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Deintensification of Diabetes Medications among Veterans at the End-of-Life in VA Nursing Homes

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Abstract

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Conflict of Interest: JNH is now a fulltime employee at GlaxoSmithKline; however, he was a VA postdoctoral fellow during the conduct of this study. All other authors have no conflicts of interest to disclose.

Background: Many older adults with limited life expectancy and/or advanced dementia (LLE/AD) are potentially overtreated for diabetes and may benefit from deintensification. We examined incidence and predictors of diabetes medication deintensification in older Veterans with LLE/AD who were potentially overtreated at admission to VA nursing home (Community Living Centers).

Design: Retrospective cohort study using linked VA and Medicare clinical/administrative data and Minimum Data Set (MDS) assessments.

Setting: VA Community Living Centers (CLCs).

Participants: 6,960 Veterans with diabetes and LLE/AD admitted to VA CLCs in fiscal years 2009–2015 with HbA1c measured within 90 days of admission.

Measurements: We evaluated treatment deintensification (discontinuation or dose reduction for a consecutive 7-day period) among residents who were potentially overtreated (HbA1c≤7.5% and receiving hypoglycemic medications). Competing risk models assessed 90-day cumulative incidence of deintensification.

Results: Over 40% (n=3,056) of Veteran CLC residents with diabetes were potentially overtreated. The cumulative incidence of deintensification at 90 days was 45.5%. Higher baseline HbA1c values were associated with lower likelihood of deintensification (e.g., HbA1c 7.0–7.5% vs. <6.0%, adjusted risk ratio (aRR): 0.57, 95% CI: 0.50–0.66). Compared to non-sulfonylurea oral agents (e.g. metformin), other treatment regimens were more likely to be deintensified (aRR 1.31–1.88), except for basal insulin (aRR: 0.59, 95% CI: 0.52–0.66). The only resident factor associated with increased likelihood of deintensification was documented end-of-life status (aRR: 1.12, 95% CI:1.01–1.25). Admission from home/assisted living (aRR: 0.85, 95% CI: 0.75–0.96), obesity (aRR: 0.88, 95% CI: 0.78–0.99), and peripheral vascular disease (aRR: 0.90, 95% CI: 0.81–0.99) were associated with decreased likelihood of deintensification.

Conclusion: Deintensification of treatment regimens occurred in under half of potentially overtreated Veterans, and was more strongly associated withlow HbA1c values and use of medications with high risk for hypoglycemia, rather than other resident characteristics.

Keywords

Nursing homes; deprescribing; diabetes; diabetes overtreatment; Veterans Affairs

INTRODUCTION

One in four older adults over age 65 has diabetes[1], which is the seventh leading cause of death in the United States and a major contributor to cardiovascular disease.[2] Guideline recommendations aimed at slowing the sequalae of diabetes progression have long recommended tight glycemic control, defined as hemoglobin A_{1C} (HbA1c) < 6.5–7.0% for healthy, youngerindividuals.[3–5] However, tight glycemic control may cause more harm than benefit in older adults with limited life expectancy and/or advanced dementia (LLE/AD).[6] For example, these individuals may not live long enough to experience potential benefits.[7,8] In addition, strict glycemic control increases the risk of adverse drug events such as hypoglycemia.[9–11] Therefore, many guidelines now advocate for less stringent HbA1c

targets (e.g., between 8.0–9.0%) in older adults who have multiple comorbidities, limited life expectancy, and/or reside in nursing homes.[3,4,6,12,13]

Many older adults with diabetes, including those with comorbid dementia, are potentially overtreated based on HbA1c measurements, according to updated recommendations[14–16,17] Among potentially overtreated older outpatients with diabetes, few have their regimens deintensified.[15] However, little is known about diabetes overtreatment and efforts to deintensify regimens among older adults with LLE/AD, who are least likely to benefit and most likely to experience harms of tight HbA1c control.[18–21] Specifically, deintensifying diabetes treatment regimens in patients with LLE/AD has the potential to prevent unnecessary hospitalizations due to adverse drug events, reduce medication burden, and increase comfort.[22,23] Similarly, potential overtreatment and deintensification has also not been well described in the nursing home setting. However, nursing home admission may present an opportunity to assess patients' goals and preferences and review and adjust medications accordingly. The purpose of this study was to quantify: 1) the prevalence of potential diabetes overtreatment among older adults with LLE/AD residing in Veteran nursing homes, known as Community Living Centers (CLCs); 2) the extent to which potentially overtreated residents with LLE/AD had their regimens deintensified; and 3) association of resident-level characteristics with deintensification.

METHODS

Data sources

We conducted a national retrospective cohort study by merging administrative and clinical data from fiscal years (FY) 2009–2015. This included the VA Residential History File (RHF)[24], the VA Minimum Dataset (MDS) for CLCs[25,26], the VA Corporate Data Warehouse (CDW)[27–30], Medicare claims for Veterans dually enrolled in Medicare[31,32], and the VA Vital Status File. The VA Pittsburgh Healthcare System Institutional Review Board approved this study.

The VA RHF (FY2009–2015) tracked the location of Veterans using linked VA, Medicare, Medicaid, and MDS records and was used to identify CLC episodes of care. The MDS is a standardized assessment of functional, psychosocial, and healthcare needs of nursing home residents that is mandated at CLC admission and at least quarterly thereafter. Because the MDS underwent a version change during our study period, we used MDS 2.0 data from Oct. 1, 2008 – June 30, 2012 and MDS 3.0 from July 1, 2013 – Sept. 30, 2015. The MDS was used to identify Veterans with LLE/AD at admission and to capture resident characteristics not available in utilization/claims data (e.g., physical functioning). The CDW provided VA inpatient and outpatient utilization data (FY2007–2015) needed to identify diabetes patients and develop covariates, laboratory records to obtain HbA1c values (FY2009–2015), and medications administered to CLC residents through the Bar Code Medication Administration system (BCMA; FY2009–2015). BCMA records captured drug names and doses each time a medication is administered to CLC resident. Medicare claims for Veterans dually enrolled in Medicare provided additional diagnosis and procedure information for non-VA healthcare settings to identify patients with diabetes and develop specific covariates. The VA Vital Status File provided date of death.

Study sample

We identified all CLC admissions between FY2009–2015 (n=200,333 episodes). We required all residents to meet at least one of three criteria for LLE/AD (n=81,271): 1) MDS Mortality Risk Index – Revised (MMRI-R) score ≥36, which has been validated in both MDS 2.0 and 3.0 and is associated with >50% likelihood of death within 6 months[33,34]; 2) endorsement of ≤6 months life expectancy on the MDS admission assessment (MDS 2.0: J5c; MDS 3.0: J1400); or 3) advanced dementia identified using either the Brief Interview for Mental Status for residents who were able to self-report with MDS 3.0 (scores ≤7 considered severely impaired)[35] or the Cognitive Performance Scale for residents who were assessed with MDS 2.0 or unable to self-report with MDS 3.0 (scores ≥4 are considered severely impaired).[36] Residents <65 years old at CLC admission (n=20,135); and those with lengths of stays <7 days (n=2,355) were excluded. We required patients to have diabetes, defined as having ≥1 inpatient or ≥2 outpatient encounters with an ICD-9 diagnosis code for diabetes in the 2 years prior to admission in VA and/or Medicare records[37] or endorsement of diabetes as an active diagnosis on the MDS admission assessment (n=33,440 excluded). To assess potential overtreatment, we required residents to have at least one HbA1c measurement during the first 90 days of the CLC stay (n=18,381 excluded). We then identified episodes where residents were potentially overtreated for diabetes based on having HbA1c ≤ 7.5% and receiving ≥1 diabetes medication (i.e., insulin, metformin, sulfonylureas, biguanides, meglitinides, GLP-1 receptor antagnoists, alpha-glucosidase inhibitors, DPP-4 inhibitors, SGLT-2 inhibitors – see Table S3) on the day of or day after HbA1c measurement (n=3,539 excluded). In order to observe potential deintensification in this group, we required participants to have ≥7 days of follow-up after medication index date (i.e., HbA1c date + 1 day, n=267 excluded). Finally, for Veterans ≥2 admissions during the study time frame, we selected one episode at random (n=98 excluded). See Supplementary Figure 1 for further detail.

Overtreatment and baseline diabetes treatment regimens

Using laboratory data, we grouped the index HbA1c into the following categories: <6.0%, 6.0-<6.5%, 6.5%-<7.0%, and 7.0–7.5%. Consistent with treatment guidelines for this population which propose a HbA1c target of 8–9%,[3,4,6] we defined potential overtreatment as having an index HbA1c ≤7.5% and receiving diabetes medications on the day of or day following HbA1c measurement. Among those potentially overtreated, we categorized baseline treatment regimens based on medications administered on these two days, specifically the maximum number of medications and the maximum dosages (for non-insulin medications) administered.

Treatment deintensification

The primary outcome for this analysis was treatment deintensification. Among residents identified as potentially overtreated, we examined the extent to which their baseline diabetes treatment regimens were deintensified within 90 days of follow-up after the medication index date. Similar to previous work[15], deintensification was defined as decreasing the dose or completely discontinuing a non-insulin agent and/or stopping a type of insulin (e.g., switching from using both short- and long-acting insulin to just long-acting insulin;

discontinuing insulin treatment altogether), with no addition of new agents or dose increase of a non-insulin agent. We did not consider insulin dose changes when defining deintensification, since insulin doses may be influenced by factors such as variable eating habits and thus cannot reliably be interpreted as deintensification. Changes had to be sustained over 7 days of follow-up to qualify as deintensification, with the first day of the 7-day period recorded as the deintensification event time. Although prior studies using prescription refill records have required longer gaps in medication supply (i.e. ≥30 days) for discontinuation[38,39], we believed that the granularity contained in daily medication administration records would allow us to identify medication changes using a shorter time-frame with sufficient accuracy. In sensitivity analyses, we used a 14-day window to test the stability of our findings.

Follow-up

Residents were followed from the day after medication index date until the earliest of the following: deintensification, death, CLC discharge, administrative censoring (i.e. end of available data), or end of follow-up period (90 days). If a resident was censored or died, their follow-up time was truncated by seven days (e.g., censoring date – 7 days) because any deintensification occurring in this period would be unobservable.[40]

Resident characteristics associated with deintensification

We selected resident characteristics that may be associated with deintensification based on prior literature of diabetes overtreatment and deintensification, and behavioral theories applied to deprescribing.[14–17,41,42] Resident characteristics fell into five categories: socio-demographics, environment of care, diabetes-related factors, cardiovascular risk factors, and markers of poor prognosis. Most characteristics were operationalized using the MDS admission assessment, with additional information on comorbidities captured using VA/Medicare records from the year preceding admission, as well as BCMA data for medication covariates.

Socio-demographics factors included age (65–74 years, 75–84 years, ≥85 years), gender, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latino, other), and being married. Environment of care included admission source (hospital, home/assisted living, or other long-term care facility), hospice use in the year prior to CLC admission, and fiscal year of admission. Diabetes-related factors included baseline HbA1c (<6.0%, 6.0-<6.5%, 6.5%-<7.0%, and 7.0–7.5%), potential diabetes-related complications (e.g., diabetic eye disease, hospitalization for serious hypoglycemic events[43]) and baseline treatment regimens, with non-insulin medications aggregated into two categories of sulfonylureas and non-sulfonylurea/non-insulin agents, and insulin use classified as short-acting only, basal only, or both short-acting and basal. Cardiovascular factors included coronary artery disease, congestive heart failure, stroke, and hypertension. Markers of poor prognosis included advanced dementia, having explicit documentation at admission that the resident was nearing the end-of-life (admitted to a hospice treatment specialty, or MDS documentation of hospice care in the prior 14 days, or the item for <6 months life expectancy), physical functioning as measured by the MDS Activities of Daily Living Self-Performance Hierarchy[44], the Elixhauser comorbidity index[45], body mass index (underweight [<18.5],

normal [18.5–24.9], overweight [25–29.9], obese [≥30]), recent weight loss, difficulty swallowing, pain and other comorbidities that may affect decision to deintensify from the MDS (e.g., history of falls/fractures). We also considered antidepressant and antipsychotic use, based on any use in the first 7 days of the episode, as these medications may induce metabolic syndromes that would subsequently affect diabetes management.[46,47]

Statistical Analysis

After estimating the prevalence of potential overtreatment in the entire sample, all subsequent analyses were restricted to residents who were potentially overtreated. In this restricted sample, we described resident characteristics, number of diabetes medications used, and treatment regimens overall and stratified by HbA1c categories (<6.0%, 6.0-<6.5%, 6.5%-<7.0%, and 7.0–7.5%).

We used competing risk survival methods for all time-to-event analyses to account for censoring (e.g., leaving the CLC) and competing risks (death). After describing the crude overall cumulative incidence of treatment deintensification, we then examined the crude cumulative incidence of specific hypoglycemic agents that were deintensified overall and stratified by the most common baseline treatment regimens. We then used Fine and Grey competing risk models to estimate marginal crude and adjusted risk, risk ratios, and risk differences for resident characteristics during 90 days of follow-up; 95% confidence intervals were estimated using 1,000 bootstrap samples. We concluded that all covariates sufficiently met the proportional sub-distribution hazards assumption after examining complimentary log-log transformation of the nonparametric cumulative incidence function and Schoenfeld residual plots.[37] A more detailed discussion of our statistical approach is included in the Supplementary Methods Appendix.

In sensitivity analyses, we used a 14-day gap in medication administration (as opposed to a 7-day gap) to evaluate how these definitions affected our results. All analyses were conducted using Stata version 15.0.

RESULTS

We observed potential overtreatment of diabetes in 43.9% of CLC admissions (3,056 / 6,960) for Veterans with diabetes and LLE/AD who had HbA1c measured within the first 90 days. The CLC episodes contributed a total of 306 person-years of follow-up (median follow-up: 25 days; Interquartile range [IQR]: 8–67 days). Most episodes ended with discharge (36.8%) or deintensification (35.3%), followed by censoring at 90 days (18.1%), death (8.6%), and end of data (1.3%).

Potentially overtreated residents had a mean age of 77.6 years (standard deviation: 7.9) and were predominantly male (99.1%) and non-Hispanic white (75.8%; see Table 1). Two-thirds were admitted to CLCs from hospital settings. Twenty-nine percent had advanced dementia, 13.8% had explicit documentation of end-of-life status, and 79% had MMRI≥36. Many were physically dependent (37.1%) and had cardiovascular disease and/or potential diabetes-related complications, including 8.5% with serious hypoglycemic events in the previous year.

Table 2 summarizes overall and HbA1c-stratified diabetes treatment regimens administered to potentially overtreated Veterans. Nearly half of residents received ≥2 diabetes medications and those with higher HbA1c values (6.5-<7.0% or 7.0–7.5%) received more diabetes medications than those with lower HbA1c. Overall, the most common treatment regimens were combination short-acting and basal insulins (28.6%), short-acting insulin only (16.0%), basal insulin only (13.7%), and sulfonylureas only (13.8%), though these regimens varied across HbA1c levels. Three-quarters were administered at least one agent associated with a high risk of hypoglycemia[48], defined as either short-acting insulin (56.7%) or sulfonylureas (26.4%). Use of short-acting insulin ranged from 50.7% (HbA1c 6.0-<6.5%) to 66.7% (HbA1c 7.0–7.5%).

The respective cumulative incidence of deintensification at 15, 30, 60, and 90 days of follow-up was 22.0%, 30.1%, 38.0%, and 45.5% (see Figure 1). Figure 2 provides detail on specific medications deintensified overall and after stratifying by most common baseline treatment regimens. The most common hypoglycemic medications to be deintensified overall were short-acting insulin (20.7%), followed by sulfonylureas (9.7%), basal insulin (7.2%), and non-insulin / non-sulfonylurea agents (5.6%). Deintensification of multiple medications simultaneously only occurred in 2.3% of Veterans.

Figure 3 shows selected adjusted risk ratios (aRR) for resident characteristics and deintensification at 90 days of follow-up. Higher baseline HbA1c values were associated with lower likelihood of deintensification (e.g., HbA1c 7.0–7.5% vs. <6.0%, aRR: 0.57, 95% CI: 0.50–0.66). Treatment regimens other than non-sulfonylurea oral agents (e.g., short-acting insulin only) were associated with higher likelihood of deintensification (aRR ranging from 1.31–1.88). The only exception was basal insulin which was associated with decreased likelihood of deintensification (aRR: 0.59, 95% CI: 0.52–0.66). The associations of other non-diabetes resident factors with deintensification at 90 days were not as profound: source of admission (e.g., home / assisted living versus hospital admission (aRR: 0.85, 95% CI: 0.75–0.96), explicit documentation of end-of-life prognosis (versus none; aRR: 1.12, 95% CI:1.01–1.25), obese versus normal/healthy weight (aRR: 0.88, 95% CI: 0.78–0.99), and peripheral vascular disease (vs. none; aRR: 0.90, 95% CI: 0.81–0.99)). Other characteristics including demographics, pain, functional status, other cardiovascular and diabetes-related complications, antipsychotic use, and antidepressant use had risk ratios that were not statistically significant, with ≤10% change in risk compared to the referent group, albeit with varying degrees of precision. We did not observe consistent time trends in deintensification. See Appendix Table S1 for complete model-based results including crude/adjusted risk, risk ratios, and risk differences.

In sensitivity analyses using a 14-day gap in medication administration as our definition for deintensification, associations were substantively unchanged (Table S2), although the cumulative incidences of deintensification were lower at all time points (Figure S2 - 15-day: 16.1%; 30-day: 22.9%; 60-day: 29.6%; 90-day: 36.1%).

DISCUSSION

A substantial portion of Veteran CLC residents with LLE/AD may be overtreated for management of their diabetes at the time of admission. Among those who were potentially overtreated, the cumulative incidence of deintensification was 45% within the 90 days after having an HbA1c level measured that fell below minimum levels recommended for older patients with greater comorbidity burden and reduced life expectancy. Residents with higher HbA1c values, but who were still defined as overtreated, tended to have more complex diabetes treatment regimens at baseline and were less likely to be deintensified during follow-up. The most common agents to be deintensified were those with a high risk for hypoglycemia (i.e., short-acting insulin and sulfonylureas). Overall, the medications received for management of diabetes appeared to be stronger predictors of deintensification than other resident characteristics.

This is one of the first national studies to evaluate potential overtreatment and deintensification of diabetes management in a sub-group of nursing home residents with LLE/AD. Although patterns of overtreatment and deintensification in diabetes have been described previously in the literature[14,16,17,41,42,49–51], only one investigation has examined the influence of life expectancy on diabetes management.[15] The proportion of residents who were overtreated in our sample (nearly half) aligns with previously reported estimates from large observational studies conducted in non-nursing home populations.[16,17] The fact that the frequency of potential overtreatment remains just as high in this more vulnerable population is concerning and signals a need for interventions to increase the uptake and implementation of treatment deintensification or deprescribing in other care settings (e.g. office visits and hospital stays), prior to nursing home admission. Although almost half of residents in this study eventually had their regimens deintensified after admission, it begs the question of whether this should have occurred at an earlier point in time, especially given that a striking number of potentially overtreated Veterans (8.5%) had evidence of a serious hypoglycemic event in the prior year. Although this proportion is conservative compared to prior estimates[52], it nevertheless emphasizes the importance of reducing potential overtreatment in frail older individuals and the need to screen patients at all points on the care continuum for medications with high risk for hypoglycemia.

Treatment deintensification was more strongly associated with the characteristics of each resident's treatment regimen rather than other resident-level factors. We observed that residents with higher baseline HbA1c values were less likely to have medications deintensified and those receiving medications known to have a high risk of hypoglycemia (e.g. short-acting insulin and sulfonylureas) were more likely to have their regimens deintensified. One study of deintensification conducted in the outpatient setting also found that lower HbA1c was associated with greater likelihood for deintensification, in agreement with our findings.[15] This makes sense given the potential increased risk of hypoglycemia in these patients. However, other studies of community-dwelling older adults with diabetes identified several other factors that were associated with increased likelihood for deintensification including more chronic conditions, greater frailty and more outpatient visits.[41,42] One could argue that patients with these characteristics are common among older adults in the nursing home setting and that some may actually serve as drivers of

institutionalization. Taken together, our findings indicate that in older CLC residents with LLE/AD, a population in which complex comorbidity and frailty are likely common, deintensification is not so much driven by individual clinical characteristics, but rather by a general concern for hypoglycemic adverse events that apply to all older adults.

We identified no strong time trends in terms of deintensification rates during FYs 2009–2015. This was surprising, given the increasing awareness of hypoglycemia risk associated with certain classes of medications as well as updated recommendations that have advocated for less conservative management of diabetes in older nursing home residents.[12,4–6,14] There has also been a major system-wide initiative rolled out within the VA, the VHA Choosing Wisely Hypoglycemia Safety Initiative, which aims to improve diabetes management and reduce the risk for hypoglycemic events. However, this initiative was only implemented in 2014, so it is possible that its impact is not reflected given the limited period of overlap with our data.

There are several strengths to this analysis compared to previous studies. Our sample included a large number of residents and evaluated patterns of medication use over a period of several years. We used detailed daily medication administration data (BCMA data) to characterize medication exposures. The level of granularity contained within these data allowed us to identify deintensification with greater certainty by evaluating dosages administered each day as opposed to using medication dispensing data, where the dosages and administration are assumed, based on days-supply. We also implemented statistical models that accounted for death as a competing event, which provided more accurate estimation of cumulative incidence over prior studies, given the increased likelihood for mortality in this population. Finally, our investigation focused on a clinically relevant population of nursing home residents, those with LLE/AD, who likely have the least to gain from overly intense diabetes management considering long-term benefits relative to risk for adverse events.

There are several limitations to this study that should be acknowledged. First, in using administrative data to capture medication use, we were not able to identify intentional versus unintentional discontinuation of diabetes medications. Although we can be reasonably confident that the data from BCMA records captured periods during which patients did not actually receive medication, without information on actual medication orders, we were not able to definitively discern whether gaps may have been due to temporary discontinuations. Our ability to identify Veterans as potentially overtreated was dependent on availability of HbA1c data from the electronic health record. There were a large portion of residents with diabetes who did not have HbA1c measured within the first 90 days of their stay. Although the lack of monitoring may serve as an indicator of less aggressive disease management, by excluding these individuals it is possible that we have over- or underestimated the proportion of Veterans who were potentially overtreated. We did not have complete laboratory or medication data prior to each CLC episode and we therefore have not captured deintensification that occurred prior to admission. We also used a crude definition for deintensification with regards to insulin use that did not take into account the number of units of insulin administered. This study was focused on resident-level factors and did not examine provider or facility characteristics, which may provide additional insight into

diabetes management in this setting and should be examined in future research. Finally, we acknowledge the potentially limited generalizability of our findings to non-veterans, women, or patients in other care settings (e.g. community and hospital).

CONCLUSION

This study found that a substantial portion of CLC residents with diabetes may be overtreated for management of diabetes at the time of admission, despite having LLE/AD. Deintensification of treatment regimens among occurred in just under half of potentially overtreated residents, and was more strongly associated with low HbA1c values and use of medications with high risk for hypoglycemia, rather than other resident characteristics. Future studies should examine the impact of deintensification on health outcomes and adverse events to better understand the risks and benefits of diabetes management strategies in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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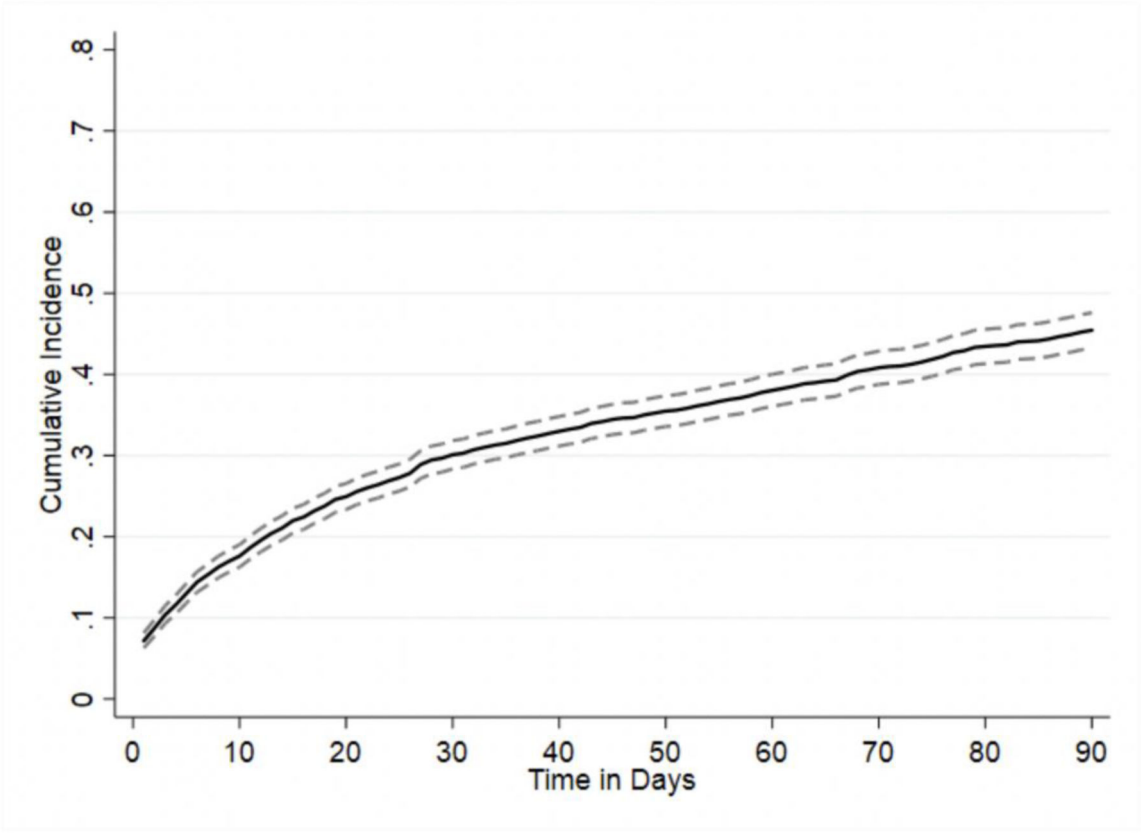
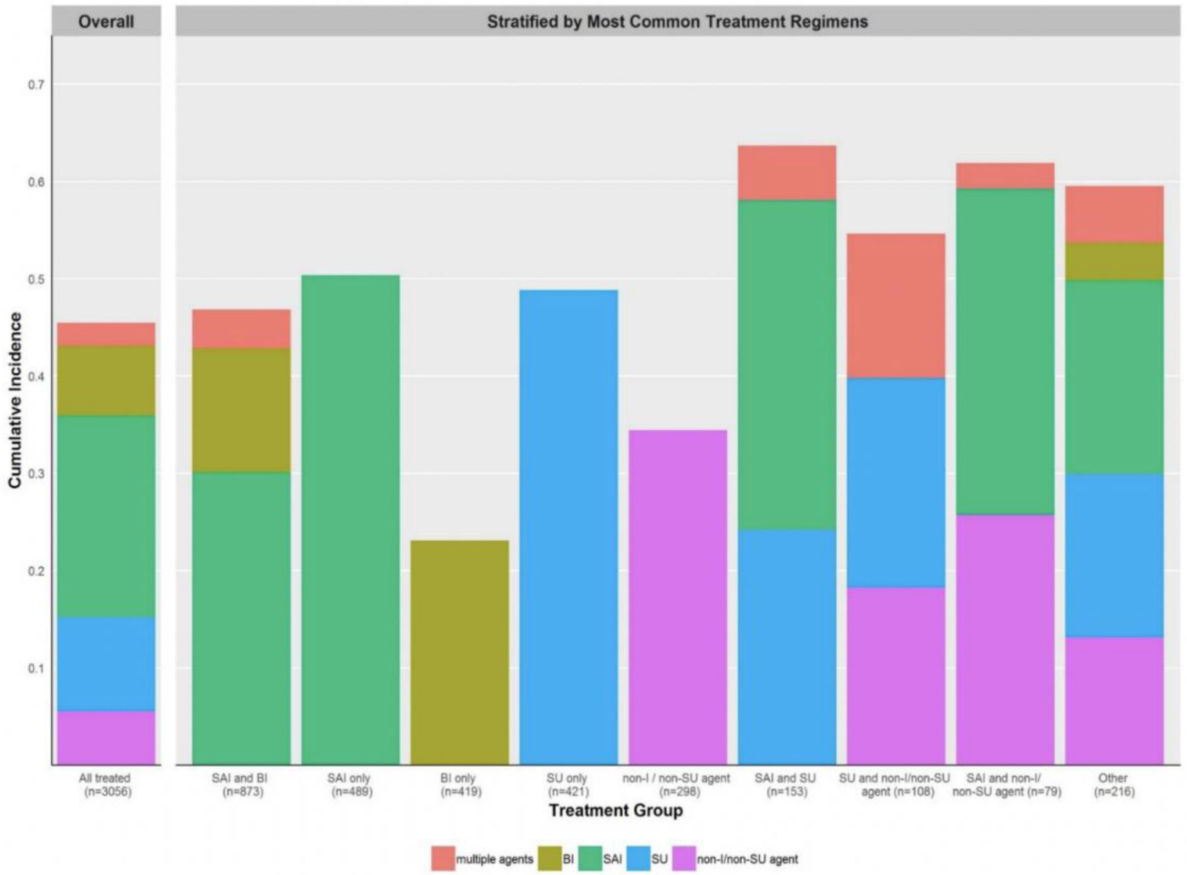


Note: solid line is non-parametric cumulative incidence estimate, dotted line is 95% confidence interval estimated from 1,000 bootstrapped samples.

Figure 1.
Cumulative incidence of diabetes treatment deintensification during 90 days of follow-up.



Abbreviations: BI, basal insulin; non-I/non-SU, non-insulin/non-sulfonylurea; SAI, short-acting insulin; SU, sulfonylurea.

Figure 2.

Crude 90-day cumulative incidence of deintensifying specific hypoglycemic medications overall and stratified by most common treatment regimens.

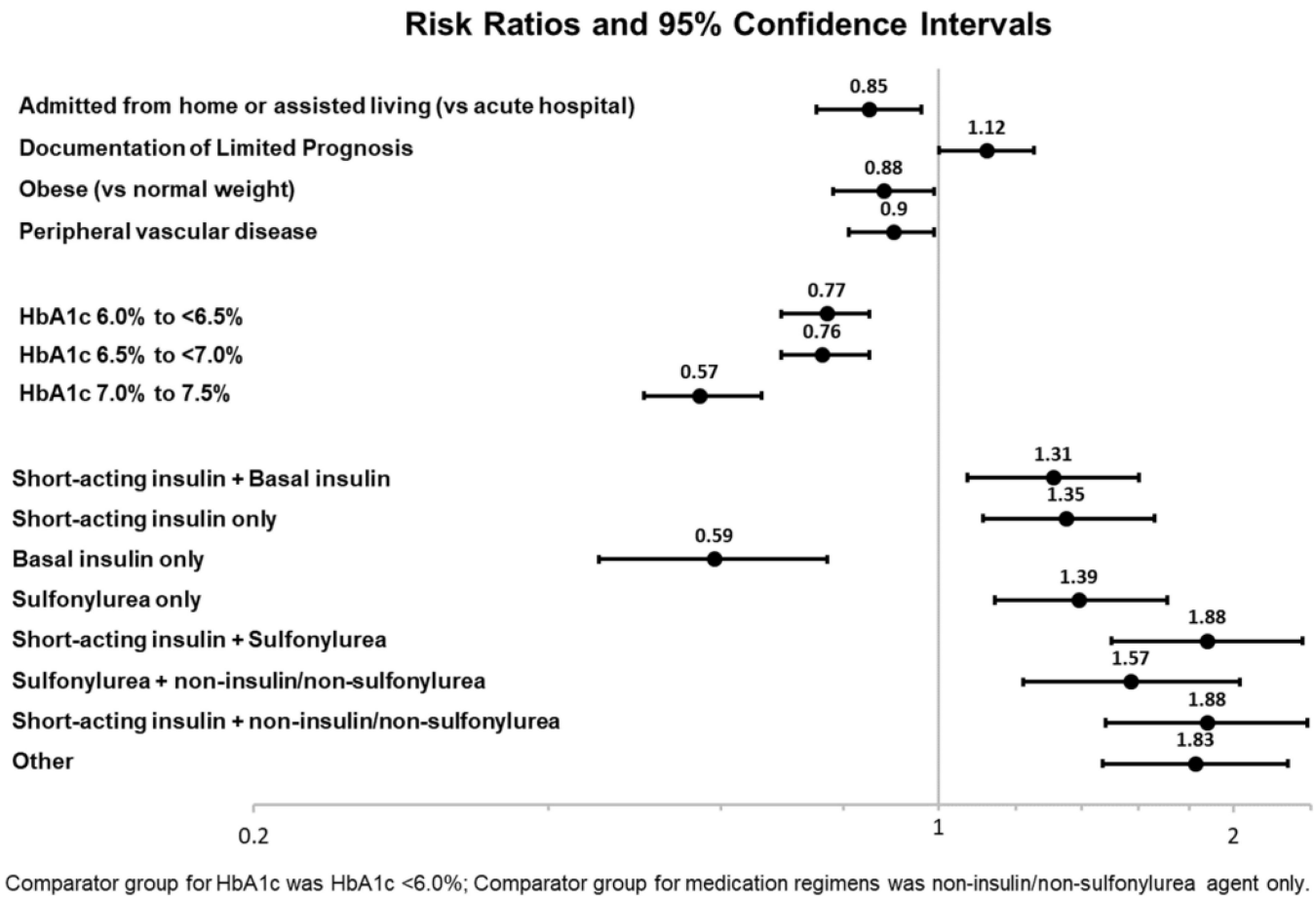


Figure 3.
Select Risk Ratios for Factors Associated with Diabetes Regimen Deintensification

Table 1.

Characteristics of older Veterans with potentially overtreated diabetes living in Community Living Centers with limited life expectancy or advanced dementia, overall and stratified by baseline HbA1c (N=3,056).

Characteristics, %	Overall (N=3,056)	Stratified by baseline HbA1c, %			
		<6.0 (n=811)	6.0-<6.5 (n=769)	6.5-<7.0 (n=816)	7.0–7.5 (n=660)
Age in years					
65–74	37.9	43.3	37.5	35.2	35.0
75–84	41.0	39.7	41.2	41.4	41.7
≥85	21.2	17.0	21.3	23.4	23.3
Racial/ethnic minority	24.2	26.1	23.1	24.1	23.0
Married	53.1	51.4	54.2	53.7	53.0
Nursing home source of admission					
Acute hospital	67.5	68.8	65.8	67.0	68.3
Home / assisted living	21.6	21.7	22.6	21.3	20.8
Nursing home	8.0	6.3	8.8	8.6	8.2
Other	2.9	3.2	2.7	3.1	2.7
End of life conditions					
Advanced dementia[1]	29.0	25.2	31.9	29.3	29.8
Documentation of end-of-life prognosis[2]	13.8	12.1	12.6	12.7	18.5
Physical functioning[3]					
Requiring extensive dependence	38.9	37.7	39.8	35.2	43.8
Physically dependent	37.1	39.3	36.8	37.9	33.8
Pain in the five days preceding MDS admission assessment	67.7	67.9	66.8	66.2	70.5
Body mass index					
Underweight	3.8	4.3	3.4	3.1	4.5
Normal or healthy weight	33.8	33.3	35.2	35.4	30.9
Overweight	32.0	33.4	31.3	31.1	32.3
Obese	30.3	29.0	30.0	30.4	32.3
Number of Elixhauser comorbidities					
0–1	8.8	9.5	7.3	9.2	9.2
2–3	21.6	18.0	22.4	25.1	20.6
4–5	30.2	28.7	29.6	31.1	31.7
≥6	39.4	43.8	40.7	34.6	38.5
Cardiovascular disease					
Coronary artery disease	68.4	67.2	68.7	69.0	68.8
Congestive heart failure	44.9	46.7	45.3	44.2	43.2
Stroke	29.0	28.1	30.7	29.3	27.7
Hypertension	95.4	95.6	95.2	96.1	94.7
Potential diabetes-related complications					
End-stage renal disease	26.8	31.7	25.6	23.2	26.5

Characteristics, %	Overall (N=3,056)	Stratified by baseline HbA1c, %			
		<6.0 (n=811)	6.0-<6.5 (n=769)	6.5-<7.0 (n=816)	7.0–7.5 (n=660)
Peripheral vascular disease	31.9	34.3	31.3	30.6	31.2
Diabetic eye disease	16.7	16.3	14.8	17.3	18.8
Lower extremity ulcers	22.6	26.0	19.6	22.5	22.0
Serious hypoglycemic event	8.5	8.9	7.2	8.5	9.8
Difficulty swallowing	18.1	19.2	19.8	17.3	15.6
Recent weight loss	48.9	53.8	49.9	49.5	41.1
History of falls / fractures	47.1	44.0	47.5	48.7	48.5
Specific medications					
Antidepressants	39.3	39.8	43.6	37.6	35.9
Antipsychotics	15.6	14.9	17.4	14.7	15.3

Abbreviations: MDS: Minimum Data Set; MMRI-R: MDS Mortality Risk Index – Revised.

[1]Advanced dementia was defined as having a Brief Interview for Mental Status score ≤7 (range: 0–15) or a Cognitive Performance Score ≥4 (range: 0–6).

[2]Documentation of end-of-life prognosis was defined as having hospice treatment specialty, receiving hospice care in the 14 days prior to the MDS admission assessment, or having ≤6 months life expectancy documented on the MDS assessment.

[3]Physical functioning was defined using the MDS Activities of Daily Living Self-Performance Hierarchy (range: 0–6) to categorize residents as being independent to requiring mild assistance (0–2), requiring extensive assistance (3–4), or being physically dependent (5–6).

Table 2.

Diabetes treatment regimens administered to older Veterans with potentially overtreated diabetes living in Community Living Centers with limited life expectancy or advanced dementia, overall and stratified by baseline HbA1c (N=3,056).[1]

Treatment Administered, %	Overall (N=3,056)	Stratified by baseline HbA1c, %			
		<6.0 (n=811)	6.0-<6.5 (n=769)	6.5-<7.0 (n=816)	7.0–7.5 (n=660)
Number of diabetes medications used					
1	53.1	61.5	59.0	50.2	39.4
2	41.9	35.6	37.8	43.6	52.1
≥3	5.0	2.8	3.1	6.1	8.5
Most common treatment regimens[2]					
Short-acting insulin and basal insulin	28.6	23.4	24.6	31.5	35.9
Short-acting insulin only	16.0	19.7	15.5	15.4	12.7
Basal insulin only	13.7	15.4	13.4	13.8	11.8
Sulfonylureas only	13.8	14.9	18.3	13.0	8.0
Non-insulin / non-sulfonylurea agent only	9.8	11.6	12.1	8.0	7.0
Short-acting insulin and sulfonylureas	5.0	4.3	5.5	3.8	6.8
Sulfonylureas and non-insulin / non-sulfonylurea agent	3.5	3.2	2.6	4.7	3.6
Short-acting insulin and non-insulin / non-sulfonylurea agent	2.6	2.8	2.5	2.0	3.2
Other regimens[3]	7.1	4.6	5.6	7.8	10.9
High-risk hypoglycemic agents	75.3	71.9	73.2	77.3	79.4
Short-acting insulin	56.7	52.9	50.7	58.2	66.7
Sulfonylurea	26.4	25.0	29.8	27.1	23.3

[1] Diabetes medications and treatment regimens were classified based on medications administered on the day of and day following the first HbA1C measurement following admission to the Community Living Center

[2] Treatment regimens were classified after grouping medications into basal insulin, short-acting insulin, sulfonylureas, and non-insulin / non-sulfonylurea hypoglycemic agents. Most common treatment regimens are mutually exclusive and add to 100%.

[3] 3Includes all other regimens with a prevalence <2.0%. Note: all other regimens contained ≥3 of basal insulin, short-acting insulin, sulfonylureas, and non-insulin / non-sulfonylurea agents except for 1) basal insulin and other non-insulin / non-sulfonylurea use (1.2%) and 2) basal insulin and sulfonylurea use (1.1%).