# Population Health Diabetes Education: The Role of Digital Health & Patient-Generated Health Data

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## Introduction

Digital health solutions represent a new category of self-management tools that leverage the anytime capability of smartphones to provide contextual real-time coaching to create the opportunity to provide ongoing diabetes self-management support and tracking. This provides robust patient-generated health data (PGHD) to inform the patient-provider dialogue for shared decision-making. However these data are only beneficial when they are fully integrated into the clinical workflow. Here we share findings from a real-world use of a type 2 digital health tool in population health.

### Classification of Health Data by Source and Frequency[1]

| Data Capture Source | Data Capture Frequency: Low (~Static) | Data Capture Frequency: High (~Dynamic) |
|---|---|---|
| Patient | • Registration data (e.g., demographics, medication history, daily regimen, etc.)<br>• Psycho-social data (health literacy, cultural, social, etc.) | • Physiologic data<br>• Symptom data<br>• Lifestyle data<br>• Medication data |
| Non-Patient (e.g., 3rd party, system, etc.) | • Labs and screenings<br>• Evidence-based guidelines<br>• Medication regimen<br>• Metabolic targets and ranges<br>• Clinical rules<br>• Physician instructions | • System-generated KPI's, alerts, trends<br>• System and feature-level utilization data<br>• Absence of data |

## Methods

The Diabetes Population Health Program is part of an Integrated Delivery Network in the Mid-Atlantic with 8 primary care practices, an endocrinology practice and an ADA recognized DSMES program. In this quality improvement project, adults with type 2 diabetes were introduced to a clinically validated[2], FDA-cleared, digital tool (BlueStar®, WellDoc®, Inc., Columbia, MD[3]) as part of a population health initiative. The lead diabetes educator (population health manager) mentored the care team to provide individualized education, barrier identification, and provider support. Starting in 2014, medical providers have been prescribing the BlueStar product for patients with type 2 diabetes. The software is downloaded onto smart phones with the iOS™ or Android™ operating systems. Users interact with the product on the phone, tablet, or on a personal computer. Data is encrypted and uploaded to WellDoc servers. Individual patient reports were sent (in-app) to the providers by the patients based on provider preference or patient-identified need. Population reports were generated at a provider, practice, or system level. For the purpose of this analysis, user data was de-identified in accordance with the Health Insurance Portability and Accountability Act of 1996.

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## Results

### Demographics

| Data collection period | July 1, 2016 – June 1, 2017 |
|---|---|
| Number of active users | 36 |
| Number of providers | 20 |
| Female/Male % | 64/36 |
| Age <40 years | 16% |
| Age 41-50 | 14% |
| Age 51-60 | 40% |
| Age >60 | 30% |
| Non-insulin users | 48% |
| Basal insulin users | 8% |
| Basal + bolus insulin users | 25% |
| Medications unknown | 19% |
| Mean baseline A1C | 9.7% |
| Mean baseline BP | 132/82 |
| Mean BMI | 38.6 |

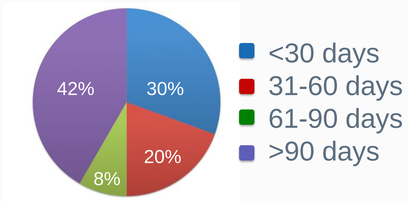
### Population Data and Opportunities

BlueStar

**Practice Population Summary Report**

July 1, 2016 – June 1, 2017

**Persistence of Use**




Measure persistence of use to understand population's potential for engagement with a digital tool.

**Types of Entries**

| Entry | % of users with entry type |
|---|---|
| Blood glucose | 69 |
| Medication | 69 |
| Exercise | 33 |
| Carbs | 47 |
| Notes | 31 |

Monitor user engagement and support optimal use; develop engagement strategies for educators, coaches, and team.

**Standard of Care Measures**

| Exam | % of users with entries | % of users with current entries |
|---|---|---|
| Dilated eye exam | 25 | 14 |
| Influenza vaccine | 19 | 11 |
| Foot exam | 17 | 11 |
| DSME/S | 22 | 19 |
| Pneumonia vaccine | 11 | 5 |

Track adherence with SOC metrics. Develop practice-based protocols for achievement.

**Blood Glucose Population Data**

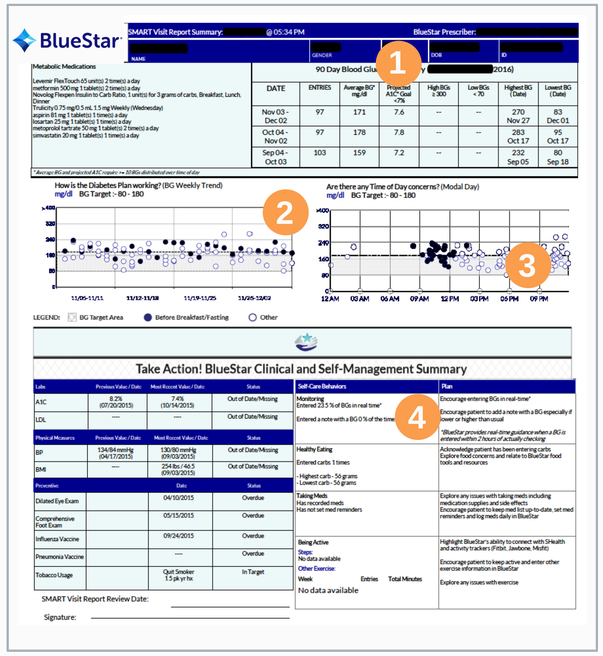
| 2,734 total entries | In 25 users |
|---|---|
| 13 hypo events | In 2 users |
| 77 hyper events | In 7 users |

Identify users with recurrent extreme BG events; trigger "hypo" or "hyper" and patient outreach protocol.

*Hypo event BG<70 mg/dL; hyper event BG>300 mg/dL*

### Individual User Data and Opportunities

**16 patients sent a total of 46 SMART Visit Reports to providers during the observation period**




Healthcare provider reviews BG trends, standards of care, and patient self-management behavior; clinical decision support informs conversation for shared decision-making.

**SMART Visit Observations**

1. Projected A1C is above target
2. Fasting hyperglycemia suggests increase in basal insulin
3. Post-meal hypoglycemia suggests change in meal-time insulin
4. Self-Management: suggest that patient record carbs more frequently

## Conclusions

Digital health tools have recently made available a tremendous amount of PGHD. If summarized and presented properly, these data may facilitate population health management. Diabetes educators care coordinators, and health coaches may be able to deploy targeted, protocol-driven interventions to the patients who need them. As shown above, PGHD may also enhance clinical decision-making for the provider at the time of or in between patient visits. Given the prevalence and complexity of diabetes and the limited time providers have with patients, digital health tools and PGHD will be critical in improving care, supporting practice efficiency, and impacting the cost burden.

## References

1. Iyer, A. (2017). *Case Study*: The IoT and Big Data in Healthcare Unleashing the Next Generation of Value Creation in R. Krohn, D. Metcalf, P. Salber (Eds.), *Connected Health: Improving Care, Health, and Efficiency with Wearables and IoT Solutions* (pp. 202-210). Boca Rotan, FL: CRC Press.
2. Quinn C et al. Cluster-Randomized Trial of a Mobile Phone Personalized Behavioral Intervention for Blood Glucose Control Diabetes Care September 2011; vol. 34 no. 9: 1934-1942
3. https://www.bluestardiabetes.com/ and http://www.welldoc.com

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