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HOW EFFECTIVE IS CONTINUOUS GLUCOSE MONITORING? CUMULATIVE META-REGRESSION ANALYSIS

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IEEE 28thInternational Conference on Intelligent Engineering Systems 2024 INES 2024
July 17-19, 2024 Gammarth, Tunisia.

Project ID: TKP2021-NKTA-36

NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE
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PROJECT FINANCED FROM THE NRDI FUND

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Background

Over the last two decades , more than 40 systematic reviews were published on the efficacy of CGM examining different patient groups, settings , disease types and CGM devices types.

However, it is not clear whether additional published evidence have added to knowledge regarding the efficacy of CGM over time.

Cumulative meta-analysis and meta-regression are popular techniques, but cumulative meta-regression has not been reported in the literature yet.

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Aims

To assess the stability of the efficacy outcome of CGM studies over time and to explore whether new published evidence have added to knowledge

Using the novel cumulative meta-regression analysis to explore how the evidence has developed with respect to explanatory variables for the heterogeneity of CGM efficacy

To understand how the reporting quality affects the certainty of evidence.

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Systematic review of systematic reviews

40 meta-analyses

79 eligible studies

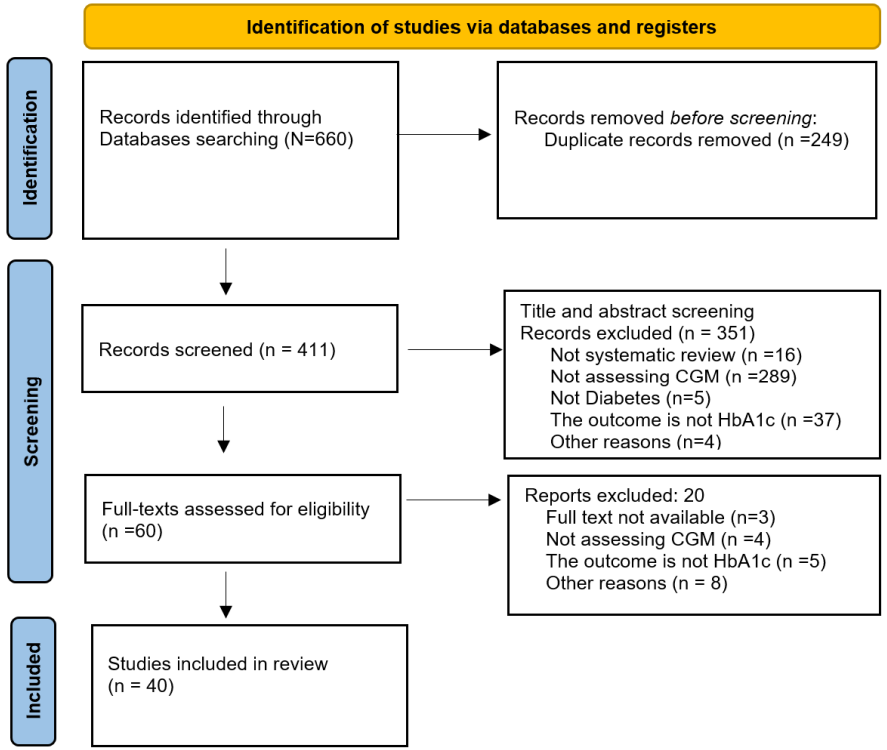
Overall 78261 patients

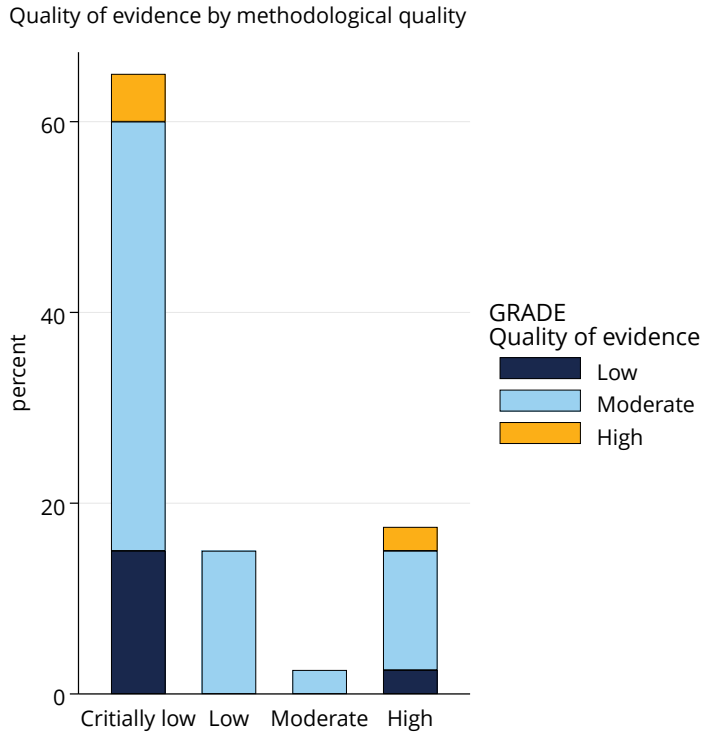
Quality of evidence

High in 3/40 (7.5%)

Methodological quality

High in 7/40 (17.5%)





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Methods

All studies compared CGM with self-monitoring of blood glucose (SMBG)

Studies varied in terms of type of diabetes (1 or 2), type of CGM (continuous, intermittent), insulin treatment, and age (adults, children). Study characteristics were included as covariates in meta-regression.

Effect size: absolute difference in the change of Hb1Ac from baseline

Standard error of effect size:

$$SE_{ES} = \sqrt{\frac{sa_t^2 + sb_t^2 - 2 * r_t * sa_t * sb_t}{n_t} + \frac{sa_c^2 + sb_c^2 - 2 * r_c * sa_c * sb_c}{n_c}}$$

(imputed in over half of the studies, r_t and r_c were derived via meta-analysis from reported studies)

Cumulative meta-regression

Mean effect size
at zero covariates

Sampling variance
of study k

$$\hat{\theta}_k = \theta + \beta x_k + \epsilon_k + \zeta_k$$

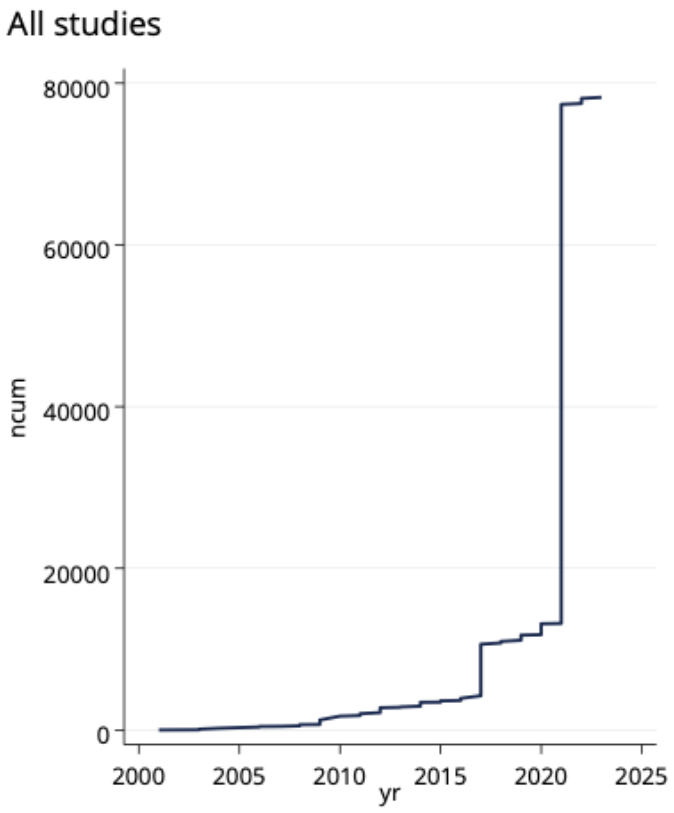
Observed effect
size of study k

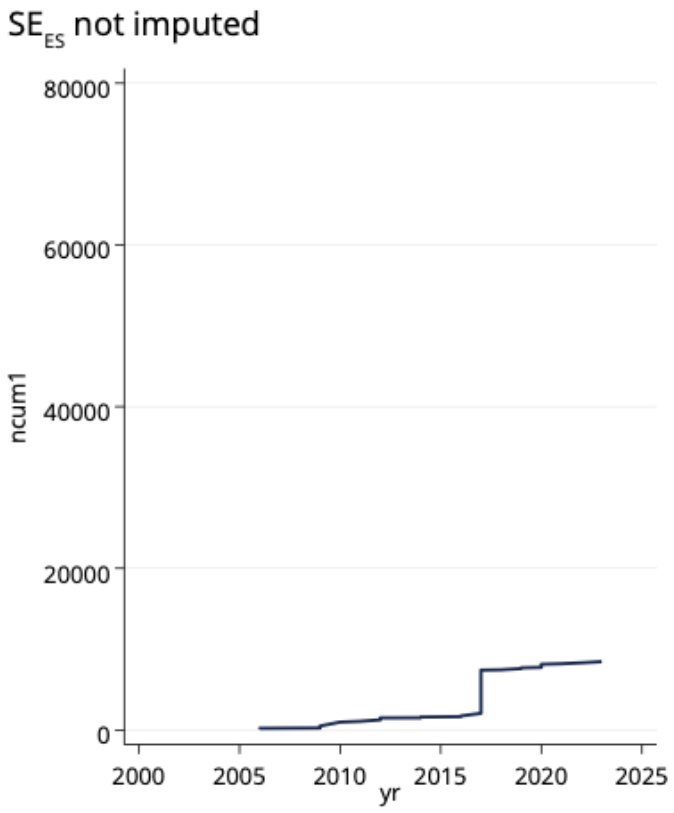
Study level covariates
and their coefficients

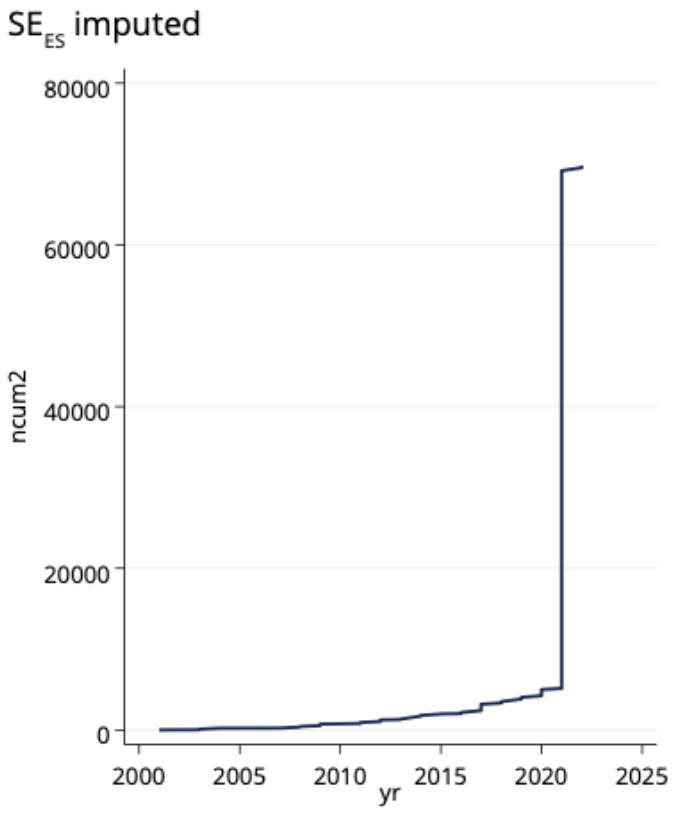
Residual heterogeneity
of the effect size of study k
not explained by the covariates

The meta regression is run by consecutively adding studies one by one until the last one, starting from the first study in time where the variance of all covariates is greater than zero.

Cumulative number of patients







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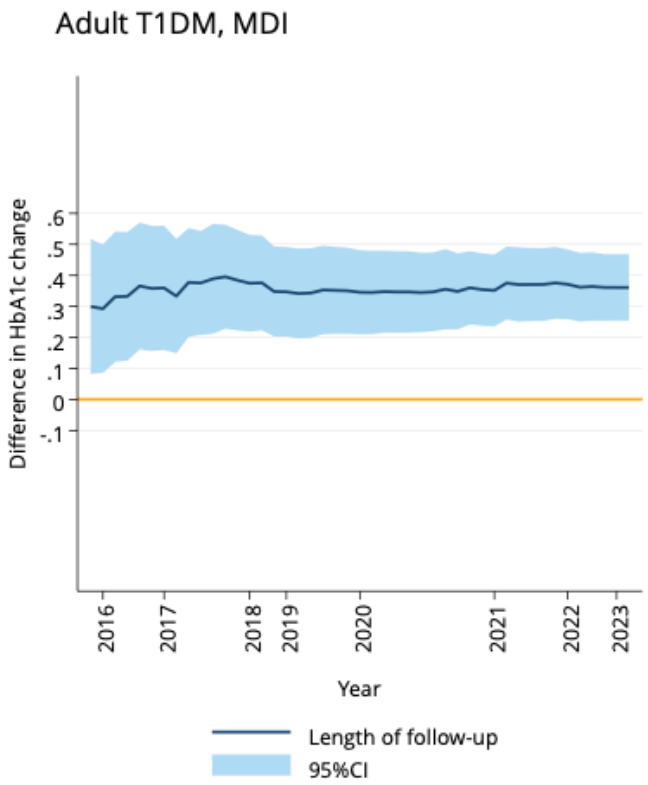
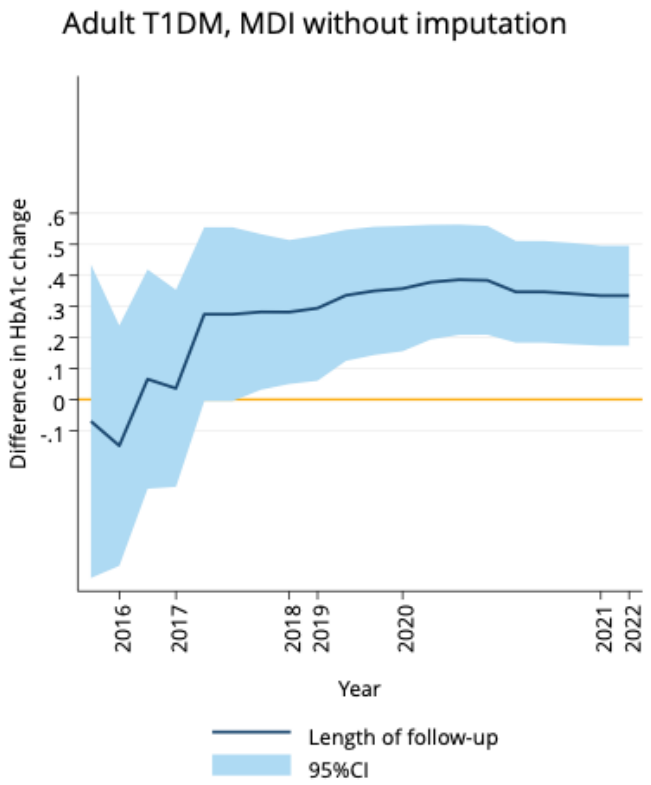
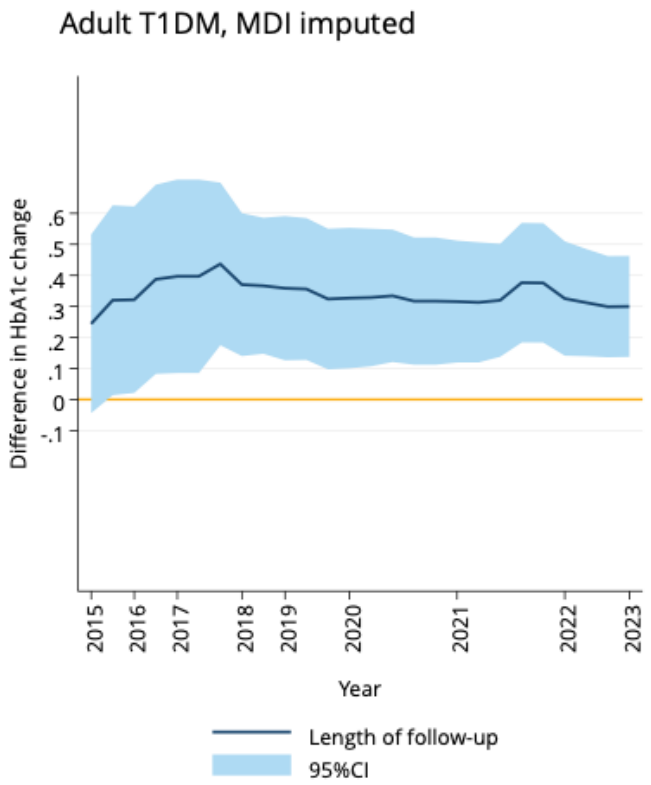
Adults, Type 1 diabetes, multiple daily insulin







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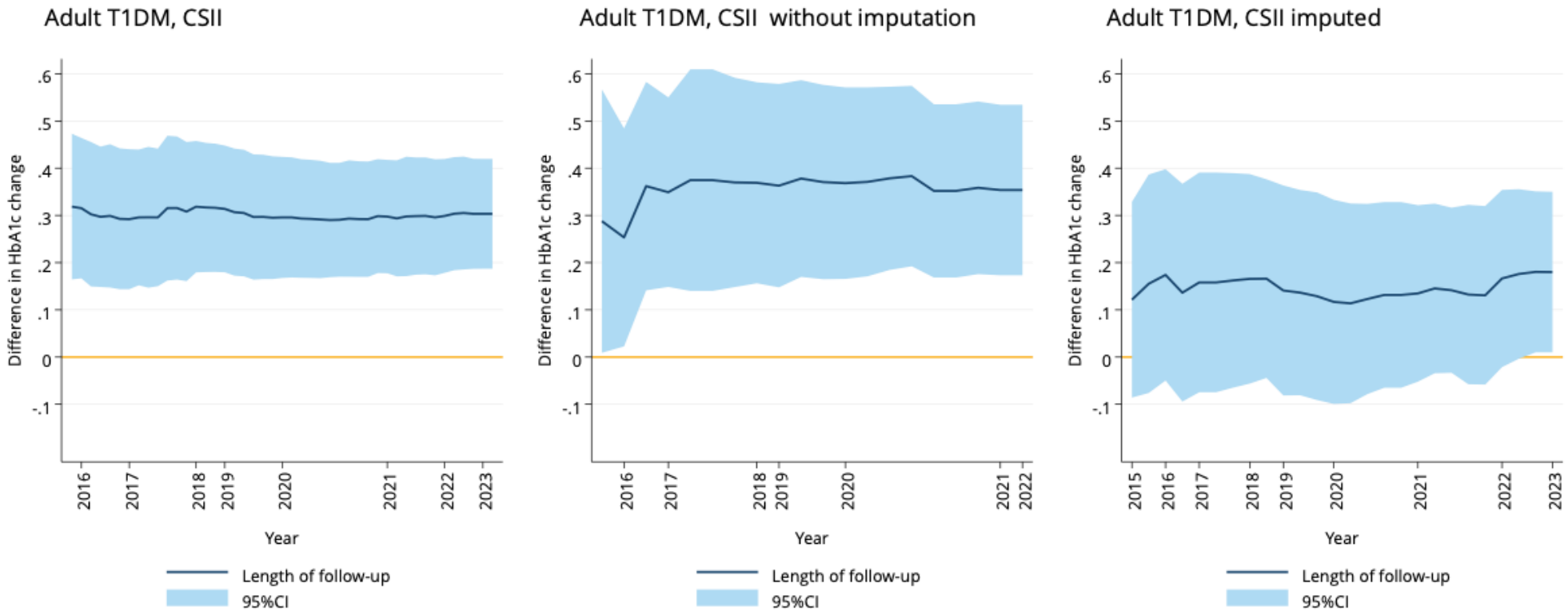
Adults, Type 1 diabetes, continuous subcutaneous insulin infusion



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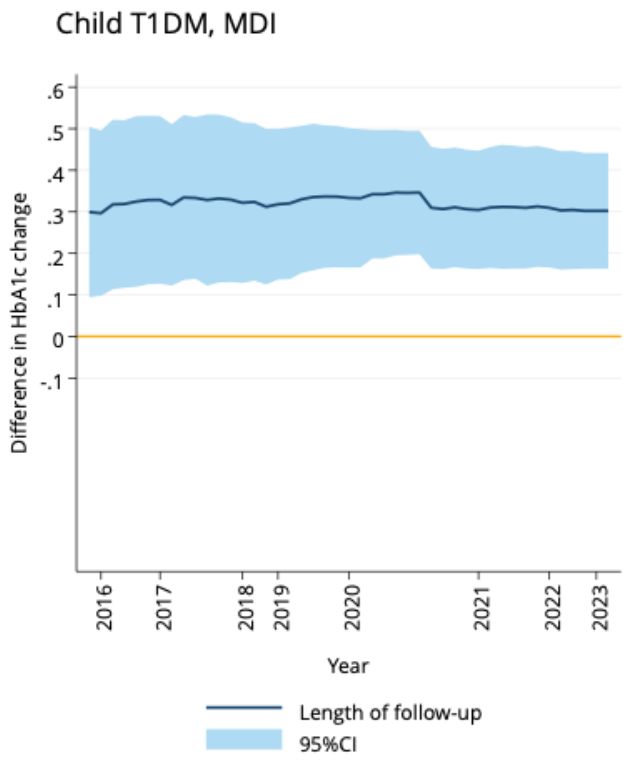
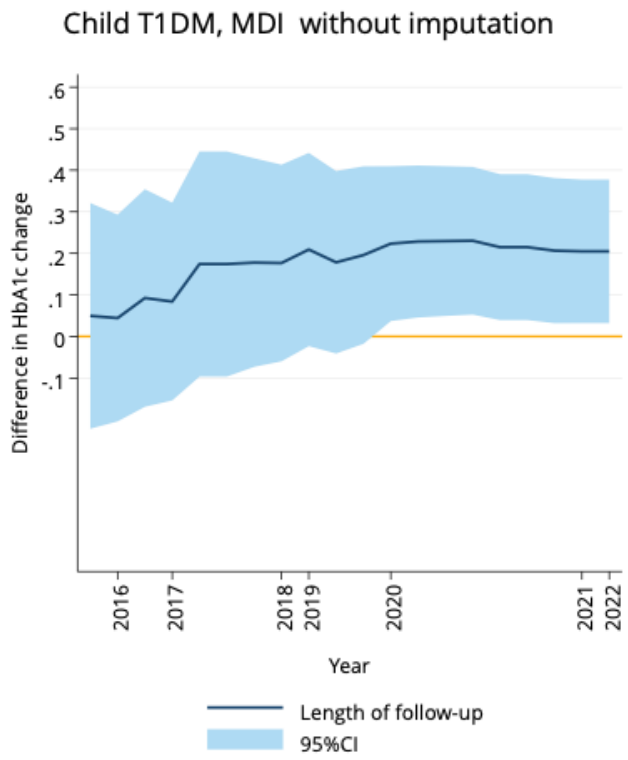
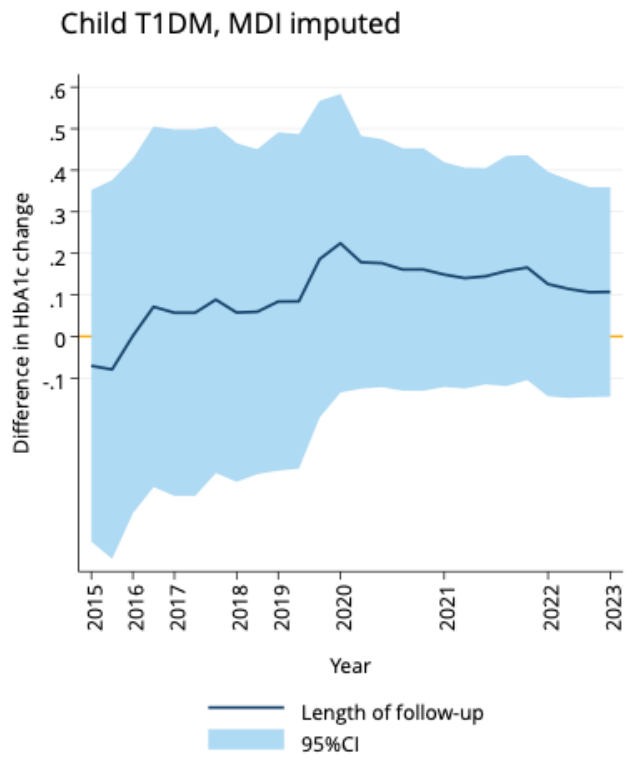
Children, Type 1 diabetes, multiple daily insulin







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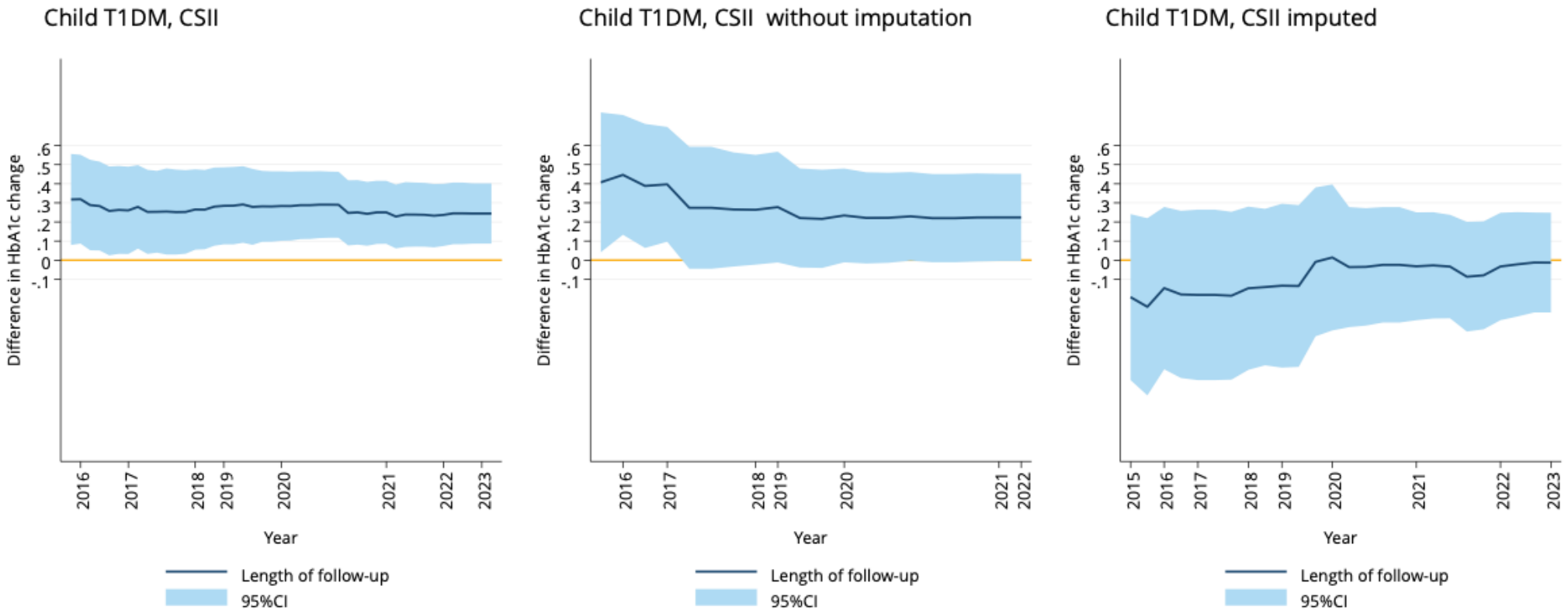

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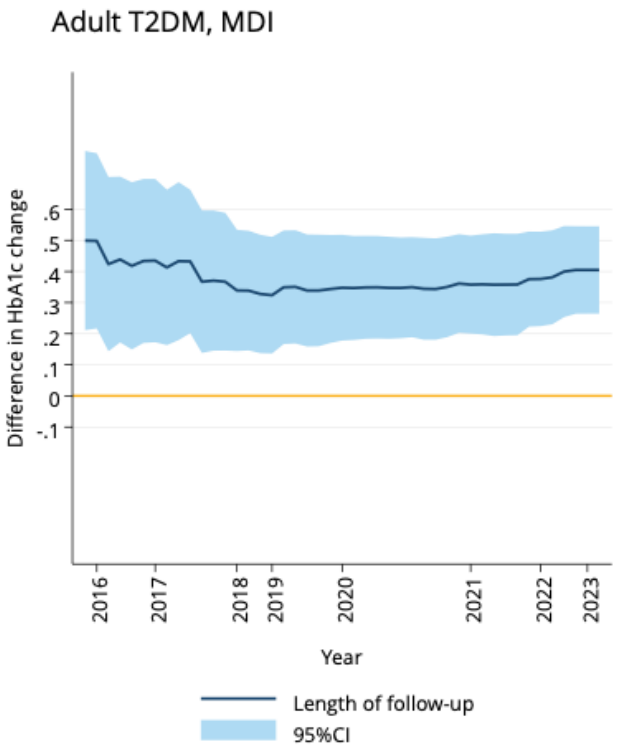
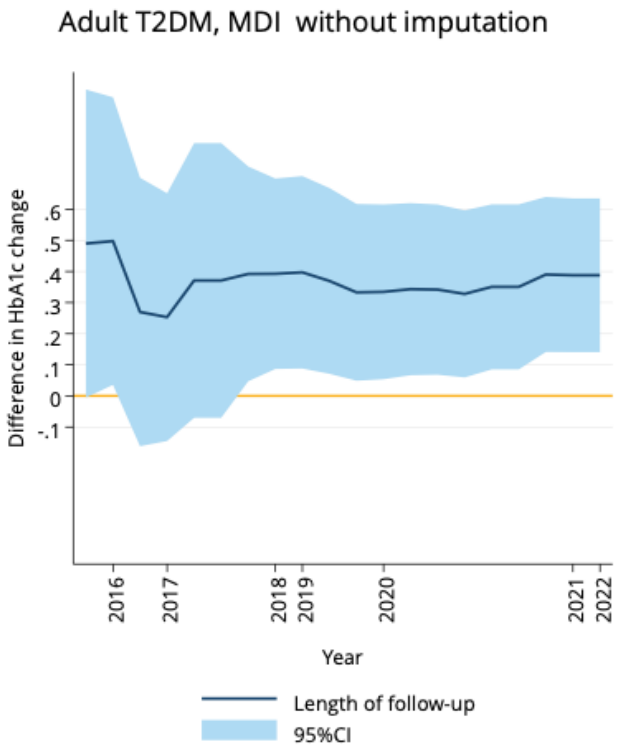
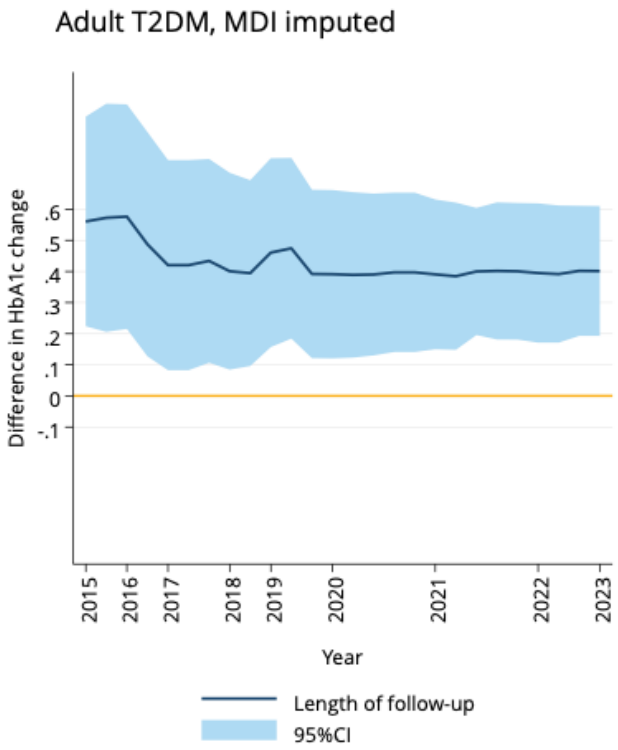
Adults, Type 2 diabetes, multiple daily insulin







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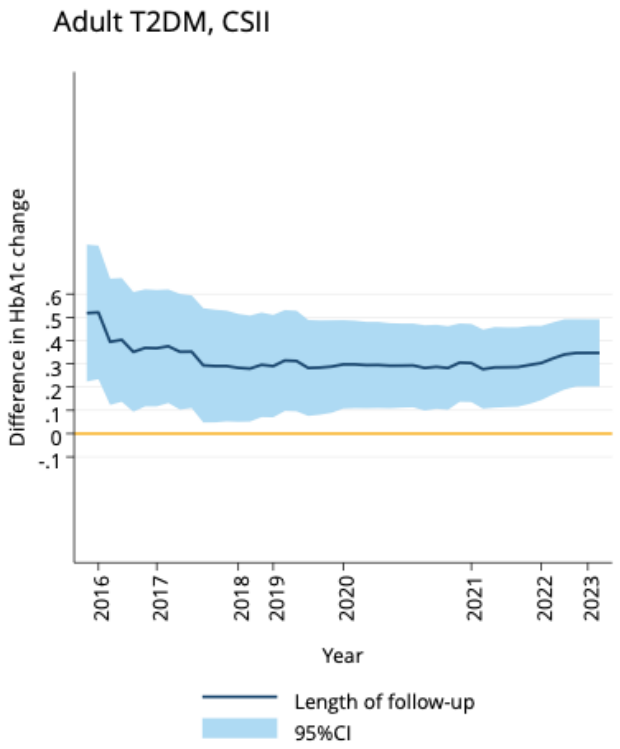
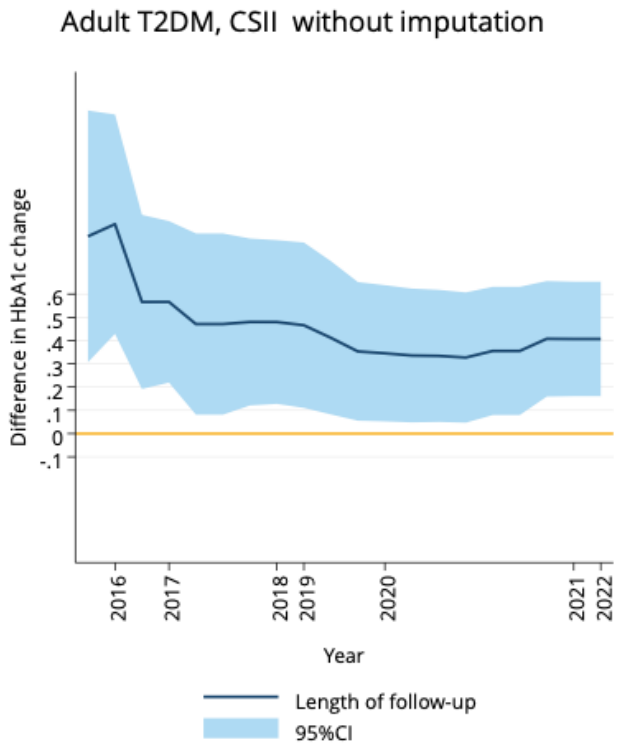
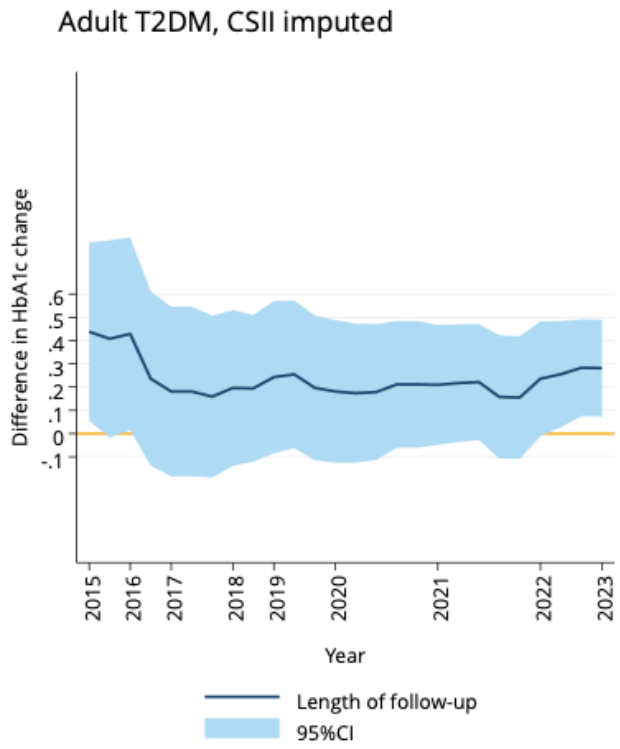
Adults, Type 2 diabetes, continuous subcutaneous insulin infusion







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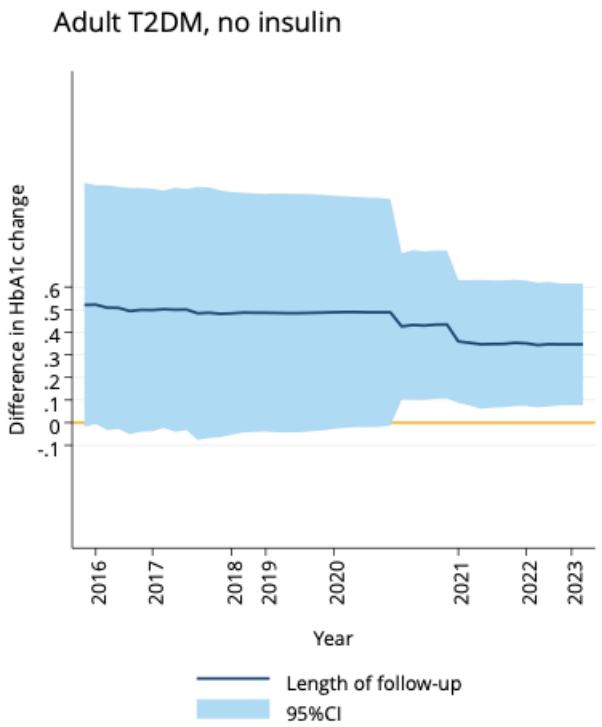
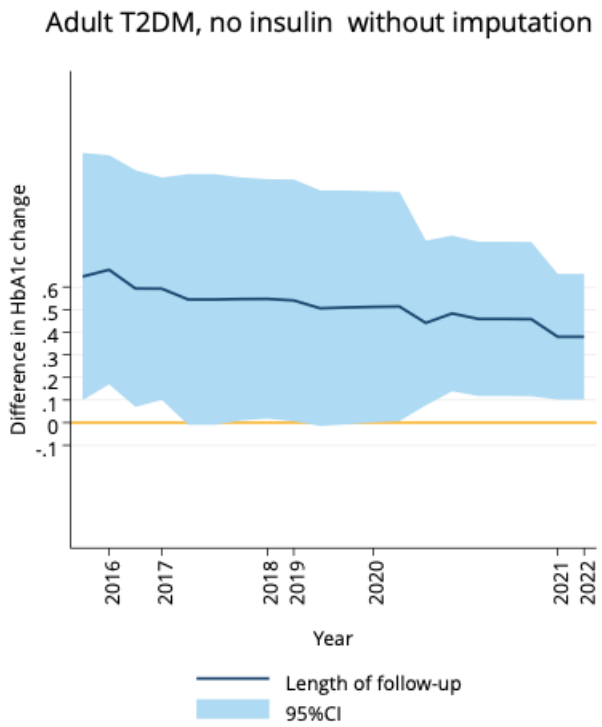
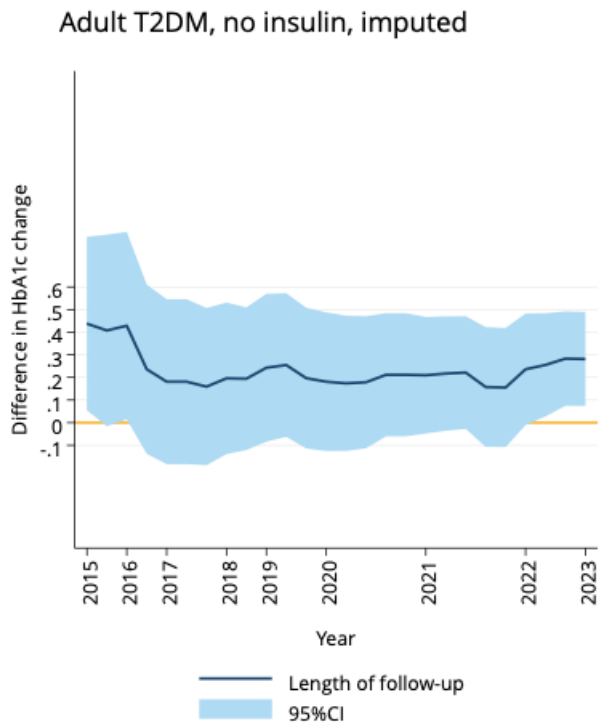
Adults, Type 2 diabetes, without insulin therapy







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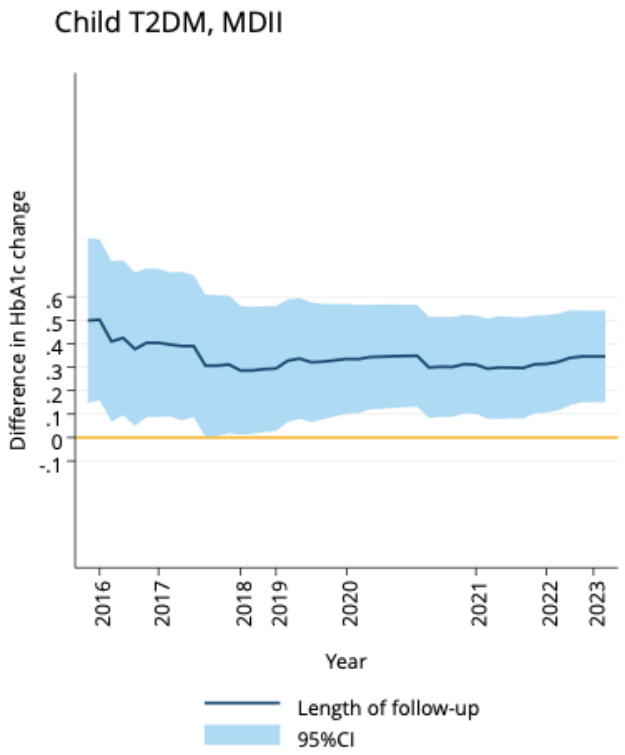
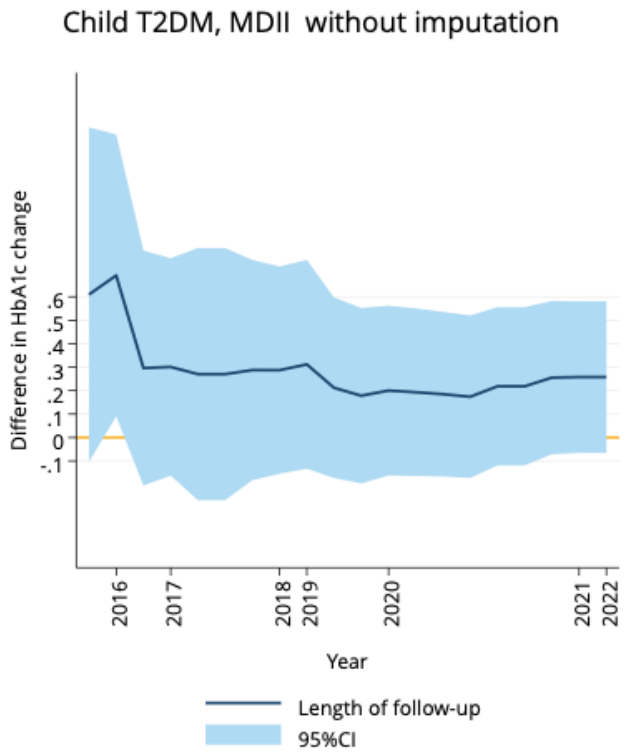
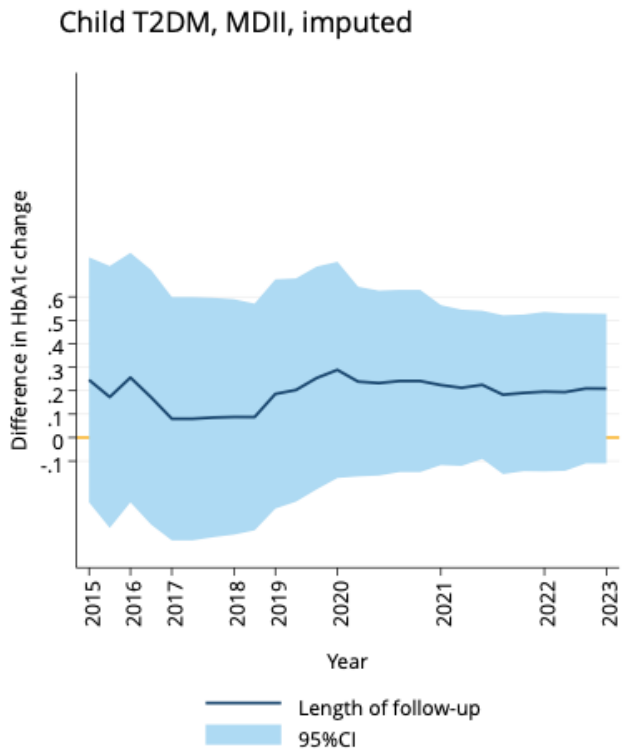
Children, type 2 diabetes, multiple daily insulin







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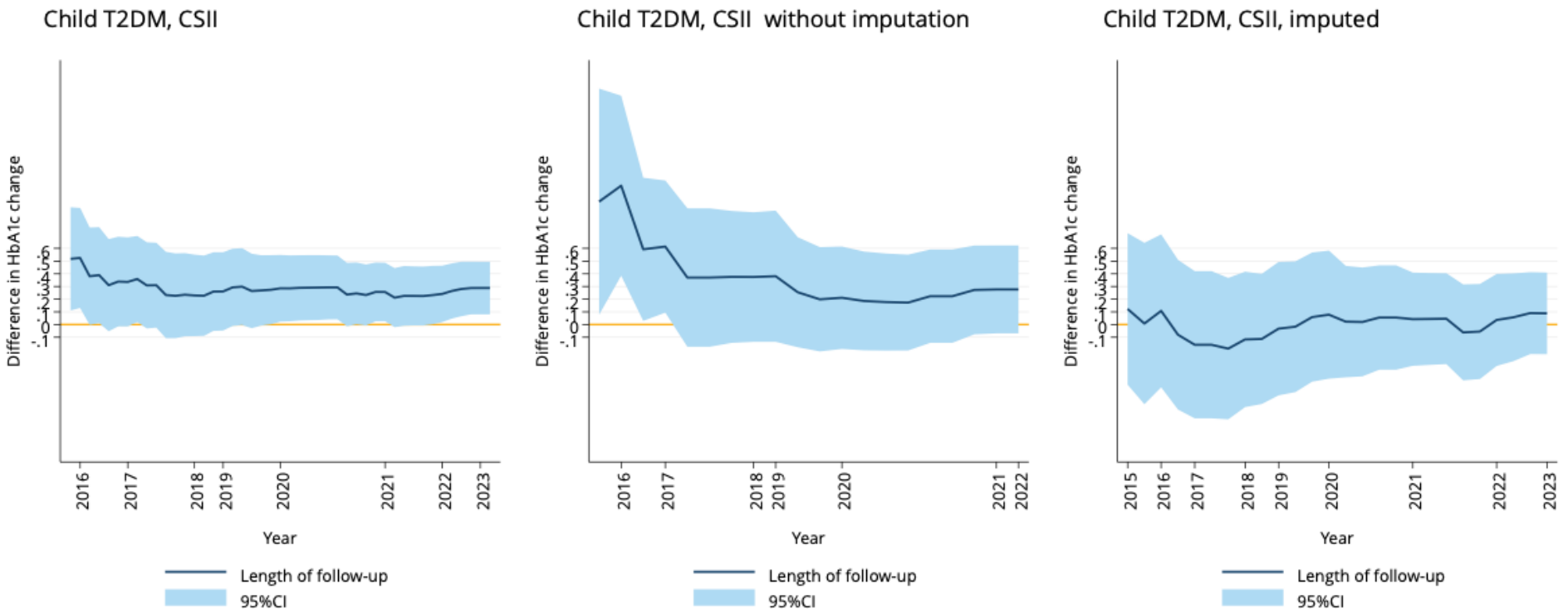
Children, type 2 diabetes, continuous subcutaneous insulin infusion



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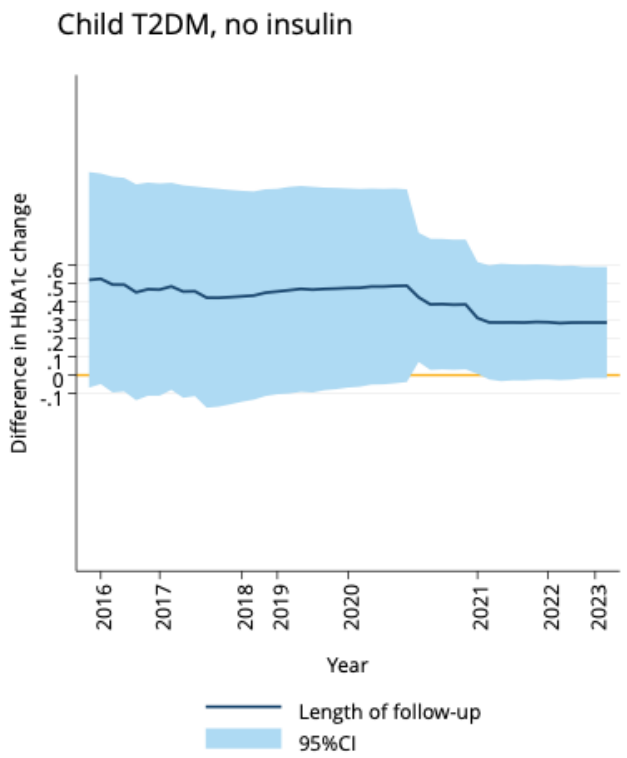
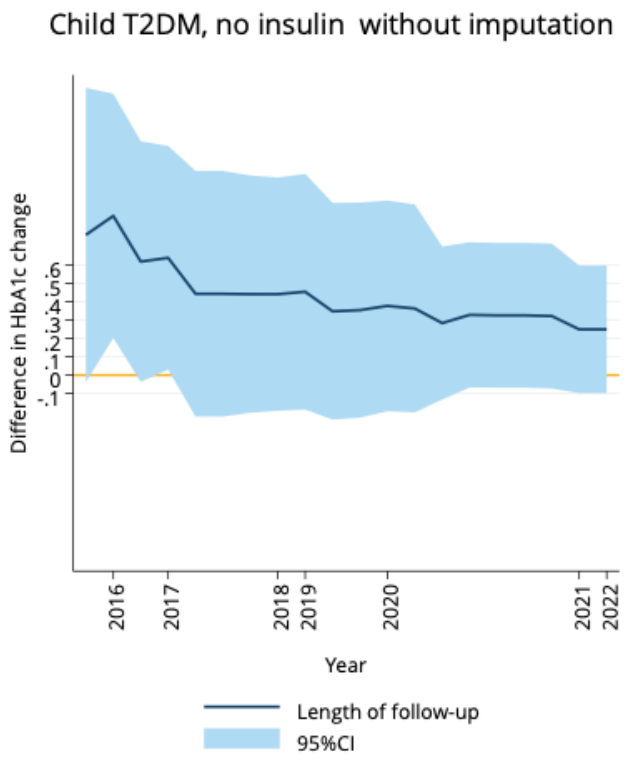
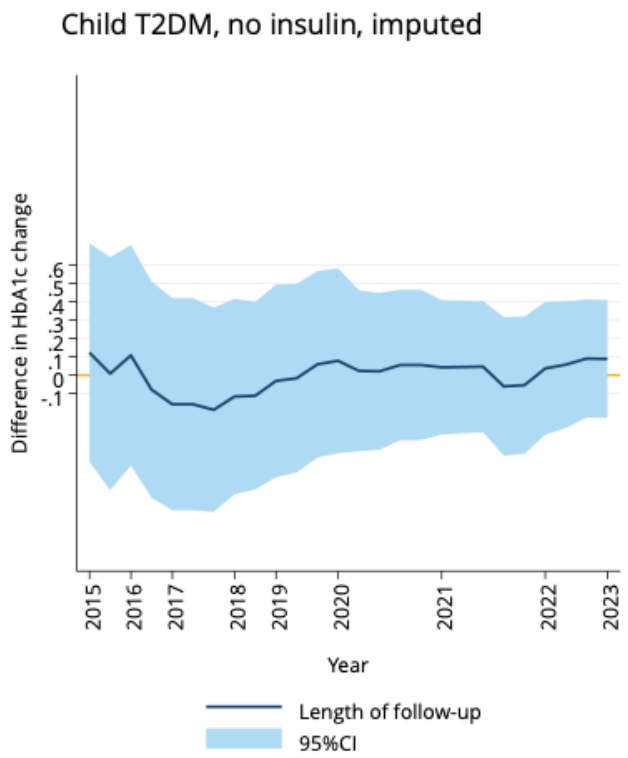
Children, type 2 diabetes, no insulin therapy







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Conclusions

Over the last 6 years our knowledge has not changed: CGM improves Hb1Ac outcomes vs self-monitoring of blood glucose in most studies subgroups

We have remaining questions about the efficacy of CGM in children with Type 2 diabetes, who are not treated with insulin.

In over half of the studies, the data necessary to calculate the effect size was not reported, and had to be imputed. Although the outcomes in most imputed studies were lower compared to the studies with full reporting, they added to the overall power of the analysis.

The number of patients was much greater in the studies with imputation, so results need to be interpreted with caution, raw data has to be obtained from the authors.

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Thank you for your attention! Questions?

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