CENTER FOR INNOVATION IN HEALTHCARE LOGISTICS
• The Center for Innovation in Healthcare Logistics (CIHL) is an industry-university partnership that leads a nationwide effort to identify and foster system-wide adoption of ground-breaking healthcare supply chain and logistic innovations.

• CIHL provides a leading role in setting and pursuing healthcare supply chain innovation through a collaboration between healthcare professionals and their industrial organizations, joining with Center staff in intensive but objective engineering analysis of supply chain challenges with system-wide reach.
CIHL Overview

- CIHL was launched in 2007 with founding support from Wal-Mart, Blue Cross Blue Shield, and the VHA Inc. hospitals
  - Additional support from AHRMM, Covidien, HIGPA, IBM, Johnson & Johnson, Logi-D, Owens & Minor, P&G, and Tecsys
- Leverages the University’s broad background in engineering of logistics and supply chains
  - Provides access to industrial engineering faculty experts in applied operations research, economic analysis, systems engineering, data, operations, and quality management
- Maintains vigorous interactions with a variety of healthcare providers, and healthcare supply chain opinion leaders
  - Data gathering and pilot testing with multiple provider hospitals
  - Collaboration, network access, and dissemination through SMI, AHRMM, GS1, GHX
CIHL Impact Model

Starting Points
- Best Practices
- Partner Identification
- Commercial Analogs
- New Technologies
- Opportunities / Deficiencies

CIHL Investigation
- Comparative Studies
- Data Collection & Analysis
- Decision Models
- Solution Identification

Replication & Scaling
- Pilot Tests with Partners
- Evaluative Models of Scale Effects
- Barrier & Roadblock Identification
- Replication Site Testing

Promotion & Advocacy
- Reports & Publications
- Meeting Presentations
- Training Programs
- Partner Leverage
- Public Policy Advocacy

Objective engineering analysis, free of commercial/institutional interests
Avoiding “one-off” single-site investigations in favor of scalable projects with system-wide impact
Commitment to broad dissemination of findings, practices & decision aids
Current CIHL Projects

• Identifying Cost and Quality Opportunities in the Healthcare Supply Chain
  – In collaboration with AHRMM and HIGPA
  – GS1 adoption surveys
  – Developing activity-based logistics cost analysis tool with Mercy Northwest Arkansas

• Electronic Health Records
  – Proof-of-concept study explores how healthcare supply chain inventory management and tracking systems can be integrated with best-practice tracking and recording in clinical and HER
  – Related project extension with Logi-D
Current CIHL Projects (cont.)

• Retail vs. Healthcare Supply Chain Gaps
  – Identify process and technology transfer opportunities between retail and healthcare supply chain
  – Understand unique healthcare issues that prevent adoption of others
  – Related project extension with Covidien

• Characterizing the Home Healthcare Medical Equipment Supply Chain
  – Investigating supply chain aspects of home health with a focus on more efficient utilization of resources (e.g. nurses, supplies, and transportation)
  – Pathway to broader look at other non-hospital alternate care
Completed CIHL Projects

• **Data Standards**
  – Adoption of GS1 data standards
  – Provider-focused in collaboration with GS1, SMI, and AHRMM
  – Pilots and data collection with multiple providers
  – Levels, Readiness, and Impacts Model (LRIM) tool

• **Unit and Dose Packaging Systems Analysis**
  – Re-packaging medications into unit-doses for administration to patients
  – Systems analysis to recommend best practices in the interest of safety and efficiency

• **Receiving-to-Patient Hospital Supply Chain Digitalization**
  – Digital technologies for tracking and inventory management of dock-to-patient material and portable clinical equipment
  – Predictive models for identifying best practices
CIHL’s National Reach
CIHL Publications & Research Reports
Involvement with CIHL

• CIHL is recognized across the broader healthcare industry as a source of advanced supply chain innovations
  – Industry leaders have affirmed CIHL’s impact

• CIHL provides access to academic researchers with expertise in healthcare logistics
  – Access to future workforce

• CIHL research partnerships exist as strategic partners, focused project partnerships, affiliate members, and supporting collaborators

• CIHL can provide access to state-of-the art education in healthcare logistics and operations management
IE Faculty Doing Healthcare Research

- Dr. Justin Chimka
- Dr. Russell Meller
- Dr. Ashlea Bennett Milburn
- Dr. Heather Nachtmann
- Dr. Kim LaScola Needy
- Dr. Greg Parnell
- Dr. Ed Pohl
- Dr. Chase Rainwater
- Dr. Manuel Rossetti
- Dr. Shengfan Zhang

- Data analytics
- Activity based costing
- Healthcare cost and quality
- Simulation modeling of patient flow
- Lean Processes
- Policy analysis with systems dynamics
- Coordination mechanisms for transition to post-acute care settings
- Inventory management strategies
- Predictive length of stay modeling and analysis
- Decision support tools for reducing pharmaceutical waste
- Scheduling and appointment models (nurses, OR, ER, outpatient radiation)
Research Areas
Applied Multivariate Statistical Analysis
Statistical Quality Control

Example Applications
Microarray Quality Control Standards
Medication Error Severity Data
Influenza Activity

Photo-credits: latimes.com, genome.gov, michaeljfox.org
Research Focus
Applying operations research tools and techniques to problems encountered in healthcare systems and other public sectors; primarily home health care and disaster management

Application Areas
• Incorporating information taken from social media and other Web 2.0 technologies in disaster relief planning:
  • vehicle routing decisions
  • facility location decisions

Application Areas (cont.)
• Developing decision support models to enable better use of home health resources:
  • nurse routing and scheduling
  • assignment of nurses to service regions
  • allocation of remote monitoring systems
• Developing quantitative methods to identify and explain variations in access, quality, and efficiency in home health services and providers
• Characterizing the home health care supply chain and quantifying time home health nurses spend on supply chain duties

Haiti earthquake, day 8: food/water request locations from social media

Home health nurses, supply chain duties

<table>
<thead>
<tr>
<th>Observation</th>
<th>Time/nurse/yr (hrs)</th>
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<tbody>
<tr>
<td></td>
<td>Driving</td>
</tr>
<tr>
<td>1</td>
<td>48.0</td>
</tr>
<tr>
<td>2</td>
<td>24.0</td>
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<td>6</td>
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<td>7</td>
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<tr>
<td>8</td>
<td>62.4</td>
</tr>
<tr>
<td>9</td>
<td>0.0</td>
</tr>
<tr>
<td>10</td>
<td>187.8</td>
</tr>
</tbody>
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Planned relief routes
“Food water needed for group of 30 people (15 children). The address is #7 Marin 878 with the Blue Gate...”
- Ushahidi, Haiti dataset, 02/01/2010
Research Focus
- Transportation systems engineering
- Logistics modeling
- Economic decision analysis
- Engineering pedagogy

Application Areas
- Maritime transportation
- Rural transportation networks
- Transportation security and resilience
- Healthcare logistics
- Inventory control and management

Mack-Blackwell Rural Transportation Center

Photo Courtesy of MBTC 3024

Photo Courtesy of AHTD

Photo Courtesy of MBTC 1102
Research Focus
- Sustainable Engineering
- Engineering Management
- Engineering Economic Analysis
- Integrated Resource Management

Application Areas
- Impact of green building construction and its improvements in worker productivity, health & safety, maintenance costs and energy savings with a focus on healthcare facilities, public and commercial buildings.
- Quality management in the capital facilities delivery industry
- Assessing and mitigating risk in the design for supply chain (DFSC) problem

Additional Information

<table>
<thead>
<tr>
<th>Economic Analysis with Sensitivity</th>
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<tbody>
<tr>
<td><strong>NPV</strong></td>
</tr>
<tr>
<td><strong>Break Even Period (Years)</strong></td>
</tr>
<tr>
<td><strong>B/C (Additional Investment)</strong></td>
</tr>
<tr>
<td><strong>B/C (Annual TAS and TAC)</strong></td>
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Castcon Stone Production Facility, Saxonburg, PA.

Children’s Hospital of Pittsburgh
GREGORY S. PARNELL, PH.D.
VISITING PROFESSOR

Research Focus
- Strategic Planning
- Performance Measurement & Analysis
- Resource Allocation Decision Making
- Systems Engineering
- Decision Analysis
- Risk Analysis

Application Areas
- Defense
- Homeland Security
- Intelligence
- Environmental
- Healthcare

Health Care System

Systems Decision Process

**Research Focus**
- Reliability and Quality
- Decision and Risk Analysis
- Engineering Optimization
- Stochastic Modeling
- Systems Engineering

**Application Areas**
- Healthcare Logistics
- Supply Chain Risk
- Complex Systems Analysis
- Operations Management
- Healthcare Policy Analysis
- Homeland Security - Disaster Relief
- Project and Engineering Management

**Additional Information**
Research Focus

- Decomposition-based algorithm approaches to exploit advancements in parallel computing
- Integration of optimization and constraint programming
- Dynamic network optimization
- Large-scale heuristic design

Application Areas

- Medical supply chain
- Patient scheduling at proton therapy cancer treatment facilities
- Transportation of medical equipment and supplies
- Medical inventory systems analysis

Additional Information
**Research Focus**
- Multi-echelon inventory optimization
- Forecasting methods for intermittent demand
- Simulation modeling and analysis
- Computing methods for large scale simulations
- Supply chain modeling and optimization

**Application Areas**
- Emergency Room Staffing and Scheduling
- Healthcare automation for clinical laboratories
- Inventory and supply management and best practices
- Benchmarking analysis
- Forecasting material usage, patient load
- Healthcare simulation

SKU Proliferation Control for Physician Preference Items

Robotic Delivery Systems for Hospitals
**Research Focus**

- System fortification and hardening infrastructure against disruption
- Optimization under uncertainty
- Integer programming
- Network optimization

**Application Areas**

- Locating electronic health records across virtual hubs in order to minimize delays experienced by network users
- Allocation of scarce resources in the design of reliable systems
- Cyber security
- Prevention of nuclear smuggling

**Network Optimization in Prevention of Nuclear Smuggling**
Research Focus
• Mathematical and statistical modeling of stochastic systems
• Decision and risk analysis
• Data mining and data analytics for complex systems
• Health informatics
• Quality engineering and management

Application Areas
• Medical decision making related to the detection, treatment and prevention of chronic diseases
• Healthcare delivery and process improvement
• Inventory record inaccuracy analysis
• Scheduling and planning
• Facility location planning

Additional Information

Source: NovaSim Outpatient clinic flow
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