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Introduction

Time in-range blood glucose level (70-140 mg/dl) is one of the greatest challenges when managing Diabetes. Digital engagement can play a pivotal role-in the care of patients with Diabetes and other chronical conditions, potentially improving the patient's treatment engagement. In this study DarioTM Blood Glucose Monitoring System (BGMS) users were evaluated to examine whether higher App engagement contributes to better Diabetes management. Dario data includes the following streams:

- 1. Automated data captured during glucose measurement such as: blood glucose reading, date, time and location.
- 2. Data that is voluntarily inputted into the mobile application by the user related to measurement such as: Carb consumption, Insulin intake, meal reference (fasting, pre-meal, post-meal or bedtime) or physical activity.
- 3. Diabetes profile information as set by the user in the mobile application such as: Diabetes type, years since diagnosis or target ranges.

Engagement was measured in correlation to for the level of tagging meal reference/carbs/physical activity occurrences.

Method

A retrospective data evaluation study was performed on the Dario cloud database. A population of active users with Type 2 Diabetic (T2D) (>15 measurements per month on average) was evaluated. The study assessed the ratio of in-range blood glucose readings (70-140 mg/dL) as a function of App engagement level for 6 months as recorded in the database compared to the first 30 days as a starting point of analysis.

Results

A population of 4917 T2D non-insulin users measuring more than 15 times per month on average for 6 months in a row was evaluated. The ratio of in-range (70-140 mg/dL) readings was increased in correlation to the level of tagging meal reference/carbs/physical activity occurrences:

- (10%) and sustained for 6 months (Table 2).

 Table 1: % In-range (70-140 mg/dL) readings in T2D

non-Insulin Dario users after three (3) months.

F	opulation	% In-range on average		
Ν	Engagement level	Month 3		
4917	0-1/day	4.0%		
	1-2/day	9.1%		
	>2 /day	11.9%		

T2D Users of a Digital Diabetes Management System Experience an Increase of In-Range Glucose Levels Linked to App Engagement

• N=4917 General population - following 3 months relative increase by 4.0%, 9.1% and 11.9% for tagging 0-1, 1-2 and >2 times per day on average, respectively and sustained for 6 months (Table 1, Fig.1).

• N=833 Highly engaged population tagging >7times/week on average - following 3 months increased their in-range ratio from 59.9% to 65.8%

Table 2: % In-range (70-140 mg/dL) readings in Dario users with Type 2 Diabetes measuring more than 15 times per month on average.

Engagement levelAnalysisNMonth 1Month 2Month 3Month 4Month 5Month 6>7/week 04.2018 83359.964.165.866.066.165.3	Population			% In-range on average					
>7/week 04 2018 833 59.9 64.1 65.8 66.0 66.1 65.3	Engagement level	Analysis	Ν	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
	≥7/week	Q4 2018	833	59.9	64.1	65.8	66.0	66.1	65.3

Relative Increase of % In-Range Linked to App Engagement



Figure 1: Relative Increase in in-range events (70-140 mg/dL) over six (6) months in T2D active Dario users linked to App engagement.

Discussion

Increase of in-range levels (70-140 mg/dL) in a large group, using a digital blood glucose management system in this study is substantial. Time-in-range is expressed as "% of glucose readings". Targeted blood glucose time-in-range may be a suitable descriptor of the efficacy and safety of glycemic control and an index of the quality of care¹. The proposed target range of 70–180 mg/ dL was considered acceptable for clinical practice, as it has been observed that if 50% of the SMBG readings are in such range, A1C would be around 7%². Recent values of about 56% time-in-range median level (70-180 mg/dL) have been observed for NFC glucose sensors³. ADA suggests stringent A1C goals such as 6.5% (equivalent to average of 140 mg/dL) for selected individual patients if this can be achieved without significant hypoglycemia. Moreover, keeping blood glucose at target levels helps people with Diabetes to avoid serious complications from their condition⁴. Remission of diabetes has been defined recently in type 2 diabetes as HbA1C of less than 6.5% (<140 mg/dL on average) after at least 2 months off all antidiabetic medications, from baseline to 12 months, as a co-primary outcome with weight loss⁵.

The results of the present study show an increase and sustainability of in-range (70-140 mg/dL) percentage (%) of glucose readings in T2D active users (>15 measurements per month on average) after 6 months. Furthermore, the percentage (%) of in-range readings is linked to App engagement showing a 10% improvement after 3 months vs. first month, exceeding 65% in T2D tagging meal references/carbs/physical activity 7 times per week on average, excluding glucose measurements (Table 2).

Those findings may be explained by the fact that the Dario App provides the users several decision support features to understand their clinical results and condition better. Features include a color scheme on their measurement in-range status (red - low, green - in-range, purple - high). The time in-range percentage of measurements shows as the main screen of the App and may motivate the users to improve their levels. The App gives a set of graphs and a detailed logbook that the user can browse and easily learn the cause and effect of behavioral activities. For example, how a certain meal, physical activity or mood affect a corresponding blood glucose level.

These digital Diabetes data points may help the users to enhance their awareness, understanding and better manage their condition, and consequently improve their clinical outcomes. Previous supported studies have shown that users of a mobile digital platform had fewer hyperglycemic events compared to the control group and the display of data from a mobile application can contribute to improving glycemic control^{6,7,8,9}.

Conclusion

Patients using a digital Diabetes management platform have the potential to promote behavioral modification and sustain adherence to diabetes management, demonstrating better glycemic control.

References

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