

Trends and Disparities in U.S. Emergency Department Visits for Hypoglycemia, 1993–2005

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OBJECTIVE — To characterize the epidemiology of hypoglycemia in U.S. emergency departments.

RESEARCH DESIGN AND METHODS — We analyzed data from the 1993–2005 National Hospital Ambulatory Medical Care Survey and evaluated trends and disparities over time.

RESULTS — There were ~5 million emergency department visits for hypoglycemia from 1993–2005, and 25% resulted in hospital admission. The visit rate per 1,000 of the diabetic population was 34 (95% CI 30–37) and did not change significantly during the study period ($P = 0.70$ for trend). These visit rates were higher in patients aged <45 years ($n = 62$) and ≥ 75 years ($n = 54$) versus those aged 45–74 years ($n = 21$), in female ($n = 37$) versus male ($n = 30$) patients, in black ($n = 40$) vs. white ($n = 25$) patients, and in Hispanic ($n = 21$) versus non-Hispanic ($n = 12$) patients (all $P < 0.001$).

CONCLUSIONS — Greater emphasis on intensive glycemic control has not resulted in increased emergency department visit rates for hypoglycemia. We identified demographic disparities, however, that merit further evaluation. The emergency department provides an important opportunity for epidemiologic study and intervention for severe hypoglycemia.

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Hypoglycemia is a serious complication among patients with diabetes that has significant morbidity. While tight glycemic control remains the hallmark of decreased complications in diabetes, the barrier of hypoglycemia is a major limiting factor in the maintenance of euglycemia (1–4). Severe hypoglycemia, or episodes requiring external assistance, may occur at least once a year (5,6). Although some episodes are treated at home by administration of glucose or glucagon by family members, the most severe episodes may require treatment by paramedics or the emergency department. Emergency department visits for severe hypoglycemia represent a small percentage of the total episodes of hy-

poglycemia but serve as a good epidemiological marker of the complication. Additionally, severe hypoglycemia causes significant cost from ambulance and hospital expenses (7). Several population-based datasets have provided important information to characterize hypoglycemia (8–12); however, these were based on single communities and may not be generalizable. In this study, we characterized the epidemiology and national trends in emergency department visits for hypoglycemia.

RESEARCH DESIGN AND METHODS

— We analyzed the emergency department component of the 1993–2005 National Hospital Ambula-

tory Medical Care Survey (NHAMCS). Our institutional review board waived review of this analysis. Methodological details are described elsewhere (13,14). Briefly, the NHAMCS is conducted annually in U.S. noninstitutional general and short-stay hospitals, which provide a representative sample of all U.S. hospitals, excluding military and long-term hospitals. Trained personnel collected data annually during randomly assigned 4-week periods in selected emergency departments. Based on the ICD-9 coding manual (15) and our chart validation (16), we identified cases based on the presence of ICD-9 codes 251.0 (hypoglycemic coma), 251.1 (other specified hypoglycemia), 251.2 (hypoglycemia, unspecified), 270.3 (leucine-induced hypoglycemia), 775.0 (hypoglycemia in an infant born to a diabetic mother), and 775.6 (neonatal hypoglycemia) in any of the three diagnosis fields. We included ICD-9 code 250.8 (diabetes with other specified manifestations), except when any of the following co-diagnoses were specifically coded: 259.8, 272.7, 681.xx, 682.xx, 686.9x, 707.xx, 709.3, 730.0–730.2, and 731.8.

We used Stata 9.0 software (Stata-Corp, College Station, TX) to determine nationally representative estimates with 95% CIs using assigned weights, which adjust for selection probability. We calculated rates based on Centers for Disease Control and NHAMCS data (17) and made comparisons using a two-sample test of proportions. We analyzed trends over time using the least-squares method of linear regression and a nonparametric Wilcoxon-based test for trends, where appropriate. All P values were two tailed, with $P < 0.05$ considered statistically significant.

RESULTS — Between 1993 and 2005, hypoglycemia accounted for ~5.0 million emergency department visits in the U.S., or an average 380,000 visits/year. The most common ICD-9 codes for identification of hypoglycemia were 251.2 (83%), 250.8 (11%), and 251.0 (5%), and hypoglycemia was the primary (first-listed) diagnosis for 72% of visits.

Table 1 shows patient and hospital

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Abbreviations: NHAMCS, National Hospital Ambulatory Medical Care Survey.

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Emergency department visits for hypoglycemia

Table 1—Emergency department visits for hypoglycemia according to patient and hospital characteristics, 1993–2005

	<i>n</i>	Estimated total number of cases (95% CI)	Rate per 1,000 of the diabetic population (95% CI)	Rate per 1,000 emergency department visits (95% CI)
Overall	1,303	4,960 (4,460–5,460)	34 (30–37)	3.7 (3.4–4.1)
Years				
1993–1995	215	773 (578–969)	30 (23–38)	2.8 (2.1–3.5)
1996–1997	152	672 (524–820)	43 (32–54)	3.6 (2.8–4.4)
1998–1999	141	740 (543–937)	26 (19–33)	3.6 (2.7–4.6)
2000–2001	222	897 (663–1,130)	40 (30–50)	4.2 (3.1–5.2)
2002–2003	262	776 (633–920)	32 (24–39)	3.5 (2.8–4.1)
2004–2005	311	1,100 (864–1,340)	33 (26–39)	4.9 (3.8–5.9)
Age (years)				
<45	401	1,550 (1,330–1,780)	62 (53–71)	1.7 (1.5–2.0)
0–19	78	359 (229–489)	—	0.9 (0.6–1.2)
20–44	323	1,200 (1,020–1,370)	—	2.3 (2.0–2.7)
45–64	364	1,230 (1,060–1,400)	19 (17–22)	5.5 (4.7–6.2)
65–74	219	845 (698–991)	25 (20–29)	10 (8.5–12)
≥75	319	1,330 (1,090–1,580)	54 (44–64)	12 (9.4–14)
Sex				
Female	730	2,840 (2,470–3,200)	37 (32–42)	4.0 (3.5–4.5)
Male	573	2,120 (1,870–2,380)	30 (26–34)	3.4 (3.0–3.8)
Race				
White	829	3,270 (2,910–3,640)	28 (25–31)	3.6 (3.2–4.0)
Black	326	1,210 (970–1,450)	50 (40–60)	4.8 (3.9–5.8)
Other	36	104 (50–159)	14 (6.5–21)	3.4 (1.6–5.1)
Ethnicity				
Hispanic	100	329 (241–416)	21 (15–27)*	2.5 (1.8–3.2)
Non-Hispanic	985	3,720 (3,290–4,150)	12 (10–13)*	3.9 (3.5–4.4)
Insurance				
Private	285	1,140 (963–1,300)	NA	2.6 (2.2–3.0)
Public	643	2,430 (2,090–2,760)	NA	5.8 (5.0–6.6)
Self-pay	111	414 (316–513)	NA	2.2 (1.7–2.7)
Other/unknown	124	416 (316–515)	NA	2.4 (1.8–3.0)
U.S. region				
Northeast	319	903 (747–1,060)	NA	3.4 (2.8–4.0)
Midwest	299	1,320 (1,080–1,570)	NA	3.9 (3.2–4.6)
South	485	2,010 (1,630–2,380)	NA	4.1 (3.3–4.8)
West	200	726 (551–901)	NA	3.0 (2.3–3.8)
Urban status				
Urban	1,078	3,730 (3,270–4,190)	NA	3.5 (3.1–4.0)
Non-urban	225	1,230 (806–1,660)	NA	4.5 (3.0–6.1)
Disposition				
Admitted	318	1,230 (1,060–1,400)	NA	7.2 (6.0–8.3)
Not admitted	969	3,630 (3,450–3,810)	NA	3.2 (2.8–3.5)

*Data available 1997–2005. NA, data not available.

characteristics for emergency department visits for hypoglycemia. While the total number of visits for hypoglycemia increased during the study period ($P < 0.001$ for trend), the rate per diabetic population or emergency department visits did not change significantly ($P = 0.70$ and 0.14 for trend, respectively). Hypoglycemia visit rates per diabetic population were three times higher in younger

(aged 0–44 years) and older (aged ≥ 75 years) patients compared with those aged 45–74 years (both $P < 0.001$). Visit rates per diabetic population for female, black, and Hispanic patients were higher than those for male, white, and non-Hispanic patients (all $P < 0.001$). Additionally, emergency department visit rates for hypoglycemia were higher in the South and Midwest than in the West (both $P <$

0.001). Rates per diabetic population or emergency department visits stratified by sex, race/ethnicity, and region subgroups did not change significantly over time (all $P > 0.05$ for trend).

CONCLUSIONS— This study is the first report of national and emergency department–based epidemiological data for severe hypoglycemia. Prior epidemiologic data suggest that the incidence of severe hypoglycemia has increased in the era of greater attention to tight glycemic control (2,3,8,9). Our data indicate that this increased emphasis has not changed the incidence of hypoglycemia requiring emergency care. Between 1993 and 2005, we found an increasing number of hypoglycemia visits, but the rate remained unchanged, suggesting that the increased overall prevalence of diabetes accounts for the growth in hypoglycemia visits.

However, we did find demographic disparities in emergency department visits for hypoglycemia by age, sex, race, ethnicity, and region. An increased incidence of severe hypoglycemia has been previously observed in older patients and those of lower socioeconomic status (9–12). While demographic disparities clearly exist, current data do not explain the cause for these differences, and further evaluation of these observations is warranted.

With the large number of annual visits for hypoglycemia and the majority (75%) resulting in discharge, the emergency department should be an important venue for education and referral. Indeed, a hypoglycemic event requiring an emergency care is a clinical red flag for diabetes, which requires substantial education on self-management, possible dietary or medication adjustment, avoidance of recurrent hypoglycemia, and close outpatient monitoring (18,19).

This study has a few limitations. The ICD-9 classification system is imperfect for case identification, as it was created for reimbursement rather than research purposes. However, we validated our coding algorithm and found a high level of accuracy by chart review (16). Because NHAMCS lacks individual identifiers, data pertain to emergency department visits, not individual patients. Additionally, a limitation of the NHAMCS study design is that data may be missed due to relying on medical records, the and cause of hypoglycemia is not known. Nevertheless, NHAMCS provides important epidemiologic data collected using rigorous methodology (14).

In summary, the rate of emergency department visits for hypoglycemia has not changed in the past decade; however, we identified demographic disparities that merit further study.

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