Clinical Big Data and Practice Based Research Networks are the Foundations for a Rapid Learning Health System

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Disclosure Statement

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I have no conflicts of interest to report
Objectives

- Learning
- Intelligence
- Big Data
- PBRNS
• Knowledge Generation from Practice
• Outgrowth and Product of Healthcare Delivery
• Continual Improvement
• Practice Based Evidence
• Narrows Research-Practice Divide
• Relevant to Clinical Practice & Environments
• Better Care, Health, Cost
• Real-Time Access
• Digital Capture Care of Experience
• Engaged, Empowered Patients
• Rapid Data Driven Results
• Now Possible Because of Electronic Health Record Adoption
Health Systems Intelligence

- Raw Data into Information & Action
- Enormous Data Volumes
- Easy Interpretation
- Opportunities & Strategies
- Process and Health Improvement
Health Intelligence Analytic Phases

Healthcare Value

Health Intelligence

Optimize

Prescriptive

Predictive

Descriptive

Achieve the Best

What Actions?

What’s Next?

What, How Many, Where?
1) Descriptive Analytics

- Hindsight/What Happened
- Simple Summaries
- Tables, Charts, Graphs
- Dashboards
- Queries
- Clinical QI Reporting

% In Control

Clinic 1
Clinic 2
Clinic 3
2) Predictive Analytics

- Insight - Why & What’s Next
- Regression Modeling
- Machine Learning
- Data Mining
- Simulation
- Forecasting
- Predict Future / Unknown Events

Asthma = Age + Gender

Asthma Prevalence

Age as of the most recent BMI
3) Prescriptive Analytics

- Foresight – Take Action by
- Taking Advantage of Predictions
- Suggest Interventions
- Test & Monitor Outcomes
- Optimization
- Effectiveness
3) Prescriptive Analytics

• Patient Centered Care = Patient Relationship Management

• IT Systems to automate, organize and synthesize
  – Services/Team Care Coordination
  – Navigation/Literacy
  – Patient Centered Compliance

• Optimize Health System Response, Outcomes, Lower Costs

• Unrealized Opportunity in Healthcare
Rapid Learning Conceptual Model

Big Data

PHINEX
- Descriptive Analytics
- Predictive Analytics

PBRN
- WREN
  - Prescriptive Analytics
  - Targeted Interventions
  - Assessment
  - Optimization
Clinical Big Data
✓ UW Primary Care
✓ 500,000 Patients
✓ 21 Million Encounters
✓ 15 Million Prescriptions
✓ 3.1 Million Diagnoses

Linked Community Factors (~6,000 Variables)
✓ Economic Hardship
✓ FFV Consumption
✓ Retail Food Environment
Geographic Distribution of Patients in PHINEX Database

PHINEX Patient Population (per 1,000 pop by block group)
- 0
- 1-10
- 11-50
- 51-100
- > 100
Health Outcome Drivers

- **Health Behaviors**
  - Patient Factors: 30%

- **Social and Economic**
  - 40%

- **Environment**
  - 10%

- **Clinical Care**
  - 20%
Predictive Analytics
Asthma; Control = Behaviors + SES + Environment + Clinical Care
Descriptive & Predictive Analytic Approach

Mapping
- Risk Factors
- Prevalence & Control

Multiple Logistic Regression Prediction
- Disease Risk
- Control
### PHINEX Analytics
Asthma Risk and Control

<table>
<thead>
<tr>
<th>Outcomes =</th>
<th>Health Behaviors Patient Factors +</th>
<th>Clinical Care Factors +</th>
<th>Physical Environment, Social, and Economic Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma Risk 40,011 / 258,837 15.5%</td>
<td>Age Gender Race BMI Smoking Insurance Payor Census Block Group</td>
<td>Clinic</td>
<td>Census Block Group: Economic Hardship Index Urban/Suburban/Rural</td>
</tr>
<tr>
<td>Uncontroled 6,554 / 40,011 16.4%</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Electronic Health Record Data</th>
<th>Community Level Data</th>
</tr>
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</table>
Logistic Regression
Predictive Models

Asthma = Age, Gender, Race, BMI, Smoking, Payor, Urban, EHI
Wisconsin Research & Education Network

- 300 Members
- 200 Practicing Clinicians
- 80 Clinic Sites
- 37 Healthcare Orgs
Practical Asthma Control Evaluation (PACE)
Sorkness, Guilbert, Hahn, Hanrahan

- Systems Approach to Improve Outcomes
- Evaluate Efficacy - Targeting Interventions, Tracking Results
- Risk Factors for Poor Outcomes
PACE

• Pilot – for Cluster Randomized Trial
• Usual Care vs
• Systematic Assessment & Management
• Intervention
  – ACT
  – Step-Care Guideline Treatment
  – Reassessment
• Efficacy
Practical Advice to PBRNs – Using Big Data

Need for Multidisciplinary Teams

- Informatics
- Database Engineering
- Communications Outreach
- PBRN
- Biostatistics & Geographic Analytics
- Epidemiology
- Public Health
- Primary Clinical Care
- Specialty Clinical Care
- Specialty
- Clinical Care
- Clinical Care

Health Study
Contact Information

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