



Published in final edited form as:

JAMA Intern Med. 2018 July 01; 178(7): 987–988. doi:10.1001/jamainternmed.2018.1014.

Hypoglycemia Surveillance: Limitations of Emergency Department and Hospital Utilization Data

Andrew J Karter, PhD,

Kaiser Permanente - Division of Research, 2000 Broadway, Oakland, CA 94612, (360) 778-1346

Howard H Moffet, MPH,

Kaiser Permanente - Division of Research, 2000 Broadway, Oakland, CA 94612, (510)891-5902

Jennifer Y Liu, MPH, and

Kaiser Permanente - Division of Research, 2000 Broadway, Oakland, CA 94612, (510) 891-3693

Kasia J Lipska, MD, MPH

Yale School of Medicine, Department of Internal Medicine, Section of Endocrinology, 333 Cedar St, PO Box 208020, New Haven, CT 06520-8020

Hypoglycemia is a common and life-threatening adverse drug event associated with glucose-lowering medications. Hypoglycemia is classified as severe when assistance from another person is required to actively administer carbohydrates, glucagon or other resuscitative actions.¹ U.S. surveillance has relied on data from electronic medical records (EMR) or administrative claims from emergency department (ED) visits and hospital admissions for hypoglycemia, which are presumably the most severe and costly events.^{2,3} However, this surveillance fails to account for events treated outside of the healthcare system (e.g., by family members). We estimated the proportion of all severe hypoglycemic events that are captured by surveillance based on healthcare utilization alone among pharmacologically-treated diabetes patients.

Methods

We estimated the frequency of self-reported severe hypoglycemic events based on responses to the question, “In the past year, how many times have you had a severe low blood sugar reaction such as passing out or needing help to treat the reaction?” included in the Diabetes

Corresponding Author: Andrew J Karter, PhD, Kaiser Permanente - Division of Research, 2000 Broadway, Oakland, CA 94612, (360) 778-1346; andy.j.karter@kp.org.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

Author Contributions: Dr. Karter had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Karter, Lipska.

Acquisition of data: Karter.

Analysis and interpretation of data: Karter, Lipska, Liu, Moffet.

Drafting of the manuscript: Karter.

Critical revision of the manuscript for important intellectual content: Karter, Lipska, Liu, Moffet.

Statistical analysis: Liu.

Obtained funding: Karter.

Study of Northern California (DISTANCE) survey of Kaiser Permanente members.⁴ Survey responses were linked with EMR data during the matching 12-month time frame covered by the survey. Hypoglycemia-related utilization was based on the primary diagnosis of hypoglycemia in the ED or principal discharge diagnosis in the hospital using a validated, ICD-9 based algorithm.⁵ This research was approved by the Kaiser Foundation Research Institute institutional review board.

Results

In total, 20,188 (62% of eligible patients with diabetes) responded to the DISTANCE survey.⁴ We excluded 3,018 patients who were not treated with glucose-lowering medications and 3,811 who did not provide a valid response to hypoglycemia questions, yielding a study sample of 13,359. The mean age was 58.9 years, 49.4% were female, 25.7% non-Hispanic white, 74.3% minority, 97.7% had type 2 diabetes, 26.4% were insulin-treated, and 63.2% sulfonylurea-treated. Of 13,359 patients included in the study, 1,566 (11.7%) reported having 1 severe hypoglycemic events requiring third-party assistance in the previous 12 months, while only 102 (0.8%) had a documented hypoglycemia-related ED or hospital utilization during the same time window (see table). Only 82 (5.2%) of those self-reporting severe hypoglycemia also had an ED or hospital admission for hypoglycemia during the same 12-month window.

Discussion

U.S. surveillance of severe hypoglycemia is currently based on hypoglycemic events resulting in ED or hospital utilization recorded in the EMR. While hypoglycemia-related ED visit or hospitalization is rare (~0.8% annually), self-reported severe hypoglycemia events are relatively common (~12% annually). Based on our comparison of these two sources of data, we estimate that only ~5% of self-reported events among pharmacologically-treated diabetes patients are captured by healthcare utilization-based surveillance. Thus, current surveillance grossly under-estimates the overall burden of severe hypoglycemia.

Because most severe hypoglycemic events occur outside of the healthcare system, a more complete understanding of the burden of severe hypoglycemia will require collecting self-reported events. Currently, there are no validated instruments to collect these patient-reported outcome data. A brief assessment tool that reliably captures severe hypoglycemic event history should be developed and tested in clinical settings. Notably, self-report in our study did not capture all hypoglycemia related utilization suggesting that a combination of modes of data collection may be required to ascertain the total burden of severe hypoglycemia. While the proportion of total severe hypoglycemic events that result in ED or inpatient utilization likely differs across healthcare delivery settings, our qualitative observation that most severe hypoglycemic events are not captured in ED and hospital utilization data may be widely generalizable. Determining the total burden of severe hypoglycemia, not just the small subset of events leading to healthcare utilization, will better inform clinical decision-making, public health policy and quality measure development to enhance patient safety.

Acknowledgments

Funding/Support: This project was supported by the National Institute of Health (R01 DK103721, R01 DK065664). Dr. Lipska receives support from the National Institute on Aging and the American Federation of Aging Research through the Paul Beeson Career Development Award (K23 AG048359) and the Yale Claude D. Pepper Older Americans Independence Center (P30 AG021342). Dr. Karter is also supported by the NIDDK Centers for Diabetes Translational Research (P30 DK092924). Karter and Moffet also received unrelated funding from AstraZeneca. Moffet, and Liu also received unrelated funding from Regeneron.

References

1. American Diabetes Association Standards of Medical Care in Diabetes-2017. *Diabetes Care*. Jan. 2017 40(Supplement 1):135.
2. Geller AL, Shehab N, Lovegrove MC, et al. National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med*. 2014
3. Number of Emergency Department Visits (in Thousands) with Hypoglycemia as First-Listed Diagnosis and Diabetes as Secondary Diagnosis, Adults Aged 18 Years or Older, United States, 2006–2009. 2014. <https://www.cdc.gov/diabetes/statistics/hypoglycemia/methods.htm>
4. Moffet HH, Adler N, Schillinger D, et al. Cohort Profile: The Diabetes Study of Northern California (DISTANCE)--objectives and design of a survey follow-up study of social health disparities in a managed care population. *International journal of epidemiology*. Feb; 2009 38(1):38–47. [PubMed: 18326513]
5. Ginde AA, Blanc PG, Lieberman RM, Camargo CA Jr. Validation of ICD-9-CM coding algorithm for improved identification of hypoglycemia visits. *BMC Endocr Disord*. 2008; 8:4. [PubMed: 18380903]

Table

Frequency (12-month rate) of self-reported severe hypoglycemia and hypoglycemia-related utilization (emergency department visits or hospitalizations) in pharmacologically-treated, diabetes patients *

Hypoglycemia-related utilization	Self-reported hypoglycemia		Totals
	YES	NO	
YES	82	20	102
NO	1,484	11,773	13,257
Totals	1,566	11,793	13,359

* Includes 13,389 survey respondents from the Diabetes Study of Northern California (DISTANCE) with pharmacologically-treated diabetes who completed a question regarding hypoglycemia.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript