

# Impact of a Novel Digital Medicine Offering on Real-World Outcomes in Patients with Cardiovascular and Metabolic Disease

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## Introduction

- In the United States, 29.0% (72M) of adults have hypertension (HTN) and the prevalence increases with age: 18-39, 7.3%; 40-59, 32.2%; and 60 and over, 64.9%<sup>1</sup>
- By 2030, prevalence of HTN is expected to increase 7.2% from 2013 estimates<sup>2</sup>
- Average cardiometabolic medication adherence rates are estimated at 33.3% for oral antidiabetic, 26.6% for antihypertensive, and 34.2% for lipid-lowering medications<sup>3</sup>
- Non-adherence to prescribed medications is associated with poor therapeutic outcomes, progression of disease, and in the US, ~\$100-\$300 billion of annual avoidable healthcare costs<sup>4</sup>

## Objectives

1. To evaluate the first real-world impact of a digital medicines offering on adherence, outcomes and healthcare utilization at Barton Health, a community health system located in South Lake Tahoe, CA.
2. To discuss the challenges associated with implementing and adopting a new technology in a primary care setting.

## Methods

Patients used Proteus Discover for approximately 30 days from December 2015 to July 2016.

### Selection criteria:

- Patients with uncontrolled HTN (systolic blood pressure [SBP]  $\geq$  140 mm Hg)
- Patients on one or more of the following digital medicines: furosemide, bumetanide, lisinopril, hydrochlorothiazide, amlodipine, losartan, metoprolol tartrate, carvedilol, atorvastatin, metformin, glipizide, Januvia<sup>®</sup>

**Exclusion criteria:** History of skin allergy or sensitivity to adhesive medical tape, acute or chronic dermatitis

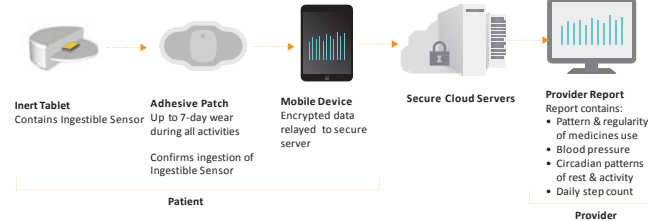
### Outcomes for analysis:

- Medication adherence
    - Changes (pre vs. post) using paired t-test:
    - systolic blood pressure (SBP)
    - diastolic blood pressure (DBP)
    - hemoglobin A1c (HbA1c)
    - healthcare resource utilization (emergency department (ED) visits and inpatient admissions)
  - Patient satisfaction
- \*post-period was calculated as day of first Proteus use to last day of available follow-up, including 30-day period on Proteus.

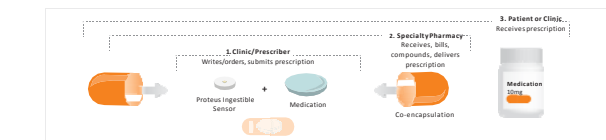
## Digital Medicine Offering

Proteus Discover, a Digital Medicine offering from Proteus Digital Health, consists of sensor-enabled medicines, a wearable sensor patch, patient app and provider portal to directly measure medication-taking, activity and rest to support patient self-management and facilitate provider therapy optimization.

### Elements of the Digital Medicine Offering

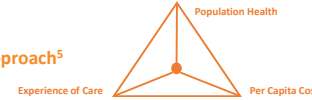


### Digital Medicines Co-Encapsulation by Pharmacy



## Results

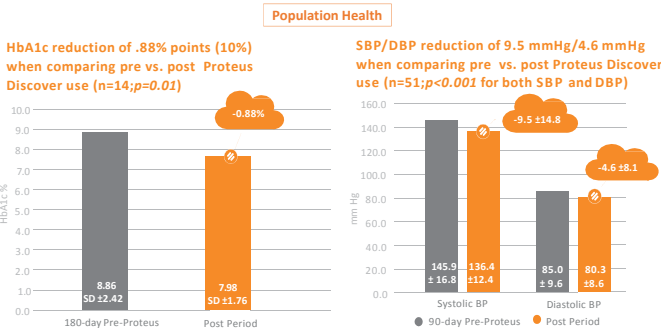
### Results framed around the Triple Aim Approach<sup>5</sup>



### Patient Demographics

# On-boarded on Proteus Discover	59	% Alcohol use	65%
# Included in analysis*	52	% Smoking	12%
Age $\pm$ SD	61 $\pm$ 12 yrs	% Cardiometabolic comorbidities	75%
% Female	51%	Diabetes	35%
Race		Hyperlipidemia	63%
Caucasian	80%	Heart failure	2%
African-American	2%	Cardiovascular disease (CVD)	27%
Hispanic	2%	% Mental illness comorbidities	42%
Asian	4%	Depressive disorder	19%
Other	12%	Anxiety	48%

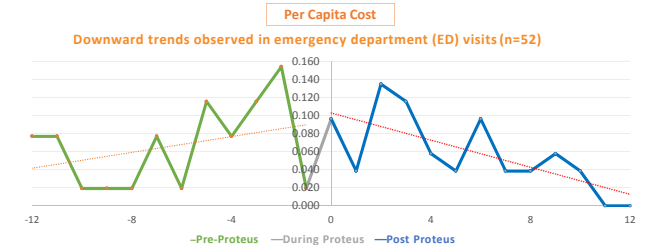
\*Patients were excluded if they had <180 days follow-up (N=5) or had no hospital account record data (N=2)



### Experience of Care

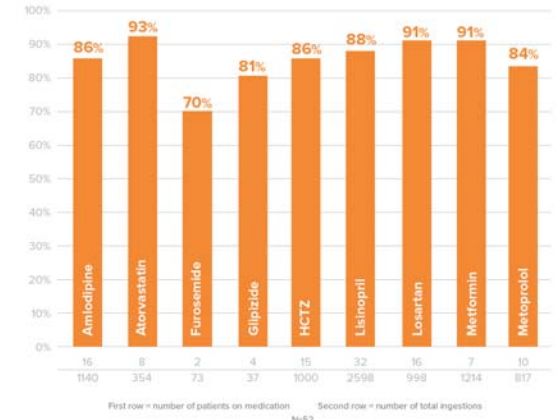
Most (94%) patients agreed it was easy to learn how to use Proteus Discover, and 88% agreed that Proteus Discover motivated them to improve their health (N=19)

Statement	Agree (%)
Using Proteus Discover motivated me to improve my health.	89%
Using Proteus Discover helped me to understand my treatment plan.	79%
Using Proteus Discover gave me a greater sense of control over managing my health condition(s).	77%
Proteus Discover helped me understand the importance of taking my medications regularly.	84%
Proteus Discover helped me to better understand how I use my medication(s) from day to day.	77%
Proteus Discover helped me feel more connected to my healthcare team.	90%
It was easy to use the mobile device and Proteus Discover app.	88%
It was easy to use Proteus Discover in my daily routine.	89%
It was easy to learn how to use Proteus Discover.	95%
In general, I did not mind wearing the patch.	72%
I was comfortable sharing my Proteus Discover data with my healthcare team.	100%
Connecting and applying each new patch was easy for me to do.	89%



- Mean ED visits on a per patient month difference [Pre: 0.112 (SD 0.29); Post: 0.072 (SD 0.17); Difference: -0.040 (SD 0.25); p-value: 0.258]
- Mean inpatient admissions also trended downward on a per patient month difference: [Pre: 0.013 (SD 0.06); Post: 0.035 (SD 0.02); Difference: -0.010 (SD 0.06); p-value: 0.242]

Mean ingestion adherence was 87% across all Proteus medications



## Managing adoption and sustainability

The table below provides details into how the Barton and Proteus teams overcame implementation challenges with team-based solutions.

Challenges	Solutions
Training with limited provider availability	Training occurred in small "bites" and was reinforced over time. Training was successfully delivered to multiple team members with the goal of training them to be "trainers" for their patients.
New workflow process	Implementation plans were drafted with workflow details and roles/responsibilities of clinic staff. Efficiency was top-of-mind when planning the workflows so the appropriate provider was tasked with each step of the workflow. For instance, medical assistants trained patients on Proteus Discover and prescribers focused on optimizing medical decisions based on Proteus data. Despite workflow changes, several providers expressed satisfaction in being able to provide their patients with a tool to improve outcomes.
Patients' comfort with new technology	Patients often surprised providers with their technical capabilities and generally managed the technology very well. Overall, patients were extremely satisfied with use of the program, and many requested to continue use of the system past the expected end date. Others requested to restart the program to provide additional guidance and support.

## Conclusions

- Patients who used Proteus Discover for 4 weeks demonstrated high ingestion adherence to common cardiometabolic medications.
- Use of Proteus Discover was associated with significantly improved clinical outcomes including blood pressure reduction, lower lipid levels, decreased HbA1c as well as reductions in healthcare utilization.
- Proteus Discover is a platform for improving patient/provider engagement and medication adherence, which may be used to help patients reduce their risk of cardiovascular disease.

### References:

1. National Center for Health Statistics. Hypertension Prevalence and Control Among Adults: United States, 2011-2014. NCHS Data Brief No. 220, November 2015.
2. American Heart Association/American Stroke Association. Statistical Fact Sheet. 2013 Update.
3. López-Simero J, Brinson C, Nouri L et al. Concordance between two methods in measuring treatment adherence in patients with type 2 diabetes. Patient Prefer Adherence 2016;10:743-750.
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5. Steffel M, Nolan K. A Guide to Measuring the Triple Aim: Population Health, Experience of Care, and Per Capita Cost. IHI Innovation Series white paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2012.