Towards a Continuous Learning Ecosystem:
Data Innovations and Collaborations to Improve Clinical Outcomes and Reduce Cost of Care

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May 16, 2014
Innovation Enterprise Big Data & Analytics in Healthcare
Philadelphia, PA
Outline

• The Healthcare Ecosystem:
  – Current State ➔ Continuous Learning Ecosystem

• Collaboration & Alignment: The Key to Improvement

• Using Data, Analytics and Insights: Move from Silos ➔ Collaboration

• Scenarios: How will all this work out?
  – Medication Adherence
  – Shortage/Overage of Medicines

• Frameworks
  – Collaborative Health Interventions
  – Collaborative Healthcare Supply Chain

• Conclusions and Next Steps
The Healthcare Ecosystem: Current State

Siloized Ecosystem – Lack of collaboration/coordination
Fragmented, inefficient supply chains!
Ability to share and exchange clinical information and knowledge is a critical enabler.
Collaboration: Key to Improvement

- Two modes of collaborations
  - Business Driven Optimization Imperative
  - Data/Analytics Sharing: Ad Hoc Collaboration

- Business Driven Collaboration
  - Optimization based on Supply Chain and Procurement Efficiencies
  - Formal contracts and business relationships – prevalent in other domains – e.g., Manufacturing, Automotive Parts (AIAG), etc.

- Sharing of Data, Analytics and Insights
  - Benefits of Data/Analytics Sharing are being explored and discovered
  - Collaboration is still ad-hoc and informal
Silo: Clinical Care

Follow Instructions:
Lab Tests, Medications, others

Medical History? Medications?
Allergies? Contraindications?
Referrals? Follow Up? Reimbursement

Continuous Learning Ecosystem: Roadblock

Does the physician have time and incentive to identify insights, research new ideas and share them with other stakeholders?
Continuous Learning Ecosystem: Roadblock partially addressed
Transition to Pay for Performance has begun!

However: Improving Performance requires research – and sharing of insights and results

Pay for Insight/Pay for Research is not yet on the agenda!
New Interventions (Therapeutic, Incentives, Engagement)?
Impact of new ongoing research? Patient Participation?
Contribution of Insights:
New Cost Effective approach, Drug Side Effects, New Behavioral Incentives
Granular Care Delivery contexts where Interventions are effective?
Genomic correlates of behavioral/activation characteristics?
From Silos ➔ Collaboration

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<tr>
<th>Population</th>
<th>Clinical Care Dimensions*</th>
<th>Genome</th>
<th>Toxicity/Efficacy</th>
<th>Cost</th>
<th>Risk</th>
<th>Quality</th>
<th>Behavioral/Activation</th>
<th>Therapeutic Intervention</th>
<th>Engagement/Outreach</th>
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Interventions that need to be studied/evaluated

Alignment
Patient Care Archetypes ↔ Cost/Quality Populations ↔ Behavioral/Activation Segments ↔ Patient Stratification
Do physicians have the orientation to do research in the context of clinical practice?

Physicians continue as usual – Automated Infrastructure pulls data and performs “Research Analytics”

Is this transition feasible: Fee for Service => Pay for Performance => Pay for Insight
Scenario 1: Medication Adherence

- Need to incentivize sharing data generated from ongoing observations and measurement
- Need for a trusted “Third Party Research Organization/Aggregator”
Scenario 2: Medical Supply Shortage

- Weather Patterns
- Crime Rates
- Area Disease Prevalences
- Area Demographics

External Variables

Patient Arrival → Emergency Room → ICU/CCU → General Ward → Step Down Unit → Patient Discharge

Drug Inventory Levels
Consumption/Utilization characteristics

Patient Variables
- Diagnoses
- Severity
- Cost
- Effectiveness
- Utilization

Process Variables

- Weather Patterns
- Crime Rates
- Area Demographic
Scenario 2: Medical Supply Shortage

External Variables
- Weather Patterns
- Crime Rates
- Area Disease Prevalences
- Area Demographics

Hospital Process Variables
- Drug Inventory Levels
- Consumption/Utilization characteristics
Framework: Collaborative Healthcare Intervention

- Therapeutic Intervention
  - Drugs, Procedures
  - Devices

- Informational
  - Outreach
  - Wellness Apps

- Motivational
  - Engagement
  - Personal Incentive

- Cost and Risk Sharing
  - Provider Incentive

- Coordinated Health Intervention

• Optimal Health Interventions will require collaborations between stakeholders across the ecosystem
• Optimizes a set of criteria:
  outcomes, cost, toxicity, efficacy, utilization, economic benefit
Framework: Collaborative Healthcare Supply Chain

External Variables
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Pharmaceutical Manufacturing Flow
- Ingredient Inventory Levels
- Reliability Parameters
- Quality Parameter
Conclusions

• The Health Ecosystem needs to evolve into a Continuous Learning Ecosystem to achieve cost/outcome objectives

• Collaboration is a critical component for enabling the Ecosystem
  – Business Driven Collaborations around Supply Chain Alignments and Procurements are well understood in other domains, e.g., manufacturing
  – Need to evolve healthcare supply chain framework to better align various stakeholders and improve efficiencies

• The role of Data, Analytics and Insight Sharing is understood at a conceptual level
  – Notion of various stakeholders collaborating around a Health Intervention needs to be developed

• Need for Alignment across various analytics outputs to enable sharing of insights
  Care Archetypes $\Leftrightarrow$ Populations $\Leftrightarrow$ Activation/Behavioral Segmentations $\Leftrightarrow$ Toxicity/Efficacy Stratifications