A Data Science Framework for Mobile Health--Engagement and Outcomes
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Objectives
Knowledge about patient behavior is a critical element for managing chronic medical conditions such as type 2 diabetes. Until recently, data about what patients are doing outside their physicians’ offices were limited. Mobile health technology has the potential to collect and process new sources of data, which can then be used to provide real-time coaching to patients and clinical decision support for providers. Our aim was to evaluate our processes for knowledge extraction from patient-generated data in a mobile health platform.

Methods
The first mobile prescription therapy, WellDoc’s BlueStar, was launched in 2014 for patients with type 2 diabetes. This platform was designed to collect data that would not otherwise be available to providers. Users interact with the product on their smart phone or via a web portal on their personal computer. Usage is not prescriptive but variable based on a number of factors such as patient interest and the complexity of their diabetes treatment plan.

Results
We conceptualized a data framework for mobile health that includes (1) driver metrics, which are measurable factors which influence results and include enrollment, usage, and satisfaction data and (2) results metrics, which examine outcomes such as improved quality of care, improved diabetes control, and potential healthcare cost savings. From March 2014 to May 2015, we identified 1,036 diabetes patients who were prescribed BlueStar, enrolled and activated their accounts, and used the product for over 30 days. We characterized 161,602 active engagements from this population. We report here improvements in SMBG values over time, fewer hypoglycemia SMBG entries, as well as significant reductions in A1C for those users who entered multiple A1C values. User attributes, which are associated with usage and with outcomes, were identified.

Outcomes
Using a systematic approach to evaluating patient-generated data delivers new knowledge for transforming care for patients. The usage metrics demonstrate a high degree of patient engagement which persists over time, is a function of age, provider-type, and complexity of the medication regimen. The outcomes metrics demonstrate improved glycemic outcomes. As mobile health products evolve, there will be growth in their potential for patient coaching and provider clinical decision support based on real-world data and not just the sparse information available at a patient visit.