Using Predictive Analytics to Build a World Class Healthcare System

Blue Health Intelligence®

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- President and CEO of Blue Health Intelligence

BHI Overview

- Represents the largest health information database in the U.S.

  - Contains claim line level detail on more than 110 million lives

  - Reflects national coverage representing significant sample size of membership and medical utilization in every U.S. ZIP code

  - Captures seven years of longitudinal claims experience

- Focus on Quality of data

  - Undergoes four levels of certification, including independent external actuarial review

- Enhanced and transformed data to facilitate analytics and predictive modeling

  - Consistency of groupers, dimensions and metrics that promote analytic efficiencies

- Complies fully with HIPAA regulatory requirements

The State of Healthcare

- **Healthcare Cost Rising**
  - United States spends **more than twice** as much on each person for health care as most other industrialized countries. But it has fallen to last place among those countries in preventing deaths through use of timely and effective medical care.[1]

- **Healthcare Quality is not improving**
  - The World Health Organization's ranking of the world's health systems places the United States at **#37**[2]
  - At least 30 cents of every healthcare dollar goes to care that is ineffective or redundant.[3]

- **Patient Safety clearly remains a concern**
  - In the Medicare program alone, preventable adverse events have been estimated to cost hundreds of millions of dollars annually

- **Fragmentation continues to plague the system**
  - Patients have only a 50% chance of getting the most advisable care, with "dangerous gaps" between best known practices and actual received care.[4]
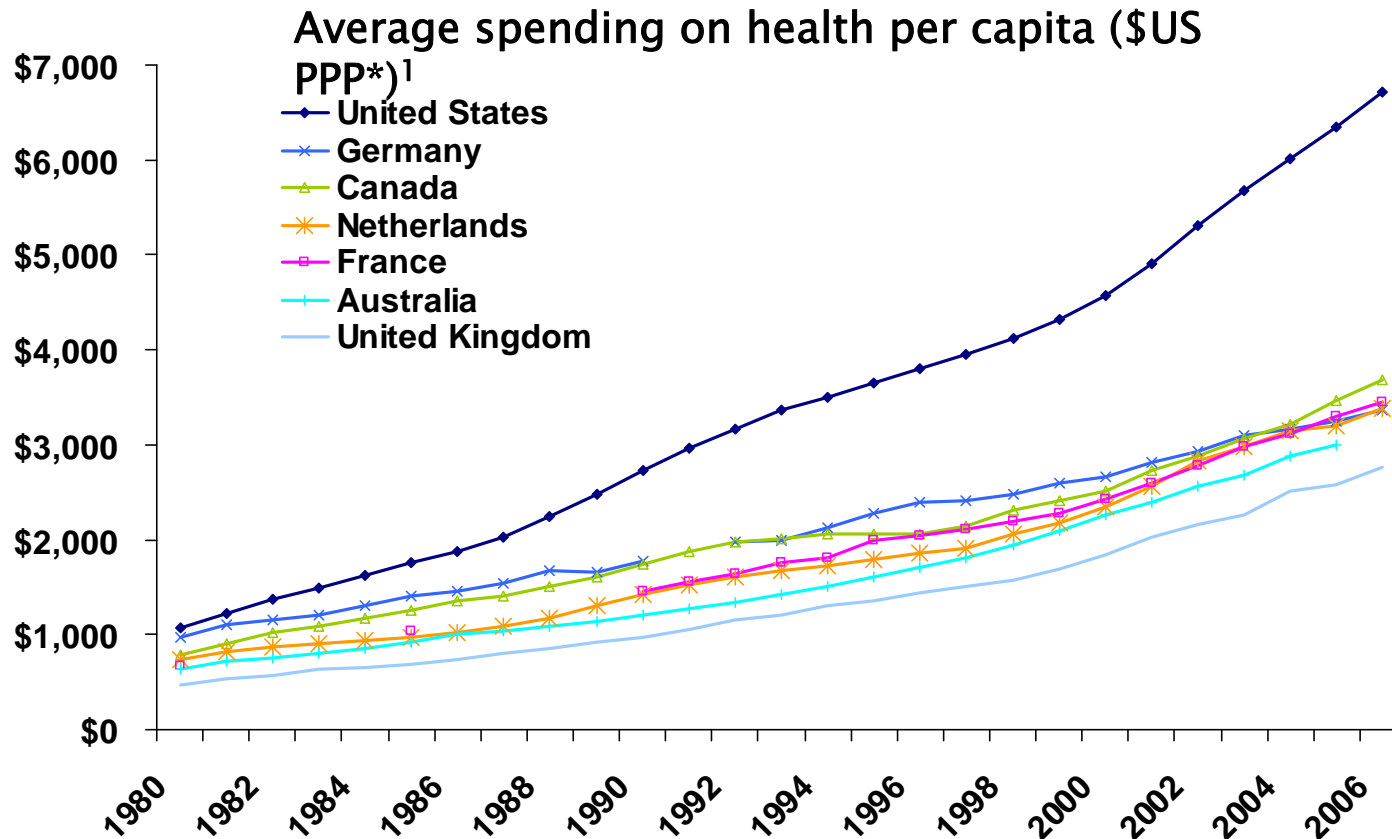
1. T*he Path to a High Performance U.S. Health System: A 2020 Vision and the Policies to Pave the Way*, February 2009.
2. World Health Organization World Health Report 2000 press kit: http://www.who.int/whr/2000/media_centre/press_release/en/ accessed August 2011.
3. Fisher and Wennberg, 2003
4. Schuster, 1998 and Robert Wood Johnson Foundation, 2010

Spending on health

Average spending on health per capita ($US PPP*)[1]

Legend:
- United States
- Germany
- Canada
- Netherlands
- France
- Australia
- United Kingdom

Where is the industry today?

- A **disproportionate share of medical costs** are incurred by chronic care patients

- **Limited resources** requires effective allocation and management

- Sufficient data exists but many players **do not have the analytical tools** to generate accurate, actionable insights

- Providers do not have the **infrastructure** in place to become engaged in the care management process (i.e., identify their patients by disease state, utilize and comply with disease management guidelines)

Chronic care drives healthcare costs

Patients with chronic medical conditions account for:

- *76% of inpatient admissions[1]*
- *88% of prescription drug use[1]*
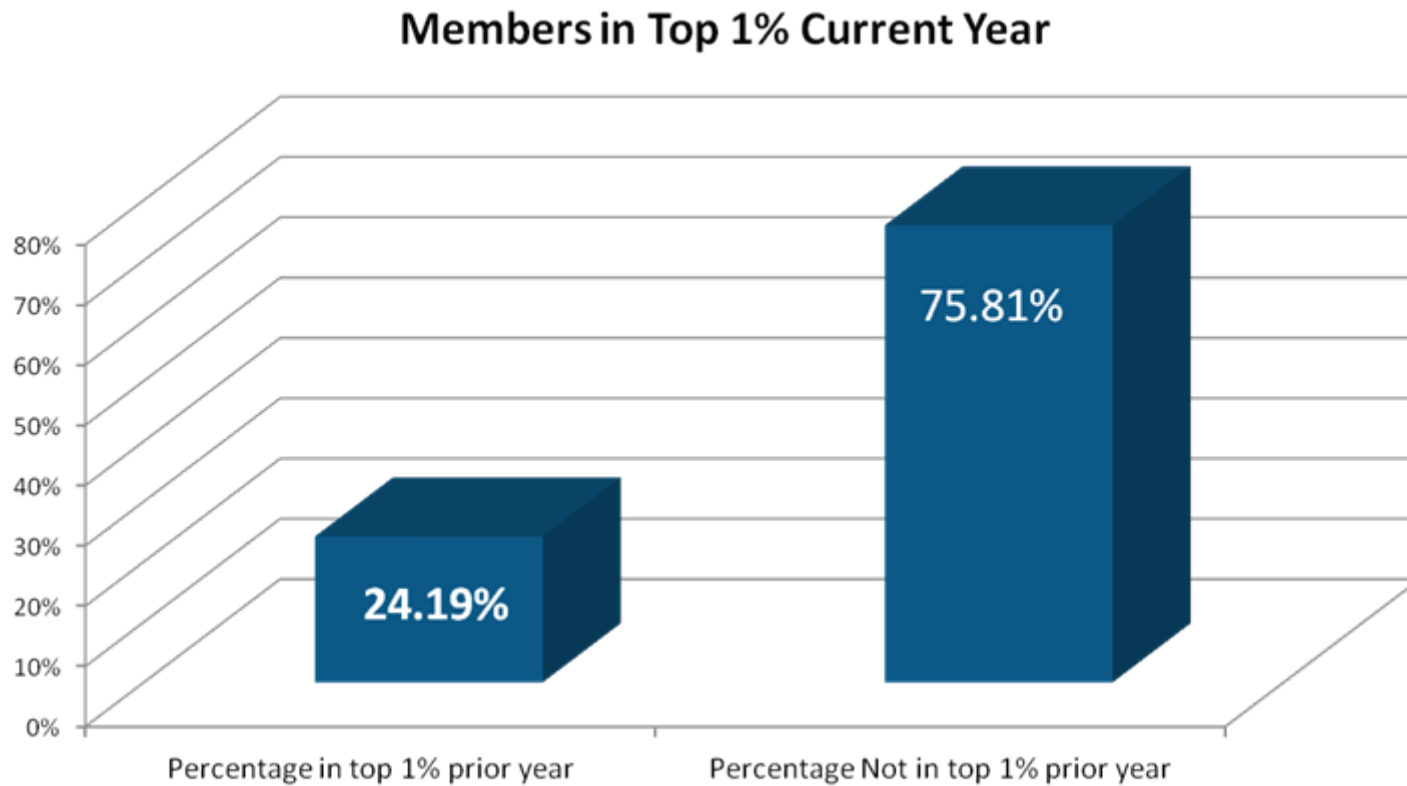- *96% of home care visits[1]*
- *72% of physician visits[1]*

Population Contribution to Total Health Care Costs [2]

Membership	Medical Costs
95%	45%
4%	28%
1%	27%
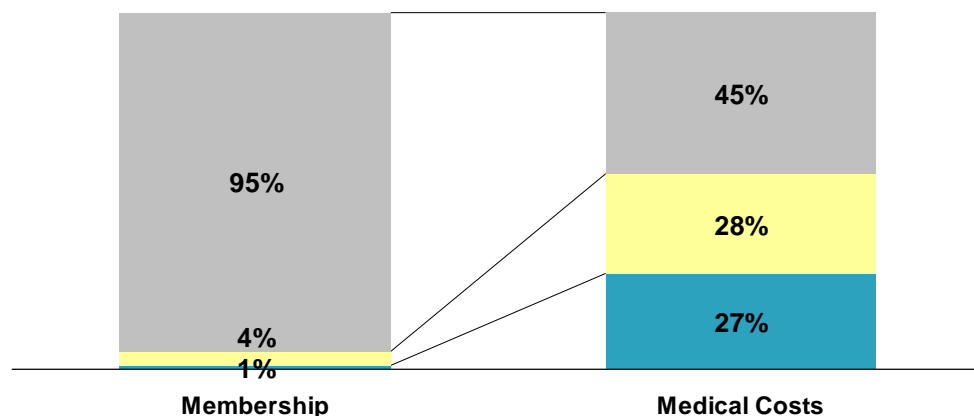
- Chronic Disease – 50–75% of US healthcare spend
- Chronic Diseases – 125mm Americans with at least 1 chronic disease, 45mm with >2 chronic conditions

1. Chronic Conditions: Making the Case for Ongoing Care; December 2002; Partnership for Solutions, Johns Hopkins University, for The Robert Wood Johnson Foundation. 2. AC Monheit, "Persistence in Health Expenditures in the Short Run: Prevalence and Consequences," Medical Care 41, supplement 7 (2003): III53–III64.

Prior Cost Identification Results

Members in Top 1% Current Year

Bar chart showing: Percentage in top 1% prior year = 24.19%; Percentage Not in top 1% prior year = 75.81%
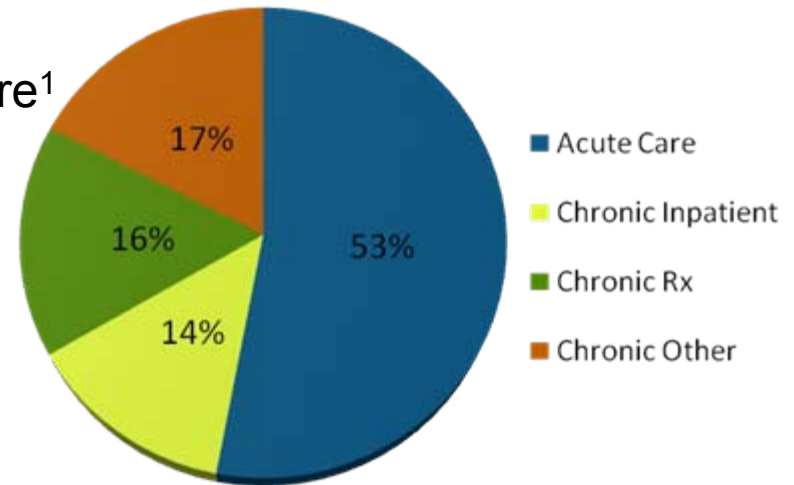
So, what do we need?

Predictive Modeling to Facilitate Quality Improvement & Contain Costs

- Predict high-risk/high-impact members who are motivated in order to provide appropriate care

- Addresses Prevention, Wellness & Safety initiatives

- Promotes effective disease management initiatives

- Identify effective paths that lead to quality outcomes

Impact of Chronic Conditions: Diabetes

- Diabetes cost the country an estimated $194 billion in 2010[1]

- Age of onset continues to get younger.

- If current trends continue:
  - More than half of all Americans will have diabetes or pre-diabetes by 2020[1]
  - Diabetes will account for an estimated 10 percent of total healthcare[1] spending, or almost $500 billion
  - Distribution of Diabetes healthcare expenditures is highly skewed to Acute Care[1]

Pie chart:
- Acute Care 53%
- Chronic Inpatient 14%
- Chronic Rx 16%
- Chronic Other 17%

1. The United States of Diabetes: Challenges and Opportunities in the Decade Ahead Working Paper 5 November 2010 http://www.unitedhealthgroup.com/hrm/UNH_WorkingPaper5.pdf Accessed August 2011.

What do we really know about Joe?

- Is Joe at risk for future complications of his diabetes that could result in a hospitalization?

- Can we quantify his risk for the next 12-months?

- How does his risk compare to that of other persons with diabetes?

- What about Joe's delivery system?

- What can Joe's primary care physician do to reduce his risk?

- What can Joe do to reduce his risk?

- What can Joe's Health Plan do?

Health Management – What would Joe, his physician & employers want to know?

- **What is his risk of hospitalization?**
  - Due to short-term complications of his Diabetes?
  - Due to long-term complications of his Diabetes?

- **What factors put him at risk?**

- **What factors can we do something about to reduce his risk?**

- **How many "Joes" are out there?**

What if we had a tool that told us about Joe?

- Joe is in the high-risk group relative to his peers for both short-term and long-term diabetic complications
  - He has a **26%** chance of a hospitalization for <u>any</u> reason
  - He has a **24%** chance of a <u>diabetic</u> hospitalization
  - He is in the **top 5th percentile** (relative to other individuals with diabetes) for risk of a diabetic hospitalization that AHRQ has defined as avoidable
  - The mean **annual medical and pharmacy costs** of peers in his risk group are in the $17,000 - $25,000 range

- Joe's high risk of an avoidable diabetic complication is driven by modifiable factors, such as:
  - Lack of regular, evidence-based primary care such as he might get from a patient-centered medical home
  - Lack of compliance with diabetic drug therapy
  - Behaviors that seem to keep him from managing his diabetes well

Risk Group Comparisons for Short Term Complications Model

Any Diabetes-Related Hospitalizations in 2008 By Discrete Risk Stratification Groups of STC Model
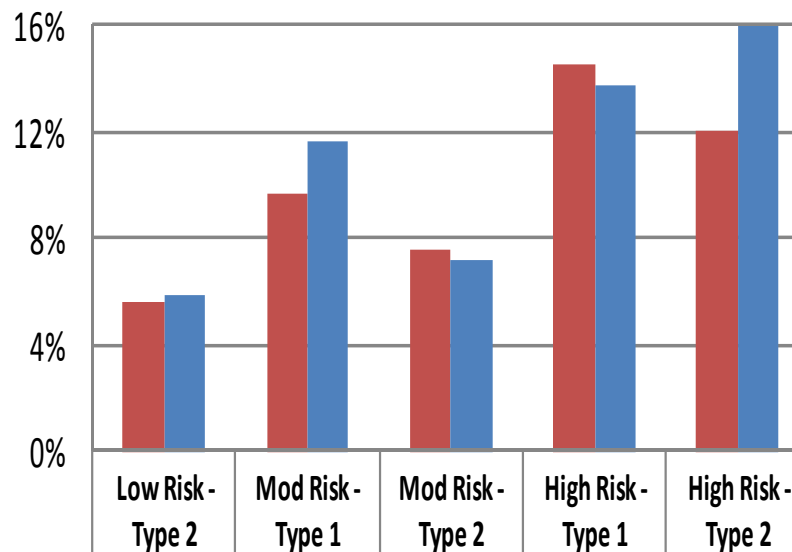
	Low Risk - Type 2	Mod Risk - Type 1	Mod Risk - Type 2	High Risk - Type 1	High Risk - Type 2
Predicted Rate of Diabetes Hospitalization	5.65%	9.64%	7.54%	14.46%	12.07%
Actual Rate of Diabetes Hospitalization	5.83%	11.63%	7.22%	13.68%	18.28%

- The short-term complications model was also used to predict member risk for any diabetic hospitalization
- The three risk groups showed very good discrimination for predicted risk of hospitalization in 2008
  - All differences between risk categories, as stratified by phenotype, were significant (p <.05 on ChiSq).
- Predicted rates of hospitalization were very close to actual rates experienced in 2008 across the risk groups

BHI models score sheets: Joe's scored Risk Profile

Risk Scoring for Short-Term Complications

Adding Up the Points by Category	Points
Diabetic Phenotype	0
Sociodemographics	4
Co-Morbidities	2
Ambulatory Care	7
Diabetes Pharmacy Care	9
Emergent Care	3
Inpatient Care	0
Total Risk Points	**25**
Risk Ranking	**High**

Risk Scoring for Long-Term Complications

Adding Up the Points by Category	Points
Diabetic Phenotype	0
Sociodemographics	2
Co-Morbidities	3
Ambulatory Care	5
Diabetes Pharmacy Care	8
Emergent Care	1
Inpatient Care	0
Total Risk Points	**19**
Risk Ranking	**High**

Computed Risk for Short-Term Complications

	Joe's Risk Profile
Risk Points	Risk Points: 14 - 49
Risk Category	High Risk
Risk Percentile Rank (vs. all diabetics)	95th - 99th
Predicted Risk of STC Hospitalization	2.19%
Predicted Risk of Diabetes Hospitalization	12.07%
Predicted Risk of Any Hospitalization	20.83%

Computed Risk for Long-Term Complications

	Joe's Risk Profile
Risk Points	Risk Points: 11 - 34
Risk Category	High Risk
Risk Percentile Rank (vs. all diabetics)	95th - 99th
Predicted Risk of LTC Hospitalization	2.67%
Predicted Risk of Diabetes Hospitalization	24.49%
Predicted Risk of Any Hospitalization	26.25%

What it all means

What we KNOW about Joe's risks

→

What can we DO to assist Joe & his physician to REDUCE HIS RISKS

- Care (emergent, ambulatory, inpatient, Rx) history factors that places him at higher risk
- Co-morbidities
- For <u>any</u> hospitalization
- For hospitalization of short-and long-term complications
- Percentile ranking
- What factors put him at risk that cannot be controlled
- What factors can we (Blue Plans), Joe, and his physician **do** something about to reduce his/Joe's risk

- Prioritize interventions for members at highest risk, with modifiable risk factors
- Targeted health management strategies (case management, diabetes, wellness)
- Hospitalization – active case management strategies
- Physician /provider engagement identifying Joe's risk factors
- Physician member population profiling
- Educate and engage Joe, providing him information, education and support specific to his risk factors he can impact

Predictive Models also need to be built for "*RARE*" populations like Pediatric Diabetes

Large databases are necessary to support model development and accuracy of application

- Pediatric Diabetes claims prevalence increased 4% over 3 years[1]
  - Highest trends in observed 15-19 age groups[1]
    - Prevalence trends vary by geography indicating areas where local interventions are most necessary
  - Less than 60% of pediatric diabetes members met appropriateness of diabetes care[1]
    - Informing providers of which pediatric patients have compliance gaps helps to promote evidence based care and improves outcomes

- Obesity and Depression predicts high risk of hospitalization

- Obesity and Depression predicts lower probability of meeting appropriate diabetes care guidelines

Predicting Diabetes-Related Hospitalization among Pediatric Members with Diabetes

- 5.4% Hospitalization Rate for Pediatric Members with Diabetes

- Strongest Predictors of Hospitalization
  - Race (% Caucasian, U.S. Census)
  - Presence of Depression
  - Presence of Liver / Gall Bladder Disease
  - Relationship of HbA1c tests
  - Prior Hospital LOS

- Model Statistics
  - Odds Ratio = 7.1
  - CI95% = [4.7, 10.4], p-value < 0.0001
  - Sensitivity = 73%, Specificity = 72%

Gains Curve (Validation Set)

% of Hospitalized Members (y-axis)

% of All Members (x-axis)
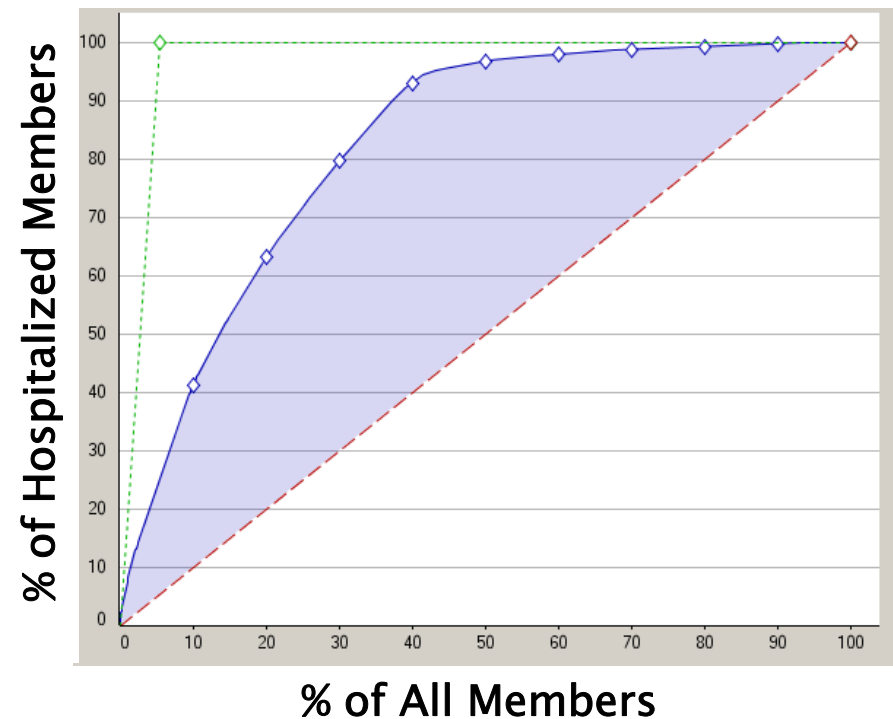
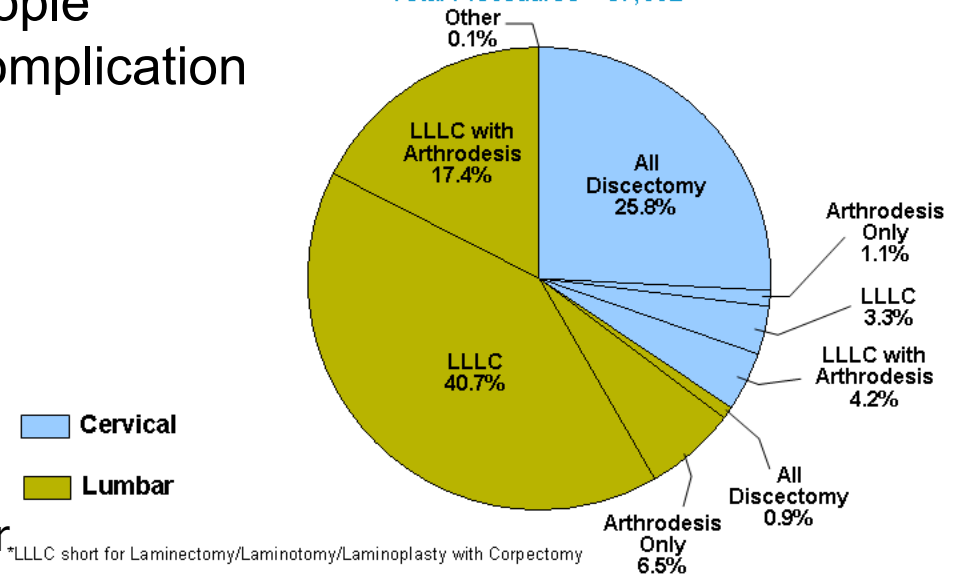# Predictive models are needed to assess quality and safety for high impact procedures: Spinal Surgery

- Prevalence rate for spinal surgery is high and growing
  - 1.54 per 1,000 members (65% lumbar and 35% cervical)

- People who underwent surgeries and had complications cost twice as much ($27,669 vs. $13,707)

- What if we could predict those people who were more likely to have a complication with surgery?

WE CAN

- Predictors of complications:
  - Diabetes, Cancer, <u>Mental health disorder and substance abuse</u> increase risk of complications
  - Predictions hold for both lumbar and cervical spine surgeries
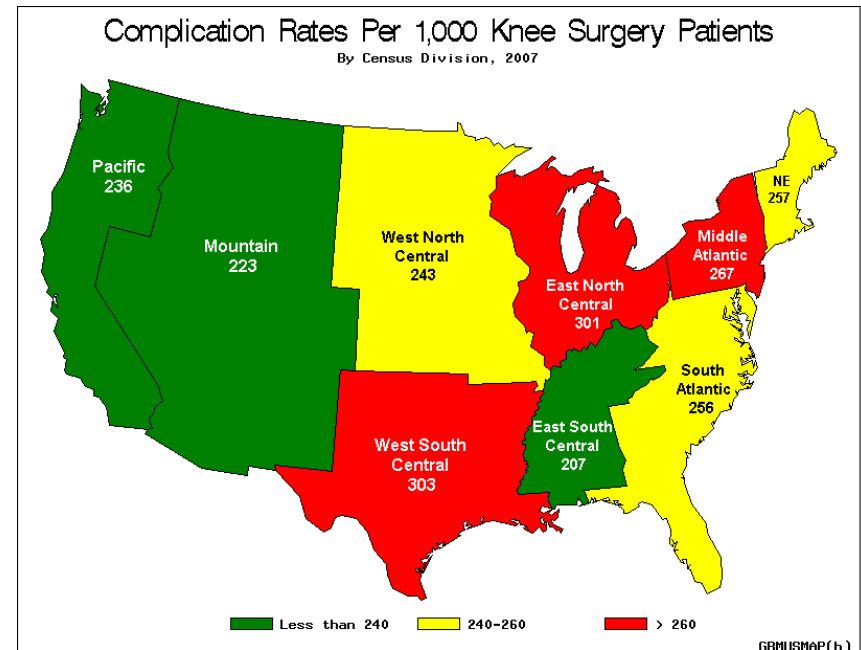
Distribution of Procedures (2007)
Total Procedures = 57,662

- Other 0.1%
- LLLC with Arthrodesis 17.4%
- All Discectomy 25.8%
- Arthrodesis Only 1.1%
- LLLC 3.3%
- LLLC with Arthrodesis 4.2%
- All Discectomy 0.9%
- Arthrodesis Only 6.5%
- LLLC 40.7%

Cervical
Lumbar

*LLLC short for Laminectomy/Laminotomy/Laminoplasty with Corpectomy

# Predictive models are needed to assess quality and safety for high impact procedures: Knee Replacements

- Wouldn't you like to know if you are at higher risk for a complication? **WE KNOW**

- Patient age, regional norms of care and types of co-morbidities have a significant influence on complication rates
  - Younger ages have higher risk.
  - Certain geographies have higher risk, implying high variance in how medicine is practiced.
  - Obesity, pain, diabetes, osteoporosis, <u>mental health, substance abuse</u> have an independent statistically significant higher odds of a complication *(controlling for age, gender and census division)*

Complication Rates Per 1,000 Knee Surgery Patients
By Census Division, 2007

Pacific 236 | Mountain 223 | West North Central 243 | East North Central 301 | Middle Atlantic 267 | NE 257 | West South Central 303 | East South Central 207 | South Atlantic 256

Less than 240 | 240-260 | > 260

GRMUSMAP(b)

Complications include: Hematoma, Blood Clots, Infections, Cellulitis, Pneumonia, Stroke, Sepsis, Orthopedic Device/Prosthesis

BHI is Impacting Medical Cost Management and Highlighting Best Practices

Prometheus Potentially Avoidable Complications Initiative

- Potentially avoidable complication can represent anywhere from 5% – 75% of overall condition/procedure costs.
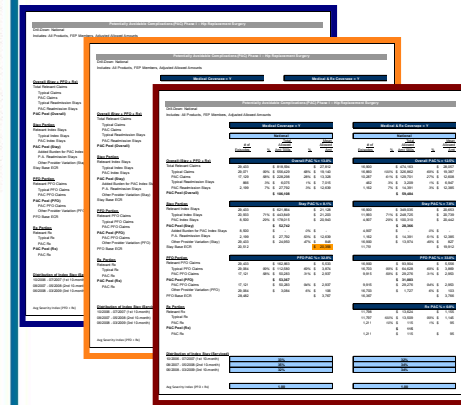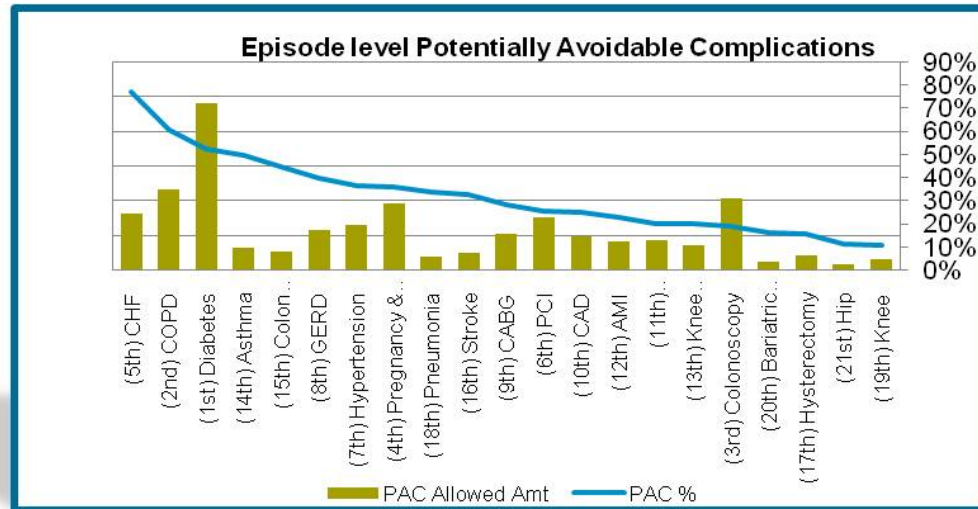
- Wouldn't you want to know which physicians or facilities had the lowest complication rates? **WE DO KNOW**

- Wouldn't you want to share best practice knowledge across facilities?
  WE CAN

Power of BHI through Predictive Modeling

"This type of data does not exist anywhere else."

– *Physician Advisory Group Member*

"This information can inform policy development."

– *Plan Medical Officer, Medical Policy*

"Finally, we have a way of obtaining directional insights."

– *Physician Advisory Group Member*

"We should share this information with accounts to promote the concept of promoting child health in the workplace."

– *Employer Advisory Group Member*