OBESITY AND DISPARITY IN GLYCEMIC OUTCOMES ARE PREVALENT AMONG ADULTS WITH TYPE 2 DIABETES (T2D) ON MULTIPLE DAILY INJECTIONS (MDI) OF INSULIN: A LARGE US RETROSPECTIVE COHORT STUDY

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Introduction

- Real-world studies examining glycemic outcomes in people with type 2 diabetes (T2D) on multiple daily injections (MDI) of insulin are limited
- Approximately 50-80% of people with T2D are not able to achieve recommended glycemic targets due to many reasons, including difficulties with insulin optimization, treatment adherence, and disease management[1]
- We aimed to evaluate glycemic outcomes in adults with T2D on MDI in a large, nationally representative cohort

Methods

- This retrospective observational cohort study identified US adults (aged ≥18 years) with T2D who were prescribed ≥3 daily insulin injections (MDI), in the IQVIA ambulatory electronic medical record (aEMR) dataset from 01/2017 to 07/2022, and who had hemoglobin A1c (A1c) data available.
- Glycemic outcomes included overall A1c levels and A1c levels disaggregated by total daily dose (TDD) of insulin quartiles
- Descriptive analyses evaluated demographic and clinical characteristics

Table 1. Study cohort identification

Criteria	N
1. Unique people with 1 or more T2D diagnoses[a]	3,437,290
2. Of #1, unique people with no T1D diagnosis[b]	3,350,464
3. Of #2, people aged 18 years or older on 1/1/2017	3,339,663
4. Of #3, people with ≥1 order for basal OR prandial insulin[c] from 1/1/2017 through end of study period[d]	520,847
5. Of #4, people with ≥1 basal AND ≥1 prandial insulin[c] order from 1/1/2017 through end of study period[d]	206,000
6. Of #5, people with no U-500 or premixed insulin	183,324
7. Of #6, people with ≥1 prandial insulin order[c] with frequency AND dose information available[e]	46,350
8. Of #7, people using MDI[f]	41,926
9. Of #8, number of people after excluding top and bottom 1% of TDD values[g]	**41,215**
10. Of #9, people with A1c record ≥90 days after MDI occurrence	**26,032**

[a]ICD-9-CM codes 250.x0 or 250.x2 or ICD-10-CM code E11.x
[b]ICD-9-CM codes 250.x1 or 250.x3 or ICD-10-CM code E10.x
[c]Insulin NDC codes used to identify basal and prandial insulin were for the commonly used insulin types.
[d]Last date available in aEMR dataset.
[e]Prescription records with missing or invalid information on dose quantity or frequency of administration were not included while identifying the MDI cohort. This may underestimate the MDI cohort size.
[f]MDI was defined as receiving 3 or more insulin injections per day (basal-prandial regimen).
[g]Top and bottom 1% of TDD values removed due to potential coding errors. These values were considered not clinically feasible.

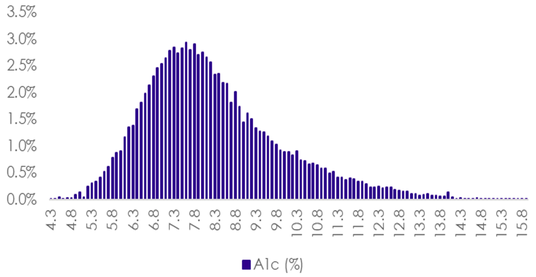
Table 2. Baseline clinical and demographic characteristics of people with T2D on MDI

Variable	Total n=26,032	A1c (%)[a]			
		< 7.0 n=5,532	≥ 7 to < 8 n=7,090	≥ 8 to < 9 n=5,818	≥ 9.0 n=7,592
Female, n (%)	13,579 (52.2)	2,810 (20.7)	3,577 (26.3)	2,987 (22.0)	4,205 (31.0)
Male, n (%)	12,453 (47.8)	2,722 (21.9)	3,513 (28.2)	2,831 (22.7)	3,387 (27.2)
Age, mean (SD)	58.5 (12.8)	59.1 (13.7)	61.2 (12.0)	59.5 (12.2)	54.7 (12.6)
BMI (kg/m^2) at index, mean (SD)	34.2 (6.7)	34.2 (6.8)	34.1 (6.6)	34.3 (6.6)	34.3 (6.7)
Weight (kg), mean (SD)	98.9 (25.1)	99.4 (25.9)	98.6 (24.6)	99.3 (25.2)	98.5 (25.0)
Race, n (%)					
African American	3,696 (14.2)	719 (19.5)	774 (20.9)	756 (20.5)	1,447 (39.2)
Asian	611 (2.4)	139 (22.7)	208 (34.0)	135 (22.1)	129 (21.1)
Caucasian	16,641 (63.9)	3,615 (21.7)	4,745 (28.5)	3,823 (23.0)	4,458 (26.8)
Hispanic	34 (0.1)	5 (14.7)	6 (17.6)	4 (11.8)	19 (55.9)
Other/unknown	5,050 (19.4)	1,054 (20.9)	1,357 (26.9)	1,100 (21.8)	1,539 (30.5)
Total daily dose (U) mean (SD)	98.5 (58.4)	84.7 (55.6)	96.1 (57.1)	104.2 (59.2)	106.4 (58.9)
A1c (%), mean (median)	8.3 (8.0)	6.4 (6.5)	7.5 (7.5)	8.4 (8.4)	10.5 (10.1)

[a]A1c category data for sex and race are presented as row percentages.

- **People with T2D using MDI were prescribed a mean TDD of 98.5 U and had a mean A1c of 8.3% (median A1c of 8.0%).**
- **People with A1c < 7.0% were prescribed a mean TDD of 84.7 U, while people with A1c ≥ 9.0% had a mean TDD of 106.4 U.**

Figure 1. Distribution of A1c among people with T2D on MDI



- **The A1c values among people with T2D on MDI in this study ranged from 4.2% to 15.9%, with a mean of 8.3%.**
- **About 78.7% of people with T2D on MDI had an A1c ≥ 7.0%.**

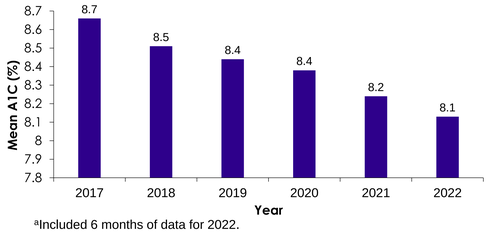
Table 3. Glycemic control among people with T2D on MDI, overall and by insulin total daily dose (TDD) quartile

Measure	Total n=26,032	TDD quartile[a]			
		Quartile 1 n=5,997	Quartile 2 n=6,382	Quartile 3 n=6,789	Quartile 4 n=6,864
Total daily dose (U), mean (SD)	98.5 (58.4)	39.0 (9.1)	66.8 (7.9)	100.4 (12.2)	178.2 (47.6)
A1c (%), mean (SD)	8.3 (1.7)	7.9 (1.7)	8.3 (1.7)	8.5 (1.7)	8.6 (1.7)
A1c (%), median (IQR)	8.0 (2.1)	7.6 (1.9)	8.0 (2.2)	8.2 (2.1)	8.3 (2.1)
A1c (%), range	4.2-15.9	4.2-15.8	4.5-15.6	4.5-15.3	4.6-15.9
A1c, n (%)					
< 7.0%	5,532 (21.3)	1,922 (32.1)	1,369 (21.5)	1,189 (17.5)	1,052 (15.3)
7.0% to 7.9%	7,090 (27.2)	1,718 (28.7)	1,797 (28.2)	1,808 (26.6)	1,767 (25.7)
8.0% to 8.9%	5,818 (22.4)	1,113 (18.6)	1,370 (21.5)	1,620 (23.9)	1,715 (25.0)
9.0% to 9.9%	3,412 (13.1)	581 (9.7)	822 (12.9)	972 (14.3)	1,037 (15.1)
≥ 10.0%	4,180 (16.1)	663 (11.1)	1,024 (16.1)	1,200 (17.7)	1,293 (18.8)

[a]Patients (n=41,215) were previously stratified by TDD quartiles; 26,032 patients with A1c values were included in the A1c analysis

- **Mean A1c values ranged from 7.9% in TDD quartile 1 to 8.6% in TDD quartile 4.**
- **Overall, 21.3% of people had an A1c of < 7.0%, 49.6% of people had an A1c of 7.0% to 8.9%, and 29.2% of people had an A1c of ≥ 9.0%.**

Figure 2. Mean A1C among people with T2D on MDI, 2017-2022[a]



[a]Included 6 months of data for 2022.

- **On average, there was a decline in average A1c year over year in the study cohort of people with T2D on MDI.**
- **Mean A1c decreased from 8.7% in 2017 to 8.1% in 2022.**

Key Findings

- Overall, the mean and median A1c among people with T2D on MDI were 8.3% and 8.0%, respectively, indicating that most people with T2D on MDI have suboptimal glycemic control.
- About half (52%) of people with T2D on MDI were women, and nearly two-thirds (64%) were Caucasian.
- Overall, 21% of people had A1c levels <7.0%, 50% had A1c levels of 7.0% to 8.9%, and 29% had A1c levels ≥9.0%.
- Mean TDD was higher among people with A1c ≥9% (TDD 106.4 ±58.9 U) than among people with A1c <7.0% (TDD 84.7 ±55.6 U).
- Approximately 39% of African American, 27% of Caucasian, and 21% of Asian individuals had A1c ≥ 9.0%.
- Obesity, as evidenced by a mean BMI of 34, was consistent across the A1c categories.
- Our real-world findings highlight the need for additional research to close the diabetes care disparity.

21% Of people had **A1c of <7.0%**

50% Of people had **A1c of 7.0–8.9%**

29% Of people had **A1c of ≥9.0%**

39% Of African American individuals compared with

27% Of Caucasian individuals had A1c of ≥9.0%

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Abbreviations

aEMR, ambulatory electronic medical records
BMI, body mass index
MDI, multiple daily injections of insulin
T1D /T2D, type 1 / type 2 diabetes
TDD, total daily dose of insulin

References

1. Giugliano D, et al. Diabetes Care 2011;34(2):510-517.

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