6%, compared with 5.3% for presyncope for an RD of 2.3% (0.89%, 3.7%). This difference in estimated risk remained even after adjusting for demographic and clinical characteristics (Table E4, available at http://www.annemergmed.com).

A higher risk of serious cardiac outcomes was associated with a higher logit physician-estimated risk (OR 1.45 [1.22, 1.72]), whereas there was no effect of syncope/presyncope (OR 1.09 [0.60, 1.81]). Higher physician risk estimates were associated with overestimation of empirical risk of serious cardiac outcomes in both syncope and presyncope, as illustrated in Figure 2. As shown in Table 2, the rate of adverse outcomes in patients discharged after initial ED evaluation was similar in syncope (0.8%, n=6) and presyncope (1.1%, n=6), RD -0.27% (-3.5%, 0.95%). However, patients with syncope were more likely to be admitted or placed under observation, 49.5% versus 38.2%, RD of 11.3% (1.2%, 21.5%) (Table 4).

LIMITATIONS

Several limitations should be mentioned. Given the significant rate of nonenrollment of screened patients, there is potential for selection bias. Our study sample was recruited primarily at urban academic centers; thus, our results may not apply to patients from different clinical settings. Because we enrolled only patients aged 40 years or older, our findings do not apply to younger patients presenting with syncope or presyncope. Although our rate of successful follow-up at 30 days was high (>98%), it is possible that certain patients who were lost to follow-up experienced serious outcomes. Serious outcomes were assessed through a combination of patient self-report and chart review by investigators not fully blinded to the presenting histories. In addition, serious outcomes may have been missed in patients not admitted by the clinicians after initial ED evaluation. Although these may have introduced bias, we used rigorous preset outcome definitions and careful chart abstraction quality review to mitigate these common limitations of studies of this type.[17] Despite the numerous clinical variables we collected, it is possible that unmeasured confounding variables remain, including features of history or examination that may influence physician risk assessment. We did not collect data on the physicians providing risk estimation, so we are unable to report on their background or experience, nor account for clustering by individual clinician. Furthermore, our study was not designed to explore questions regarding the clinical significance of different levels of estimated risk. Finally, our study was not powered to detect differences between incidence of cardiac outcome subtypes, such as supraventricular tachycardias versus ventricular tachycardias.

DISCUSSION

Our study found that the rate of 30-day serious cardiac outcomes was similar between presyncope and syncope, but physician-estimated risk was higher in patients with syncope. In both presyncope and syncope, a higher estimated risk was associated with a higher rate of serious cardiac outcomes, although it overestimated the true incidence of adverse outcomes when elevated. We also found that although physicians were less likely to admit patients with presyncope, the incidence of serious cardiac

Table 1. Baseline characteristics of the study population.

Characteristic	Overall N = 1,263	Syncope N = 721	Presyncope N = 542	Difference
Age				0.97 (−0.49, 2.4)
Mean (SD)	64.8 (13.1)	65.2 (13.1)	64.3 (13.0)	
Median (Q1, Q3)	66.0 (55.0, 74.0)	66.0 (55.0, 75.0)	64.0 (54.0, 74.0)	
Age category (y)				
40 to <50	183 (14.5%)	102 (14.1%)	81 (14.9%)	
50 to <60	272 (21.5%)	153 (21.2%)	119 (22.0%)	
60 to <70	311 (24.6%)	168 (23.3%)	143 (26.4%)	
70 to <80	325 (25.7%)	194 (26.9%)	131 (24.2%)	
80 to <90	146 (11.6%)	89 (12.3%)	57 (10.5%)	
90+	26 (2.1%)	15 (2.1%)	11 (2.0%)	
Sex				
Male	587 (46.5%)	336 (46.6%)	251 (46.3%)	0.3% (−5%, 6%)
Female	676 (53.5%)	385 (53.4%)	291 (53.7%)	
Hispanic/Latino ethnicity	455 (36.0%)	254 (35.2%)	201 (37.1%)	−2% (−7%, 4%)
Race				
Asian/PI/AI	30 (2.4%)	14 (1.9%)	16 (3.0%)	
Black/African American	283 (22.4%)	162 (22.5%)	121 (22.3%)	
Multiracial	45 (3.6%)	27 (3.7%)	18 (3.3%)	
Other	367 (29.1%)	202 (28.0%)	165 (30.4%)	
White/Caucasian	538 (42.6%)	316 (43.8%)	222 (41.0%)	
Hypertension	852 (67.5%)	471 (65.3%)	381 (70.3%)	−5% (−10%, 0.4%)
Heart failure	144 (11.4%)	83 (11.5%)	61 (11.3%)	0.3% (−3%, 4%)
Coronary artery disease	243 (19.2%)	143 (19.8%)	100 (18.5%)	1% (−3%, 6%)
Arrhythmia	217 (17.2%)	130 (18.0%)	87 (16.1%)	2% (−2%, 6%)
Diabetes	363 (28.7%)	202 (28.0%)	161 (29.7%)	−2% (−7%, 4%)
Valvular heart disease	242 (19.2%)	139 (19.3%)	103 (19.0%)	0.3% (−4%, 5%)
Dyspnea (shortness of breath)	296 (23.4%)	157 (21.8%)	139 (25.6%)	−4% (−9%, 1%)
Chest discomfort/pain	198 (15.7%)	101 (14.0%)	97 (17.9%)	−4% (−8%, 0.4%)
Hypotension (SBP < 80 mmHg)	42 (3.3%)	19 (2.6%)	23 (4.2%)	−2% (−4%, 0.6%)
Abnormal ECG	750 (59.4%)	424 (58.8%)	326 (60.1%)	−1% (−7%, 4%)
Creatinine (mg/dL)				0.00 (−0.13, 0.12)
Mean (SD)	1.2 (1.1)	1.2 (1.1)	1.2 (1.2)	
Median (Q1, Q3)	1.0 (0.8, 1.3)	1.0 (0.8, 1.3)	1.0 (0.8, 1.3)	
Missing	17	9	8	
NT-proBNP (pg/mL)				14 (−217, 245)
Mean (SD)	550.0 (2,042.1)	556.0 (1,928.7)	542.2 (2,184.8)	
Median (Q1, Q3)	111.2 (39.6, 320.5)	116.2 (39.4, 341.8)	103.8 (39.6, 295.6)	
Missing	33	21	12	
NT-proBNP > 125 pg/mL	577 (46.9%)	331 (47.3%)	246 (46.4%)	0.9% (−5%, 7%)
Missing	33	21	12	
HS troponin T (ng/L)				0.91 (−2.1, 3.9)
Mean (SD)	16.4 (26.5)	16.7 (25.3)	15.8 (28.0)	
Median (Q1, Q3)	9.5 (3.0, 17.4)	9.7 (3.0, 18.2)	9.3 (3.0, 16.2)	
Missing	43	21	22	
HS troponin T > 19 ng/L	272 (22.3%)	166 (23.7%)	106 (20.4%)	3% (−2%, 8%)
Missing	43	21	22	

Table 1. Continued.

Characteristic	Overall N = 1,263	Syncope N = 721	Presyncope N = 542	Difference
Physician estimate of SCO risk (%)				2.3 (0.89, 3.7)
Mean (SD)	6.6 (11.9)	7.6 (13.3)	5.3 (9.5)	
Median (Q1, Q3)	2.0 (1.0, 5.0)	3.0 (1.0, 8.6)	2.0 (1.0, 5.0)	
Missing	187	117	70	

AI, American Indian; *HS*, high sensitivity; *PI*, Pacific Islander; *Q1, Q3*, interquartile range; *SBP*, systolic blood pressure; *SCO*, serious cardiac outcome; *SD*, standard deviation.

outcomes in patients discharged after initial ED evaluation was low in both groups. These findings suggest that there is a tendency to consider presyncope to be less dangerous than syncope, but that general overestimation of cardiac risk may be a protective factor against inappropriate undertreatment.

Previous prospective studies directly comparing outcomes in ED presyncope and syncope patients also

Table 2. All cause-death and serious cardiac outcomes at 30 days based on syncope or presyncope.

Characteristic	Overall N = 1,263	Syncope N = 721	Presyncope N = 542	Difference
Any 30-d SCO	62 (4.9%, 3.8%-6.3%)	34 (4.7%, 3.3%-6.6%)	28 (5.2%, 3.5%-7.5%)	−0.45% (−5.56%, 4.09%)
ED discharge SCO	12 (1.0%, 0.52%-1.7%)	6 (0.8%, 0.34%-1.9%)	6 (1.1%, 0.45%-2.5%)	−0.27% (−3.48%, 0.95%)
Admitted SCO	50 (4.0%, 3.0%-5.2%)	28 (3.9%, 2.6%-5.6%)	22 (4.1%, 2.6%-6.2%)	−0.18% (−4.89%, 3.88%)
30-d death	5 (0.4%, 0.15%-0.98%)	2 (0.3%, 0.05%-1.1%)	3 (0.6%, 0.14%-1.7%)	−0.28% (−3.10%, 0.43%)
Arrhythmia	37 (2.9%, 2.1%-4.1%)	18 (2.5%, 1.5%-4.0%)	19 (3.5%, 2.2%-5.5%)	−1.01% (−5.40%, 2.50%)
Symptomatic supraventricular tachycardia	17	5	12	
Sick sinus syndrome/pause > 3 sec	7	6	1	
Symptomatic bradycardia	5	3	2	
Symptomatic ventricular tachycardia (<30 sec)	5	2	3	
Ventricular tachycardia (>30 sec)	2	2	0	
Ventricular fibrillation	0	0	0	
Mobitz type II atrioventricular heart block	1	0	1	
Myocardial infarction	3 (0.2%, 0.06%-0.75%)	2 (0.3%, 0.05%-1.1%)	1 (0.2%, 0.01%-1.2%)	0.09% (−2.45%, 0.80%)
Myocarditis	1 (0.1%, 0.00%-0.51%)	1 (0.1%, 0.01%-0.90%)	0 (0.0%, 0.00%-0.88%)	0.14% (−2.33%, 0.64%)
Cardiac intervention	29 (2.3%, 1.6%-3.3%)	21 (2.9%, 1.9%-4.5%)	8 (1.5%, 0.69%-3.0%)	1.44% (−2.18%, 3.71%)
Pacemaker	14	9	5	
AICD	5	4	1	
CABG	2	1	1	
PTCA	2	1	1	
Other cardiac intervention*	6	6	0	
New diagnosis of structural heart disease	2 (0.2%, 0.03%-0.64%)	1 (0.1%, 0.01%-0.90%)	1 (0.2%, 0.01%-1.2%)	−0.05% (−2.58%, 0.46%)
CPR	1 (0.1%, 0.00%-0.51%)	0 (0.0%, 0.00%-0.66%)	1 (0.2%, 0.01%-1.2%)	−0.18% (−2.71%, 0.00%)

As individual participants may experience more than one serious outcome, column totals may be greater than overall N.
AICD, automatic implantable cardioverter-defibrillator; *CABG*, coronary artery bypass graft; *CPR*, cardiopulmonary resuscitation; *PTCA*, percutaneous transluminal coronary angioplasty.
*Other cardiac interventions included aortic valve surgery (4), electrical cardioversion (1), and left atrial mass resection (1).

Table 3. Logistic regression on serious cardiac outcomes at 30 days based on presyncope versus syncope (reference).

Characteristic	Unadjusted	Adjusted
Presyncope	1.13 (0.66, 1.79)	1.17 (0.66, 1.92)
Log BNP		1.42 (1.10, 1.82)
Log troponin		0.99 (0.62, 1.49)
Log creatinine		0.82 (0.38, 1.53)
Heart failure		0.98 (0.44, 1.86)
Arrhythmia		1.93 (0.99, 3.37)
Abnormal EKG		1.78 (0.84, 3.42)
Age (10-y change)		1.27 (0.98, 1.63)
Male		1.40 (0.75, 2.39)
Hispanic/Latino ethnicity		0.50 (0.19, 1.10)
Race		
White		Reference
Black		1.02 (0.45, 1.95)
Asian		0.73 (0.10, 2.41)
Multiracial		1.24 (0.20, 3.78)
Other		2.64 (0.99, 5.64)
Site		
Columbia		Reference
Rochester		1.47 (0.65, 2.88)
Vanderbilt		2.30 (0.95, 4.68)
UC Davis		1.07 (0.29, 2.63)
Mt Sinai		2.93 (1.07, 6.22)
Allen		0.95 (0.18, 2.74)
Hypertension		1.24 (0.58, 2.40)
Hypotension		1.24 (0.31, 3.13)
Coronary artery disease		1.17 (0.59, 2.05)
Diabetes		0.79 (0.40, 1.39)
Valvular heart disease		1.24 (0.64, 2.13)
Shortness of breath		0.83 (0.38, 1.53)
Chest pain		1.27 (0.52, 2.53)

BNP, B-type natriuretic peptide.

reported the incidence of adverse events to be similar between the groups, although at rates far higher than we observed in this study. The smaller, single-center studies conducted by Grossman et al[12] in Boston and Greve et al[18] in Germany found the 30-day incidence of adverse events (not limited to cardiac) to be 20% in presyncope and 23% in syncope (Grossman et al[12]) and 27% in presyncope and 34% in syncope (Greve et al[18]). Similarly, Bastani et al[10] in a cohort of 3,581 ED patients aged ≥60 years found the incidence of 30-day cardiac and noncardiac adverse events to be 18.7% in presyncope and 18.2% in syncope. These markedly higher incidences of adverse outcomes are due to methodological differences, including different exclusion criteria, outcome definitions, and age thresholds. There was significant variability in outcome selection between these studies and disparities in the distributions of adverse outcomes observed. In addition, these studies did not exclude patients who had important causes of syncope/presyncope detected during the ED workup. By excluding patients who had apparent dangerous conditions diagnosed during the ED visit, and focusing on adverse cardiac outcomes, our study better quantifies the risk in the subset of syncope/presyncope presentations and outcomes that causes uncertainty for clinicians. On the other hand, although overall outcome rates differed significantly between our study and these earlier ones, both Greve et al[18] and Bastani et al[10] reported more ventricular dysrhythmias, bradydysrhythmias, and device implantations in their syncope cohorts compared with presyncope cohorts, as did we. The low number of events limits the conclusions we can draw from this finding.

In contrast to some previous studies, we did not find evidence of significant underestimation of risk in patients with presyncope. Bastani et al[10] found that clinicians on average estimated the 30-day risk of any serious adverse event at 9.8% for syncope versus 8.2% for presyncope, well below the true rates of adverse events in their study. We found that the mean physician-estimated risks (7.6% in syncope and 5.3% in presyncope) were not dissimilar from the rates of serious cardiac outcomes (4.7% in syncope and 5.2% in presyncope). These rates are closer to those found by Thiruganasambandamoorthy et al[11] in their 2015 study of 881 adult ED patients, which reported median physician predictions in the range of 1% to 3% for 30-day incidence of serious adverse events, and a 5.1% overall rate of serious adverse outcomes at 30 days, including a 2.3% rate of arrhythmia. We did see a lower admission rate in presyncope compared with syncope, which has been observed in other studies as well.[5] However, the low incidence of serious outcomes in patients discharged after initial evaluation in both groups preclude us from concluding that there is evidence of clinical harm from this difference.

To sum up, patients with unexplained presyncope and syncope had similar rates of serious cardiac outcomes at 30 days after their ED visit. Patients with syncope had a higher mean physician-estimated risk and were more likely to be admitted. Future research should be directed at better understanding how resource utilization can be optimized for both ED patients with syncope and presyncope to safely reduce low-yield health care services. Further studies are also needed to detect

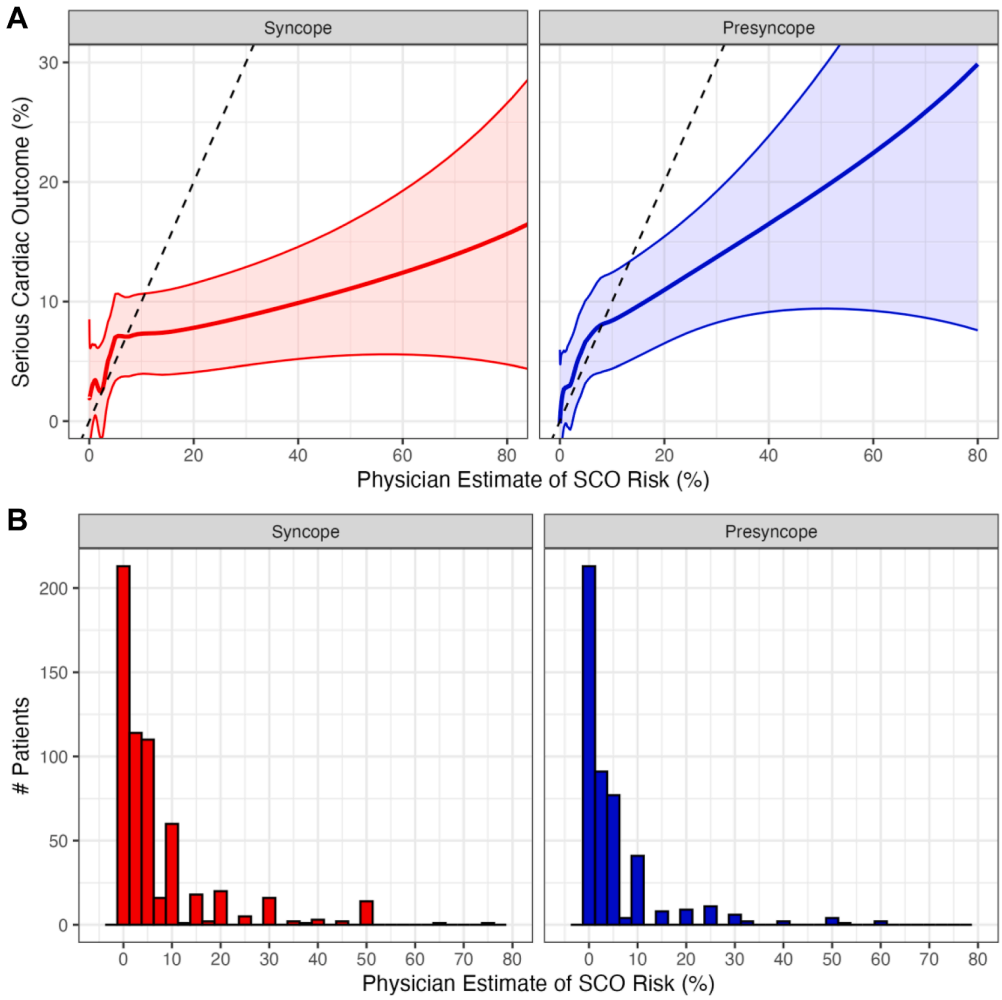

Figure 2. *A*, Serious cardiac outcome versus physician risk assessment with a locally weighted scatterplot smoothing (LOWESS) curve. The dashed line represents the theoretical trajectory that physician risk assessment perfectly predicts serious cardiac outcomes. Solid lines represent the locally estimated scatterplot smoothing observed in serious cardiac outcome occurrence versus physician-estimated risk. Shaded areas represent 95% confidence intervals. *B,* Distribution of physician-estimated risks.

differences in the incidence of ventricular arrythmias between presyncope and syncope, and to better understand the clinical significance of prodromal symptoms in syncope versus presyncope, both of which may help us further refine clinical approaches to risk stratification in these groups.

Table 4. Resource utilization of participants presenting to ED based on syncope or presyncope.

Characteristic	Overall N = 1,263	Syncope N = 721	Presyncope N = 542	Difference
Admission	564 (44.7%, 42%-47%)	357 (49.5%, 46%-53%)	207 (38.2%, 34%-42%)	11.3% (1.2%, 21.5%)
Admitted (hospital)	391 (31.0%, 28%-34%)	257 (35.6%, 32%-39%)	134 (24.7%, 21%-29%)	
Admitted (observation)	173 (13.7%, 12%-16%)	100 (13.9%, 11%-17%)	73 (13.5%, 11%-17%)	
Discharged from ED	699 (55.3%, 53%-58%)	364 (50.5%, 47%-54%)	335 (61.8%, 58%-66%)	
Echocardiogram obtained	427 (33.8%, 31%-37%)	273 (37.9%, 34%-42%)	154 (28.4%, 25%-32%)	9.5% (−0.1%, 19.0%)
Ambulatory cardiac monitoring obtained	124 (9.8%, 8.3%-12%)	80 (11.1%, 8.9%-14%)	44 (8.1%, 6.0%-11%)	3.0% (−3.0%, 9.0%)
Troponin ordered	1,049 (83.1%, 81%-85%)	601 (83.4%, 80%-86%)	448 (82.7%, 79%-86%)	0.7% (−7.0%, 8.4%)

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