### 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

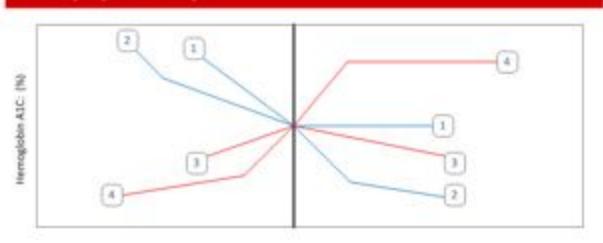
Management of Hypoglycemia

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 HbALc 2 patients (1, 2) have worsening trends of HbALc

#### After Day 0

2 patients (2, 3) have improving trends of HbA1c 1 patient (4) has a worsening trend of HbA1c

	Improving patient(s)	Worsening patient(s)	Improving patient(s)	Worsening patient(s)
# of smoker:	0 (0%)	1 (50%)	0 (0%)	1 (100%)
# of overweight:	1 (50%)	2 (300%)	2 (100%)	1 (100%)
# of hospitalized:	1 (50%)	2 (100%)	1 (50%)	\$ (200%)
Dentise (minutes/week):	120	60	120	٥
Complications: (see more details)	Strake: 2 (100%)	Stroke: 2 (100%) Blindness: 2 (100%)	Stroke: 1 (50%)	Stroke: 1 (100%) Heart attack: 1 (100%)
Treatments:	Metformin: 2 (100%)	Methormin: 2 (100%) Invalin: 2 (100%)	Metformin: 2 (100%) Insulin: 1 (50%)	Metformin: 1 (100%) Weather: 1 (100%)

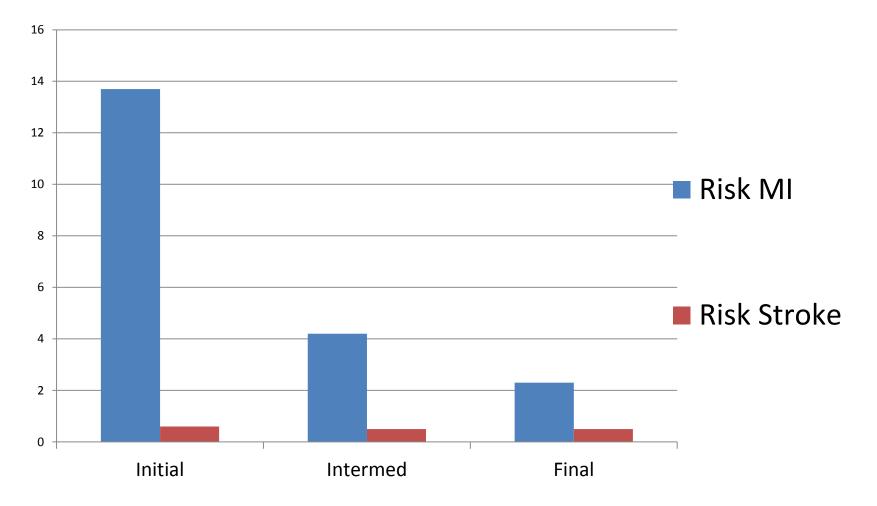
## **DiabeticLink-US: Risk engine**

Gendee     Male • Female       Smoking     • Yee • No       Smoking     • Yee • No       Current Age     45       Current Age     45       Duration of     12       Diabotes (Yourn)     7.6       A1c (%)     7.6       Cholesterol (mdigi)     60.0       HOL Cholesterol (mdigi)     120.0       LDL Cholesterol (mdigi)     120.0       LDL Cholesterol (mdigi)     120.0       Systolic Bin     120.0       Cholesterol (mdigi)     120.0       Cholesterol (mdigi)     120.0       Cholesterol (mdigi)     120.0       Cholesterol (mdigi)     120.0       Cholesterol (mdigi)     120.0       Cholesterol (mdigi)     120.0	Select 'yes' if you have smalled any cogneties in the past month coord pressure - Syntoxic blood pressure in the first number of your blood pressure
Simoking        • Yes * No         Simoking       Systolic b       reading Fit       120       Total       Cholesterol       (md/gf)         Total       Collesterol       (md/gf)	20 2017 전문 전 1월 2018 년 1월 2018 전문 1월 2018 전문 1월 2019 전문 1월 2017 전문 1월 2
Smoking     O Yes (Mo     Systelic b       Current Age     45     120       Duration of     12     Total choin higher you       Diabotes (Yourn)     7.5     Considered can clog a clot forms and called period blood to the thore of the the thore of the the thore of the	20 2017 전문 전 1월 2018 년 1월 2018 전문 1월 2018 전문 1월 2019 전문 1월 2017 전문 1월 2
Current Age     45     120.       Duration of Diabotes (Years)     12     Total choic higher you UDL choice considers a clot forms forms and choicesterol (md/gf)     7.5     consider considers considers considers forms and called per blood to th HDL choicesterol (md/gf)       HDL Choicesterol (md/gf)     60.0     HDL choicesterol third of blo protect age to increase Systelic BP     160.0       Systelic BP     160.0     Creatining third of blo protect age to increase Creatining	가 있는 것같은 2000년 2001년 1월
Duration of Diabotes (Yourn)     12     higher you LOL chole considered can clog a clot forms and clot for	r example, if your reading is 120/90 (120 over 80), your systolic blood pressure is
Diabotes (Yours)  ATc (%)  Total  Cholesterol  (md/g0)  HDL Cholesterol  (md/g0)  HDL Cholesterol  (md/g0)  LDL Cholesterol  (md/g0)  (md/g0)  LDL Cholesterol  (md/g0)  (md	esterol - Total cholesterol is the sum of all the cholesterol in your blood. The
A1c (%)     7.5     considered can clog a clot forms and clot forms and called per blood to the bloo	total cholesterol, the greater your risk for heart disease. sterol - Low density lipoproteins (LDL) is the 'bod' cholesterol. LDL cholesterol is
Afte (%)     7.5     can clog a clot forms and called periy blood to the HDL Cholesterol (md/g0)       HDL Cholesterol (md/g0)     60.0     is consider Experts be and back to the d blog protect age to increase Systelic BP       Systelic BP     160.0     creating of the increase Cr	the 'bad' cholesterol because it contributes to plaque, a thick, hard deposit that
Total     200.0     forms and called period       Cholesterol     (mily0)     blood to the HDL chole       HDL Cholesterol     60.0     is conside       (mily0)     Experts be and back the init of blood protect age to increase       LDL Cholesterol     120.0     protect age to increase       Systolic BP     160.0     Creatining normal, cmithing)	teries and make them less flexible. This condition is known as atherosclerosis. If a
Cholesterol     200.0     called period       (mdigit)     HDL cholesterol     60.0     HDL chole       (mdigit)     Experts be and back to (mdigit)     and back to their of blo protect age to increase Systelic BP     160.0       Systelic BP     160.0     Creatining through yo	and blocks a nanoved artery, heart attack or stroke can result. If a blood clot
(milligit)     blood to th       (milligit)     HDL chole       (milligit)     Experts be and back there of (milligit)       LDL Cholesterol     120.0       (milligit)     protect age to increase Systolic BP       (milligit)     160.0       (milligit)     creatining rormal, creatining through yo	blocks a nanowid artery, a heart attack or stroke can result. Another condition heral artery disease can develop when plaque buildup narrows an artery supplying
Hot, Crosseneror     Gold     Experts be and back t       LDE, Cholesterol     120.0     third of blo protect ag to increase Systolic BP       Systolic BP     160.0     Creativity through yo	tegs: (Anescan Heat Association: Good vs. Bad Cholesters) )     eterol - High density lipoproteins (HDL) is the 'good' cholesterol HDL cholesterol
LDL Cholesterol         120.0         and back t           LDL Cholesterol         120.0         protect age           (md/gi)         to increase         to increase           Systolic BP         160.0         Creatining           (immitig)         through yo         through yo	ed 'good' cholesterol because it helps remove LDL cholesterol from the artisties.
LDL Cholesterol 120.0 third of blo protect age to increase Systelic BP 160.0 Creatinine protect age to increase Creatinine normal, cre through yo	beve HDL acts as a scaveoger, canying LDL cholesterol away from the atteries. o the liver, where it is broken down and passed from the body. One-fourth to one-
CDC Construction         F2000         protect age to increase           Systulic BP (mothg)         160.0         Creatining normal, cn through yo	In the second seco
printing) normal, cri printing) through yo	inst heart attack and stroke, while low levels of HOL chalesterol have been shown the risk of heart disease. (American Heart Association: Good vis. Bad Cholesterol)
(hinned) through yo	- Creatinine indicates how well your kidney's work. If kidney function is not
	atnine level increases in your blood. This is because less creatinine is released or uses. (MedimePros Page: Creatinine blood test.)
1.9	
A 23 K	
Atrial O Yes & No Fibrillation	
T THE FRANKING	Ontional inputs regarding
	Optional inputs regarding

# Patient A Diabetic Variables Initial, Intermediate and Final

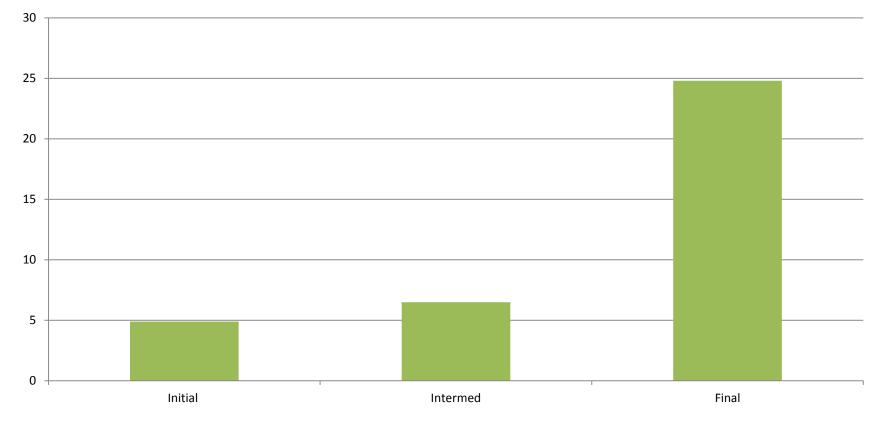
HgbA1C%	12.9	9	6.9
Corresponding Average Glucose	324	212	151
Ulucose	524	212	IJI
Total Cholesterol	240	141	114
HDL cholesterol	39	35	30
LDL Cholesterol	155	60	59
Systolic Blood Pressure	120	118	100

# Motivating patient A to keep working to improve diabetic control



# Odds Ratio for Hospitalization as a Function of Treatment over Time

## Hospitalization



# 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.