ICD-9-CM Coding of Emergency Department Visits for Food and Insect Sting Allergy

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PURPOSE: Little is known about the role of *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes for identification of specific allergic reactions in the emergency department (ED).

METHODS: Investigators in 10 EDs reviewed 1395 charts of consecutive patients presenting with food allergy (ICD-9-CM codes 693.1 and 995.60 to 995.69) and insect sting allergy (code 989.5). They also reviewed charts of patients with "unspecified" allergic reactions (codes 995.0 [other anaphylactic shock] and 995.3 [allergy, unspecified]) to identify additional patients with food or insect sting allergy.

RESULTS: Of 406 patients with food allergy, 216 patients (53%) were coded as food allergy, whereas the remaining 190 patients (47%) were not. Of 394 patients with insect sting allergy, 341 (87%) were coded as insect sting allergy, whereas 53 patients (13%) were not. Characteristics of ICD-9-CM–identified compared with chart-review–identified patients differed for both food and insect sting allergy. ICD-9-CM–identified patients with food allergy were less likely to experience anaphylaxis.

CONCLUSIONS: Almost half the patients with food allergy would have been missed by using food-specific ICD-9-CM codes alone, whereas only 13% of patients with insect sting allergy would have been missed. Furthermore, characteristics of these allergy patients would have been biased by studying only patients identified by using the allergen-specific ICD-9-CM codes.
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KEY WORDS: Food Allergy, Insect Sting Allergy, *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) Codes, Emergency Department.

INTRODUCTION

Ascertainment of cases for epidemiologic studies performed in clinical settings often involves the use of *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes. Many studies examined the accuracy of identifying disease cases by ICD-9-CM code (1–5) and found that the ICD-9-CM classification system has several limitations, including diagnostic codes that do not completely encompass the condition of interest and conditions being distributed across multiple codes (3). These studies found that identification of soft tissue disorders of the neck and upper limbs (2), ischemic cerebrovascular disease (3), acute ischemic stroke (1), pneumococcal pneumonia (5), and cerebrovascular malformations (4) by using ICD-9-CM codes often yielded incomplete or inaccurate case lists and concluded that ICD-9-CM codes should not be the only source used to identify cases of disease.

In 1993, the ICD-9-CM system introduced codes to identify specific food allergies. To our knowledge, no study has examined the accuracy of ICD-9-CM coding for allergic reactions or anaphylaxis. Additionally, little is known about how frequently these specific codes are used to identify specific allergic reactions, such as food allergy or insect sting allergy, in the emergency department (ED). The objective of the current study is to determine the accuracy of using ICD-9-CM codes to identify ED visits for food and insect sting allergies and determine the potential bias that might be introduced by sole reliance on ICD-9-CM codes.

METHODS

This retrospective cohort study was performed as part of the Multicenter Airway Research Collaboration, a division of the Emergency Medicine Network (EMNet) (6). Using a standardized protocol and data abstraction forms,

investigators at 10 EDs examined two cohorts, one of ED visits for food allergy and one of ED visits for insect sting allergy, each during any 1-year period between January 1999 and November 2001. Sites reviewed charts of randomly selected patients who presented with *ICD-9-CM*–identified food allergy (693.1 [dermatitis due to food], 995.60 [allergy due to unspecified food], and 995.61 to 995.69 [allergy due to specified foods]) and charts of all patients who presented with insect sting allergy (*ICD-9-CM* code 989.5 [toxic effect of venom]). Additionally, sites reviewed charts of patients with "unspecified" allergic reactions (995.0 [other anaphylactic shock] and 995.3 [allergy, unspecified]) to identify additional patients with food or insect sting allergy.

Charts of patients with unspecified allergic reactions were screened to identify patients with definite or probable food or insect sting allergy. Definite cases identified among the unspecified allergic reaction codes were patients with charts suggesting that the allergic reaction clearly was caused by food or insect sting. Probable cases were charts in which the documentation suggested that the allergic reaction very likely was caused by food or insect sting. Patients were not considered to have a food or insect sting allergic reaction if the cause of the reaction was unknown or the reaction possibly or definitely was not caused by a food or insect sting.

The institutional review board at each of the 10 participating hospitals approved the study. Details of data collection have been described elsewhere (7, 8).

Statistical Analysis

All analyses were performed using STATA 9.0 (StataCorp., College Station, TX) (9). The association between method of identification and other factors was examined by using chi-squared test, Fisher exact test, Student t-test, and Kruskal-Wallis rank test, as appropriate. All p are two tailed, with $p < 0.05$ considered statistically significant.

RESULTS

Food Allergy

Of 775 consecutive patients with an acute allergic reaction, 216 patients (28%) were coded as having a food-related allergic reaction. Of the remaining 559 patients with unspecified allergy, 190 patients (34%) were identified as having

probable or definite food allergy based on chart review. Thus, only 53% (95% confidence interval, 48%–58%) of patients with a food-related allergic reaction were identified by specific *ICD-9-CM* codes. The number of patients identified by each *ICD-9-CM* code is listed in Table 1.

ICD-9-CM–identified patients with food allergy did not differ from those identified by chart review for many characteristics, but there were some notable differences (Table 2). *ICD-9-CM*–identified patients were more likely to have a history of asthma. They also were more likely to have documentation of skin and cardiovascular involvement. Although the groups did not differ according to ED management, patients with an *ICD-9-CM*–identified reaction were less likely to experience a reaction classified as anaphylaxis by our study criteria and more likely to be discharged to home. Discharge instructions to avoid the offending allergen and prescription of self-injectable epinephrine did not differ between the two groups, but *ICD-9-CM*–identified patients were significantly less likely to be referred to an allergist as part of the discharge instructions.

Insect Sting Allergy

Of 620 consecutive patients with acute allergic reaction, 341 patients (55%) were coded as having an insect sting allergic reaction. Of the remaining 279 patients with unspecified allergy, 53 patients (19%) were identified as having a probable or definite insect sting allergy based on

TABLE 1. Identification of patients with food allergy and insect sting allergy

	ICD-9-CM–identified	Chart-identified only
Food allergy		
693.1 (dermatitis due to food)	168	—
995.60 (allergy due to unspecified food)	6	—
995.61 (allergy due to peanuts)	13	—
995.62 (allergy due to crustaceans)	3	—
995.63 (allergy due to fruits & vegetables)	1	—
995.64 (allergy due to tree nuts & seeds)	9	—
995.65 (allergy due to fish)	4	—
995.66 (allergy due to food additives)	0	—
995.67 (allergy due to milk products)	1	—
995.68 (allergy due to eggs)	4	—
995.69 (allergy due to other specified food)	7	—
995.0 (other anaphylactic shock)	—	37
995.3 (allergy, unspecified)	—	153
Insect sting allergy		
989.5 (toxic effect of venom)	341	—
995.0 (other anaphylactic shock)	—	1
995.3 (allergy, unspecified)	—	52

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.

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TABLE 2. Characteristics of patients presenting to the emergency department with a food-related or insect sting-related allergic reaction according to method of identification

	Food allergy (n = 406)			Insect sting allergy (n = 394)		
	ICD-9-CM–identified (n = 216)	Chart-identified only (n = 190)	p	ICD-9-CM–identified (n = 341)	Chart-identified only (n = 53)	p
Demographic characteristics						
Age (years)	29 ± 19	32 ± 17	0.19	37 ± 19	33 ± 24	0.24
Female (%)	56	52	0.37	41	49	0.28
White (%)	41	64	<0.001	70	63	0.49
Past medical history						
Known allergy to food or insect sting (%)	39	46	0.32	35	15	0.008
History of other allergic problems (%), total	58	49	0.15	27	33	0.38
Asthma (%)	18	8	0.03	6	9	0.29
Other allergic problems (%)	12	6	0.13	3	6	0.22
Current allergic reaction						
Documentation of specific food (%), total	93	89	0.27	—	—	—
No. of times stung	—	—	—	1 (1–1)	1 (1–1)	0.55
Organ system involvement						
Skin (%)	95	44	<0.001	85	98	0.008
Respiratory (%)	40	45	0.42	21	19	0.71
Cardiovascular (%)	25	16	0.02	5	0	0.15
Gastrointestinal (%)	5	7	0.48	9	2	0.10
Presentation and clinical course						
Arrived by ambulance (%)	15	13	0.62	16	12	0.42
Duration of symptoms < 1 hour (%)	36	41	0.44	35	18	0.04
Severe reaction , i.e., anaphylaxis (%)[a]	48	78	<0.001	28	34	0.41
Treatments received in emergency department						
Antihistamines (%)	77	74	0.65	53	67	0.05
Systemic steroids (%)	50	45	0.39	31	31	0.94
Respiratory treatments (%)[b]	28	22	0.31	2	4	0.63
Epinephrine (%)	11	17	0.34	6	6	0.99
Discharged to home (%)	94	82	<0.001	96	95	0.79
Discharge instructions						
Avoid offending allergen (%)	38	42	0.43	17	18	0.87
Prescribed self-injectable epinephrine (%)	18	13	0.18	17	12	0.39
Referred to an allergist (%)	8	18	0.009	23	16	0.23

Values expressed as mean ± SD, percent, or median (interquartile range).
ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.
[a]Involvement of two or more organ systems or hypotension alone (see Methods section).
[b]Respiratory treatments include inhaled β-agonists and inhaled anticholinergics.

chart review. Thus, 87% (95% confidence interval, 83%–90%) of patients with an insect sting allergic reaction were identified by specific ICD-9-CM code. The number of patients identified by each ICD-9-CM code is listed in Table 1.

In general, ICD-9-CM–identified patients with insect sting allergy did not differ from chart-review–identified patients. ICD-9-CM–identified patients were more likely to have a known history of allergy to insect stings, but the two groups did not differ by other measured past medical history factors (Table 2). Although the groups had similar reaction severity, ICD-9-CM–identified patients had a shorter duration of symptoms and were less likely to be administered antihistamines while in the ED. ICD-9-CM–identified patients also were less likely to have cutaneous signs and symptoms documented.

DISCUSSION

To our knowledge, we present the first study assessing the accuracy of using ICD-9-CM codes to identify ED visits for food-related and insect sting-related acute allergic reactions. The use of ICD-9-CM codes in epidemiologic studies of acute allergic reactions and anaphylaxis requires that the codes accurately and completely identify cases to ensure valid conclusions. In our cohort of patients with food and insect sting allergy, specific ICD-9-CM codes identified only 53% of patients with food allergy versus 87% of patients with insect sting allergy. The remaining patients were coded with less specific allergy codes and identified by manual review of potentially eligible charts. The use of ICD-9-CM codes for these specific allergic disorders alone would have missed half the food allergy cases and one tenth of insect

sting–allergy cases presenting to these 10 EDs during a 1-year period.

The *ICD-9-CM* classification system was not created for research purposes, but rather for reimbursement purposes. This may affect the codes assigned for particular disorders or signs and symptoms because of the level of reimbursement (10). Additionally, hospital personnel may not use certain *ICD-9-CM* codes because they are not familiar with them or do not recognize diagnoses (11). Our data suggest that a lack of familiarity with particular *ICD-9-CM* codes leads to underuse. The more recent introduction of food allergy codes into the system may account for the marked difference in identification of cases of food allergy and insect sting allergy by specific *ICD-9-CM* code.

Not only would the frequency of both food allergy and insect sting allergy cases be underestimated by the use of specific *ICD-9-CM* codes alone, but some study results including only these patients likely would be biased. Severity of the allergic reaction would have been underestimated by inclusion of only *ICD-9-CM*–identified patients with food allergy. This suggests that severity of food reactions could have had a role in the use of specific *ICD-9-CM* codes for food reactions.

Discharge instructions generally were similar for *ICD-9-CM*–identified and chart review–identified patients for both allergic reactions; however, the proportion of patients referred to an allergist would have been underestimated if only *ICD-9-CM*–identified patients with food allergy were included in the current study. Given that *ICD-9-CM*–identified patients were more likely to have asthma and other allergic disorders, these patients may already have allergists, therefore prompting the ED physician not to give the patient a formal referral.

The current study has some potential limitations. These patients were seen in the ED and admitted to an inpatient unit or discharged to home. These results may not generalize to other areas within the hospital. In addition, participating EDs typically were in academic medical centers. Site investigators who implemented the study had a research interest in allergic disorders, which could lead to more knowledge about specific *ICD-9-CM* codes for allergic disorders. This would suggest that estimates presented here may overestimate the accuracy of *ICD-9-CM* codes to identify food allergy and insect sting allergy in other EDs.

Additionally, we did not formally evaluate false-positive results in our data set. Although we believe false-positive results would be low, we are unable to provide a formal evaluation. Finally, it is possible that the observed frequencies of food and insect sting allergic reactions are still underestimates. It is possible that cases of food or insect sting allergy could have been found by reviewing charts of patients with other allergy-related diagnoses, such as urticaria or angioedema. However, we do not think the inclusion of patients

with these even broader diagnoses would have yielded enough cases to affect the frequency of food- or insect sting–allergy cases.

In summary, our results suggest that prevalence estimates of food allergy based on *ICD-9-CM* codes for identification should be interpreted cautiously because they significantly underestimate the true prevalence of food allergy. Whereas the estimates for insect sting allergy do not appear to be as biased, in our sample, there are disease history and management differences between the *ICD-9-CM*–identified and chart review–identified groups for both types of allergic reactions. Clinical studies identifying patients with allergy should include both *ICD-9-CM* codes specific to the allergy of interest and more general allergy codes combined with chart review to identify the underlying cause of the allergic reaction. Such an approach, although more onerous than simple reliance on *ICD-9-CM* codes, would provide the most complete and representative group of patients for the study.

APPENDIX

EMNet Steering Committee: Michelle P. Blanda, MD; Edwin D. Boudreaux, PhD; Barry E. Brenner, MD, PhD; Carlos A. Camargo Jr, MD (Chair); Rita K. Cydulka, MD; Theodore J. Gaeta, DO, MPH; and Michael S. Radeos, MD, MPH.
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