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Orthostatic vital signs do not predict 30 day serious outcomes in older emergency department patients with syncope: A multicenter observational study

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ABSTRACT

Background: Syncope is a common chief complaint among older adults in the Emergency Department (ED), and orthostatic vital signs are often a part of their evaluation. We assessed whether abnormal orthostatic vital signs in the ED are associated with composite 30-day serious outcomes in older adults presenting with syncope.

Methods: We performed a secondary analysis of a prospective, observational study at 11 EDs in adults ≥ 60 years who presented with syncope or near syncope. We excluded patients lost to follow up. We used the standard definition of abnormal orthostatic vital signs or subjective symptoms of lightheadedness upon standing to define orthostasis. We determined the rate of composite 30-day serious outcomes, including those during the index ED visit, such as cardiac arrhythmias, myocardial infarction, cardiac intervention, new diagnosis of structural heart disease, stroke, pulmonary embolism, aortic dissection, subarachnoid hemorrhage, cardiopulmonary resuscitation, hemorrhage/anemia requiring transfusion, with major traumatic injury from fall, recurrent syncope, and death) between the groups with normal and abnormal orthostatic vital signs.

Results: The study cohort included 1974 patients, of whom 51.2% were male and 725 patients (37.7%) had abnormal orthostatic vital signs. Comparing those with abnormal to those with normal orthostatic vital signs, we did not find a difference in composite 30-serious outcomes (111/725 (15.3%) vs 184/1249 (14.7%); unadjusted odds ratio, 1.05 [95%CI, 0.81–1.35], p = 0.73). After adjustment for gender, coronary artery disease, congestive heart failure (CHF), history of arrhythmia, dyspnea, hypotension, any abnormal ECG, physician risk assessment, medication classes and disposition, there was no association with

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composite 30-serious outcomes (adjusted odds ratio, 0.82 [95%CI, 0.62–1.09], p = 0.18).
Conclusions: In a cohort of older adult patients presenting with syncope who were able to have orthostatic vital signs evaluated, abnormal orthostatic vital signs did not independently predict composite 30-day serious outcomes.

1. Introduction

Syncope is a common chief complaint among patients presenting to the emergency department (ED), accounting for 740,000 ED visits annually [1]. Differentiating between the serious and benign causes of syncope can be challenging, particularly in the older adult. Orthostatic hypotension affects up to 50% of all older adults [2]. Orthostatic hypotension causing syncope can be the manifestation of simple volume depletion in an otherwise healthy patient or herald a more serious etiology, such as acute blood loss or cardiac dysfunction.

The 2017 AHA/ACC/HRS guidelines on the evaluation of syncope in the ED recommend orthostatic vital signs as part of the standard evaluation [3]. Prior studies have conflicting data regarding the utility of orthostatic vital signs in the diagnostic work up of syncope in the ED. [4-6] Older patients are more likely to have baseline abnormal orthostatic vital signs due to medications and autonomic dysfunction, and the finding of orthostasis in the ED may be unrelated to the cause of syncope [7-11]. On the other hand, abnormal orthostatic vital signs in older patients with syncope could herald potentially modifiable causes such as gastrointestinal hemorrhage, medication side-effects or dehydration.

The purpose of this study was to evaluate whether abnormal orthostatic vital signs in the setting of syncope were independently associated with 30-day composite serious events in older adults.

2. Methods

We conducted a secondary analysis of a large, multicenter, prospective cohort study (ClinicalTrials.gov identifier NCT01802398) to determine whether abnormal orthostatic vital signs are predictive of composite 30-day serious adverse outcomes in older adults presenting to the ED with syncope or near-syncope. The institutional review boards at all sites (Appendix A) approved the study and we obtained written informed consent from all participating subjects. We report data per STROBE guidelines (Appendix B) [12].

2.1. Setting and patient population

Eligible patients were ≥60 years of age with a complaint of syncope or near-syncope at 11 academic EDs across the United States. Exclusion criteria were as follows: intoxication, medical or electrical intervention to restore consciousness and inability or unwillingness to provide informed consent or follow-up information. Patients with a presumptive cause of loss of consciousness due to seizure, stroke or transient ischemic attack, or hypoglycemia were also excluded. For this analysis, we also excluded patients that did not have orthostatic vital signs obtained or documented, or were lost to follow up. The full study protocol has been published elsewhere [13].

2.2. Study protocol

All patients included in this analysis underwent standardized history, physical examination including orthostatic vital signs, laboratory testing, and 12-lead electrocardiogram (ECG) testing. Patient disposition was directed by the treating clinical providers. We conducted 30-day patient follow-up through a process that included review of the electronic medical records by local research personnel to evaluate for serious outcomes within 30 days from the index ED visit. Additionally, all patients were called at 30 days by a research assistant blinded to clinical course to identify out-of-hospital deaths and subsequent ED visits and hospitalizations that occurred outside of the study sites. If a patient or their authorized representative reported an ED or hospital visit that occurred outside of the study site, their medical charts associated with those visits were reviewed. All potential serious outcomes identified by research staff were reviewed and adjudicated by a study physician blinded to clinical course.

2.3. Measurements

Data variables collected were consistent with reporting guidelines for ED based syncope research [12]. Data on current medications were organized by class of drug and included beta-blockers, calcium channel blockers, and other antiarrhythmic agents (e.g., amiodarone). We based ECG interpretations on the first ECG obtained in the ED, which were abstracted by one of five research study physicians who were blinded to all clinical data. Clinical staff obtained orthostatic vital signs during the ED evaluation. When not collected, the reason for them not be obtained was recorded as a free text field. Abnormal orthostatic vital signs were defined as a systolic blood pressure drop of 20 mm Hg after two minutes of standing OR 10 mm Hg upon standing OR symptoms of dizziness or lightheadedness upon standing [3,5].

2.4. Outcome

Our primary study outcome was a composite endpoint of 30-day serious events. We defined serious outcomes as any of the following: a significant arrhythmia (ventricular fibrillation, symptomatic ventricular tachycardia >30 s, sick sinus syndrome, sinus pause >30 s, Mobitz II heart block, complete heart block, symptomatic supraventricular tachycardia, or symptomatic bradycardia <40 beats per minute), myocardial infarction, a cardiac intervention, new diagnosis of structural heart disease, stroke, pulmonary embolism, aortic dissection, subarachnoid hemorrhage, cardiopulmonary resuscitation, internal hemorrhage/anemia requiring transfusion, recurrent syncope/fall resulting in major traumatic injury, or death. Although not part of our pre-specified analysis, we also reported short-term serious events, those that occurred during the ED or hospital course (prior to discharge).

2.5. Analysis

Continuous variables are presented as means and standard deviations and categorical variables and percent frequency of occurrence. We tested independence between categorical variables with a chi-square test or with Fisher's exact test, as appropriate. In the study cohort, we compared patients with and without orthostatic findings on demographic and medical characteristics. After assessing the univariate effect of orthostatic findings on composite 30-day serious events, we ran a multivariable logistic regression of composite 30-day serious events on orthostatic findings with pre-specified adjustments for gender, coronary artery disease, congestive heart failure (CHF), history of arrhythmia, dyspnea, hypoten-

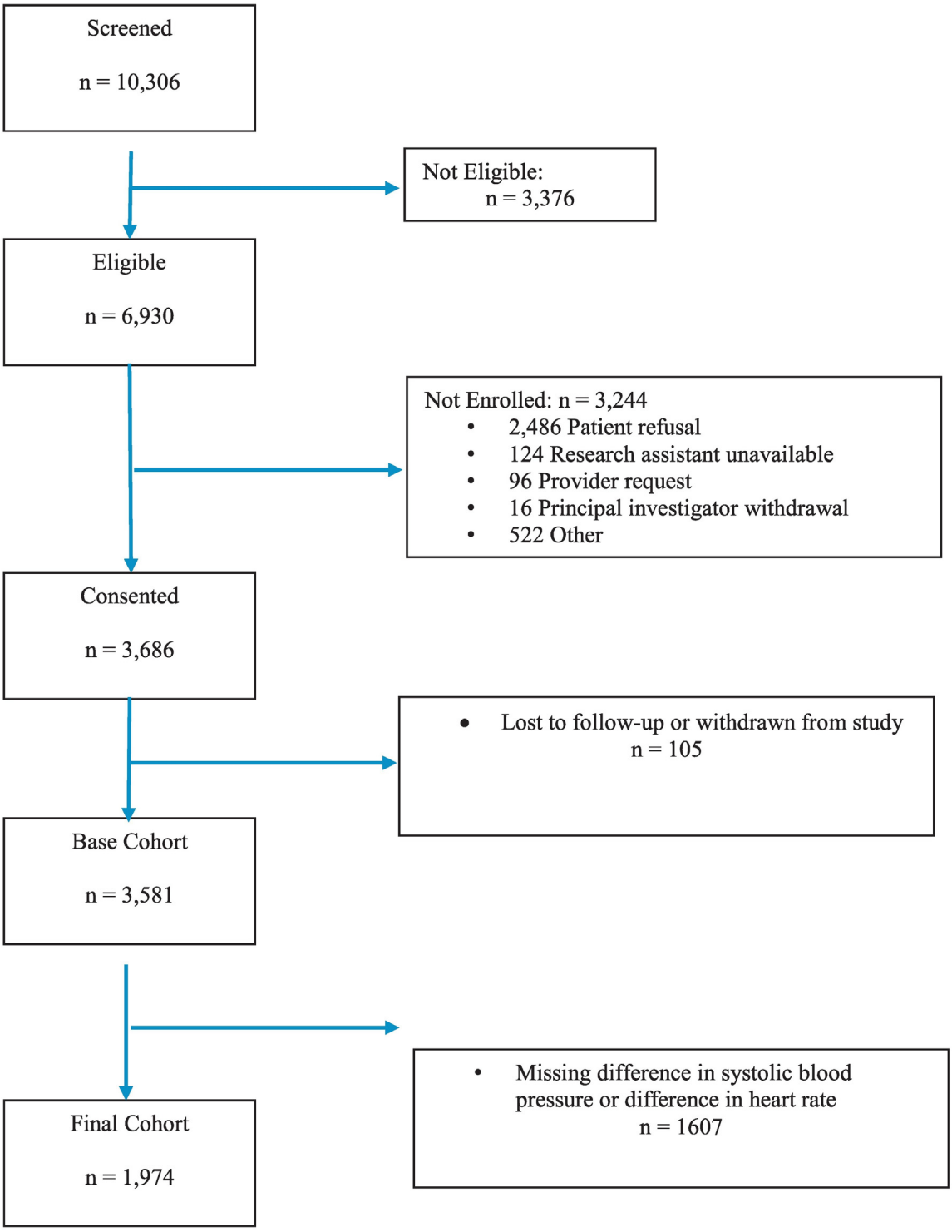

Fig. 1. Flow diagram of study cohort.

sion, any abnormal ECG, physician risk assessment, medication classes and disposition. We selected these variables based on prior literature that suggests these are important predictors of serious outcomes in patients with syncope [2]. We used similar analytical techniques for the short-term outcomes. We recorded the reasons for not obtaining orthostatic vital signs and compared patients who did and did not receive orthostatic vital signs to assess bias (Appendix C). All statistical analyses were performed in the R package [15]. All p-values are two-sided and considered significant at the 5% level.

3. Results

3.1. Characteristics of the subjects

There were 6930 subjects that met eligibility criteria for the primary study, of which 3686 (53.2%) consented and were enrolled (Fig. 1). Of the 3686 enrolled subjects, there were 1974 patients (53.6%) who had orthostatic vital signs performed in the ED, representing the cohort for this study. Compared to the study cohort, subjects not receiving assessment of orthostatic vital signs were

Table 1
Baseline characteristics of study cohort.

Patient characteristics	Overall Cohort (n = 1974)	Normal Orthostatic Vital Signs (n = 1249)	Abnormal Orthostatic Vital Signs (n = 725)	p-value
Age, mean [6]	72.1 (8.6)	72.1 (8.8)	72.1 (8.4)	0.969
Age				0.017
60 to <70	898 (45.5)	586 (46.9)	312 (43.0)	
70 to <80	647 (32.8)	388 (31.1)	259 (35.7)	
80 to <90	367 (18.6)	227 (18.2)	140 (19.3)	
90+	62 (3.1)	48 (3.8)	14 (1.9)	
Gender				0.510
Male	1010 (51.2)	632 (50.6)	378 (52.1)	
Female	964 (48.8)	617 (49.4)	347 (47.9)	
Race				0.348
White or Caucasian	1646 (83.7)	1055 (84.8)	591 (81.7)	
Black or African American	255 (13.0)	149 (12.0)	106 (14.7)	
Asian	29 (1.5)	18 (1.4)	11 (1.5)	
Other	37 (1.9)	22 (1.8)	15 (2.1)	
History of				
Congestive Heart Failure	210 (10.6)	112 (9.0)	98 (13.5)	0.002
Coronary Artery Disease	503 (25.5)	300 (24.0)	203 (28.0)	0.052
Arrhythmia	432 (21.9)	259 (20.8)	173 (23.9)	0.107
Prescribed medication				
Beta blockers	763 (38.7)	481 (38.5)	282 (38.9)	0.876
Calcium channel blockers	346 (17.5)	216 (17.3)	130 (17.9)	0.726
Diuretics	543 (27.5)	328 (26.3)	215 (29.7)	0.106
Dyspnea	387 (20.0)	228 (18.7)	159 (22.2)	0.060
Hypotension	212 (10.7)	82 (6.6)	130 (17.9)	<0.001
Abnormal ECG	1030 (52.8)	625 (50.6)	405 (56.6)	0.012
Physician Risk Assessment, mean [6]	8.0 (11.3)	8.2 (12.0)	7.7 (10.0)	0.370
Disposition				0.004
Hospitalized	1538 (79.0)	945 (77.0)	593 (82.5)	
Discharged	409 (21.0)	283 (23.0)	126 (17.5)	

Unless otherwise noted, data are presented as number (%).

more likely to be older, have CAD, HF, dyspnea, or an abnormal ECG, and more likely to have a higher physician risk estimate or be hospitalized (see Appendix C). Reasons recorded, in free text, for not obtaining orthostatic vital signs (n = 1125) most commonly included too symptomatic at baseline {395 (35%)], unable to stand [305 (27%)] most often related to injuries from fall or baseline condition, provider determined it was not indicated [170 (15%)], and the patient refused [129 (11%)].

Study subjects had a mean age of 72.1 years and 1010 (51.2%) were male (Table 1). Compared to patients who had normal orthostatic findings, those that had abnormal orthostatic findings were more likely to have heart failure, an abnormal ECG, hypotension on initial triage vital signs, and be hospitalized (Table 2).

3.2. Main results

Overall, 295 (14.9%) study subjects had a composite 30-day serious outcome (Table 3). One hundred eighty-four of 1249 (14.7%) of patients with normal orthostatic vital signs and 111/725 (15.3%) of patients with abnormal orthostatic vital signs had a composite 30-day serious outcome (odds ratio [OR] 1.05; 95% CI 0.81–1.35). After adjustment for pre-specified co-variates (Table 4), the adjusted OR was 0.83 (95% CI 0.62–1.10). Similarly, orthostatic vital signs were not associated with short-term serious outcomes (Appendix D).

Of the 20 different items within the composite 30-day serious event outcome, events rates for 18 conditions were similar between the two groups (Table 2). Patients with abnormal orthostatic vital signs were more likely to have GI hemorrhage/anemia 4.4% vs 2.2% (p = 0.007), and stroke 1.2% v 0.4% (p = 0.032). Both of these conditions were also associated with serious short term (Appendix E).

4. Discussion

In a large cohort of older adults with syncope with orthostatic vital signs measured, abnormal orthostatic vital signs in the ED did not have increased composite 30-day serious outcomes compared to patients with normal orthostatic vital signs. Current AHA/ACC/HRS guidelines recommend incorporation of a set of orthostatic vital signs into the standard ED work up for syncope despite conflicting evidence [3]. Our study specifically focused on patients where the clinicians felt orthostatic vital signs may have some role, as patients that clinicians felt were too sick did not receive orthostatic vital signs. It also adjusted for multiple co-morbidities including physician risk assessment. We found that orthostatic vital sign abnormalities did not predict 30-day serious outcomes in unadjusted or adjusted models. This does not mean that they are useless, but does suggest that they should not be a required standard of care for all patients.

The reliability of abnormal orthostatic vital signs in patients with syncope has not been well established. In fact, the Canadian Syncope rule did not evaluate orthostatic vital signs [4]. Abnormal orthostatic vital signs may be associated with both serious and non-serious conditions such as pulmonary embolism, GI hemorrhage, cardiac tamponade dehydration, autonomic dysfunction and sleep deprivation [2,8,15,16,19]. Older adults have altered physiologic response compared to younger patients making the interpretation of abnormal orthostatic vital signs in older adults more difficult [18]. In theory, abnormalities may suggest intravascular depletion or an occult process that has not yet been recognized. However, this assumes a normal physiologic state; one without peripheral arterial disease, baseline hypertension, or medications that may distort heart rate or blood pressure responsiveness to normal shifts in position.

Older adults with baseline abnormal orthostatic vital signs and atherosclerosis, hypertension, stroke, and neurologic conditions have worse long term outcomes in prior studies [9,19-23]. When symptomatic (with syncope), as in our study, abnormal orthostatic vital signs are not an independent predictor of adverse events. This is analogous to cardiac risk factors predicting long-term cardiovascular risk in asymptomatic patients but not being predictive of short-term events in symptomatic ED patients [6].

In our univariate analysis assessing the relationship between orthostatic vital signs and 20 outcomes, there were two 30-day serious outcomes that were more common in patients with abnormal orthostatic vital signs: GI hemorrhage/anemia and stroke. Biological plausibility for the findings in GI bleeding is obvious, but it is less clear in stroke patients. It might be an artifact of multiple testing (e.g., Type 1 error). As such, this finding should be considered exploratory. It is worth noting that patients who presented with stroke as the cause of syncope were excluded so these patients represent only those without clinically obvious stroke prior to enrollment.

One criticism of our study could be that not all patients had measurement of orthostatic vital signs. Bias may result from not obtaining orthostatic vital signs on patients in the two extremes – those judged too well to need them, and those judged too sick to obtain them. In general, orthostatic vital signs are not measured on critically ill patients that cannot stand up or those that have a clear etiology of their syncope, excluding an important group from most large studies. This was also seen in our study, where approximately half of all study patients did not

Table 2
Individual and composite 30-day serious outcomes stratified by normal and abnormal orthostatic vital signs

Outcome	Overall cohort (n = 1974)	Normal orthostatic vital signs (n = 1249)	Abnormal orthostatic vital signs (n = 725)	p-Value
Any 30-day serious outcome	295 (14.9)	184 (14.7)	111 (15.3)	0.728
Pulmonary embolism OR internal hemorrhage/ anemia	73 (3.7)	36 (2.9)	37 (5.1)	0.012
30 day death	7 (0.4)	3 (0.2)	4 (0.6)	0.262
Serious cardiac arrhythmia				
Ventricular fibrillation	6 (0.3)	4 (0.3)	2 (0.3)	0.863
Ventricular tachycardia (>30 s)	5 (0.3)	2 (0.2)	3 (0.4)	0.280
Symptomatic ventricular tachycardia (<30 s)	8 (0.4)	7 (0.6)	1 (0.1)	0.154
Sick sinus disease	11 (0.6)	8 (0.6)	3 (0.4)	0.514
Sinus pause > 3 s	6 (0.3)	5 (0.4)	1 (0.1)	0.307
Mobitz II atrioventricular heart block	8 (0.4)	6 (0.5)	2 (0.3)	0.491
Complete heart block	10 (0.5)	8 (0.6)	2 (0.3)	0.271
Symptomatic supraventricular tachycardia	70 (3.5)	45 (3.6)	25 (3.4)	0.858
Symptomatic bradycardia	24 (1.2)	18 (1.4)	6 (0.8)	0.230
Pacemaker/ICD	2 (0.1)	1 (0.1)	1 (0.1)	0.697
Other serious outcomes				
Myocardial infarction	30 (1.5)	21 (1.7)	9 (1.2)	0.441
Cardiac intervention	85 (4.3)	62 (5.0)	23 (3.2)	0.059
New diagnosis of structural heart disease	24 (1.2)	19 (1.5)	5 (0.7)	0.104
Stroke	14 (0.7)	5 (0.4)	9 (1.2)	0.032
Pulmonary embolism	14 (0.7)	9 (0.7)	5 (0.7)	0.937
Aortic dissection	0 (0.0)	0 (0.0)	0 (0.0)	1.000
Subarachnoid hemorrhage	0 (0.0)	0 (0.0)	0 (0.0)	1.000
Cardiopulmonary resuscitation	2 (0.1)	1 (0.1)	1 (0.1)	0.697
GI hemorrhage/anemia	60 (3.0)	28 (2.2)	32 (4.4)	0.007
Recurrent syncope/fall with major injury	4 (0.2)	1 (0.1)	3 (0.4)	0.112

Unless otherwise noted, data are presented as number (%).

have orthostatic vital signs measured in the ED. Although this may be considered a flaw in our ability to determine the value of orthostatic vital signs, it does reflect what is seen in the "real world' and thus should not limit the generalizability of our findings. This is consistent with our analysis of the characteristics of these patients which found that the cohort who did not get a set of orthostatic vital signs in the ED were statistically older, had more cardiovascular co-morbidities, and were more likely to be admitted to the hospital. Patients judged to be too sick and require inpatient admission or ICU level care were not able to stand up and did not get orthostatic vital signs.

In addition, although our protocol did standardize the ascertainment of orthostatic vital signs - the method of measurement was determined locally. As a result, we cannot be sure that all providers waited the appropriate amount of time when altering positioning. Although obtaining blood pressure too rapidly or too slowly can change the likelihood of the test being abnormal, it does represent the real-world experience and allows our study to be generalizable. Although we used only academic sites, patients presenting with syncope are usually those from the local community, rather than high complex referrals. Finally, our results cannot be applied to younger patients or others with characteristics who were ineligible for our study.

5. Conclusions

In a cohort of older adult patients presenting with syncope who were able to have orthostatic vital signs evaluated, abnormal ortho-

Table 3
Unadjusted odd's ratios for composite 30-day serious outcomes.

Predictor variables	Odds for 30-day serious outcome (95% CI)	95% CI	p-Value
Abnormal orthostatic	1.05	(0.81, 1.35)	0.728
Male	1.40	(1.09, 1.81)	0.008
History of congestive heart failure	2.12	(1.50, 2.96)	<0.001
History of coronary artery disease	1.59	(1.22, 2.07)	0.001
History of arrhythmia	2.55	(1.95, 3.32)	<0.001
Abnormal ECG	2.34	(1.79, 3.07)	<0.001
Dyspnea	2.17	(1.64, 2.86)	<0.001
Physician risk assessment	1.03	(1.02, 1.04)	<0.001
Hypotension	2.03	(1.43, 2.84)	<0.001
Discharged	0.25	(0.15, 0.39)	<0.001
Beta blocker	1.41	(1.10, 1.81)	0.007
Diuretics	1.21	(0.92, 1.58)	0.166
Calcium channel blocker	0.93	(0.66, 1.28)	0.650
Hosmer-Lemeshow goodness of fit test			
X-squared			6.06
df			8
p-Value			0.640

There is no evidence of poor fit.

Table 4
Multivariate logistic regression model predicting composite 30-day serious outcomes.

Predictor variables	Odds for 30-day serious outcome (95% CI)	95% CI	p-Value
Abnormal orthostatic	0.83	(0.62, 1.10)	0.192
Male	1.22	(0.93, 1.61)	0.158
History of congestive heart failure	1.44	(0.95, 2.16)	0.083
History of coronary artery disease	0.90	(0.65, 1.24)	0.524
History of arrhythmia	2.14	(1.59, 2.88)	<0.001
Abnormal ECG	1.78	(1.32, 2.40)	<0.001
Dyspnea	2.05	(1.51, 2.76)	<0.001
Physician risk assessment	1.02	(1.01, 1.03)	<0.001
Hypotension	1.84	(1.24, 2.69)	0.002
Discharged	0.29	(0.17, 0.46)	<0.001
Beta blocker	1.07	(0.80, 1.45)	0.639
Diuretics	0.78	(0.56, 1.07)	0.128
Calcium channel blocker	0.93	(0.64, 1.33)	0.683

static vital signs did not independently predict composite 30-day serious outcomes.

Conflicts of interest

JLW has no conflicts to report.

JEH has received research funding from Alere, Siemens, Roche, Portola and Trinity.

AMC has received research funding from Abbott, Akers, Alere, Nanomix, Siemens, Roche, Ortho Diagnostics, Portola and Trinity.

ALL has no conflicts to report.

ES has no conflicts to report.

REW has no conflicts to report.

ANY has no conflicts to report.

SEM has no conflicts to report.

DHA has received research funding from Roche.

AB has received research funding from Radiometer and Portola and has been a consultant for Portola.

CWB has received advisory board and speaker's fees from Roche, research funding from Janssen and Boehringer Ingelheim and consulting and advisory board fees from Janssen.

JMC has received research funding from Aztra Zeneca.

CLC has received institutional research funding from Radiometer, Ortho Clinical Trials, Janssen, Pfizer, Portola, Glaxo Smith Klein, and Hospital Quality Foundation and is a consultant for Portola, Janssen, and Hospital Quality Foundation.

DBD is a consultant for Janssen and Roche, has received institutional research support from Novartis, ortho Scientific, and Roche and is on the editorial board for AEM and Circulation.

DKN has received honorarium for Pfizer.

BAN has no conflicts to report.

MNS has received research funding from Roche Molecular Systems.

KAS has no conflicts to report.

ABS is a consultant for Quidel, Siemens, and MCM Education.

STW has no conflicts to report.

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Appendix A. Characteristics of enrolling sites

Name and location	Annual ED volume	Hospital beds
Oregon Heath & Science University, Portland, OR	46,782	576
UC Davis School of Medicine, Sacramento, CA	69,293	625
University of Rochester, NY	99,519	739
William Beaumont Hospital-Troy, Troy, MI	80,000	418
William Beaumont Hospital-Royal Oak, Royal Oak, MI	119,950	1070
Brigham & Women's Hospital, Boston, MA	59,851	769
Ohio State University Wexner Medical Center, Columbus, OH	72,000	971
Thomas Jefferson University Hospital, Philadelphia, PA	60,270	717
Wake Forest School of Medicine, Winston Salem, NC	109,687	885
Summa Health System, Akron, OH	90,656	544
Vanderbilt University, Nashville, TN	65,000	864

Appendix B. Checklist STROBE statement

	Item no	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract Done. "Orthostatic Vital Signs Do Not Predict 30 Day Serious Outcomes in Older Emergency Department Patients with Syncope: A multicenter observational study" (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Done.
Introduction		
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported. Done. Para 1 & 2.
Objectives	3	State specific objectives, including any prespecified hypotheses Done. Para 3
Methods		
Study design	4	Present key elements of study design early in the paper Done. Methods, paragraph 1.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Done. Methods, paragraph 2, 3, 4, 5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Methods, paragraph 3 (*b*) For matched studies, give matching criteria and number of exposed and unexposed. N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Methods, paragraph 5 & 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Methods, paragraph 5 & 6
Bias	9	Describe any efforts to address potential sources of bias. See limitations section
Study size	10	Explain how the study size was arrived at noted, secondary analysis of clinical trial
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Page 7, Analysis section
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding Page 7, Analysis section (*b*) Describe any methods used to examine subgroups and interactions Page 7, Analysis section (*c*) Explain how missing data were addressed Not imputed (*d*) If applicable, explain how loss to follow-up was addressed noted (*e*) Describe any sensitivity analyses N/A
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed Page 8 and flow diagram (b) Give reasons for non-participation at each stage Page 8 and flow diagram (c) Consider use of a flow diagram Fig. 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders Table 1 (b) Indicate number of participants with missing data for each variable of interest See tables (c) Summarize follow-up time (eg, average and total amount) See Fig. 1
Outcome data	15*	Report numbers of outcome events or summary measures over time Results and Tables 2, 3, 4
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Results and Tables 2, 3, 4 (*b*) Report category boundaries when continuous variables were categorized Results and Tables 2, 3, 4 (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Results and Tables 2, 3, 4
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses see appendecies
Discussion		
Key results	18	Summarize key results with reference to study objectives Discussion, para 1
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Discussion para 4 & 5
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence in Discussion
Generalisability	21	Discuss the generalisability (external validity) of the study results in discussion
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based see title page

Appendix C. Comparison of patients who did not have any orthostatic vital signs obtained compared to the group that did get orthostatic vital signs assessed (normal and abnormal)

Variable	Overall cohort (n = 3581)	Did not obtain orthostatic vital signs (n = 1607)	Obtained OVS (n = 1974)	p-Value
Age, mean [6]	72.8 (9.0)	73.6 (9.3)	72.1 (8.6)	<0.001
Age				<0.001
60 to <70	1539 (43.0)	641 (39.9)	898 (45.5)	
70 to <80	1156 (32.3)	509 (31.7)	647 (32.8)	
80 to <90	729 (20.4)	362 (22.5)	367 (18.6)	
90+	157 (4.4)	95 (5.9)	62 (3.1)	
Gender				0.559
Male	1848 (51.6)	838 (52.1)	1010 (51.2)	
Female	1733 (48.4)	769 (47.9)	964 (48.8)	
Race				0.196
White or Caucasian	2974 (83.5)	1328 (83.4)	1646 (83.7)	
Black or African American	478 (13.4)	223 (14.0)	255 (13.0)	
Asian	41 (1.2)	12 (0.8)	29 (1.5)	
Other	67 (1.9)	30 (1.9)	37 (1.9)	
History of				
Congestive heart failure	449 (12.5)	239 (14.9)	210 (10.6)	<0.001
Coronary artery disease	979 (27.4)	476 (29.7)	503 (25.5)	0.005
Arrhythmia	803 (22.4)	371 (23.1)	432 (21.9)	0.384
Prescribed medication				
Beta blockers	1422 (39.7)	659 (41.1)	763 (38.7)	0.147
Calcium channel blockers	657 (18.4)	311 (19.4)	346 (17.5)	0.157
Diuretics	1048 (29.3)	505 (31.5)	543 (27.5)	0.010
Dyspnea	747 (21.4)	360 (23.1)	387 (20.0)	0.026
Hypotension	382 (10.7)	170 (10.6)	212 (10.7)	0.877
Abnormal ECG	1948 (55.4)	918 (58.5)	1030 (52.8)	0.001
Physician risk assessment, mean [6]	9.2 (13.2)	10.7 (15.1)	8.0 (11.3)	<0.001
Disposition				0.001
Hospitalized	2860 (80.9)	1322 (83.3)	1538 (79.0)	
Discharged	674 (19.1)	265 (16.7)	409 (21.0)	

Unless otherwise noted, data are presented as number (%).

Appendix D. Multivariate logistic regression model predicting short term serious outcomes

Variables	OR	95% CI	p-Value
Abnormal orthostatic	0.81	(0.60, 1.09)	0.165
Male	1.20	(0.89, 1.61)	0.225
History of heart failure	1.21	(0.78, 1.89)	0.393
History of coronary artery disease	0.84	(0.59, 1.19)	0.331
History of arrhythmia	2.45	(1.8,0 3.34)	0.000
Abnormal ECG	1.95	(1.41, 2.69)	<0.001
Dyspnea	2.12	(1.55, 2.92)	<0.001
Physician risk assessment	1.02	(1.01, 1.03)	<0.001
Hypotension	1.67	(1.11, 2.53)	0.014
Discharged	0.13	(0.06, 0.27)	<0.001
Beta blocker	1.11	(0.81, 1.52)	0.523
Diuretics	0.71	(0.50, 0.99)	0.045
Calcium channel blocker	0.93	(0.63, 1.37)	0.717

Hosmer-Lemeshow goodness of fit test	
X-squared	4.91
df	8
p-Value	0.767

There is no evidence of poor fit.

Appendix E. Supplementary analysis of short term serious outcomes

Outcome	Overall cohort (n = 1974)	Normal orthostatic vital signs (n = 1249)	Abnormal orthostatic vital signs (n = 725)	p-Value
Any serious outcome	257 (13.0)	162 (13.0)	95 (13.1)	0.933
Pulmonary embolism OR internal hemorrhage/ anemia	66 (3.3)	31 (2.5)	35 (4.8)	0.005
Death	3 (0.2)	1 (0.1)	2 (0.3)	0.559
Serious Cardiac Arrhythmia				
Ventricular fibrillation	5 (0.3)	3 (0.2)	2 (0.3)	1.000
Ventricular tachycardia (>30 s)	4 (0.2)	1 (0.1)	3 (0.4)	0.143
Symptomatic ventricular tachycardia (<30 s)	7 (0.4)	6 (0.5)	1 (0.1)	0.434
Sick sinus disease with alternating sinus bradycardia and tachycardia	8 (0.4)	6 (0.5)	2 (0.3)	0.718
Sinus pause > 3 s	6 (0.3)	5 (0.4)	1 (0.1)	0.424
Mobitz II atrioventricular heart block	6 (0.3)	4 (0.3)	2 (0.3)	1.000
Complete heart block	8 (0.4)	7 (0.6)	1 (0.1)	0.271
Symptomatic supraventricular tachycardia	64 (3.2)	43 (3.4)	21 (2.9)	0.509
Symptomatic bradycardia	21 (1.1)	16 (1.3)	5 (0.7)	0.217
Pacemaker or implantable cardioverter-defibrillator malfunction with cardiac pauses	2 (0.1)	1 (0.1)	1 (0.1)	1.000
Other serious outcomes				
Myocardial infarction	24 (1.2)	17 (1.4)	7 (1.0)	0.439
Cardiac intervention	69 (3.5)	52 (4.2)	17 (2.3)	0.034
New diagnosis of structural heart disease	21 (1.1)	18 (1.4)	3 (0.4)	0.039
Stroke	10 (0.5)	3 (0.2)	7 (1.0)	0.044
Pulmonary embolism	13 (0.7)	8 (0.6)	5 (0.7)	0.896
Aortic dissection	0 (0.0)	0 (0.0)	0 (0.0)	1.000
Subarachnoid hemorrhage	0 (0.0)	0 (0.0)	0 (0.0)	1.000
Cardiopulmonary resuscitation	0 (0.0)	0 (0.0)	0 (0.0)	1.000
GI hemorrhage/anemia	54 (2.7)	24 (1.9)	30 (4.1)	0.004
Recurrent syncope/fall resulting in major injury	0 (0.0)	0 (0.0)	0 (0.0)	1.000

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