Insights from Big Data (1): Viewing of Real-Time Continuous Glucose Monitoring Data and its Impact on Time in Range

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Background

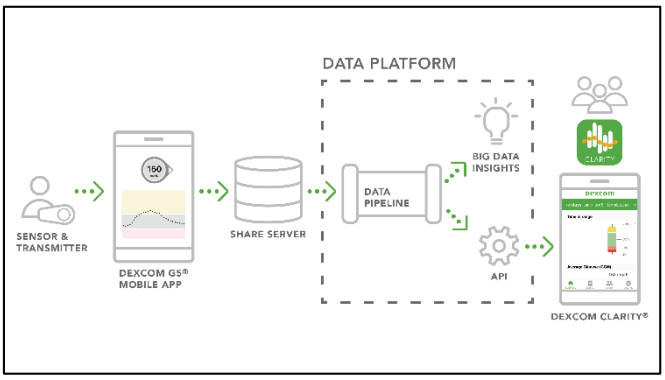
- Real-time awareness of glucose levels can inform short-term diabetes management decisions that prevent or reduce hypo- and hyperglycemia.
- Users of real-time CGM systems can check glucose levels and trends throughout the day and may benefit from real-time alerts.
- Intermittently-scanned CGM devices do not allow for real-time alerts and require a high frequency of scanning to reduce hypoglycemia.
- Screen view (SV) frequency may be a surrogate marker for patient engagement with their CGM data.
- We examined the relationship between SVs and glycemia.

Methods

- The Dexcom Mobile App allows users to view current and up to 24 hours of historical data from the Dexcom G5 Mobile CGM System.
- After a user's consent, it also uploads glucose concentration and app usage data to a database, where they are available for retrospective analysis.
- Data are a convenience sample of 50,000 anonymized users who employed an iPhone as their display device and spontaneously uploaded data in August 2017.
- Time in range (TIR) is the percentage of sensor glucose values from 70-180 mg/dL (3.9-10.0 mmol/L). Time in hypoglycemia (<54 mg/dL, <3.0 mmol/L) and hyperglycemia (>250 mg/dL, >13.9 mmol/L) were calculated similarly.
- App usage was expressed as SV/day. Parameters for each of 20 equally-sized rank-ordered groups were calculated.
- Multiple SVs within any 10-minute interval were counted as a single SV.

Figure 1.

The data platform makes sensor glucose values available to patients and their clinicians. At the heart of the data platform is the data pipeline that moves data between a server and distributed apps via an API. The anonymized aggregated convenience sample is drawn from the data pipeline for big data insights.



Results

- Mean screen view frequency was 9.1 per day. The median (IQR) was 5.7 (2.7-11.3) per day.

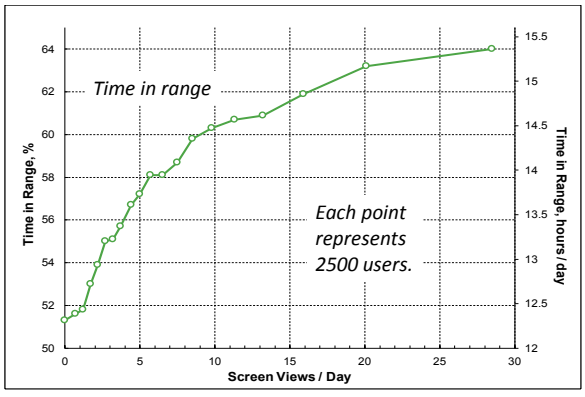


Figure 2.

Higher screen view frequencies were strongly associated with greater TIR.

The favorable trend was apparent between all groups, even those that viewed their screens at relatively high frequencies.

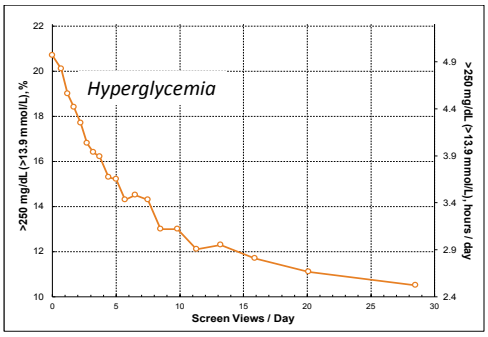


Figure 3.

People with frequent screen views had fewer sensor glucose values >250 mg/dL (>13.9 mmol/L).

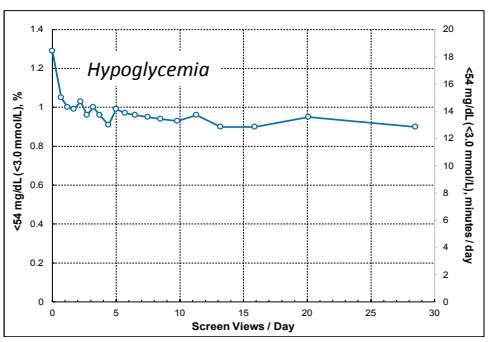


Figure 4.

Even people with very few SVs averaged <15 min/day with sensor glucose values <54 mg/dL (<3.0 mmol/L).

Conclusion

- Compared to users with fewer SVs, those with more SVs had higher proportions of sensor glucose values in the target range and lower proportions in hyperglycemia.
- Even patients with infrequent SVs had very little clinically meaningful hypoglycemia, potentially related to low glucose alerts.
- Screen view frequency may be a useful surrogate marker of patient engagement with their own CGM data and diabetes management decisions.

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