Self-Care Tracking and Blood Glucose Stability Among One Drop Mobile App Users

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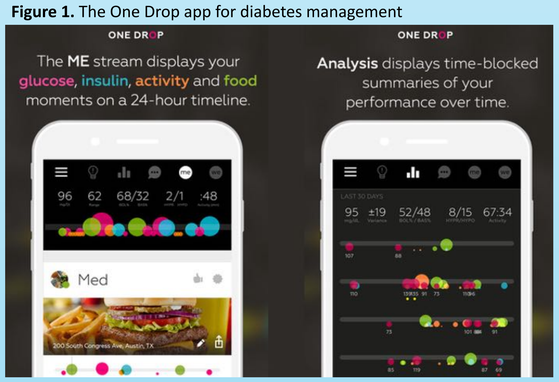
Background and Introduction

- Mobile application (app)-based self-tracking of weight, diet and exercise is growing in popularity.
- Both type 1 (T1D) and type 2 (T2D) diabetes require self-management of these areas, so there is potential for app-based tracking to improve diabetes control.[1]
- Many studies have reviewed mobile apps for diabetes,[2] but the purported health benefits of tracking behavior using apps have been hard to quantify.[1]
- We investigated the relationship between wellness tracking and self-reported blood glucose (BG) levels in individuals with T1D and T2D using the One Drop app.

Figure 1. The One Drop app for diabetes management



The One Drop mobile application

- One Drop is a mobile app for T1D, T2D, LADA, pre-diabetes, and gestational diabetes.
- One Drop's features include:
  - Blood glucose, insulin/medication, food and exercise tracking;
  - Wireless syncing with Bluetooth connected meters, insulin pumps, and continuous glucose monitors (CGMs)[3];
  - Diabetes-centered news and a community support.[3]

Methods

- **Inclusion criteria:** at least 20 BG readings between Jan. 2015 and Jan. 2016, with at least 90 days between the first and the last reading.
- Data included self-reported carbohydrate (carbs) intake, insulin doses, and physical activity reported through the One Drop app.
- **Outcome of interest:** Effective BG control, approximated by %OOR (percentage of Out-Of-Range BG readings, below 70 or above 180 mg/dL).
- **Explanatory variables:** Logarithm of the counts (log-count) of each kind of self-report.
- We created a panel dataset consisting of the %OOR and the recording log-counts measured each month for each user.
- We used **fixed-effects panel regression** to model the association between effective BG control and the amount of wellness tracking **while controlling for heterogeneity between users**. This controls for unobserved confounders such as socioeconomic status.

Figure 2. Population metrics.

	T1D population	T2D population
N users	253	488
N user-months	999	2242
Male %	61.3	62.2

Results: BG tracking and %OOR

- BG readings averaged 21±40 and 16±27 BG readings/month in the T1D and T2D populations, respectively.
- For T1D, 37% of BG readings were OOR compared to 20% for T2D.
- For T2D, there was a significant association between increased BG logging and decreased %OOR. Doubling BG logging was associated with a reduction in %OOR of 0.78 (95% CI [0.28 – 1.29], p = 0.002). That's a **relative improvement in BG control of 3.9%**.
- Users with T1D had a similar, but non-significant pattern, decreasing the %OOR by 0.59 (95% CI [0.44 – 1.62], p = 0.262).

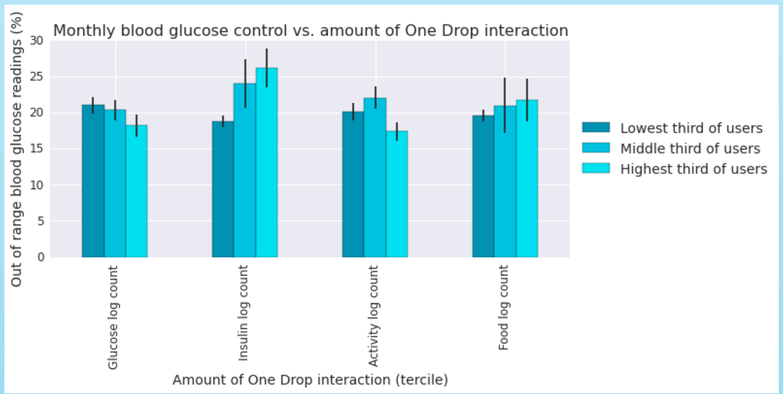
Results: Wellness tracking and %OOR

- There were no significant changes in %OOR associated with increased activity tracking.
- There were significant and near-significant increases in %OOR in T2D and T1D respectively associated with increased tracking of insulin injections, suggesting OOR BG readings encourage users to inject insulin more frequently.

Figure 3. Results of fixed-effects panel regression with %OOR as outcome.

	T1D			T2D		
	%OOR change	p-value	95% CI	%OOR change	p-value	95% CI
2x BG logging	-0.59	0.262	0.44 - 1.62	-0.78	0.002	0.28 - 1.29
2x activity logging	-0.25	0.267	0.19 - 0.68	-0.19	0.207	0.11 - 0.50
2x insulin logging	1.10	0.065	0.07 - 2.27	1.34	0.0002	0.63 - 2.04

Figure 4. Monthly BG control vs. app interaction.



Conclusions and Further Research

- Increased BG logging with the One Drop app was associated with fewer BG readings outside the ideal 70-180 mg/dL range, after controlling for heterogeneity between users.
- Future analyses will examine any relationships by user age, insulin status, and duration of diabetes.
- This study is relatively low power. Larger studies are needed, particularly on the association between BG control and activity tracking and on the smaller T1D population.
- Further research should assess whether the increased stability in observed BG measurements reflects improved glucose control among One Drop users.

References

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3. One Drop Mobile. (2016). Retrieved March 07, 2017, from http://onedrop.today/mobile/