

What factors are associated with success with insulin pumps?

Introduction

- Over 13,000 adults and 5000 children in the UK use insulin pump (continuous subcutaneous insulin infusion—CSII) therapy¹.
- Whilst CSII therapy can be very successful, not all benefit to the same degree
- We aimed to determine factors associated with improved blood glucose control on a population and individual level.

Methods:

- Observational retrospective analysis of Medtronic Carelink database from 481 adults in a single large UK pump service
- 14 “behavioural” variables and 5 glycaemic outcome measures were analysed using an R script on a population and individual basis

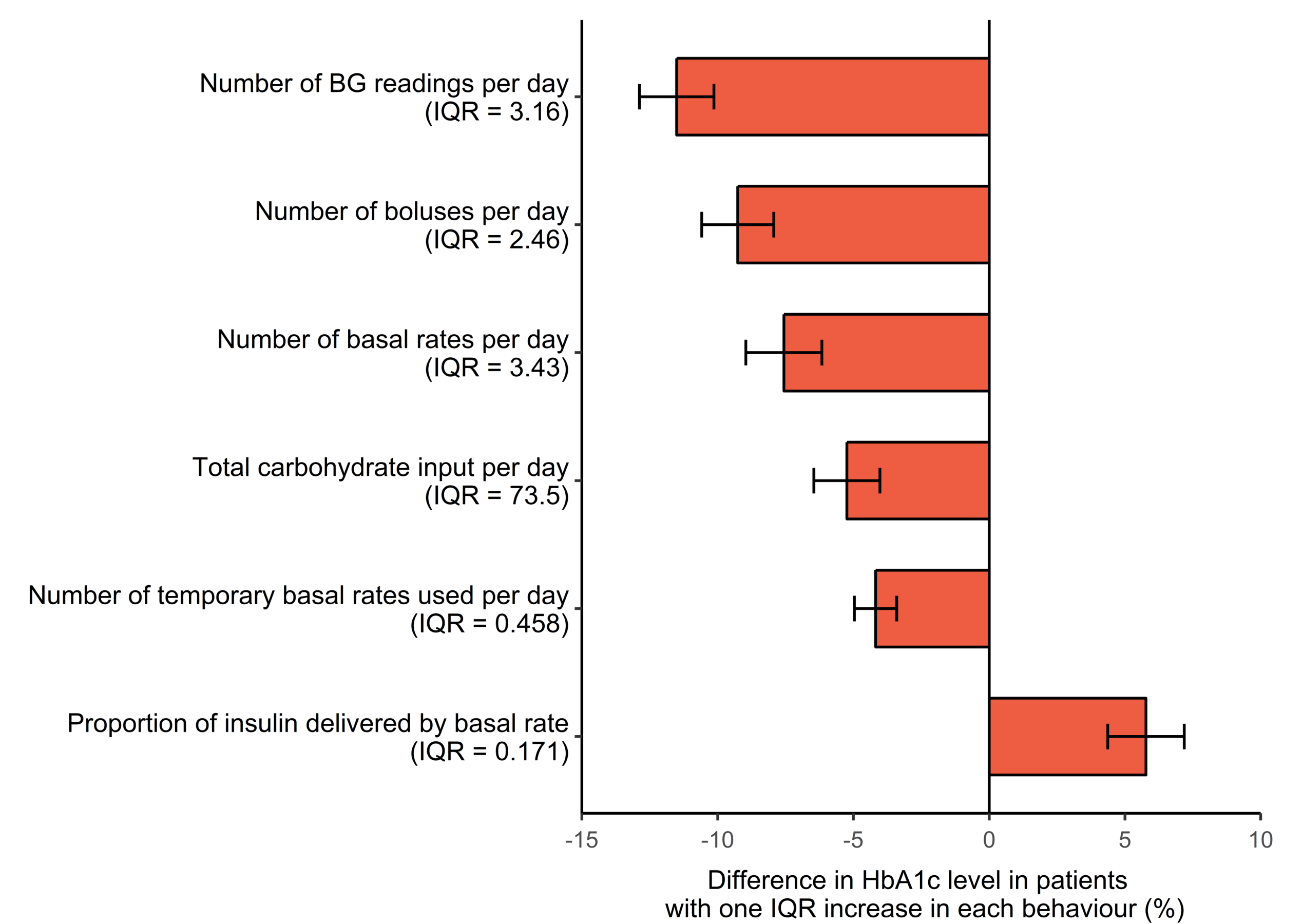
Population-based analysis

Specific methods

- Mean values were generated for each patient dataset from 2015-2018
- A linear regression was performed for each behaviour-outcome combination
- The difference in each outcome was calculated based on a one interquartile range increase in each behaviour (e.g. what is the HbA1c in patients with 3 more blood glucose readings per day?)

Results

- Multiple factors were associated with improved HbA1c (shown on right)
- For example, patients with an average of 3.16 more daily blood glucose readings had a lower HbA1c by 11.5% (CI 8.8-14.2%, $p < 10^{-14}$).
- Similar results were found for mean blood glucose readings, proportion of “time in range” and proportion of readings with Level 1 or 2 hyperglycaemia
- No correlations were found between behaviours and proportion of readings within Level 1 or 2 hypoglycaemia
- No correlation was found between the variance of basal rates and any outcome measure



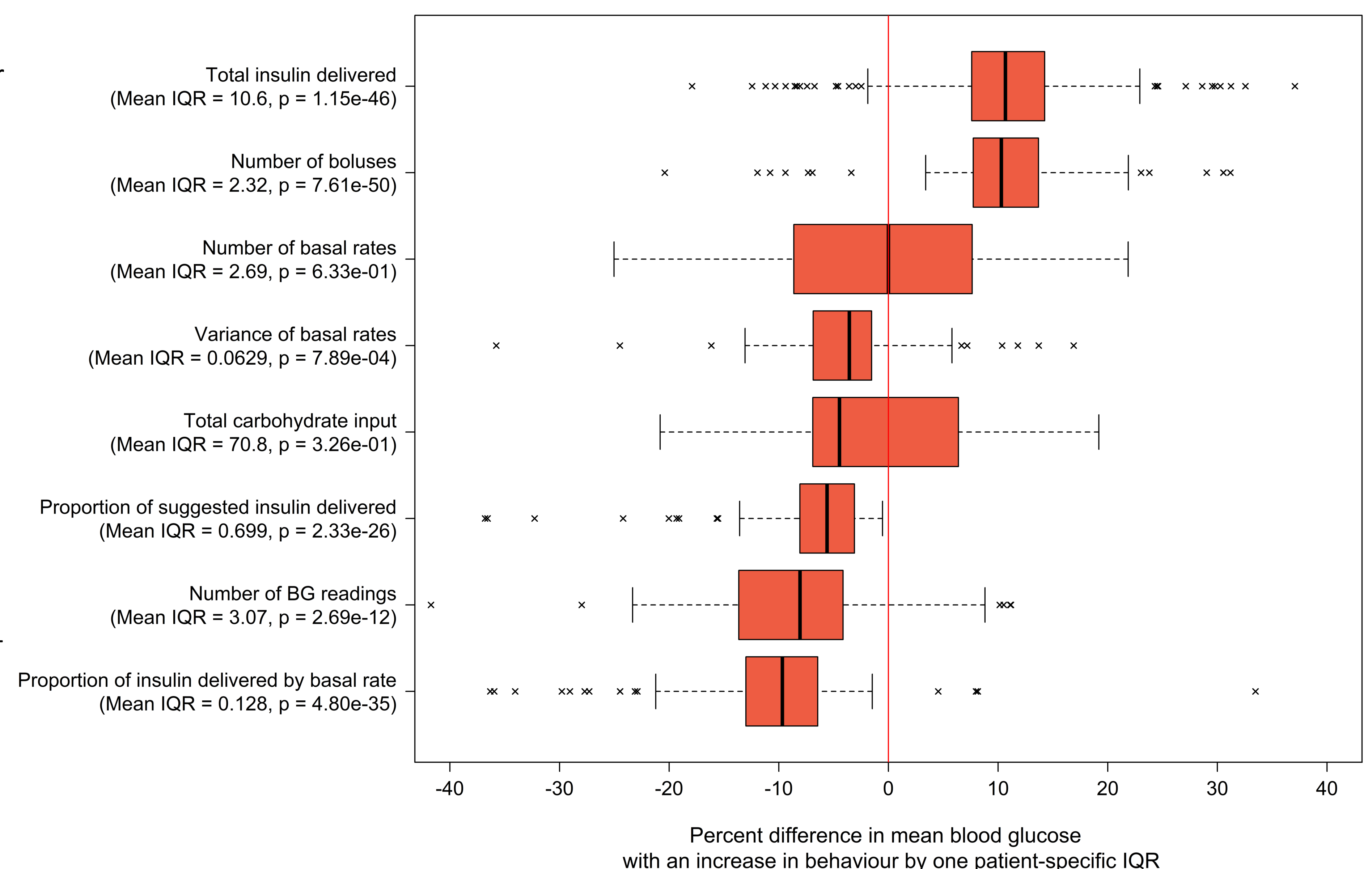
Individual-based analysis

Specific methods

- Mean values were generated for each patient dataset per day.
- A linear regression was performed for each behaviour-outcome combination per patient
- Where the model generated for a given patient was significant (p value < 0.05 / number of patients), an effect size was calculated, using the patient's own IQR for the behaviour

Results

- A lower mean blood glucose correlated with more readings per day, a higher proportion of insulin being delivered by the basal rate and more (shown on right)
- Whilst these factors reduced the time in hyperglycaemia, they also correlated with more hypoglycaemic readings
- Higher blood glucose readings were associated with more insulin being delivered and a greater number of boluses



Conclusions

- The most significant behaviour associated with improved HbA1c and glycaemic control was the number of readings taken per day
- On a population level, having more user engagement (including more basal rates, boluses, carbohydrate input etc) correlated with better blood glucose control
- On an individual level, days with better glycaemic control tended to have more BG readings and more variance in basal rates

References

- White, H. D. *et al.* The U.K. service level audit of insulin pump therapy in adults. *Diabet. Med. J. Br. Diabet. Assoc.* **31**, 412–418 (2014).

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