Current GMI can over diagnose prediabetes with updated GMI and TITR mitigating this risk

Ramzi A. Ajjan[1], Timothy C. Dunn[2], Yongjin Xu[2], Pratik Choudhary[3], Richard M. Bergenstal[4]

[1] Leeds Institute of Cardiovascular and Metabolic Medicine, University of Leeds, UK

[2] Clinical Affairs, Abbott Diabetes Care, Alameda, CA, USA

[3] Diabetes Research Centre, University of Leicester, Leicester, UK

[4] International Diabetes Center, HealthPartners Institute, Minneapolis, MN, USA

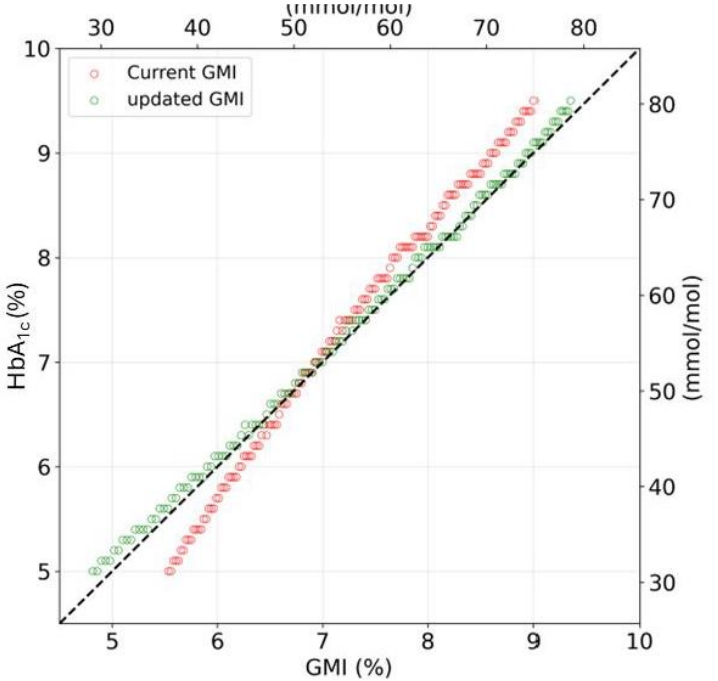
Disclosures

Company Name	Honoraria/ Expenses	Consulting/ Advisory Board	Funded Research	Royalties/ Patent	Stock Options	Ownership/ Equity Position	Employee
Abbott	x	x	x				
AstraZeneca	x	x					
Bayer	x	x	x				
Boehringer Ingelheim	x	x					
Bristol-Myers Squibb	x	x					
Dexcom		x					
Eli Lilly	x	x	x				
Glaxo SmithKline	x	x					
Menarini Pharmaceuticals	x	x					
Merck Sharp & Dohme	x	x					
NovoNordisk	x	x	x				
Roche			x				
Takeda	x	x	x				

This work is funded by Abbott Diabetes Care

Background

- HbA1c is used for the diagnosis of prediabetes and diabetes
- Role of continuous glucose monitoring (CGM)-derived glucose management indicator (GMI) in the diagnosis of prediabetes and diabetes remains unclear, particularly given the inaccuracy of this metric at glucose levels
- Also, it is unclear whether other CGM-derived metrics can be used for the diagnosis of abnormal glucose metabolism



Bergenstal, ATTD 2026

Aims

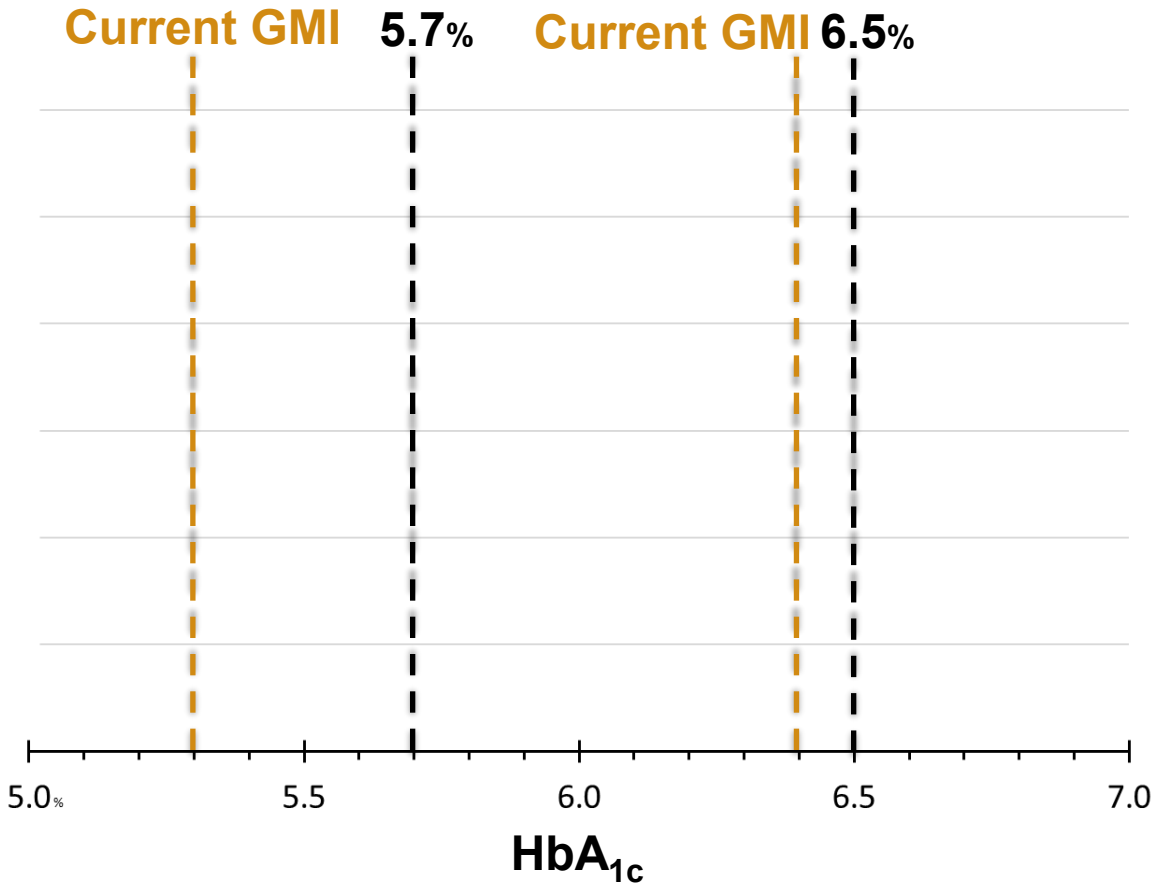
Determine CGM-derived metric in normoglycaemia, prediabetes and diabetes, including:

- **GMI**: calculated as $GMI = 0.02392*AG+3.31$
- **Updated GMI:** $uGMI = (15.36/AG+0.0426)^{-1}$
- **TIR:** 70-180 mg/dL or 3.9-10.0 mmol/L
- **TITR:** 70-140 mg/dL or 3.9-7.8 mmol/L

Materials and Methods

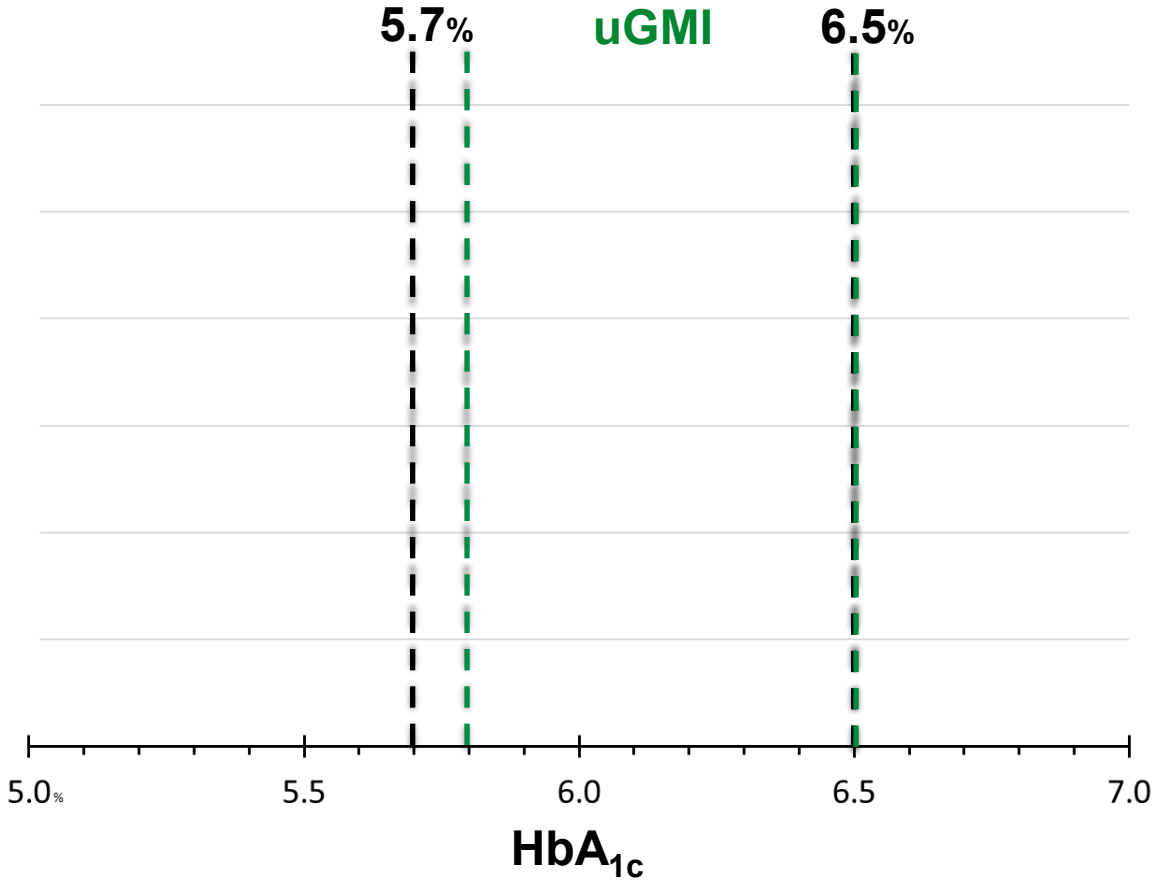
- De-identified 56-day CGM data were linked with corresponding laboratory HbA1c
  - N=88,097 data points, from 17,934 diabetes patients
- Included those with coefficient of variation <20% to reflect early stage dysglycaemia
  - N=9,801 data points from 2,561 subjects (T1D 84, T2D 674, unknown 1,803)
- Averages were calculated over rank-ordered AG and HbA1c
- TIR and TITR were evaluated across the range of HbA1c, GMI, and updated GMI, with special attention to clinically relevant cut-offs of 5.7% and 6.5%

Results – current GMI and uGMI



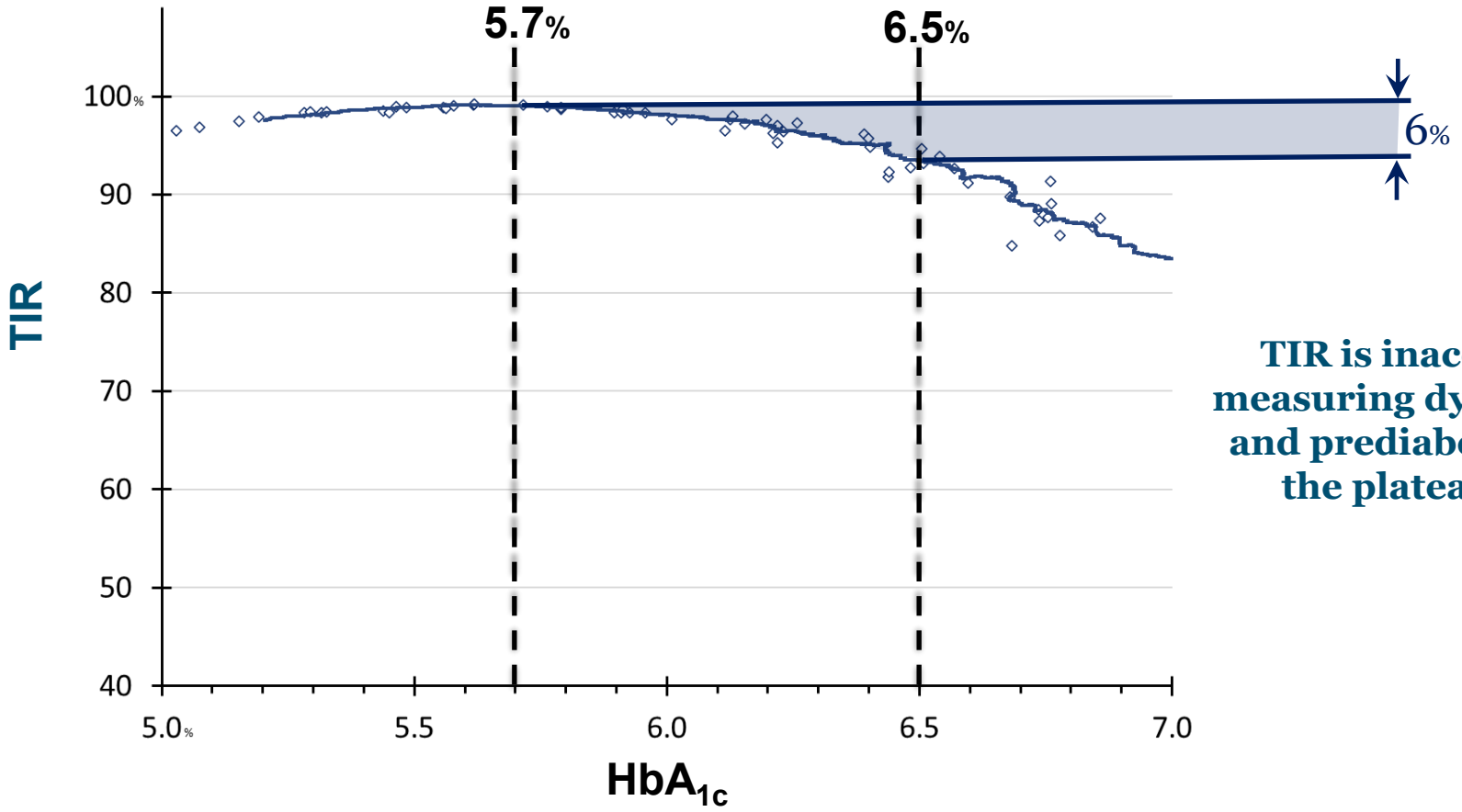
Prediabetes	
GMI	HbA1c
5.7%	5.3%
6.0%	5.7%

Results – uGMI



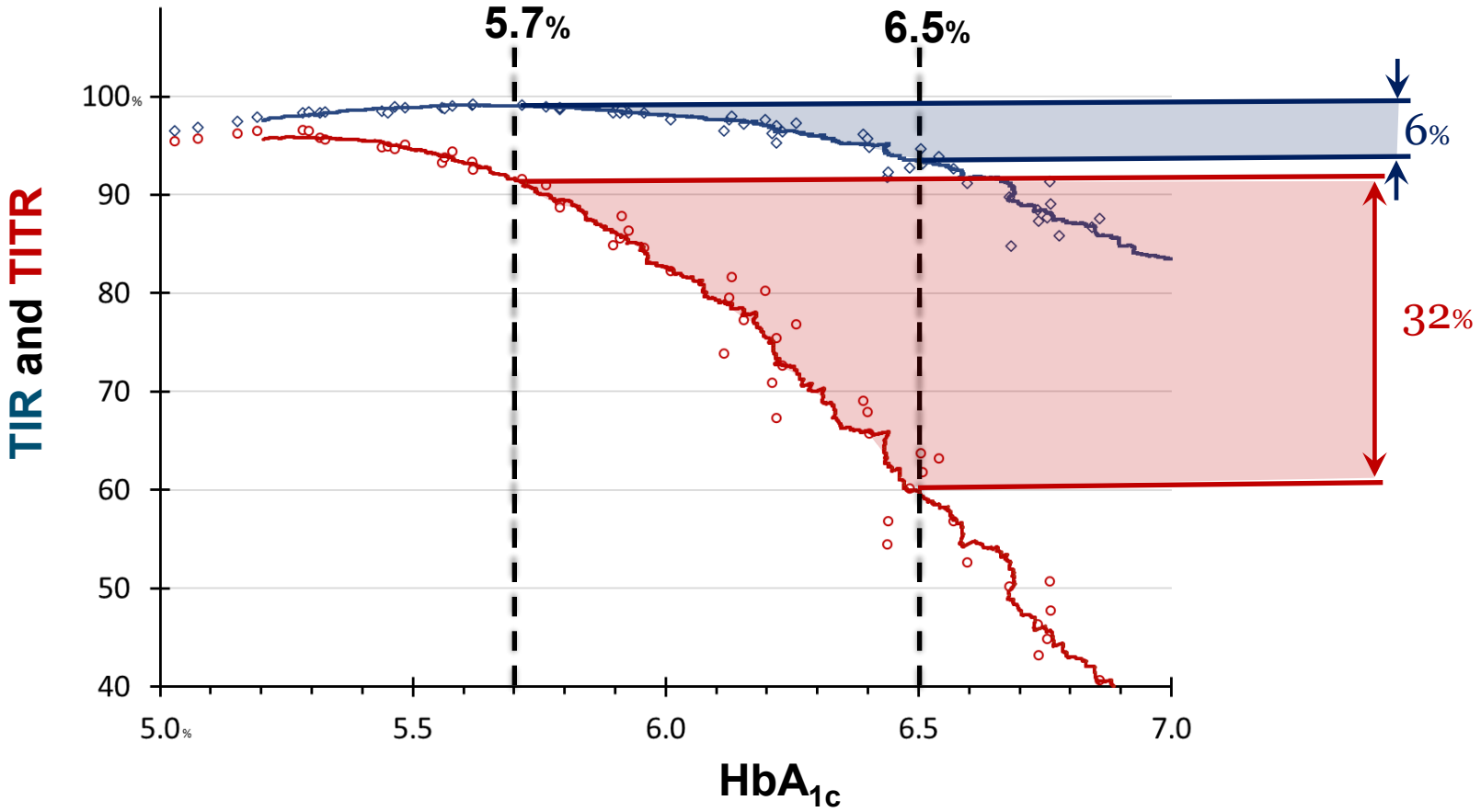
Prediabetes	
uGMI	HbA1c
5.7%	5.8%
5.6%	5.7%

Results – TIR & TITR

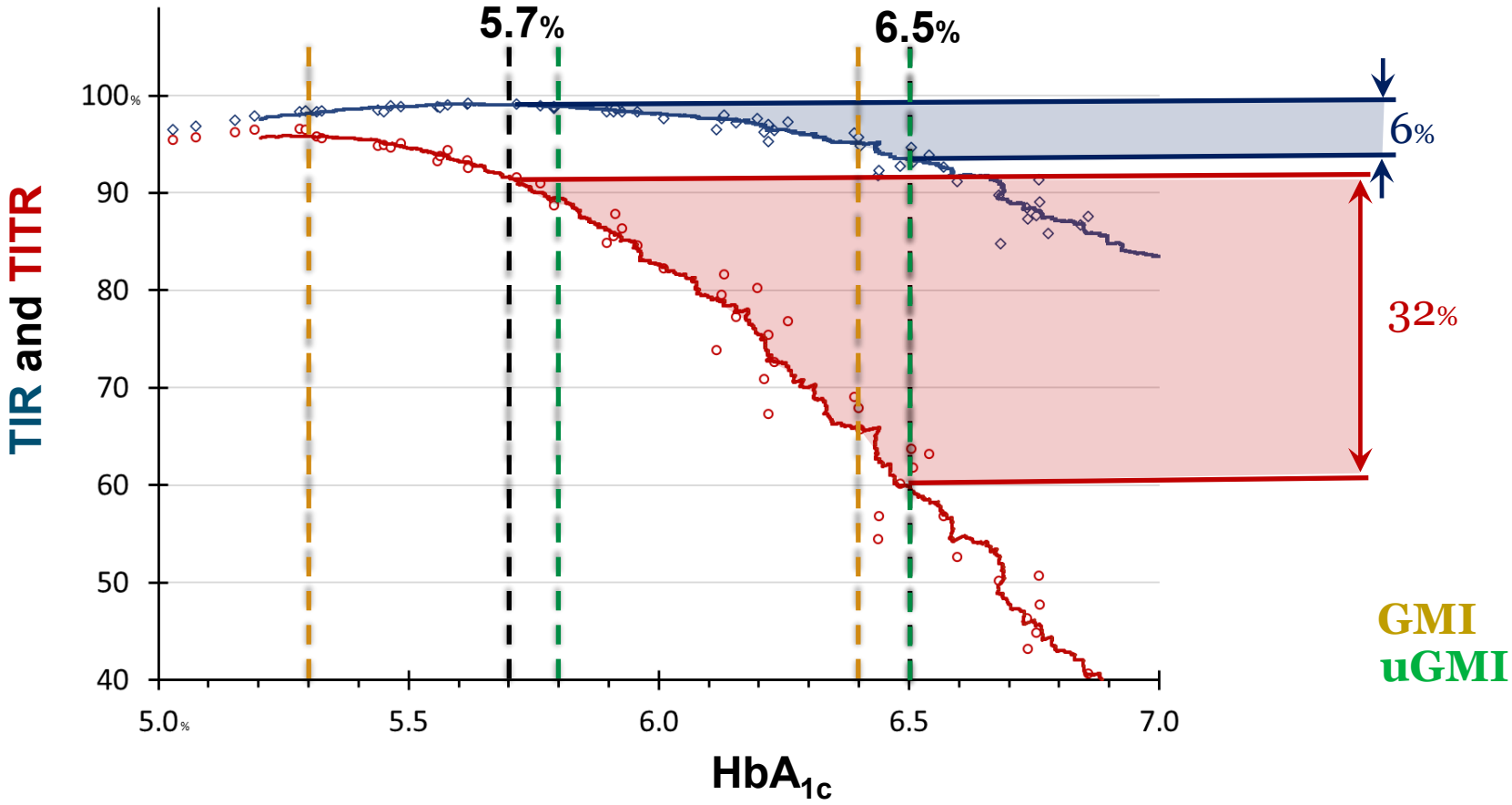


TIR is inaccurate at measuring dysglycaemia and prediabetes due to the plateau effect

Results – TIR & TITR

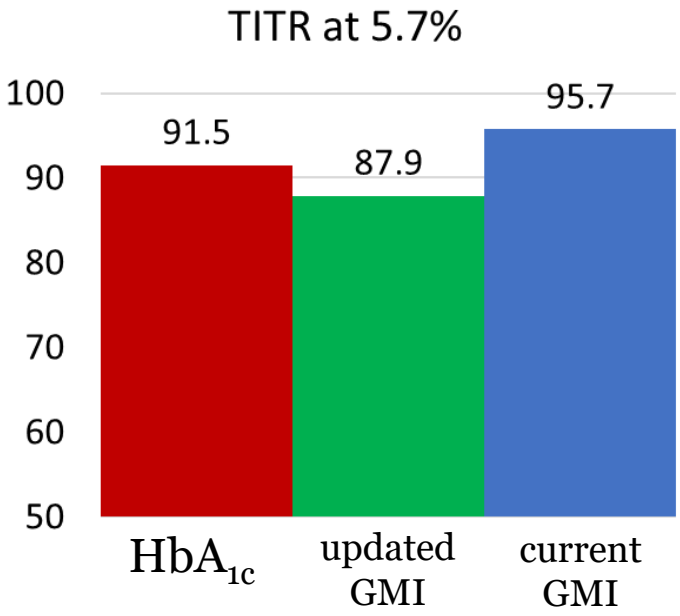


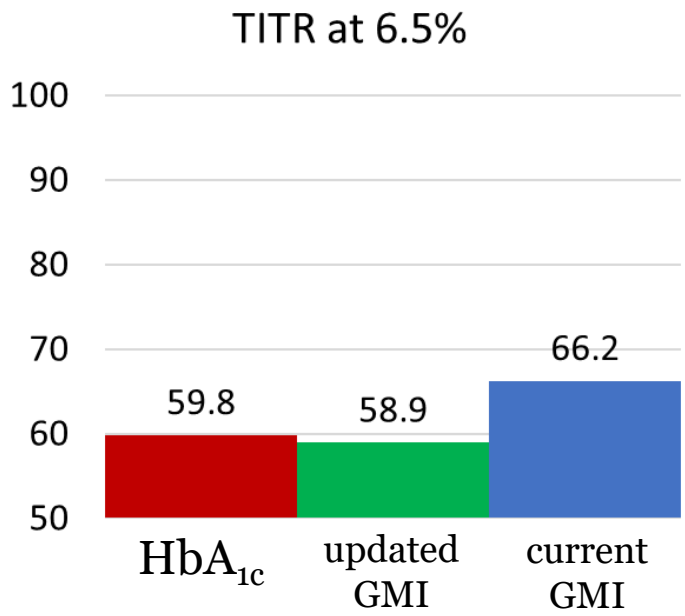
Results – TIR & TITR, GMI & uGMI



Results – TITR and HbA1c/GMI/uGMI

(TIR excluded as it has no role)





	HbA_{1c}	uGMI	TITR	GMI
Prediabetes	**5.7**	**5.6**	**91.5**	***6.0***
Diabetes	**6.5**	**6.5**	**59.8**	***6.6***

Conclusions

- Current GMI fails to reflect normoglycaemia and can over-diagnose prediabetes and, to a lesser degree, diabetes
- The uGMI is more accurate than GMI at diagnosing both prediabetes and diabetes, as it aligns more closely with HbA1c
- TIR is not a useful marker for assessing normoglycaemia and should be replaced by TITR
- Provided CV<20%, TITR can distinguish between:
  - Normoglycaemia: TITR≥92%
  - Prediabetes: TITR<92% and >60%
  - Diabetes: TITR≤60%

Thank you for your attention

Questions?