

Supplementary Material:

The panel data regression models the relationship between variables both across patients and over time. These models can allow for fixed effects and/or random effects. In the main paper we use an a priori defined model, however in order to test the robustness of the results several different models were specified including fixed effects only. The underlying panel data regression is described below followed by the results from various models, other specifications are available on demand.

The model hypothesised for patient p and time period t

$$\begin{aligned}
 HbA1c_{t,p} = & \alpha_p + \beta_1 * \text{duration of diagnosis}_{t,p} + \beta_2 * \text{PreAIP}_{t,p} + \beta_3 \\
 & * \text{PostAIP}_{t,p} + \beta_4 * \text{Gender}_p + \beta_5 * \text{TDS}_{t,p} + \beta_6 * \text{MDI}_{t,p} + \beta_7 \\
 & * \text{CSII}_{t,p} + \beta_8 * \text{Age}_{t,p} + \beta_9 * \text{SEGroup2}_p + \beta_{10} * \text{SEGroup3}_p + \beta_{11} \\
 & * \text{SEGroup4}_p + \beta_{12} * \text{SEGroup5}_p + \beta_{13} * \text{Age}_{t,p} + U_p + U_t + \varepsilon_{t,p}
 \end{aligned}$$

Equation 1

HbA1c (expressed in %) for each patient, p, at a given time, t, is modelled as being impacted by the duration since diagnosis, sex, modality of therapy, socioeconomic group and the use of AIP sessions. α represents the intercept in the linear model.

This model allows for random effects to be accounted for, in the above case with regard to year and patient. The linear mixed model approach also allows the user to control for a potentially correlated random effect for example if pump therapy impact has a relationship with year. In the above model U_p is a patient specific random effect while U_t is a year specific random effect.

This model uses a reference “dummy” approach for the insulin regimen. In the regression there are four possible regimens, BD, TDS, MDI and pump therapy. This

reference dummy approach assumes the patient is on a BD regimen by default, therefore the interpretation of β_5 , β_6 , and β_7 is the expected change in HbA1c from changing from a BD regimen to TDS, MDI or pump therapy respectively.

β_9 to β_{12} measure the expected change in HbA1c when a patient belongs to a certain socioeconomic status. The hypothesis to be tested here is if $\beta_2 = \beta_3$ then there is no significant impact on HbA1c control from AIP sessions.

β_2 and β_3 measures the

Panel data regression are based on the assumption that the relationships are linear, that variables independently and identically distributed.

Alternative model specification results

The following contains results of alternative specified models in addition to the full model specification shown in the main paper. This includes models which control for previous HbA1c and previous change in HbA1c to assess for a potential mean reversion effect to explain Pre AIP and Post AIP. These models also account for random effects. The characteristic equation is included with each model. Further specifications are available on request. The qualitative results below are similar to the main model presented. For parsimony random effects are not reported.

Supplementary Table 1: Results of and model specification without socio-economic status

Model Specification:

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Regimen Type

Random effects: Year of episode encounter, Patient

Variable	Co-efficient	95% Confidence interval [Lower, Upper]	p-value
Intercept	8.14	7.98, 8.29	0.00
Years Diagnosed	0.06	0.04, 0.07	0.00
Pre-AIP	0.94	0.85, 1.02	0.00
Post-AIP	0.14	0.06, 0.23	0.00
Male Sex	-0.08	-0.17, 0.01	0.08
Pump Therapy	-0.77	-0.90, -0.64	0.00
MDI Regimen	-0.19	-0.33, -0.05	0.01
TDS Regimen	-0.09	-0.18, -0.00	0.05
Age	0.00	-0.00, 0.01	0.65

Model fit statistics	Value
R2	0.68
Adjusted R2	0.68
BIC	36168

Supplementary Table 2

Model Specification:

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Regimen Type,

Previous HbA1c

Random effects: Year of episode encounter, Patient

Variable	Co-efficient	95% Confidence interval [Lower, Upper]	p-value
Intercept	4.81	[4.64,4.97]	0.00
Years Diagnosed	0.04	[0.03,0.05]	0.00
Pre-AIP	0.82	[0.75,0.89]	0.00
Post-AIP	0.03	[-0.02,0.10]	0.19
Male Sex	-0.05	[-0.10,0.01]	0.10
Pump Therapy	-0.42	[-0.51,-0.33]	0.00
MDI Regimen	-0.14	[-0.23,-0.05]	0.00
TDS Regimen	-0.03	[-0.09,0.038]	0.43
Age	0.00	[-0.00,0.01]	0.29
Previous HbA1c	0.39	[0.37,0.41]	0.00

Model fit statistics	Value
R2	0.72
Adjusted R2	0.72
BIC	31852

Supplementary Table 3

Model Specification:

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Regimen Type,

Change in HbA1c

Random effects: Year of episode encounter, Patient

Variable	Co-efficient	95% Confidence interval		p-value
		[Lower, Upper]		
Intercept	8.03	[7.87,8.19]		0.00
Years Diagnosed	0.06	[0.05,0.75]		0.00
Pre-AIP	0.68	[0.65,0.71]		0.00
Post-AIP	0.24	[0.21,0.27]		0.00
Male Sex	-0.10	[-0.19,-0.01]		0.03
Pump Therapy	-0.63	[-0.72,-0.55]		0.00
MDI Regimen	-0.14	[-0.23,-0.06]		0.00
TDS Regimen	-0.02	[-0.10,0.05]		0.55
Age	-0.00	[-0.01,0.01]		0.89
Δ HbA1c	0.45	[0.44,0.46]		0.00

Model fit statistics	Value
R2	0.78
Adjusted R2	0.78
BIC	29630

Supplementary Table 4

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Regimen Type

Random effects: None

Variable	Co-efficient	95% Confidence interval [Lower, Upper]	p-value
Intercept	8.02	[7.97,8.08]	0.00
Years Diagnosed	0.05	[0.04,0.05]	0.00
Pre-AIP	1.30	[1.25,1.35]	0.00
Post-AIP	0.53	[0.48,.057]	0.00
Male Sex	-0.03	[-0.06,0.00]	0.07
Pump Therapy	-0.88	[-0.93,-0.84]	0.00
MDI Regimen	-0.48	[-0.53,-0.42]	0.00
TDS Regimen	-0.16	[-0.21,-0.11]	0.00
Age	0.01	[0.01,0.02]	0.00

Model fit statistics	Value
R2	0.34
Adjusted R2	0.34
BIC	44476

Supplementary Table 5

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Socioeconomic status, Regimen Type

Random effects: None

Variable	Co-efficient	95% Confidence interval [Lower, Upper]	p-value
Intercept	8.04	[7.98,8.11]	0.00
Years Diagnosed	0.00	[0.00,0.00]	0.00
Pre-AIP	1.33	[1.28,1.39]	0.00
Post-AIP	0.57	[0.52,0.61]	0.00
Male Sex	-0.05	[-0.09,-0.02]	0.00
SE Group 2	-0.11	[-0.17, -0.06]	0.00
SE Group 3	-0.11	[-0.17, -0.06]	0.00
SE Group 4	-0.19	[-0.24, -0.14]	0.00
SE Group 5	-0.24	[-0.19, -0.29]	0.00
Pump Therapy	-0.76	[-0.93,-0.84]	0.00
MDI Regimen	-0.43	[-0.53,-0.42]	0.00
TDS Regimen	-0.08	[-0.21,-0.11]	0.00

Age	0.03	[0.01,0.02]	0.00
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Model fit statistics	Value
R2	0.33
Adjusted R2	0.33
BIC	50645

Supplementary Table 6

Fixed effects: Sex , Age, Years Diagnosed, Pre AIP, Post AIP, Regimen Type,

Pre AIP-Pump interaction variable, Post AIP-Pump interaction

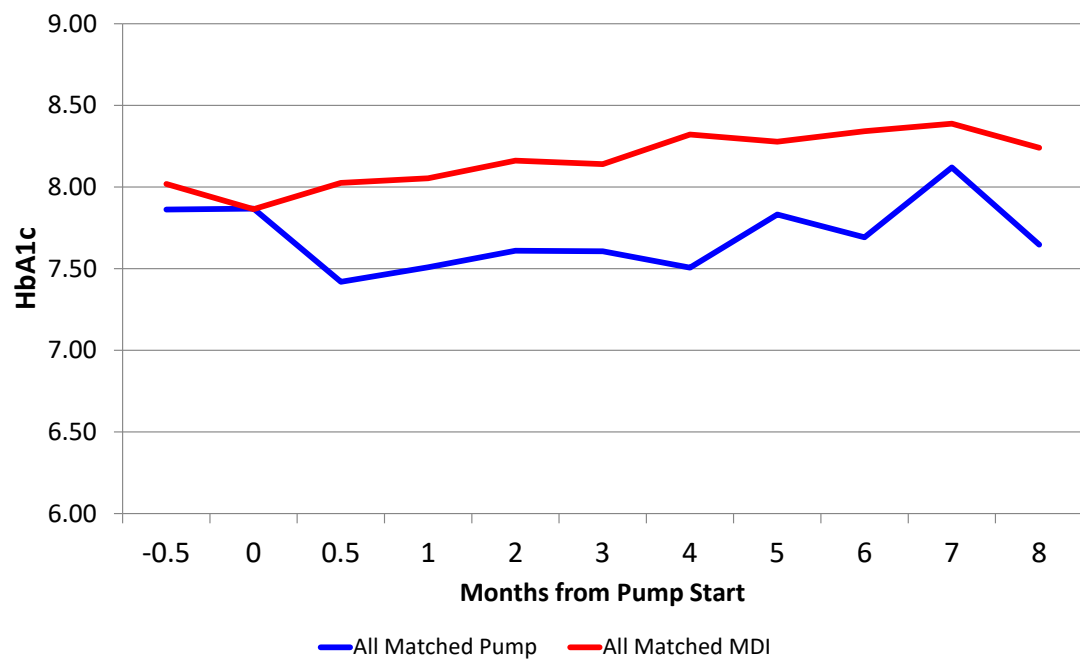
Random effects: Year, Patient

Variable	Co-efficient	95% Confidence interval [Lower, Upper]	p-value
Intercept	8.14	[7.98,8.29]	0.00
Years Diagnosed	0.06	[0.04,0.07]	0.00
Pre-AIP	0.94	[0.84,1.04]	0.00
Post-AIP	0.11	[0.03,0.20]	0.01
Male Sex	-0.08	[-0.17,+0.00]	0.07
Pump Therapy	-0.77	[-0.91,-0.64]	0.00
MDI Regimen	--0.19	[-0.34,-0.05]	0.00
TDS Regimen	-0.09	[-0.18,-0.00]	0.05
Pre-AIP-Pump	-0.05	[-0.18,0.08]	0.47
Post-AIP-Pump	+0.12	[0.00,0.23]	0.05
Age	0.00	[-0.00,0.02]	0.63

Model fit statistics	Value
R2	0.68
Adjusted R2	0.68
BIC	38359

Supplementary Figure 1

Alternative Matching methodology: Instead of using the single matching patient with the most data, all available patients which meet matching criteria are averaged.



Average HbA1c Matching method											
Years from pump start	-0.5	0	0.5	1	2	3	4	5	6	7	8
Difference	0.16	0.00	0.61	0.55	0.55	0.53	0.82	0.45	0.65	0.27	0.59
p-val	0.11	0.90	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.42	0.06
Lower Bound CI	-0.35	-0.06	-0.78	-0.78	-0.83	-0.85	-1.25	-0.79	-0.99	-0.94	-1.22
Upper Bound CI	0.03	0.07	-0.43	-0.31	-0.27	-0.22	-0.38	-0.10	-0.31	0.40	0.03