



**MEMOTEXT® Corporation**

## **Machine Learning Analytics and Engagement Design in Type 2 Diabetes**

Using Refill Claims Machine Learning to Design Precision Digital Engagement  
with a Canadian Benefits & Insurance Provider.

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## Intro & Background

MEMOTEXT data science and data-driven engagement capabilities have shown value in advanced analytics and the development of patient support and engagement programs. Building upon a capability to provide risk identification and tailored support in digital patient engagement, MEMOTEXT continues to develop capabilities in augmenting business rule driven engagement to encompass real-time ML driven next best messaging decision rules for content, timing and messaging escalations.

Identification of drug switch risk, adherence prediction and navigation prediction are use-cases made possible through machine learning analytics in claims / refill data. A model to influence next-best action messaging directly through digital communications or a patient support model of engagement providing insights and recommendations for engagement are critical in differentiating patient communications capabilities in the marketplace.

**MEMOTEXT Machine Learning (ML) in Type 2 Diabetes Mellitus (T2DM).** T2DM is a complex disease that is difficult to understand from claims data alone. The objectives of the case-study program was to explore prediabetes insurance claims data to engineer new cost/complexity risk feature-predictors and to identify members at-risk of adding a diabetes medication to their claim file.

A 2-year ML collaboration focusing on the Type 2 Diabetes (T2DM) population with one of Canada's leading health benefits providers led to the creation of feature predictors (predictive models) to address specific clinical business requirements related to identification of risk of high-cost patient types, drug switching in early stage treatment, and T2DM disease onset. Using descriptive analytics and predictive modelling exercises, it was found that the most effective means of reducing overall expenditures associated with the T2DM population was disease prevention and prevention of escalation.

The underlying treatment-related and behavioural characteristics of high cost T2DM members were also identified as: 1) treatment type (combo-therapy, switching, and regular drug use); 2) number of unique diabetes medications (the higher, the costlier); 3) low/no gapping in adherence; 4) medications associated with comorbidities (specifically mental health related).

By focusing on prevention and adherence to lower cost monotherapy medications as well as addressing the factors that increase the likelihood of cost escalations associated with T2DM, overall expenditures can be addressed. Using this knowledge and health behaviour change methodologies, a digital health intervention for plan members at risk of developing T2DM (assumed prediabetes population) and plan members with T2DM was developed to keep members at low-risk and low cost.

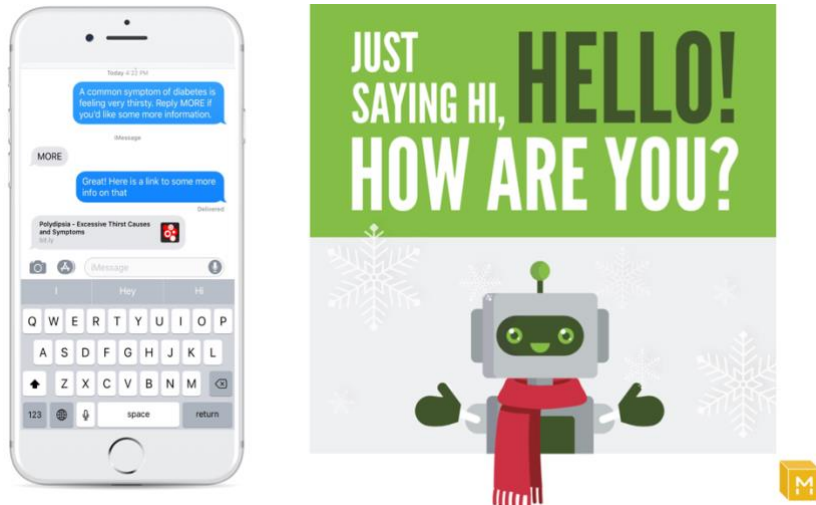
Members who had certain prediabetes risk factors were screened using the CANRISK questionnaire that was converted into a chatbot experience and then enrolled on to a prediabetes stream of the digital intervention. Members who were already claiming T2DM medications were enrolled into the T2DM stream to assess, improve, and sustain adherence to their medications.

## Diabetes Engagement Carebot

# MEMOTEXT

The resulting intervention was a digital health navigation, coach and care bot that engaged plan members for 6-12 months, promoting health benefits provider's service offerings and sending members weekly/bi-weekly and even daily support, educational content, health trivia, and medication reminder messaging. MEMOTEXT, in collaboration with the client, developed a Diabetes Bot Character a digital health intervention aimed at supporting individuals with Type 2 Diabetes Mellitus (T2DM).

This initiative sought to address the health challenges faced by disadvantaged populations with T2DM. The



intervention utilized text messaging to deliver personalized messages that addressed specific Information-Motivation-Behavioral Skills (IMB) barriers, helping patients to overcome obstacles related to medication adherence, self-care behaviors, and overall diabetes management.

The program's content spanned educational, motivational, and feedback-based messaging, tailored to each patient's needs. Notably, the intervention demonstrated significant engagement, resulting in a 91% median response rate to interactive texts over 12 months, while also yielding positive outcomes in glycemic control, medication adherence, and other health behaviors.

## Using Private Insurance Claims to Predict the Onset of T2DM



### Background

Type 2 Diabetes Mellitus is a complex disease that is difficult to understand from claims data alone. It is currently difficult to identify plan member risk of developing T2DM. The sooner the risk for an individual for developing T2DM can be identified, the more proactive and preventative measures can be taken.



### Goals

- 1) Use 'prediabetes' insurance claims data to engineer new risk features and to predict T2DM
- 2) Compare results to the manual method of risk identification using traditional rule-based tagging.



### Methodology

- Claims data dating from 2010-2013 was pre-processed and mined
- Built features to predict the onset of T2DM in the 3-year period ahead
- Applied 3 different algorithms to compare: logistics regression, random forest , and XGBoost for prediction

### Feature Engineering



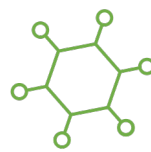
Demographics  
(Sex, Age)



Total  
Conditions



Hypertension  
Meds



Cholesterol  
Med Use



Unique Drug  
Prescriptions



Adherence  
(PDC statins)



## Results

- XGBoost was used to achieve the best performing model
- Comparing model results to manual rule tagging, it is noted that the model had great improvement on metrics such as accuracy, precision, false positive, and specificity

	Manual Rules	VS.	Machine Learning
Accuracy	66.4%		83.0%
Recall	55.1%		41.5%
Precision	8.6%		14.0%
False Positive Rate	31.1%		13.8%
Specificity	67.1%		85.4%

Identifying T2 risk using ML is a great improvement over rule-based tagging. However, a balance between ML & human intervention is required.



## Discussion

Private insurance drug-level claims data can be used to predict which plan members may be at risk for developing diabetes. The use of machine learning leads to higher precision and a decreased false positive rate, which can allow digital health interventions and higher touch resources to be proactively targeted at the right people.

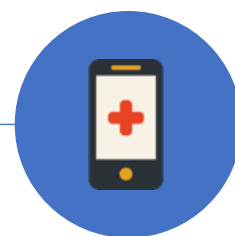


### Analytics/Predictalytics

Business Problem Definition  
Feature Generation  
Predictive Analytics

### Intervention Development

Prototyping & Iterative  
Validation of ML Driven  
Interventions



### ML Reprocessing

Real time Intervention  
Personalization and Proactive

- Engagement
- Plan Design/Modification

### Data Surveillance & Preprocessing

Real-time Surveillance on  
Population (health) / Economics

