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The Impact of a Nurse-Led Syncope Clinic: Experience from a single UK tertiary center

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Abstract

Background: Syncope is a leading cause of hospital admission and is associated with significant morbidity and mortality. Our Syncope Clinic commenced in 2014 and we sought to evaluate its impact on outcomes (1-yr mortality and syncope re-hospitalization) in patients discharged following syncope admission.

Methods: A single-center study of all consecutive patients discharged with syncope (ICD-10 R55) between April 2012 and 2017. Patient demographics, comorbidities, hospital stay, syncope re-hospitalization, and mortality at one-year were collected. Those subsequently referred and seen in Syncope Clinic were compared with those who were not and predictors of poor outcome were evaluated.

Results: In total 2950 patients were discharged from hospital with syncope (median age: 73years, 51% male) with 1220 (41%) discharged same-day; after commencement of Syncope Clinic 231were subsequently reviewed here. Overall mortality was 11%, which was lower in the Syncope Clinic group (3% vs 12%, $P < .001$). Temporal analysis revealed reduced re-hospitalization following commencement of Syncope Clinic (2% vs 6%, $P = .027$). Independent predictors of mortality were increasing age (HR 1.03, 95% CI 1.03-1.04), AF (HR 1.6, 95% CI 1.2-2.1), HF (HR 2.2, 95% CI 1.6-3.0), COPD (HR 1.9, 95% CI 1.4-2.7), and $CHADS_2$ score ≥ 1 (HR 1.45, 95% CI 1,12-1.87). Syncope Clinic attendance was associated with reduced mortality (HR 0.3, 95% CI 0.1-0.6).

Conclusions: Syncope patients discharged from hospital had reduced 1yr mortality if seen in subsequent Syncope Clinic. Independent predictors of mortality were COPD, HF, AF, and $CHADS_2$ ≥1. Prospective randomized trials of Syncope Clinics are warranted.

KEYWORDS

collapse, syncope, syncope evaluation unit

1 | INTRODUCTION

Syncope is a common hospital presentation associated with increased morbidity, mortality, and significant healthcare burden[1-4] and accounts for 1% of visits to the emergency department (ED).[5-7] Studies suggest that neurally-mediated syncope carries a benign prognosis whilst cardiac syncope and unexplained syncope carry significantly increased mortality risk.[3,4,8] The reported mortality risk following syncope admission is highly variable, ranging from 1.9% to 13% at 1 year.[7,9-11] Numerous risk scores have been developed to help identify patients at higher risk and guide decisions regarding hospital admission versus outpatient investigation.[1] Traditional risk factors associated with increased mortality risk include older age, the presence of heart failure (HF), structural heart disease, comorbidities, and electrocardiogram (ECG) abnormalities.[1] Recently, less recognized factors have been identified including recurrent syncope,[12] hospital stay duration,[7,13,14] the use of observation units within ED, and a structured approach to management of syncope using Syncope Clinics.[7] The $CHADS_2$ score has recently been shown to perform well against more complex syncope risk scores in predicting mortality in patients admitted with syncope.[15] We aimed to evaluate 1-year mortality/syncope re-hospitalization in patients discharged with a primary diagnosis of syncope from a UK tertiary center to assess the impact of our Syncope Clinic which started in 2014. We also assessed temporal trends in outcomes before and after the introduction of our Syncope Clinic and evaluated for independent predictors of poor outcome.

2 | METHODS

2.1 | Patient population

A hospital administrative database of patients admitted to University Hospital Coventry, UK was used. Data were entered prospectively into the database following review of medical records. Discharge diagnoses were coded according to the World Health Organization International Statistical Classification of Diseases and Related Health problems 10th Revision (ICD-10). Patients discharged with a primary discharge diagnosis of "Syncope and Collapse" ICD-10 code "R55" between April 1st 2012 and March 31st 2017 were identified. Patients under the age of 16years were excluded. Extracted data included patient gender, ethnicity, date of birth, and date of death where applicable. The date of death was obtained via an online database for National Health Service (NHS) patients with the NHS number as a unique identifier, allowing for identification of all registered deaths. Hospital admission and discharge dates were used to calculate length of hospital stay and age at time of admission. Comorbidities were identified using the relevant ICD-10 codes (Table 1).

The $CHADS_2$ score was calculated based on a composite score comprising history of congestive cardiac failure (1 point), hypertension (1 point), age ≥75 years (1 point), diabetes mellitus (1 point), and stroke or transient ischemic attack (2 points).[16] Inpatient investigations, interventions, discharging specialty, and dates of outpatient syncope clinic attendance were obtained. Admission and discharge dates for re-hospitalizations for syncope were also obtained as well as attendance to our outpatient Syncope Clinic. Our tertiary hospital has an ED and serves a population of just over 1 million people. Local ethical approval was obtained for the study from our UHCW Research & Development Department.

Our nurse-led Syncope Clinic was established in 2014; it applied a structured guideline-based approach[1,17] to the evaluation and management of syncope, utilizing Arrhythmia Nurse Specialists with oversight from Consultant Electrophysiologists. Patients were referred to the Syncope Clinic by hospital based medical and non-medical specialties. During the study period there was only one syncope clinic a week with a pathway agreed with Neurology and Emergency Medicine. This pathway was based on the NICE 2014

TABLE 1 ICD-10 diagnostic codes used to identify comorbidities in the present study

Cardiac
R55 Syncope and Collapse; I10 Hypertension; I20 Angina pectoris; I21 Acute myocardial infarction; I22 Subsequent myocardial infarction; I23 Certain current complication following acute myocardial infarction; I24 Other acute ischemic heart disease; I25 Chronic ischemic heart disease; I35.0 Non rheumatic aortic (valve) stenosis; I42 Cardiomyopathy; I48 Atrial fibrillation and flutter; I50 Heart failure; I95.1 Orthostatic hypotension; Z95.0 Presence of cardiac pacemaker
Neurological
G40 Epilepsy; G45 Transient cerebral ischemic attacks and related syndromes; I60 Subarachnoid hemorrhage; I61 Intracerebral hemorrhage; I62 Other nontraumatic intracranial hemorrhage; I63 Cerebral infarction; I64 Stroke, not specified as hemorrhage or infarction; I65 Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction; I66 Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction.
Trauma
S00-S09 Injuries to the head; S10-S19 Injuries to the neck; S20-S29 Injuries to the thorax; S30-S39 Injuries to the abdomen, lower back, lumbar spine, and pelvis; S40-S49 Injuries to the shoulder and upper arm; S50-S59 Injuries to the elbow and forearm; S60-S69 Injuries to the wrist and hand; S70-79 Injuries to the hip and thigh; S80-S89 Injuries to the knee and lower leg; S90-S99 Injuries to the ankle and foot; T00-T07 Injuries involving multiple body regions; T08-T14 Injuries to unspecified part of trunk, limb, or body region
Malignancy
C15 Malignant neoplasm of esophagus; C16 Malignant neoplasm of stomach; C17 Malignant neoplasm of small intestine; C18 Malignant neoplasm of colon; C19 Malignant neoplasm of rectosigmoid junction; C20 Malignant neoplasm of rectum; C25 Malignant neoplasm of pancreas; C34 Malignant neoplasm of the bronchus and lung; C50 Malignant neoplasm of breast; C809 Malignant neoplasm, unspecified
Other
E10-E14 Diabetes mellitus; J45 Asthma; J44 Other chronic obstructive pulmonary disease

TLOC Guidance[17] that was published at the time the clinic started. This had limited availability initially and was only expanded in mid-2016. Our nurse led Syncope Clinic was run by trained arrhythmia nurses with consultant Electrophysiologist supervision. The specialist arrhythmia nurses were trained in clinical health assessment, including history-taking, 12-lead ECG interpretation and cardiac auscultation.[17] All patients seen in the Syncope Clinic had a detailed clinical evaluation including clinical history, physical examination, lying/standing blood pressure assessment, carotid sinus massage, and 12-lead ECG. If deemed necessary a wide range of investigations and treatments were available including ambulatory ECG and BP monitoring, tilt testing, exercise testing, Injectable Loop Recorder (ILR) implantation, echocardiography, cardiac/brain imaging, coronary angiography, electrophysiology study/ablation, and implantation of permanent pacemaker or cardioverter defibrillator. Patients were assessed for any cardiac 'red flag' features in accordance with ESC Syncope guidelines.[1] Where a neurological disorder was suspected Neurology specialist advice was sought. Both pharmacological and nonpharmacological interventions were initiated which included patient education and admission avoidance advice. The primary outcome of our study was 1-year mortality and secondary outcomes included 1-year and 30day re-hospitalization for syncope. The temporal effect of the syncope clinic was assessed by comparing outcomes between two time periods: 1st April 2012 to 31st March 2014 (pre-Syncope Clinic) and 1st April 2015- 31st March 2017 (post-Syncope Clinic).

2.2 | Statistical analysis

Statistical analysis was performed using SPSS software, version 22 (SPSS Inc, Chicago, Ilinois). Continuous variables were tested for normality using the Kolmogorov-Smirnov normality test and reported as median (lower quartile to upper quartile) for non-normally distributed data and mean ± standard deviation for normally distributed data. Categorical data were expressed as frequency (%). Patients were divided into two groups; those that died within 1year and those that were alive at 1year. Group differences were assessed using Mann-Whitney test or Pearson Chi-Squared test as appropriate. Cox proportional multivariable regression analysis was performed to determine significant predictors of mortality and were reported as hazard ratios (HR) with 95% confidence intervals (CI). *P* value < .05 was considered statistically significant.

3 | RESULTS

A total of 3114 patients were identified. Patients under the age of 16years were excluded (N = 164) leaving a total of 2950 patients included in the final analysis. These patients were discharged from hospital between 1st April 2012 and 31st March 2017 (See Figure 1). The median age was 73 (53-84) years, 51% male and 86% Caucasian. The median length of stay was 1 (0-3) days. Patients who died within 1year were significantly older than those who were alive. The commonest comorbidities included hypertension (38%), ischemic heart disease [IHD](17%), diabetes (16%), and atrial fibrillation/flutter [AF](12%). The median $CHADS_2$ score was 1 (0-2). Lung (1%), bowel (0.2%) and breast malignancy (0.3%) were rare. Commonest reported injuries included head injury (2%) and fractures of femur (0.1%), lumbar spine/pelvis (0.1%), and clavicle (0.1%). The commonest inpatient investigations included computed tomography head (15%) and implantable loop recorders [ILR] (7%), while other investigations were rarely performed. Inpatient permanent pacemaker or defibrillator implantation was infrequent (3%). A significant proportion of patients were discharged the same-day (1220 patients, 41%); 721 patients were admitted for 1day (24%), 229 for 2days (8%), 131 for 3days (4%) and 649 for 4 or more days (22%).

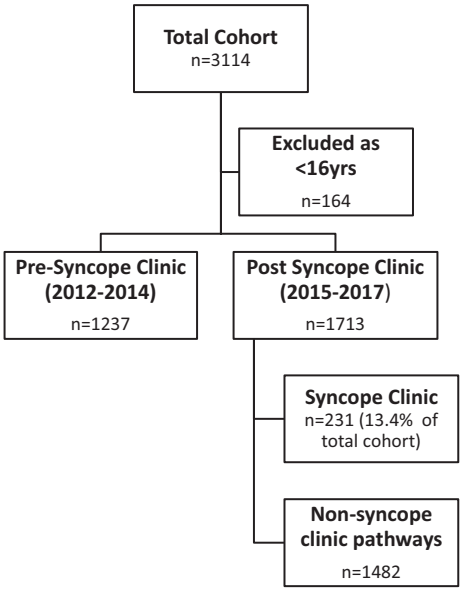

FIGURE 1 Patient flow chart

Following discharge 231 patients (8% of entire cohort) attended outpatient Syncope Clinic appointment (Table 2). There were no significant differences in age, gender, ethnicity, comorbidities, and investigations done whilst an inpatient between the two groups. One year mortality was lower in those attending Syncope Clinic compared with those not attending (3% [7] vs 12% [314], $P < .001$). The primary outcome of 1-year mortality occurred in 321 patients (11%) (Table 3); as expected those who died were older and had more comorbidity compared with who survived. Interestingly, there were no differences in investigations between the two groups except those who survived had higher ILR implants (8% vs 2%, $P < .001$). Syncope re-hospitalization at 1-year occurred in 48 patients within 30-days (2%) and in 154 patients within 1-year (5%).

Table 4 shows univariate and multivariate predictors of 1-year mortality and 1-year syncope rehospitalization respectively. Significant factors associated with increased 1-year mortality included the presence of IHD, diabetes, AF, chronic obstructive pulmonary disease (COPD), HF, aortic stenosis, cerebral infarction, and higher $CHADS_2$ score.

TABLE 2 Comparison of those attending outpatient Syncope clinic vs no Syncope Clinic

	All patients N = 2950	Syncope Clinic N = 231 (8%)	No Syncope Clinic N = 2719 (92%)	*P* value
Age, years	73 (53-84)	73	73	.395
Male	1504 (51)	129 (56)	1375 (51)	.124
Ethnicity				
Caucasian	2543 (86)	193 (84)	2350 (86)	.749
Asian	215 (7)	20 (9)	195 (7)	
Black	74 (3)	7 (3)	67 (2)	
Other	68 (2)	6 (3)	62 (2)	
Comorbidities				
Hypertension	1111 (38)	87 (38)	1024 (38)	1
Ischemic heart disease	512 (17)	35 (15)	477 (18)	.357
Diabetes	478 (16)	31 (13)	447 (16)	.232
Atrial fibrillation	349 (12)	19 (8)	330 (12)	.077
Asthma	213 (7)	21 (9)	192 (7)	.253
COPD	138 (5)	14 (6)	124 (5)	.300
Heart failure	130 (4)	6 (3)	124 (5)	.163
Epilepsy	106 (4)	5 (2)	101 (4)	.224
Orthostatic hypotension	92 (3)	9 (4)	83 (3)	.479
Aortic stenosis	39 (1.3)	3 (1)	36 (1)	.974
Cardiomyopathy	15 (0.5)	0	15 (0.6)	.258
Transient ischaemic attack	14 (0.5)	2 (1)	12 (0.4)	.367
Cerebral infarction	9 (0.3)	0	9 (0.3)	.381
CHADS2		1 ± 0.9	1 ± 1.0	.171
0	1037 (35)	91 (39)	946 (35)	.372
1	933 (32)	68 (29)	865 (32)	
2 or more	980 (33)	72 (31)	908 (33)	
Investigations done during admission				
CT head	428 (15)	44 (19)	384 (14)	.041
Implantable loop recorder	205 (7)	20 (9)	185 (7)	.287
Permanent pacemaker/ defibrillator	88 (3)	3 (1)	85 (3)	.117
CT pulmonary angiogram	26 (1)	4 (2)	22 (1)	.150
Echocardiogram	11 (0.4)	2 (1)	9 (0.3)	.200
Coronary angiogram	6 (0.2)	0	6	.475
CT aorta	4 (0.1)	0	4	.560
MRI head	2 (0.1)	0	2	.680
Electroencephalogram	3 (0.1)	0	3	.613
EPS ± ablation	2 (<0.1)	0	2	.680
Cardiac provocation	1 (<0.1)	0	1	.771
Discharge same day		106 (46)	1114 (41)	.145

$CHADS_2$ score of 1 (HR 1.574, 95% CI 1.179-2.101, $P = .002$) and ≥2 (HR 1.825, 95% CI 1.381-2.412, $P < .001$) were associated with increased 1-year mortality risk, compared with $CHADS_2$ score of 0 (Figure 2). Same day discharge and discharge specialty Cardiology were associated with lower 1-year mortality. Following multivariable regression analysis, significant independent predictors of increased 1-year mortality included increasing age, presence of HF, AF or COPD, and the $CHADS_2$ score (Figure 3). Subsequent attendance at outpatient Syncope Clinic, same-day discharge, and Cardiology as discharge specialty were independently associated with lower risk

TABLE 3 Comparison of patients who died at one-year vs those who survived

	All patients N = 2950	Died within 1 year N = 321 (11%)	Alive within 1 year N = 2629 (89%)	*P* value
Age (years - IQR)	73 (53-84)	82 (72-89)	72 (51-83)	<.001
Male (n, %)	1504 (51)	176 (55)	1328 (51)	.144
Ethnicity (n, %)				
Caucasian	2543 (86)	294 (92)	2249 (86)	.008
Asian	215 (7)	18 (6)	197 (7)	.202
Black	74 (2.5)	5 (2)	69 (3)	.238
Other	68 (2.3)	1 (0.3)	67 (3)	.021
Comorbidities (n, %)				
Hypertension	1111 (38)	129 (40)	982 (37)	.322
Ischemic heart disease	512 (17)	90 (28)	422 (16)	<.001
Diabetes	478 (16)	76 (24)	402 (15)	<.001
Atrial fibrillation	349 (12)	79 (25)	270 (10)	<.001
Asthma	213 (7)	22 (7)	191 (7)	.788
COPD	138 (5)	33 (10)	105 (4)	<.001
Heart failure	130 (4)	42 (13)	88 (3)	<.001
Epilepsy	106 (4)	9 (3)	97 (4)	.421
Orthostatic hypotension	92 (3)	12 (4)	80 (3)	.499
Aortic stenosis	39 (1.3)	11 (34)	28 (1)	<.001
Cardiomyopathy	15 (0.5)	1 (0.3)	14 (0.5)	.599
Transient ischemic attack	14 (0.5)	1 (0.3)	13 (0.5)	.653
Cerebral infarction	9 (0.3)	3 (0.9)	6 (0.2)	.030
$CHADS_2$				
0	1037 (35)	79 (25)	958 (36)	<.001
1	933 (32)	110 (34)	823 (31)	
≥2	980 (33)	132 (41)	848 (32)	
Inpatient investigations/interventions (n, %)				
CT head	428 (15)	59 (18)	369 (14)	.037
Implantable loop recorder	205 (7)	5 (2)	200 (8)	<.001
Permanent pacemaker/defibrillator	88 (3)	12 (4)	76 (3)	.385
CT pulmonary angiogram	26 (1)	3 (0.9)	23 (0.9)	.914
Echocardiogram	11 (0.4)	1 (0.3)	10 (0.4)	.848
Coronary angiogram	6 (0.2)	1 (0.3)	5 (0.2)	.649
CT aorta	4 (0.1)	0	4 (0.2)	.484
MRI head	2 (0.1)	1 (0.3)	1 (<0.1)	.076
Electroencephalogram	3 (0.1)	0	3 (0.1)	.545
EPS ± ablation	2 (<0.1)	0	2 (0.1)	.621
Cardiac provocation	1 (<0.1)	0	1 (<0.1)	—

Note: Mann-Whitney test (continuous variables) and Pearson Chi Square (categorical variables). $P < .05$ was statistically significant. COPD chronic obstructive pulmonary disease, CT computed tomography, ED emergency department, EPS electrophysiology study, MRI magnetic resonance imaging.

of 1-year mortality. History of epilepsy (all forms) and COPD were significant independent predictors of increased 1-year re-hospitalization for syncope, whilst discharge specialty Cardiology was associated with reduced risk; there were no significant differences in age/gender between those seen by cardiologists vs everyone else. Hypertension was significantly associated with increased risk of 1-year re-hospitalization in univariate analysis but was not significant after multivariable analysis.

Prior to our Syncope clinic starting (2012-2014), 1237 patients were identified compared with 1713 patients after our Syncope Clinic

TABLE 4 Univariate and multivariate predictors of 1-year mortality

	Exp (B)	95% CI	*P* Value
Univariate			
Aortic stenosis	2.560	1.404-4.666	.002
Age (per 1-year increase)	1.044	1.036-1.051	<.001
Atrial fibrillation	2.712	2.135-3.445	<.001
COPD	2.366	1.676-3.340	<.001
Diabetes	1.610	1.259-2.059	<.001
Discharge specialty Cardiology	0.295	0.183-0.474	<.001
Heart failure	3.847	2.838-5.216	<.001
Ischemic heart disease	1.845	1.458-2.336	<.001
Same day discharge	0.323	0.251-0.417	<.001
Syncope clinic attendance	0.260	0.129-0.523	<.001
Multivariate			
Model 1			
Age (per 1-year increase)	1.033	1.025-1.042	<.001
Atrial fibrillation	1.578	1.210-2.058	.001
COPD	2.120	1.476-3.045	<.001
Discharge specialty Cardiology	0.433	0.261-0.720	.001
Heart failure	2.231	1.592-3.125	<.001
Same day discharge	0.495	0.381-0.642	<.001
Syncope clinic attendance	0.268	0.126-0.566	.001
Model 2			
Atrial fibrillation/flutter	2.354	1.823-3.039	<.001
$CHADS_2$ score ≥ 1	1.451	1.124-1.872	.004
COPD	2.270	1.583-3.255	<.001
Discharge speciality Cardiology	0.432	0.260-0.717	.001
Same day discharge	0.435	0.332-0.570	<.001
Syncope clinic attendance	0.264	0.125-0.560	.001
Model 3			
Atrial fibrillation/flutter	2.329	1.801-3.010	<.001
$CHADS_2$ score ≥ 2	1.300	1.039-1.626	.022
COPD	2.335	1.628-3.350	<.001
Discharge speciality Cardiology	0.424	0.255-0.703	.001
Same day discharge	0.430	0.328-0.563	<.001
Syncope clinic attendance	0.260	0.123-0.550	<.001

Cox Proportional Hazard ratio with 95% confidence intervals. CI confidence interval, COPD chronic obstructive pulmonary disease, $CHADS_2$ score is a composite comprising congestive heart failure (1 point), heart failure (1 point), age over 75 years (1 point), diabetes (1 point), stroke (2 points).

Univariate and multivariate predictors of 1-year re-hospitalization			
	Exp (B)	95% CI	*P* Value
Univariate			
COPD	2.169	1.315-3.576	.002
Discharge specialty Cardiology	0.701	0.484-1.015	.060
Epilepsy	1.912	1.038-3.519	.037

(Continues)

TABLE 4 (Continued)

Univariate and multivariate predictors of 1-year re-hospitalization			
	Exp (B)	95% CI	*P* Value
Hypertension	1.321	0.982-1.777	.065
Multivariates			
COPD	2.197	1.332-3.625	.002
Discharge specialty Cardiology	0.678	0.468-0.982	.040
Epilepsy	1.941	1.053-3.575	.033

Cox Proportional Hazard ratio with 95% confidence intervals. CI confidence interval, COPD chronic obstructive pulmonary disease, ILR implantable loop recorder.

started (2015-2017). Since the introduction of our Syncope Clinic service a significant reduction in rates of 1-year re-hospitalization for syncope was observed (pre-Syncope Clinic 6% vs 4% post-Syncope Clinic; $P < .05$) and a trend for a fall in 1-year mortality (12% pre vs 10% post; $P = .150$). The rate of same day discharge significantly increased during this period (35% vs 55%; $P < .001$) whilst there was no change in 30-day rehospitalization for syncope (2% vs 1%; $P = .381$) (Figure 4).

4 | DISCUSSION

This is the largest reported cohort study of patients hospitalized with syncope from the UK. In our cohort the 1-year mortality rate was 11% and 1-year re-hospitalization for syncope was 5%. Independent predictors of increased 1-year mortality included increased age, presence of AF, HF, COPD, and $CHADS_2$ score ≥1. By contrast, outpatient Syncope Clinic attendance, same-day discharge, and Cardiology as discharging specialty were independent predictors of increased 1-year survival. Epilepsy (all forms) and COPD were independently associated with increased risk of re-hospitalization for syncope, whilst Cardiology as discharging specialty was independently associated with reduced risk. This would support the recommendations of the ESC that suggest specialist cardiac assessment is required for syncope patients.

There has been significant variability in the reported mortality risk of patients attending hospital with syncope, ranging from 1.9% to 13% at 1year.[7,9-11] In a study of 1516 patients attending hospital in the USA, Getchell et al[9] reported a 1-year mortality rate of 13%, which is similar to that reported in our study. In a Danish nationwide cohort database of over 37,000 healthy patients discharged from the ED with syncope,[10] the 1-year mortality was 1.9% which is lower than that reported in our study. In another Danish study[10] of 37,705 patients discharged from the ED with syncope, the authors reported a 21% mortality rate, after a median follow-up of 4.2 years with over half of deaths because of a cardiovascular cause. In that study, Ruwald et al[10] were the first to show that the $CHADS_2$ score predicted all cause and cardiovascular mortality risk in patients discharged with syncope; a higher $CHADS_2$ score predicted higher mortality risk. Our study supports these findings, although the

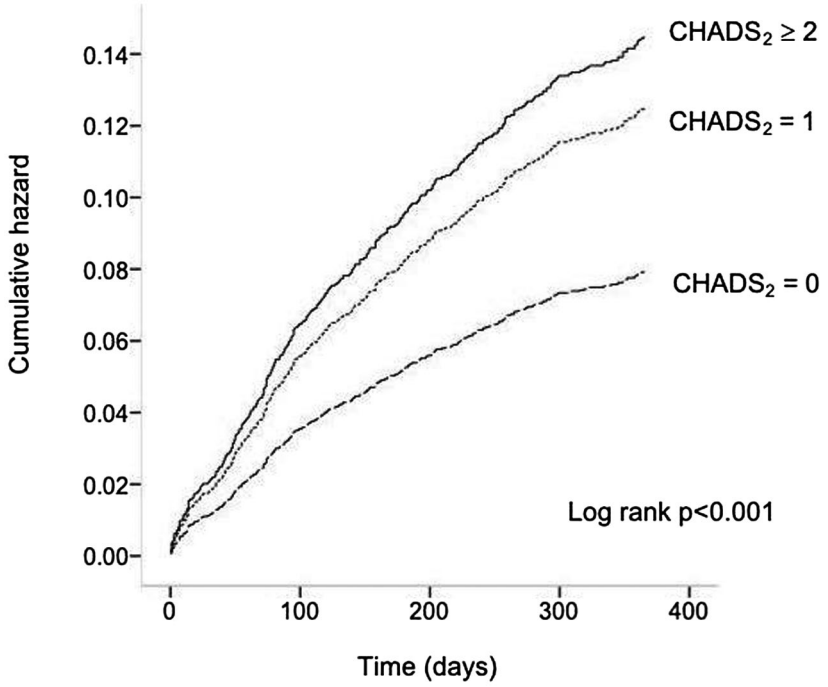

FIGURE 2 One-year mortality cumulative hazard curve according to $CHADS_2$ score. Cumulative hazard curve demonstrating increasing 1-year mortality risk with increasing $CHADS_2$ score. Cox -proportional analysis. $P < .001$

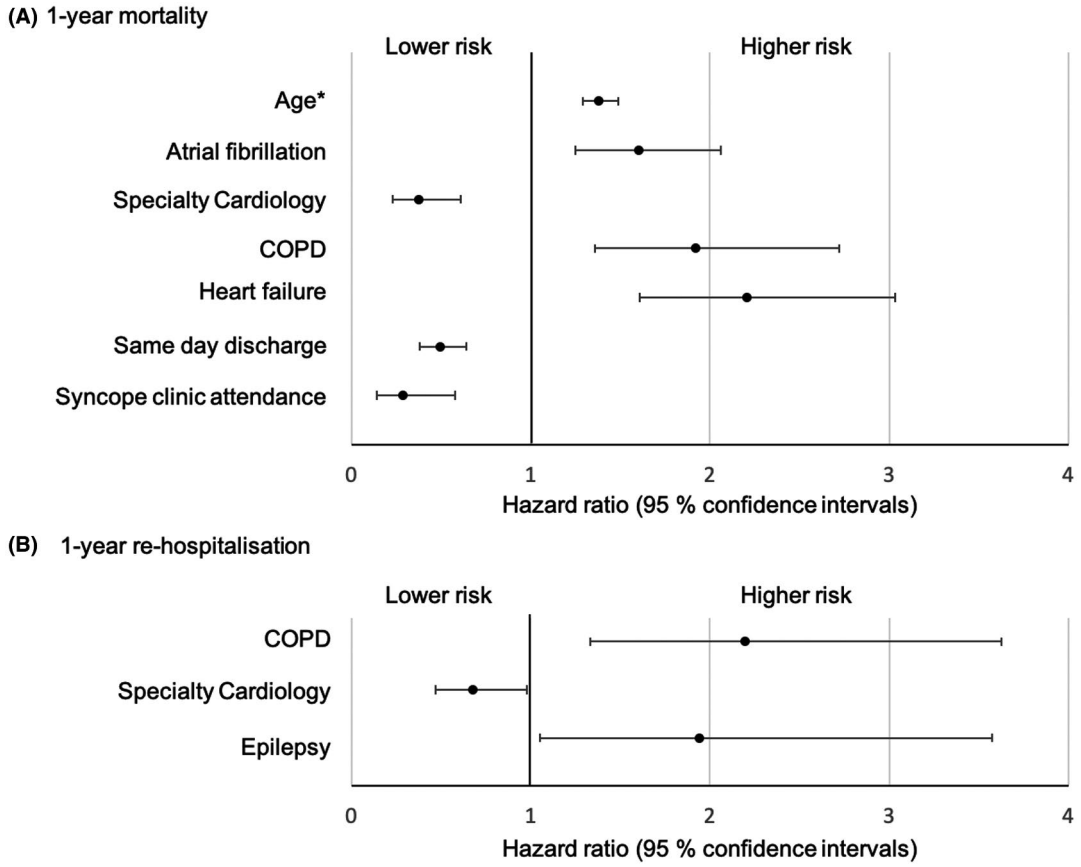

FIGURE 3 Independent predictors of 1-year mortality and 1-year re-hospitalization for syncope. Forest plots demonstrating independent predictors of (A) 1-year mortality and (B) 1-year re-hospitalization for syncope in patients discharged from hospital with syncope. Hazard ratios with 95% confidence intervals. *Age displayed per 10-year increase. $P < .05$ is statistically significant. COPD chronic obstructive pulmonary disease

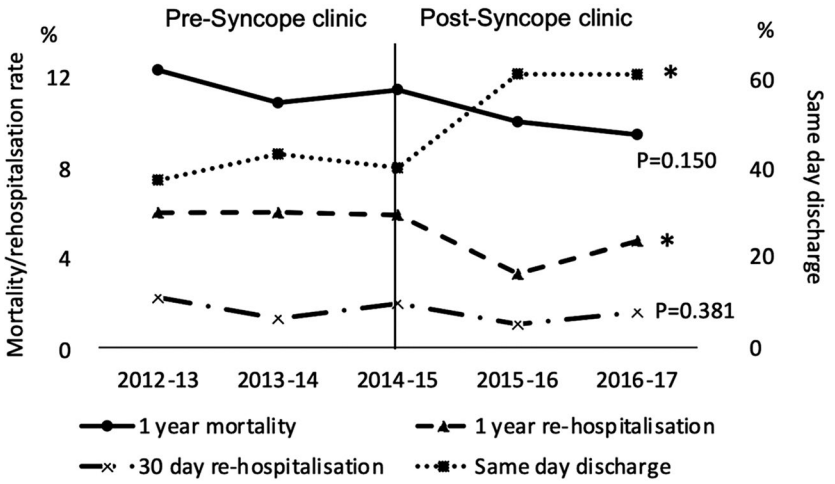

FIGURE 4 Temporal trends in mortality, re-hospitalization for syncope and same day discharge following initiation of the Syncope Clinic Service. Line charts demonstrating a significant reduction in 1-year re-hospitalization for syncope rates (dashed line, triangles), a trend in reduced 1-year mortality (solid line, circles) and a significant increase in same day discharge rates (dotted line, squares) pre- and post-Syncope Clinic service (vertical line). There was no significant change in 30-day re-hospitalization for syncope rates. *$P < .05$ pre- v post-Syncope clinic

absolute risks were higher in our study, likely because of older age with significantly more comorbidities. The $CHADS_2$ score is a simple and well-known tool initially developed for stroke risk stratification in patients with AF.[16] However, it has since been shown to predict mortality in non-AF patients with acute coronary syndrome,[18] heart failure,[19] implantable defibrillators,[20] and syncope.[10]

Our study suggests that the Syncope Clinic service is under-utilized with less than 10% of patients discharged with syncope attending a subsequent outpatient Syncope Clinic appointment. A structured approach to syncope has been shown to improve diagnostic rates,[1] reduce unnecessary hospital admissions and reduce healthcare costs associated with unnecessary investigations.[21,22] In the present study patients who attended Syncope Clinic following hospital discharge had significantly lower 1-year mortality compared with those that did not, however, we do not have the cause of death which may limit interpretation of this data. We found that COPD was independently associated with increased mortality risk in patients hospitalized with syncope in this cohort; this risk was similar to patients with HF. Recently COPD has been shown to predict increased risk of hospitalization for syncope, however, mortality outcomes were not reported.[23] Potential mechanisms of syncope in COPD include cough syncope, orthostatic hypotension because of medications used for associated comorbidities, presence of pulmonary hypertension and secondary adrenal insufficiency because of corticosteroid use. Further study is required to understand the mechanisms of syncope and reasons for increased mortality and rehospitalization risk. In our study older age, presence of AF, or HF independently predicted increased mortality risk in patients with syncope which is similar to previously published literature.[11,13]

We found that same-day discharge was independently associated with reduced 1-year mortality which is in keeping with prior studies demonstrating a worse outcome in patients requiring hospital admission following syncope compared with those discharged in the ED.[7,14] The increased risk following hospitalization may relate to co-existing pathology, from investigations and interventions performed as a result of incidental findings or from admission related adverse events (eg missed medication errors, hypoglycemia attacks, hospital acquired infection, delirium, falls, transfusion reactions, complications from intravenous/urinary catheter insertions[14]). It is also possible that clinicians may have a lower threshold to admit older patients with multiple comorbidities. However, in our analysis the association with same-day discharge remained significant even when accounting for the $CHADS_2$ score which may be considered as a marker of multi-morbidity. Interestingly we also found that same-day discharge following syncope had increased after the commencement of our Syncope Clinic.

We found that patients under the care of cardiology appeared to have a better outcome in terms of both 1-year mortality and 1-year rehospitalization for syncope. This may simply reflect a healthier group of patients with less comorbidities or could be a consequence of increased sensitivity of detecting cardiac pathology (availability of bedside echocardiography, ECG telemetry monitoring/ECG interpretation skills), better adherence to guideline-based structured management of syncope and inpatient access to specialist Consultant Electrophysiologist input.

4.1 | Study limitations

This study was a non-randomized, single-center observational cohort study and as such there are inherent limitations (eg unidentified confounding factors, causal links cannot be made). The results of this study should be considered as hypothesis generating and tested in prospective randomized controlled studies. The prevalence of malignancy or traumatic injuries in this cohort was relatively small and unlikely to contribute to the overall mortality, although malignancy diagnoses following discharge are possible. Our database did not record ECG findings, comorbidity severity (eg for COPD/HF), medications, cause of death or allow for a detailed review of etiology of syncope. In the patients who died it is unclear whether the syncope was related to the mechanism of death and whether any interventions could prevent death. Finally, the number of syncope admissions in this study was underestimated as only syncope admissions coded as a primary diagnosis was

included; if syncope was caused by another condition then that would be coded as primary diagnosis and syncope as a secondary diagnosis and hence those patients would have been excluded.

5 | CONCLUSIONS

In this UK study of patients hospitalized with syncope the 1-year mortality rate was 11% and 1-year re-hospitalization for syncope rate was 5%. This study confirms that syncope hospitalization is associated with a significant mortality risk. The main predictors of better survival included outpatient review in a specialist Syncope Clinic, inpatient Cardiology input and same-day discharge while predictors of worse outcome included older age, HF, AF, COPD, and a $CHADS_2$ score ≥1. The latter is a simple and well-known tool that may be useful in risk stratification of patients following syncope hospitalization. Patients at higher risk should be identified and referred for expert evaluation preferably to a Syncope Clinic.

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CONFLICT OF INTEREST

The authors declare no conflict of interests for this article.

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