

Evidence-based algorithms and the management of falls and syncope presenting to acute medical services

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ABSTRACT – Falls and syncope are symptoms that commonly present to medical services. Detailed international guidelines for their management are available but tend to be aimed at specialists rather than generalists. Novel, evidence-based algorithms for the management of these symptoms when they present to acute medical services were formulated and their impact on patient care audited. The percentage of people admitted with falls and syncope was unexpectedly high (10.6% at baseline); this had decreased to 8.2% at repeat audit. Readmission rates decreased from 12% at baseline audit to 0% in repeat audit, while length of inpatient stay was unchanged. Mortality was strikingly high (12%) in both audits. Although inappropriate use of investigations decreased, the use of appropriate management strategies increased. Easy-to-use algorithms can help reduce the number of patients admitted to acute medical services with falls and syncope while optimising the care of those managed as inpatients. The algorithms are provided for use by interested parties.

KEY WORDS: aged, audit, elderly, falls, guidelines, syncope

Background

Falls are common and disabling events that affect 35–60% of elderly people annually.^{1,2} Unintentional injury, usually as the result of a fall, is the fifth most common cause of death in people older than 65 years in the USA,³ while 10–15% of falls result in serious injuries, up to 50% of which are fractures.^{1,4} Within the UK, one third of adults who attend inner-city emergency departments (EDs) present with falls.^{5,6} Syncope is less common, but it is the presenting complaint in about 3–5% of adults who attend the ED and accounts for 1–6% of urgent hospital admissions.^{7–9} Syncope is particularly prevalent in elderly people, with up to 23% of this group experiencing syncope over a 10-year period and a recurrence rate of 30% over two years.¹⁰ Given the overlap between falls and syncope in older people, this may represent a significant underestimate.^{11,12}

The initial triage, management, and investigation of patients who present with falls and syncope can be challenging for the hospital general internist, with recently published guidelines aimed at those with specialist interests in these conditions.^{13–15} Guidance from the National Institute for Clinical Excellence (NICE) on the management of falls is comprehensive but lacks detailed advice on syncope.¹⁶ Indeed, succinct practical guidance for the general internist on the management of these closely related presenting symptoms is scarce. We sought to simplify best practice based on national¹⁶ and international guidelines^{13,14} and our clinical practice¹⁷ by developing clinical algorithms on the management of falls and syncope, and their use was prospectively audited in an unselected general internal medical (GIM) setting. The objectives were to reduce the numbers of admissions, the rate of readmission, and the length of stay in patients with falls and syncope after the introduction of such novel evidence-based guidelines.

Methods

Baseline audit

All acute admissions to the GIM service (at Freeman Hospital) were examined prospectively for one month. Case notes of all those who presented primarily with ‘collapse’, ‘falls’, or ‘syncope’ (according to emergency or primary care physician referral or initial clerking) were further reviewed and re-examined at seven days and at discharge or death. Patients who died within 24 hours of admission were excluded, as were those with an immediately identifiable medical cause (for example, stroke, myocardial infarction, or pneumonia). Clinical characteristics and demographics, investigations, ultimate contributory diagnoses, discharge destination, 30-day readmission rates, and untrimmed and trimmed (with a 50-day cut-off) length of hospital inpatient stay were analysed. Assessment of gait and balance was as recorded by admitting physicians’ teams, with referrals to physiotherapy and Falls and Syncope Services (FASS) recorded similarly.

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Intervention

After data collection for the baseline audit, individual algorithms for falls and syncope based on current best practice^{13,14,16,17} were printed on double-sided, pocket-sized laminates and circulated to all medical staff in the ED, to personnel from all disciplines involved in GIM, and at junior doctors' inductions (Figs 1 and 2). The algorithms provide a basic template for appropriate history, examination, and investigations, with explicit guidance on inpatient versus outpatient management and specialist referral. Three-monthly lectures were given at grand rounds and regular junior medical and nursing-staff updates were given during existing teaching sessions throughout the year. Poster-sized, laminated versions of the algorithms were displayed on ED notice boards and in all medical and geriatrics wards.

Completion of the audit cycle

Repeat one-month audit with recording of the same variables was performed one year later. The year-long interval was chosen to allow for seasonal variation in admissions and seasonal patterns in the presentation of illness and to test the potential longevity of the effects of the intervention.

Statistical analysis

Results from the two audits were compared using the Mann-Whitney test for length of stay, Student's *t*-test for age (which was normally distributed), and Fisher's exact test for binary variables. The difference between the two audits is given in the form of a mean difference for quantitative variables and a rela-

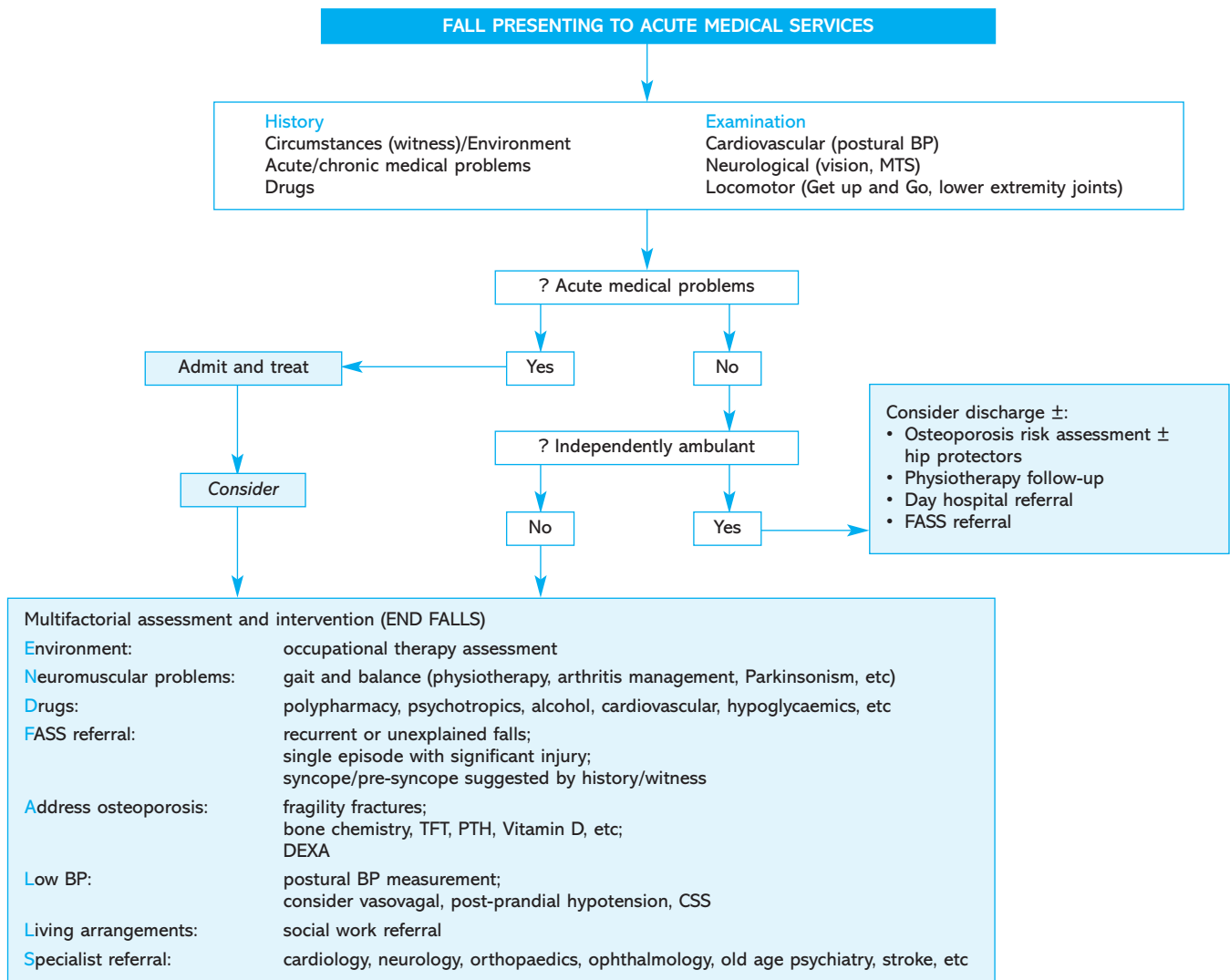


Fig 1. Algorithm for the management of falls presenting to acute medical services. BP = blood pressure; CSS = carotid sinus syndrome; DEXA = dual emission X-ray absorptiometry; FASS = Falls and Syncope Service; MTS = abbreviated mental test score; PTH = parathyroid hormone; TFT = thyroid function tests.

tive risk for binary variables; in each case, 95% confidence intervals are included.

Results

Results of the baseline and repeat audits are shown in Table 1. Conditions that predispose to falls and syncope are detailed in Table 2; these were broadly similar in both audits, although cognitive impairment and neurocardiovascular disorders were diagnosed more frequently after the intervention. Diagnoses for the latter (predominantly vasovagal syncope and orthostatic hypotension) were made largely by the responsible clinicians: referrals to the FASS fell slightly at the repeat audit (four (10%) patients *v* two (6%), *p*=not significant (NS)).

During the second audit, patients tended to be older (74.3 (standard deviation (SD) 18.2, range 19–93) years *v* 77.9 (SD 11.7, range 54–93) years, *p*=NS) women, with a slight decrease in the proportion of women (45% *v* 56%, *p*=NS) (Table 1). The proportion of individuals older than 65 years increased during the second audit (32/41 (78%) *v* 26/31 (54%)). Fewer patients

were admitted with falls and syncope at second audit. During the baseline audit, 41/388 (10.6%) patients were admitted to GIM with these symptoms compared with 31/379 (8.2%) during the repeat audit – a 2.4% reduction overall after the guidelines intervention was introduced (*p*=NS; Table 1) but also a 23% reduction in the number of those admitted with falls and syncope. The rate of readmission within 30 days was lower at repeat audit, while 19% fewer patients were admitted from home at second audit, with concomitantly higher admission rates from residential and nursing care (Table 1; NS).

Discussion

The introduction of simple flow charts that detail the management of patients who present to acute medical services with falls and syncope can have a beneficial effect on admission rates, readmission rates, and good practice in the management of these conditions.

The total number of admissions to GIM with falls and syncope was reduced at second audit, clinically but not statistically

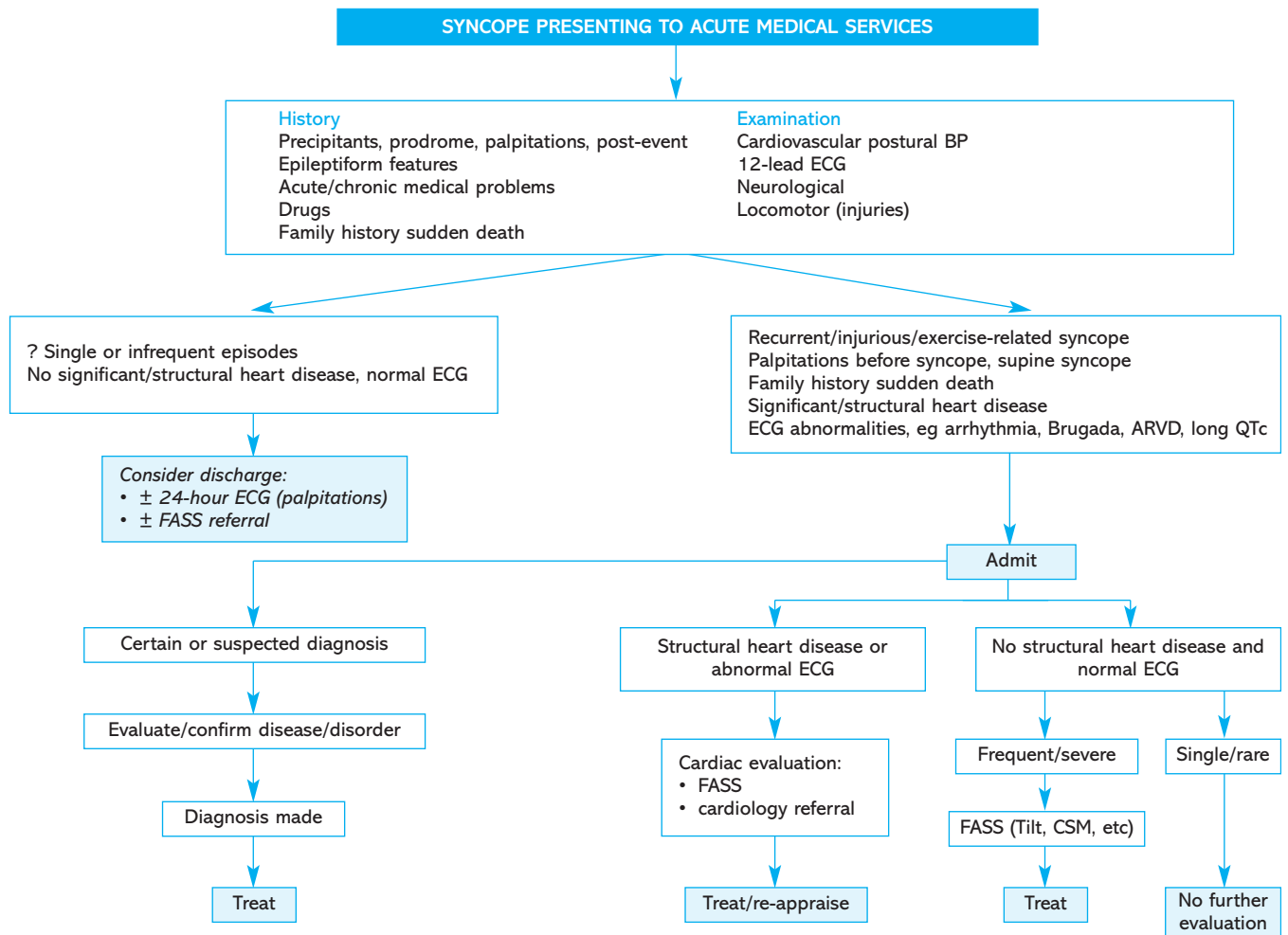


Fig. 2. Algorithm for management of syncope presenting to acute medical services. ARVD: arrhythmogenic right ventricular dysplasia; CSM = carotid sinus massage; ECG = electrocardiography; FASS = Falls and Syncope Service.

significant. If maintained over the course of a year, substantial savings in terms of bed days and associated costs are possible with negligible investment. Using the initial audit figures, annual admissions would be 4,656, with a potential saving of 112 admissions if the 2.4% reduction was maintained. As the untrimmed length of stay during the initial audit was 16.3 (median 7) days

(Table 1), there was a potential saving of 1,826 (median 784) bed days because of the fall in admission rates for patients with falls and syncope. The equivalent for trimmed length of stay (8.4 (median 5) days; Table 1) would be 941 (median 560) bed days. Length of stay was longer in the second audit (albeit not statistically so) with frailty of the patients in the second audit (as per the

Table 1. Comparison of baseline and post-intervention audits of patients presenting to acute medical services with falls and syncope.

	Number of patients (%)		Difference between baseline and repeat audit	
	Baseline audit	Repeat audit	Mean or relative risk (95% confidence interval)	p
Total admissions to medical service	388	379	0.77 (0.50–1.21)	0.27
Number due to falls/syncope (%)	41 (10.6)	31 (8.2)	NA	NA
Age (SD)	74.3 (18.2)	77.9 (11.7)	3.58 (–3.90–11.05)	0.34
Number of women (%)	23 (56)	14 (45)	0.81 (0.50–1.29)	0.48
Length of stay:				
Untrimmed (SD)	16.3 (25.3)	27.3 (33.7)	10.97 (–2.90–24.83)	0.11
Median	7	9		
Trimmed* (SD)	8.4 (9.9)	12.6 (13.0)	3.53 (–2.58–9.65)	0.23
Median	5	7		
Readmission within 30 days	5 (12)	0	NA	0.07
Discharged within seven days	22 (54)	15 (48)	0.90 (0.57–1.43)	0.81
Died	5 (12)	4 (13)	1.06 (0.31–3.62)	1.00
Presenting symptoms:				
Falls	12 (29)	14 (45)	1.54 (0.84–2.85)	0.22
Syncope	12 (29)	7 (23)	0.77 (0.34–1.73)	0.60
Both	17 (42)	10 (32)	0.78 (0.42–1.46)	0.47
Symptoms unexplained at seven days	11 (27)	5 (16)	0.60 (0.23–1.55)	0.39
Symptoms unexplained at discharge	5 (12)	3 (10)	0.79 (0.21–3.07)	1.00
Admitted from:				
Home	37 (90)	22 (71)	0.79 (0.62–1.01)	0.06
Residential care	1 (2)	3 (10)	NA	NA
Nursing home	2 (5)	6 (19)	NA	NA
Discharged to:				
Home	31 (76)	18 (58)	0.77 (0.54–1.09)	0.13
Residential care	3 (7)	2 (6)	NA	NA
Nursing home	2 (5)	4 (13)	NA	NA
Investigations:				
Blood tests	All	All	NA	1.00
Radiological	30 (73)	27 (87)	0.90 (0.68–1.20)	0.63
Cardiological	40 (98)	30 (87)	0.75 (0.62–0.91)	0.003
24-hour ECG	9 (22)	5 (16)	0.74 (0.27–1.98)	0.77
ECHO	7 (17)	3 (10)	0.57 (0.16–2.02)	0.50
Brain imaging	17 (41)	12 (39)	0.93 (0.53–1.66)	1.00
EEG	2 (5)	0 (0)	NA	0.50
Gait and balance assessment	8 (20)	16 (52)	2.65 (1.30–5.38)	0.006
Referral to physiotherapy	17 (41)	14 (45)	1.09 (0.64–1.85)	0.81

*Lengths of stay >50 days excluded.

ECG = electrocardiography; ECHO = echocardiography; EEG = electroencephalography; SD = standard deviation.

higher proportion admitted from institutional care), as well as their older age, contributing. This may also have impacted on the increased length of stay, as use of the algorithms seems to have selected those more in need of prolonged hospital admission. These, of course, are speculative potential savings given the lack of statistical significance between baseline and repeat audit variables.

Investigation and referral patterns are worthy of mention. Investigations for falls and syncope decreased overall from baseline, with fewer cardiological ($p=0.0003$) and neurological investigations at repeat audit. Reductions in requests for 24-hour electrocardiography, echocardiography, and electrencephalography were particularly noteworthy. Gait and balance were recorded by the admitting teams much more frequently (20% ν 52%, $p=0.006$), albeit with no differences in physiotherapy referral, while referral to the FASS actually decreased from 10% to 6% ($p=NS$). Neurocardiovascular diagnoses thus were made predominantly by the general physicians rather than the specialist facility.

The pattern of attributable diagnoses changed with the second audit, with a more obvious awareness of the general medical teams of falls and syncope risk factors. For example, the proportion of patients with cognitive and visual impairment-related causes of symptoms was much higher, while neurocardiovascular disorders (predominantly vasovagal syncope and orthostatic hypertension) again were diagnosed more frequently by

generalists during the repeat audit. Interestingly, the same proportion of patients remained undiagnosed at discharge or death (12% at baseline ν 10% at repeat).

The sheer number of people who present with falls and syncope is striking. It is believed that these are the first data to show such a high presentation rate for these overlapping symptoms in patients presenting to acute medical services. Presenting symptoms in the repeat audit were more likely to be falls, with syncope experienced by 71% at baseline and 55% in the repeat audit. This may represent a more rational approach to admissions for syncope after the introduction of the algorithms – a conclusion supported by the increase in the age and lower limit to the age range at second audit. The extraordinarily high mortality (mean 12.5%) is sobering; although comorbidity and consequences of falls and syncope rather than the events themselves caused death in all cases, it is clear that these are not the benign conditions they frequently are thought to be.

This audit has a number of limitations. The strength of the audit in attempting to capture a view of the effects of intervention over a prolonged period is also a potential Achilles' heel, in that less controllable factors may have influenced outcome. Although the reduction in the number of admissions with falls and syncope was striking, there was no statistical significance, but the wide confidence intervals suggest that such significance may have been missed because of the small sample size. A formal

Table 2. Attributable diagnoses by diagnostic category.

Diagnostic category	Number of patients in initial audit* (%) (n=41)	Example of diagnosis	Number of patients in repeat audit** (%) (n=31)	Example of diagnosis
Intercurrent acute medical illness	12 (29)	UTI Pneumonia with DIC DVT Pancreatitis Anaemia	6 (19)	UTI DVT
Cardiological	4 (10)	CHF Second-degree AVB VT	2 (6)	Uncontrolled AF Aortic stenosis
Neurological	6 (15)	Seizures Stroke	6 (19)	Seizures Stroke
Neurocardiovascular	9 (22)	VVS OH Cough syncope	10 (32)	VVS OH CSH
Gait and balance disorder	1 (2)		2 (6)	OA
Pharmacological	5 (12)	Hypoglycaemia (insulin) Risperidone Hypotension (metoprolol, ISMN) Digoxin toxicity	2 (6)	Hypoglycaemia (sulphonylurea) Alcohol withdrawal
Visual impairment	0		1 (3)	
Cognitive impairment	1 (2)		4 (13)	
Unexplained	5 (12)		3 (10)	

*Two patients had two diagnoses; **four patients had two diagnoses and two had four diagnoses.

AF = atrial fibrillation; AVB = atrioventricular block; CHF = congestive heart failure; CSH = carotid sinus hypersensitivity; DIC = disseminated intravascular coagulation; DVT = deep venous thrombosis; ISMN = isosorbide mononitrate; OA = osteoarthritis; OH = orthostatic hypotension; UTI = urinary tract infection; VT = ventricular tachycardia; VVS = vasovagal syncope.

economic analysis was not planned as part of this audit but would be highly desirable in future studies.

In conclusion, easy to use, evidence-based algorithms for the management of falls and syncope that give specific advice on the need for admission and guidance on investigations, management, and referral patterns resulted in a marked reduction in the number of admissions to acute medical services, a 12% reduction in the 30-day readmission rate, and an improvement in the use of appropriate clinical examination and investigations. Possible reductions in length of stay and early discharge may have been masked by the frailty of the patients in the second audit. Falls and syncope are remarkably common symptoms to present to acute medical inpatient services, with a hitherto unrecognised high mortality in this setting. Simple algorithms can improve the management of these overlapping and inter-related symptoms at minimal cost.

References

- 1 Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988;319:1701–7.
- 2 Clark RD, Lord SR, Webster IW. Clinical parameters associated with falls in an elderly population. *Gerontology* 1993;39:117–23.
- 3 Sattin RW. Falls among older persons: a public health perspective. *Annu Rev Public Health* 1992;13:489–508.
- 4 Tinetti ME, Doucette J, Claus E, Marottoli R. Risk factors for serious injury during falls by older persons in the community. *J Am Geriatr Soc* 1995;43:1214–21.
- 5 Kenny RA, Richardson DA, Steen N, Bexton RS *et al*. Cardiac pacing reduces falls in carotid sinus hypersensitivity: the SAFE-PACE trial. *J Am Coll Cardiol* 2001;38:1491–6.
- 6 Davies AJ, Kenny RA. Falls presenting to the accident and emergency department: types of presentation and risk factor profile. *Age Ageing* 1996;25:362–6.
- 7 Day SC, Cook EF, Funkenstein H, Goldman L. Evaluation and outcome of emergency room patients with transient loss of consciousness. *Am J Med* 1982;73:15–23
- 8 Kapoor WN, Karpf M, Wieand S, Peterson ER, Levey JS. A prospective evaluation and follow-up of patients with syncope. *N Engl J Med* 1983; 309:197–204.
- 9 Shen WK, Decker WW, Smars PA, Goyal DG, Walker AE. Syncope evaluation in the emergency department study (SEEDS). A multi-disciplinary approach to syncope management. *Circulation* 2004;110: 3636–45.
- 10 Lipsitz LA, Wei JY, Rowe JW. Syncope in an elderly institutionalised population: prevalence, incidence and associated risk. *Q J Med* 1985; 55:45–54
- 11 Shaw FE, Kenny RA. The overlap between syncope and falls in the elderly. *Postgrad Med J* 1997;73:635–9.
- 12 McIntosh S, da Costa D, Kenny RA. Outcome of an integrated approach to the investigation of dizziness, falls and syncope in elderly patients referred to a 'syncope' clinic. *Age Ageing* 1993;22:53–8.
- 13 Brignole M, Alboni P, Benditt DG *et al*. Guidelines on management (diagnosis and treatment) of syncope. *Eur Heart J* 2001;22:1256–306
- 14 American Geriatrics Society. Guideline for the prevention of falls in older persons. *J Am Geriatr Soc* 2001;49:664–72
- 15 Strickberger SA, Benson DW, Biaggioni I *et al*. AHA/ACCF scientific statement on the evaluation of syncope. *Circulation* 2006;113:316–27
- 16 National Institute for Clinical Excellence. *Falls: the assessment and prevention of falls in older people*. NICE clinical guideline 24. London: NICE, 2004.
- 17 Kenny RA, O'Shea D, Parry SW. The Newcastle protocols for head-up tilt table testing in the diagnosis of vasovagal syncope, carotid sinus hypersensitivity, and related disorders. *Heart* 2000;83:564–9