


Glycemic Over- and Undertreatment in VA Nursing Home Residents with Type 2 Diabetes: a Retrospective Cohort Study



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INTRODUCTION

For nursing home (NH) residents, clinical guidelines recommend less stringent hemoglobin A1c (HbA1c) targets between 7.5 and 9.0%^{1–3} while avoiding medications with higher hypoglycemia risks such as insulin. Previous studies in community-dwelling older adults have suggested that overly intensive glycemic treatment may be common.^{4, 5} However, little is known about current glycemic treatment practices among NH residents with type 2 diabetes mellitus (T2DM). Our objective was to determine the rates of glycemic overtreatment (defined as insulin use with HbA1c < 6.5%) and glycemic undertreatment (defined as no glucose-lowering medications with HbA1c ≥ 8.5%) in older adults recently admitted to the NH.

METHODS

We conducted a retrospective cohort study of Veterans Affairs (VA) nursing home residents over age 65 with T2DM from January 1, 2013, to December 31, 2015. We defined diabetes as HbA1c > 6.5% or use of glucose-lowering medication (GLM) in the year prior to NH admission. Residents with ICD codes for type 1 diabetes, length of stay (LOS) < 30 days, hospice stays, or with no HbA1c measurement during NH stay were excluded. We identified the date of the first HbA1c during NH stay (index HbA1c date) and categorized NH residents into five mutually exclusive categories based on glucose-lowering medication (GLM) use on the index HbA1c date: (1) no glucose-lowering medications, (2) metformin use without use of any other GLMs, (3) use of other oral GLMs in any combination (but without insulin use), (4) any short-acting

insulin use (in combination with oral GLMs or alone, but without use of long-acting insulin), (5) any long-acting insulin use. We defined likely overtreatment as HbA1c < 6.5 with any insulin use, and likely undertreatment as HbA1c ≥ 8.5 with no GLM use. This study was reviewed and approved by the University of California, San Francisco Committee on Human Research.

RESULTS

We identified 5471 VA NH residents who met inclusion and exclusion criteria. Mean age was 74.5, all were male, and 54% had NH LOS > 90 days. Our cohort had a high comorbidity burden (mean Charlson Comorbidity Index of 6) and most were dependent on several activities of daily living (Table 1). The index HbA1c was within the first 30 days of NH admission in 62% of residents.

Seven percent were on metformin alone, 9% were on oral GLMs without insulin, 12% were on short-acting insulin without long-acting insulin use, and 46% were on long-acting insulin (alone or in combination with short-acting insulin or oral GLMs). Of residents with HbA1c < 6.5%, 38% (762/1998) were receiving insulin and of all patients on insulin and 55% (1717/3137) had an A1c of < 7.5%. Of the 5471 NH residents, 762 (14%) met criteria for likely overtreatment, while 76 (1.4%) met criteria for likely undertreatment (Table 2).

DISCUSSION

In a national sample of VA NH residents, we found that 14% were likely overtreated with HbA1c < 6.5 while receiving insulin. A much smaller proportion of NH residents (1.4%) were likely undertreated, with HbA1c ≥ 8.5% while taking no GLMs. Given that 62% of our cohort's index HbA1c occurred within 30 days of NH admission, our results reflect the fact that glycemic treatments that were appropriate when older adults were healthier and community-dwelling may become inappropriate when older adults become more frail and transition into the NH. Thus, glycemic overtreatment appears to be

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Table 1 Characteristics of Nursing Home Residents

	Mean (SD) or N (%)
	<i>N</i> = 5471
Age, mean (SD)	74.5 (8%)
Male, <i>N</i> (%)	5471 (100%)
A1c, mean (SD)	7.1 (1.4)
Hemoglobin A1C, <i>N</i> (%)	
< 6.5	2058 (36%)
6.5–7.4	1651 (30%)
7.5–8.4	1025 (19%)
≥ 8.5	797 (15%)
Time from NH admission to A1c measurement, <i>N</i> (%)	
1–30 days	3372 (62%)
> 30 days	2099 (38%)
Glucose-lowering medication (GLM) category, <i>N</i> (%)*	
No GLM	1470 (27%)
Metformin alone	387 (7%)
Use of other oral GLMs	477 (9%)
Short-acting insulin use	645 (12%)
Long-acting insulin use	2492 (46%)
Length of NH stay, <i>N</i> (%)	
30–59	1619 (30%)
60–89	888 (16%)
90+	2964 (54%)
Hypoglycemia during NH stay (glucose ≤ 50 mg/dL), <i>N</i> (%)	1077 (20%)
Hyperglycemia during NH stay (glucose ≥ 400 mg/dL), <i>N</i> (%)	1374 (25%)
ED visit during NH stay, <i>N</i> (%)	125 (2%)
Charlson Comorbidity Index (CCI), mean (SD)	6 (3.0)
Minimum Data Set-Activities of Daily Living (MDS-ADL) score, mean (SD)†	15.3 (7.8)

*Escalating categories of glucose-lowering medication (GLM) use are mutually exclusive. I.e., residents in the “short-acting insulin use” category maybe taking metformin or other oral GLMs but are by definition not using long-acting insulins

† MDS-ADL score ranges from 0 (completely independent) to 28 (totally dependent) in 7 ADLs

Table 2 Rates of Glycemic Treatment by Hemoglobin A1C Category (%)

	<6.5% (N=1998)	6.5-7.4% (N=1651)	7.5-8.4% (N=1025)	≥ 8.5% (N=797)
No GLM (N=1,470)	872 (15.9)	397 (7.3)	125 (2.3)	76 (1.4)
Metformin alone (N=387)	196 (3.6)	130 (2.4)	47 (0.9)	14 (0.3)
Use of other oral GLMs (N=477)	168 (3.1)	169 (3.1)	91 (1.7)	49 (0.9)
Short acting insulin use (N=645)	217 (4.0)	222 (4.1)	122 (2.2)	84 (1.5)
Long Acting Insulin use (N=2,492)	545 (10.0)	733 (13.4)	640 (11.7)	574 (10.5)

Percent of total *N* = 5471

common among recently admitted NH residents, suggesting that NH admission may be an opportune time for re-evaluating and de-intensifying glycemic treatments.

Strengths of our study include our large national sample of NH residents with linked pharmacy and laboratory data. Limitations include our reliance on VA administrative and electronic health record data, resulting in a 100% male sample, and the possibility of the inclusion of small number of type 1 diabetes patients.

Our study found that glycemic overtreatment is common among NH residents with insulin often being used in the setting of HbA1c levels that are below the recommended target levels for NH residents. Given the high burden of hypoglycemia in NH residents,⁶ our results suggest that de-intensification interventions focused on decreasing GLMs in NH residents may be high yield and potentially lead to decreased rates of hypoglycemia.

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Compliance with ethical standards:

This study was reviewed and approved by the University of California, San Francisco Committee on Human Research.

Conflict of interest: The authors have no conflicts of interest to report

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