Why do Data Scientists Need Medical Experts?

The Medical Expert Role

• To explain medical concepts
• To identify clinical features, variables, guidelines
• To connect to other medical experts
• To provide clinical scenarios/patient feedback
• To interpret results of predictive models
Diabetic Medical Concepts

Hemoglobin A1C – a long term index of glucose control that when elevated correlates with the development of Diabetic Complications such as:

**MICROVASCULAR**
- Diabetic Retinopathy
- Peripheral Neuropathy
- Kidney Disease

**MACROVASCULAR**
- Peripheral Vascular Disease
- Stroke
- Heart attack
Identify Appropriate Guidelines for Model Variable Selection

Endocrinology Guidelines

Important Clinical Parameters

Hemoglobin A1C (average blood sugar) < 7%

Blood Pressure – Stroke Prevention

ACE Inhibitor - Blood Pressure Treatment

Creatinine Blood Test – Reflects Kidney Function

Cholesterol – Risk Of Heart Attack

Aspirin – Stroke and Heart Attack Prevention
Heart Disease Concepts

Searching for Heart Attack Patients in HER

“Chest Pain” Symptom vs Troponin blood test

**Troponin**: specific heart muscle enzyme released into the blood stream during a heart attack. Elevated Troponin = heart damage

**Chest pain** is not specific: could be pneumonia, muscle strain, indigestion
A Multidisciplinary Undertaking

Diabetic Educators
Endocrinologists
General Internists and Pediatricians
Cardiologists
Pharmacologists – Adverse Drug Events
Business School Marketing Personnel – Focus Groups
Medical Center Administrators (De-Identified EHR)
Institutional Review Board Directors (De-Identified EHR)
Who are Consumers and What do they Want?

**Diabetic Patients**
One website to support their self-management efforts
Tracking of glucose, blood pressure, cholesterol, diet, activity, weight
Diabetic News, Diabetic Recipes, Forums, Research

**Diabetic Educators**
Instructional Videos
  - Finger-stick glucose (FSBG) testing using glucometers
  - Insulin injection
  - Glucagon injection
  - Insulin Pump and Continuous Glucose Monitoring
  - Management of Hypoglycemia
  - Diet

**Endocrinologists**
One uniform platform to collect FSBG and insulin pump data
### Summary of patients like you

#### Before Day 0
- 2 patients (1, 2) have improving trends of HbA1c
- 2 patients (1, 2) have worsening trends of HbA1c

<table>
<thead>
<tr>
<th></th>
<th>Improving patient(s)</th>
<th>Worsening patient(s)</th>
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</thead>
<tbody>
<tr>
<td># of smoker</td>
<td>0 (0%)</td>
<td>1 (50%)</td>
</tr>
<tr>
<td># of overweight</td>
<td>1 (50%)</td>
<td>2 (100%)</td>
</tr>
<tr>
<td># of hospitalized</td>
<td>1 (50%)</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>Exercise (minutes/week)</td>
<td>120</td>
<td>60</td>
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<tr>
<td>Complications:</td>
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<td></td>
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<tr>
<td>Stroke</td>
<td>2 (100%)</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>Blindness</td>
<td>2 (100%)</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>Treatments:</td>
<td>Metformin: 2 (100%)</td>
<td>Metformin: 2 (100%)</td>
</tr>
<tr>
<td></td>
<td>Insulin: 2 (100%)</td>
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</tr>
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#### After Day 0
- 2 patients (2, 3) have improving trends of HbA1c
- 1 patient (4) has a worsening trend of HbA1c

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</tr>
<tr>
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DiabeticLink-US: Risk engine

Input values that are significant to hospitalization and stroke predictions

Optional inputs regarding diagnoses and drugs
# Patient A Diabetic Variables
Initial, Intermediate and Final

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Intermediate</th>
<th>Final</th>
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<tbody>
<tr>
<td>HgbA1C%</td>
<td>12.9</td>
<td>9</td>
<td>6.9</td>
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<tr>
<td>Corresponding Average Glucose</td>
<td>324</td>
<td>212</td>
<td>151</td>
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<tr>
<td>Total Cholesterol</td>
<td>240</td>
<td>141</td>
<td>114</td>
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<tr>
<td>HDL cholesterol</td>
<td>39</td>
<td>35</td>
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<tr>
<td>LDL Cholesterol</td>
<td>155</td>
<td>60</td>
<td>59</td>
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<tr>
<td>Systolic Blood Pressure</td>
<td>120</td>
<td>118</td>
<td>100</td>
</tr>
</tbody>
</table>
Motivating patient A to keep working to improve diabetic control
Odds Ratio for Hospitalization as a Function of Treatment over Time

Hospitalization

- Initial
- Intermed
- Final

Graph showing the odds ratio for hospitalization over time with three stages: Initial, Intermed, and Final.
Conclusion

Healthcare data analytics is a multidisciplinary effort requiring participants to learn the language of a new knowledge domain.

It is most likely to be successful when an institution has multiple partners invested in the project in a collaborative fashion.

Individual patient experience suggests a health portal like Diabeticlink can have a profound effect on patients to motivate them to maintain good control of their Diabetes. Future work could utilize EHR data to develop additional strategies to improve diabetes management.