Estimating the economic impact of novel digital therapeutics in type 2 diabetes and hypertension

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Conclusions

Digital therapeutics (DTx) that deliver intensive behavioral interventions to patients with cardiometabolic diseases may provide effective treatment outcomes to patients and substantial savings to health plans.

Cost savings are estimated at 30-40% of mean annual cost of conventional treatments for diabetes and hypertension patients.

Clinical inertia, resistance to reduce reliance on prescription drugs, may be important in realizing the benefits of DTx.

Uncertainties exist in DTx effectiveness in real-world populations, especially in the context of multiple concurrent interventions.

Background and objectives

Behavioral interventions meaningfully improve cardiometabolic conditions.¹⁻⁷

Digital therapeutics delivering these interventions may provide benefits comparable to pharmacologic therapies, displacing drugs for some patients.

There are few assessments of the economic benefits of digital therapeutics.

Our objective was to estimate the economic impact of a digital behavioral intervention in Type 2 diabetes mellitus (T2DM) and hypertension (HTN).

Methods

Model Setting

- Decision-analytic models estimated budget impact and cost-effectiveness from a US commercial payer perspective.
- A 3-year time horizon was most relevant to the intervention and payer.
- Models based on observation that biomarker levels correlate both clinical events and HRU.⁸⁻¹⁰ Each model compares two cohorts (Figure): DTx +

Results

Estimated savings in health resource utilization are meaningful:

- Average savings over the 3-year time horizon ranged from \$96 to \$145 PPPM, with higher potential benefits in T2DM.
- Savings in T2DM are estimated at \$83 PPPM in Year 1, and rise to \$174-\$177 in Years 2 and 3.
- Year 1 savings in HTN are estimated at \$68 PPPM rising to \$113 and \$107 in Years 2 and 3.
- Estimated Year 1 savings in HRU (Figure 2) are lower than savings in subsequent years due to clinical inertia: delays in realizing economic benefits of reducing medications and CVD-related hospitalizations.

Figure 2. Base case HRU savings and contributions to estimated savings

| Type 2 Diabetes N | Vellitus |
|-------------------|----------|
|-------------------|----------|

Hypertension



treatment as usual (TAU) and TAU-alone. Clinical outcomes are classified into one of 4 categories, aligning with reported costs reported and with current clinical guidelines (Bottom panel, Figure).^{8,11,12}



| | | | Enrolled Patients | | |
|-----------|------------------|------------|-------------------|------------|------------|
| Condition | Parameter | Category 1 | Category 2 | Category 3 | Category 4 |
| T2DM | HbA1c values, % | <6.5 | 6.5-7.49 | 7.5-9.0 | >9.0 |
| HTN | SBP values, mmHg | <120 | 120-129 | 130-139 | ≥140 |

Clinical Effectiveness and Clinical Inertia

The Science of Market Access

- Effectiveness of the digital therapeutic in improving clinical outcomes was based on cohort studies and published literature.
- Costs and health state utilities were drawn from the literature with costs inflated to 2018 dollars. Costs and QALYs were discounted at 3%.
- DTx effectiveness and all model inputs are listed in the table below.
- Deterministic, one-way sensitivity analyses assessed uncertainty.

| Table 1. Model Inputs | | | | | |
|--|---------------|---------------|--|--|--|
| | T2DM | HTN | | | |
| Enrolled Patient Population | | | | | |
| Average age | 50 | 50 | | | |
| % Enrolled in Category 1 | 0 | 0 | | | |
| % Enrolled in Category 2 | 47.0 | 37.0 | | | |
| % Enrolled in Category 3 | 34.0 | 19.0 | | | |
| % Enrolled in Category 4 | 19.0 | 44.0 | | | |
| Comorbid Conditions | | | | | |
| T2DM, % | - | 33 | | | |
| HC, % | 60 | - | | | |
| HTN, % | 60 | - | | | |
| Digital Therapeutic performance | | | | | |
| Mean improvement by End of Year 1 | 0.8% | 11mmHg | | | |
| Medications and Resource use | | | | | |
| Category 2 patients not on medications, % | 25% | 25% | | | |
| T2DM Meds: Annual Ave Cost | \$2,466 | \$2,466 | | | |
| T2DM Meds: HbA1c gradient for use | 0/.33/1.2/2.2 | 0/.33/1.2/2.2 | | | |
| HC Meds: Annual Ave Cost | \$775 | - | | | |
| HC Meds: Lipid gradient for use | .5/.8/1.5/2 | - | | | |
| HTN Meds: Annual Ave Cost | \$1,557 | \$1,557 | | | |
| HTN Meds: SBP gradient for use | 0/.15/.9/1.8 | 0/.15/.9/1.8 | | | |
| CVD Event Cost | \$116,423 | \$116,423 | | | |
| HRs of CVD event rate by HbA1c level | 1/1/1.25/1.98 | | | | |
| Health State Utilities | | | | | |
| Category 1 (increment) | 0.0200 | 0.0250 | | | |
| Category 2 without meds | 0.8200 | 0.8301 | | | |
| Category 2 with medications (decrement) | -0.0200 | -0.0100 | | | |
| Category 3 (decrement) | -0.0350 | -0.0300 | | | |
| Category 4 (decrement) | -0.0250 | 0.0000 | | | |
| CVD event (decrement) | -0.1000 | -0.1000 | | | |
| Clinical Inertia Measures | | | | | |
| Months required for reduction in medications | 6 | 6 | | | |
| Months required for CVD risk reduction | 3 | 3 | | | |



Sensitivity analyses showed that reduced medication costs are a primary driver of potential HRU savings. Assumptions regarding the distribution of enrollee disease severity are a significant driver of uncertainty for the T2DM population, though less important in HTN. Assumed HRU costs are not the largest driver of uncertainty in Year 1, while medication and hospitalization costs are an important driver of uncertainty in subsequent years.

A resistance to deprescribe medications when a patient's clinical outcomes improve, or "clinical inertia", can substantially reduce the estimated economic benefits.

- In T2DM greater clinical inertia reduces estimated HRU savings to \$34 PPPM from the baseline of \$66, while shorter delays (3 months vs. the baseline 6) result in estimated savings of \$99 PPPM in Year 1.
- Estimates for HTN indicate that clinical inertia assumptions vary HRU savings by 40-50% in Year 1. Clinical inertia becomes a small driver of uncertainty in subsequent years in HTN.

Cost-effectiveness acceptability analyses using a willingness-to-pay of \$50,000/QALY indicated that the intervention would be cost-effective at total three-year program costs of \$6,592 and \$6,915 for T2DM and HTN, respectively. Incremental QALYs were estimated at 0.0427 (T2DM) and 0.0827 (HTN) over the 3-year time horizon.



Figure 3. Cost-effectiveness threshold analysis

—T2DM —HTN

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