

Original Contribution

## National trends in resource utilization associated with ED visits for syncope<sup>☆</sup>



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### ABSTRACT

**Background:** Over the last 20 years, numerous research articles and clinical guidelines aimed at optimizing resource utilization for emergency department (ED) patients presenting with syncope have been published.

**Hypothesis:** We hypothesized that there would be temporal trends in syncope-related ED visits and associated trends in imaging, hospital admissions, and diagnostic frequencies.

**Methods:** The ED component of National Hospital Ambulatory Medical Care Survey was analyzed from 2001 through 2010, comprising more than 358 000 visits (representing an estimated 1.18 billion visits nationally). We selected ED visits with a reason for visit of syncope or fainting and calculated nationally representative weighted estimates for prevalence of such visits and associated rates of advanced imaging utilization and admission. For admitted patients from 2005 to 2010, the most frequent hospital discharge diagnoses were tabulated.

**Results:** During the study period, there were more than 3500 actual ED visits (representing 11.9 million visits nationally) related to syncope, representing roughly 1% of all ED visits. Admission rates for syncope patients ranged from 27% to 35% and showed no significant downward trend ( $P = .1$ ). Advanced imaging rates increased from about 21% to 45% and showed a significant upward trend ( $P < .001$ ). For admitted patients, the most common hospital discharge diagnosis was the symptomatic diagnosis of “syncope and collapse” (36.4%).

**Conclusions:** Despite substantial efforts by medical researchers and professional societies, resource utilization associated with ED visits for syncope appears to have actually increased. There have been no apparent improvements in diagnostic yield for admissions. Novel strategies may be needed to change practice patterns for such patients.

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### 1. Introduction

Syncope, defined as a transient loss of consciousness, is a common and challenging concern in the emergency department (ED). From 1992 to 2000, there were an estimated 740 000 ED visits per year in

the United States related to syncope. Approximately one-third of such visits resulted in hospital admission, although rates vary widely depending on the practice setting [1]. Such admissions often confer limited diagnostic or therapeutic yield [2,3], as many patients leave the hospital with a diagnosis identical to their chief concern. As a result, there has also been increasing pressure on emergency physicians from federal agencies via Recovery Audit Contractors to reduce admissions for syncope.

Over the last 2 decades, there has been a substantial amount of clinical research devoted to improving the diagnostic evaluation and risk stratification of ED syncope patients [4–6]. Multiple professional societies have published guidelines to standardize clinical practice and reduce unnecessary services for patients with syncope [3,7–9]. More recently, as part of the “Choosing Wisely” campaign to reduce low-value activities, neuroimaging for syncope without neurological deficits was identified as a commonly overused service.

It is important to understand how recent research and clinical guidelines have made an impact on ED practice patterns for syncope. A change in diagnostic imaging and admission rates could provide

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information as to whether such efforts have been effective at reducing resource utilization.

Our primary objective was to describe national trends in ED visits, advanced diagnostic imaging, and admission rates from 2001 to 2010 for patients presenting with syncope. Secondly, we sought to describe the diagnoses of admitted patients from 2005 to 2010 (years for which discharge diagnoses were available).

## 2. Methods

### 2.1. Study design and population

We conducted an analysis of the ED portion of the National Hospital Ambulatory Medical Care Survey (NHAMCS) ED database for 2001 through 2010. The NHAMCS is a nationally representative sample of US ED visits obtained by the National Center for Health Statistics (NCHS) branch of the Centers for Disease Control and Prevention. The data abstraction forms include information pertaining to the sampled visit including demographic information; 3 patient “Reason for Visit” fields; ED tests performed; 3 *International Classification of Diseases, Ninth Revision (ICD-9)* ED discharge diagnoses; and, starting in 2005, 1 hospital discharge diagnosis. Further data collection methods and sampling design are described in detail on the NCHS Web site (<http://www.cdc.gov/nchs>). This study was exempted from review by our institutional review board. The funding organization had no involvement in the conduct or reporting of this study.

Our study sample consisted of all ED visits where any of the 3 patient “reasons for visit” included “1030.0, fainting (syncope); includes blacking out, passing out, fainting spells; excludes unconsciousness” based on coding from the *Reason for Visit Classification for Ambulatory Care*, a standardized sourcebook used in NCHS studies. For frequency of visits, admission rates, and advanced imaging estimates, data from 2001 to 2010 were included. NHAMCS started collecting data on hospital discharge diagnoses in 2005, so relevant analyses were conducting using data from 2005 to 2010.

### 2.2. Outcome measures

Our main outcome measures were prevalence of ED visits for syncope, rates of hospital admission, rates of advanced imaging, and hospital discharge diagnostic frequencies for admitted patients by year. We defined *hospital admission* as a disposition of “admit to hospital” or “transferred to outside hospital.”

We defined hospital discharge diagnoses based on *ICD-9* codes. Admissions with a discharge diagnosis of “780.2 Syncope and collapse” were considered nondiagnostic because presumably no specific etiology for syncope was determined during the in-patient stay. The 10 most frequent hospital discharge diagnoses were compiled. Diagnoses were combined when sufficient similarities were felt to exist, for example, “Anemia, unspecified” and “Anemia due to chronic blood loss,” as well as “convulsions, not elsewhere classified” and “epilepsy, not otherwise specified.” Cardiac dysrhythmias were also grouped into 1 category. This category included “cardiac dysrhythmias, not otherwise specified/not elsewhere classified”; “paroxysmal ventricular tachycardia”; “sinoatrial node dysfunction”; “atrioventricular block, not otherwise specified”; “atrioventricular block complete”; “atrial fibrillation”; and “atrial flutter.”

To create these groupings, 2 investigators, aware of the study hypothesis (MAP, HKK), independently categorized each diagnosis, with a senior investigator serving as arbitrator in the event of disagreement. *Advanced diagnostic imaging* was defined as receipt of either magnetic resonance imaging (MRI) or computed tomography (CT) scan during the ED visit. We also analyzed data on ultrasound utilization for syncope visits. The NHAMCS data form varies from year to year. From 2001 to 2004, the survey collected information on MRI or CT without differentiating between the two. From 2005 to 2010, CT and MRI were recorded

separately. From 2007 to 2010, CT Head was recorded separately from “Any CT.” For years 2007–2008, MRI Head was recorded separately from “Any MRI.” For simplicity, we examined trends for receipt of any advanced imaging (any CT or MRI) over the 10-year period. The data set does not allow for differentiation of various types of ultrasounds, for example, cardiac vs lower extremity studies. Thus, data for “any ultrasound” are presented.

### 2.3. Data analysis

We performed all statistical analyses with STATA (version 13.1; StataCorp LP, College Station, TX), Sudaan (version 11.0; RTI International, Research Triangle Park, NC), and SAS (version 9.3; SAS Institute, Cary, NC) using standard methods for analyzing survey-weighted data. Using the SVY (survey) command from STATA, which takes into account the multilevel sample design to produce national estimates, we determined point estimates and 95% confidence intervals (95% CIs) of basic demographic characteristics as well as imaging and admission rates for all ED visits containing a “Reason for Visit” of syncope. We additionally tabulated frequencies of hospital discharge diagnoses. To assess for changes in advanced imaging, admission, and nondiagnostic admission rates over the study period, we performed survey-weighted trend analysis using weighted least squares regression with SAS. We used Sudaan to calculate standard errors and 95% CIs accounting for complex survey design. Nationally representative estimates were determined using NCHS-assigned patient weights. Estimates based on less than 30 sample records were excluded, as they are considered to be unreliable because of high relative standard errors. We did not perform any imputation other than what was done centrally by NCHS.

## 3. Results

From 2001 to 2010, there were 3549 actual ED visits in the NHAMCS database related to syncope, representing an estimated 11.9 million visits nationally. This corresponds to roughly 1% (95% CI, 0.9%–1.1%) of all ED visits during that time period. The proportion of syncope visits as a percentage of total ED visits remained constant over the 10-year period, ranging from 0.9% to 1.1%. The overall admission rate was 32% (95% CI, 28%–36%), increasing from 27.4% in 2001 to nearly 32% in 2010 (Table 1). Admission rates exhibited no significant trend over the 10-year study period ( $P = .11$  for 10-year trend). The rates of advanced imaging (CT or MRI) showed a clear upward trend over the 10-year study period, increasing from 20.9% (95% CI, 16.7%–25.9%) in 2001 to 44.6% (95% CI, 38.7%–50.1%) in 2010 ( $P < .0001$  for 10-year trend) (Figure). Looking at rates of head CTs alone shows a similar trend from 2007 to 2010, increasing from 29.8% to 39.3% over 4 years (data not shown) ( $P < .001$  for 4-year trend). Rates of ultrasound utilization for syncope visits also showed an upward trend, increasing from 1.26% in 2001 to 3.4% in 2010 (data not shown).

The most common *ICD-9* hospital discharge diagnosis was “780.2 syncope and collapse,” which was the primary diagnosis in 36.4% (95% CI, 29.3%–43.4%) of all admissions. This value was 31.3% (95% CI, 21.6%–42.8%) in 2005 and 38.4% (95% CI, 25.0%–54.0%) in 2010, peaking at 41.7% (95% CI, 31.6%–52.6%) in 2006. There was no statistically significant trend from 2005 to 2010 ( $P = .87$  for 5-year trend). Cardiac dysrhythmias were the second most common hospital discharge diagnosis, comprised primarily of “atrial fibrillation” (1.5%) and “paroxysmal ventricular tachycardia” (0.86%) (Table 2).

## 4. Discussion

We attempted to assess the effects of recent research and clinical guidelines by analyzing advanced imaging and admission rates for syncope in US EDs from 2001 to 2010. Our data show that overall ED visits have increased over the last 10 years, consistent with other studies [10]. Emergency department visits for syncope have as well, but the

**Table 1**  
Emergency department visits for syncope in the United States, 2001–2010

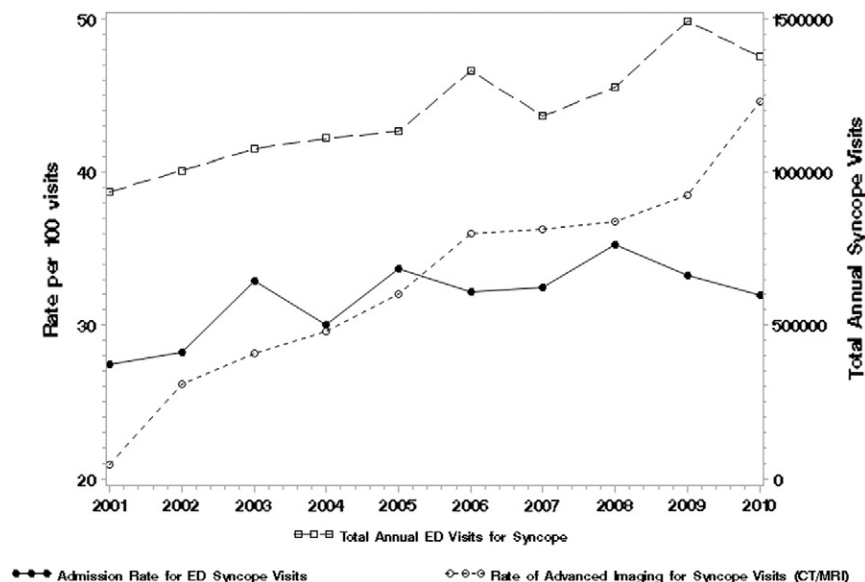
	ED visits		ED visits		Estimated ED visits per 100 population				Rate difference (2001–2010)	P value for trend
	Unweighted		Weighted		(95% CI)					
	2001	2010	2001	2010	2001	95% CI	2010	95% CI		
Total syncope visits	304	362	936000	1376000	0.87	(0.77–0.99)	1.06	(0.92–1.2)	–0.19	.019
Visits by age (y)										
<18	30	34	97000	131000	10.4	(6.96–15.3)	9.49	(6.1–14.5)	0.91	.66
18–44	111	122	332000	450000	35.5	(29.31–42.2)	32.7	(26.6–39.4)	2.81	.023
45–64	60	93	188000	363000	20.1	(14.84–26.5)	26.4	(20.9–32.7)	–6.31	.024
>65	103	113	319000	433000	34.0	(27.59–41.1)	31.5	(25.7–37.8)	2.59	.49
Total	304	362	936000	1376000						
Visits by sex										
Male	128	149	395000	500000	42.2	(36.19–48.5)	36.35	(29.5–43.8)	5.89	.87
Female	176	213	540000	876000	57.8	(51.48–63.8)	63.65	(56.2–70.5)	–5.89	
Visits by ethnicity										
Hispanic	20	38	NR	145000	NR	NR	10.5	(3.1–9.5)	NR	NR
Non-Hispanic	226	324	701000	1231000	74.9	(67.0–81.5)	89.5	(85.0–92.7)	–14.56	.18
Visits by race										
White	241	282	75000	1094000	80.1	(74.22–84.9)	79.54	(73.2–84.6)	0.56	.48
Black	54	62	152000	244000	16.2	(12.2–21.2)	17.77	(12.9–24.0)	–1.53	.6
Other	9	18	NR	NR	NR	NR	NR	NR	NR	NR
Advanced imaging <sup>a</sup>										
Yes	68	152	196000	614000	20.9	(16.7–25.9)	44.59	(38.7–50.7)	–23.69	<.0001
No	236	210	740000	762000	79.1	(74.1–83.3)	55.41	(49.3–61.3)	23.69	
Hospital admission										
Yes	89	103	257000	440000	27.4	(22.0–33.6)	31.94	(25.2–39.5)	–4.52	.11
No	215	259	680000	936000	72.6	(66.4–78.0)	68.06	(60.5–74.8)	4.52	
Total	304	362	936000	1376000						
Nondiagnostic admission	2005	2010	2005	2010	2005	95% CI	2010	95% CI	(2010–2005)	
Yes	37	37	119000	169000	31.2	(21.6–42.8)	38.4	(25.0–54.0)	–7.2	.87
No	32	16	112000	67000	29.4	(21.0–39.5)	15.29	(8.6–25.6)	14.1	
Total	115	103	382000	236000						

NR: not reliable because of insufficient sample size (<30).

<sup>a</sup> Computed tomography or Magnetic Resonance Imaging.

proportion (about 1%) has remained stable. This represents prevalence slightly greater than previously reported from the same data set in the previous decade: 0.77% (95% CI, 0.69%–0.85%) [1]. Admissions rates for syncope visits have not decreased from 2001 to 2010 and have remained stable overall as compared with those from 1992 to 2000 (32%) [1]. The rate of nondiagnostic admissions remained persistently high across the 10-year study period, with more than one-third of admitted patients leaving the hospital with a diagnosis identical to their

chief concern. These findings should be validated using other national data sets. This figure may be even higher if looking at only patients who do not receive a diagnosis in the ED yet were still admitted for further diagnostic testing and/or monitoring. The finding that convulsions/epilepsy (2.2%) was the fourth most common hospital discharge diagnosis is likely due to the inherent challenges of clinically differentiating, in the acute setting, between a syncopal event and a seizure. Ultrasound utilization, although not as common as CT/MRI, also increased during



**Figure.** Trends in resource utilization for US ED visits for syncope, 2001–2010.

**Table 2**

Survey-weighted most common hospital discharge diagnoses for patients admitted after an ED visit for syncope, 2005–2010

Diagnosis	Weighted count	Percentage
Syncope and collapse	93900	36.4%
Cardiac dysrhythmias	11100	4.3%
Dehydration	6700	2.6%
Convulsions/epilepsy, not elsewhere classified	5700	2.2%
Pneumonia, organism not otherwise specified	4300	1.7%
Anemia/chronic blood loss, not otherwise specified	4100	1.6%
Chest pain, not otherwise specified	2800	1.1%
Gastrointestinal hemorrhage/hematemesis	2800	1.1%
Dizziness and giddiness	2500	1.0%
Coronary atherosclerosis of unspecified type	2500	1.0%

the study period. The rate of advanced imaging (CT or MRI) during ED syncope visits increased significantly during the 10-year study period, consistent with prior studies of trends in ED imaging utilization. Using NAHMCS data for injury-related visits, Korley et al [11] found a 3-fold increase in CT/MRI use from 1998 to 2007. Similarly, Kocher et al [12] found that CT use in the ED increased more than 3-fold across all reasons for visit over the same time period. Our data suggest that the current, myriad risk-stratification tools and clinical guidelines have not significantly impacted resource utilization surrounding ED syncope. This may be due to a number of reasons: because of the challenges of dissemination, ED clinicians may be unaware of these tools or may choose to use their own clinical judgment instead. Alternatively, perhaps not enough time has elapsed for these instruments and guidelines to be adopted by ED clinicians. Another possibility is that clinical management may be predominantly guided by other factors such as medicolegal concerns, financial incentives, and “customary practice.” The current culture among many physicians of “zero tolerance” for missed adverse events due to acts of omission, although well intentioned, may actually be detrimental to patients in aggregate and represent an inappropriate use of resources. Other strategies may be needed to improve resource utilization in this context, such as increased use of syncope observation unit protocols, outpatient ambulatory cardiac monitoring without admission, and shared decision making for intermediate-risk patients who have not had a serious condition revealed during their ED evaluation. All of the above approaches would depend on accurate identification of intermediate-risk patients, which would require the development of novel, reliable, well-validated risk-stratification tools.

## 5. Limitations

The results of our study are dependent on the quality of the NHAMCS data themselves, which may suffer from miscoding and errors in data entry [13]. The fact that NHAMCS contains only one single hospital discharge diagnosis per admission means that key secondary diagnoses are not available to help in the diagnostic categorization and may have affected our results. Similarly, the case definition of syncope may include ED visits where the chief concern was actually chest pain,

dyspnea, or headache, with syncope as a secondary concern. However, we feel that syncope is a cardinal complaint that often supersedes most associated symptoms in guiding the clinical management of the ED patient. The vast majority of ED visits in our sample had syncope or collapse as the primary reason for visit. Importantly, NHAMCS is the largest and only nationally representative data set that can provide epidemiological data on emergency conditions in the United States. Finally, our diagnostic summary data are based on ICD-9 codes, which can lack specificity and accuracy.

## 6. Conclusions

According to our data on ED visits for syncope, admission rates have remained stable whereas advanced imaging rates have increased from 2001 to 2010. There have been no apparent improvements in diagnostic yield for admissions. Novel strategies may be needed to change ED practice patterns for such patients.

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