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Program Committee Report December 2012

Regenstrief Center for Healthcare Engineering

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Regenstrief Center
for Healthcare Engineering

Semi-Annual Report to the Program Committee of the Regenstrief Foundation

December 2012

Dear Board Members:

I am pleased to have this opportunity to present RCHE's recent research activities and accomplishments. This report lists our research focused upon two national health priorities, an update on our research-to-impact efforts, and our performance metrics.

RCHE continues to promote new research within our established focus areas. Our research portfolio on page two illustrates both the scope of research and how research results will be integrated to address the complex challenges inherent in care coordination and population health. I am very pleased with the scope and quality of research being conducted in association with RCHE.
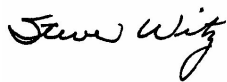
A significant portion of our efforts are being placed upon the development of CatalyzeCare as a strategy to attain impact from our research. CatalyzeCare allows RCHE research to be applied in decision-support systems designed to address important issues identified by providers. However, this strategy requires us to extend our work beyond the traditional research boundaries. We are working to develop information technology infrastructure for CatalyzeCare, enlist and support providers using this new decision support, and evaluate this approach to improve healthcare delivery. I foresee CatalyzeCare as a strategy to be replicated by others interested in the translation of research into practice.

RCHE is developing a similar decision-support application utilizing CatalyzeCare to impact healthcare using our research on preventable hospital readmissions. We describe this research and resulting application for clinicians in this report. We are anxious to accumulate more experience with this strategy and are very optimistic about the benefits of this innovative approach in positively impacting healthcare delivery.

We look forward to our immediate future, which includes increased research on pilot projects involving accountable care models and service delivery through the safety net system. We also will be evaluating options available to RCHE to sustain our maturing decision support systems.

I recognize that this work would not be possible without the advice, encouragement, and support of the Regenstrief Foundation Board. I thank you for the opportunity to work with you to do this research.

Sincerely,

Steve Witz

Steve Witz
Director, Regenstrief Center for Health Care Engineering at Purdue University

Regenstrief Center
for Healthcare Engineering

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The Regenstrief Center for Healthcare Engineering will pursue its mission of a **transformed healthcare delivery system** by developing **impactful research** based on **collaborative partnerships** and focused on **national priority** research areas.

Research focus

Guided by national research priorities, partner input, and researcher feedback, the center continues to develop work in its research focus areas of care coordination and population health. A diagram on the next page illustrates the relationship of past, present, and pending RCHE projects to each other and these two focus areas.

Care coordination is the marshaling of personnel and other resources needed to support a continuous healing environment, enabled by integrated clinical services and characterized by the proactive delivery of evidence-based care and follow-up.

Examples of center research in care coordination include:

- Readmissions
- Older adults and at-home care use
- Infusion Pump Informatics system

In the population health focus area, RCHE seeks to apply advancements found to be beneficial on the individual patient level to improve the care of larger population-level groups. Population health refers to the wellbeing of a population and the art and science of predicting and preventing disease, prolonging life, and promoting health through organized efforts and informed choices of society, organizations, public and private; communities and individuals.

Examples of center research in population health include:

- Health disparities and access to care
- Clinical education
- Utilization model

Research portfolio

Within each focus area (care coordination and population health), the center has selected several research topics and worked with faculty and partners to develop appropriate lines of research. The diagrams below help illustrate how these seemingly broad research lines connect to inform a greater strategy that promotes better, more coordinated patient care, and population health improvements.

Care Coordination

- Readmissions
  - Risk Prediction
  - Remote Monitoring
  - Social Barriers and Facilitators
  - Family Influence
- Safety
- Patient Centered Care
  - Physician-Patient Communication
  - Patient Engagement
  - Care Transitions
    - Unique Clinical Approaches
    - Activities for Daily Living (ADL) Support
  - Health Literacy

Population Health

- Utilization Model
- Education
  - Clinical/ Provider
  - Public Campaigns
  - Patient/ Caregiver
- Disparities
  - Geographic
  - Ethnic
  - Socio- economic

Creating change

In 2011, the Regenstrief Center for Healthcare
Engineering introduced the Research-to-Impact
Model as its approach in bridging academic research
and application with the goal of positively impacting
healthcare delivery. The model articulates five distinct
steps through which a project progresses to ensure
optimal stakeholder engagement and front-line
relevancy and impact.

A key differentiator in RCHE's research approach is
the focus on partner engagement, which reflects the
center's view that active partnerships are essential
to creating meaningful change through research. An
October 2012 *Health Affairs* article cited ambiguity
of study results, failure of research to address the needs of the end-users, and limited use of decision support
by patients and clinicians as three key factors limiting research from creating change (Timbie et al. 2012). As
illustrated in this report, the close relationship between center researchers and partners enables feedback that
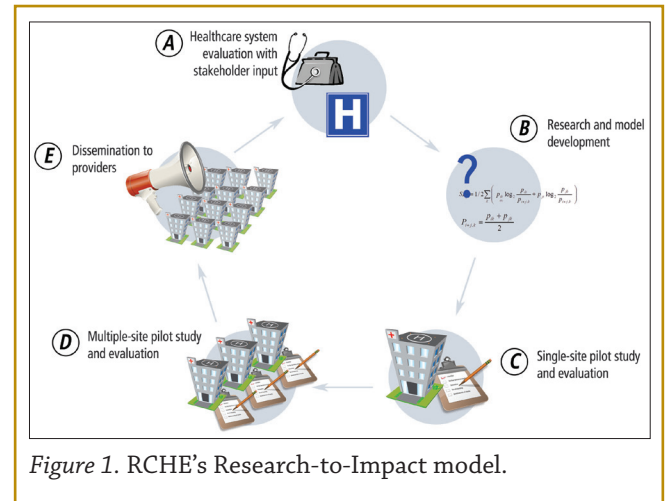can mitigate these issues and deliver stronger results.

Figure 1. RCHE's Research-to-Impact model.

Building knowledge networks for better patient safety

Project summary:
The Infusion Pump Informatics (IPI) System was developed to make it easy to analyze medication data and best practices to improve patient safety. The tool allows for infusion pump data to be readily accessible, meaningful, and actionable. The participating hospitals form a virtual community that exchanges information, shares analysis results, and collaborates on ways to improve the tool and patient safety.

Research partners:
St. Francis Health, Community Health Network, University

Figure 2. Wishard had noticed an increase in the number of Propofol alerts in their Critical Care unit. They decided to use IPI to compare their performance in this area against other hospitals of similar size and orientation. They looked at where nurses were actually setting the pumps administering Propofol and noted a predominance of attempts at a setting above their limit. They compared, through IPI, their Propofol Guardrail against what the other hospitals were using. Armed with this information, they proposed to change their settings, which was accepted by the committee overseeing this. The results have been fewer alerts (as shown above) with no adverse effects in care quality. By reducing unnecessary alarms, hospitals like Wishard reduce patient disruptions and lessen the detrimental effects of alert fatigue among nurses, which has been shown to be correlated with increased errors.

of Iowa Hospitals and Clinics, Wishard Health Services, Nebraska Medical Center, University of Wisconsin Hospitals and Clinics, IU Health, Witham Hospital, Roudebush VAMC, Mercy Medical Center — Cedar Rapids, Deaconess Hospital, St. Vincent Health, Aurora Health.

Research partners (in progress): MD Anderson, U.S. Department of Veterans Affairs VISN 11 Hospitals, University of Cincinnati, Ascension Health.

Dissemination partners (in progress): Institute for Safe Medication Practices, University HealthSystem
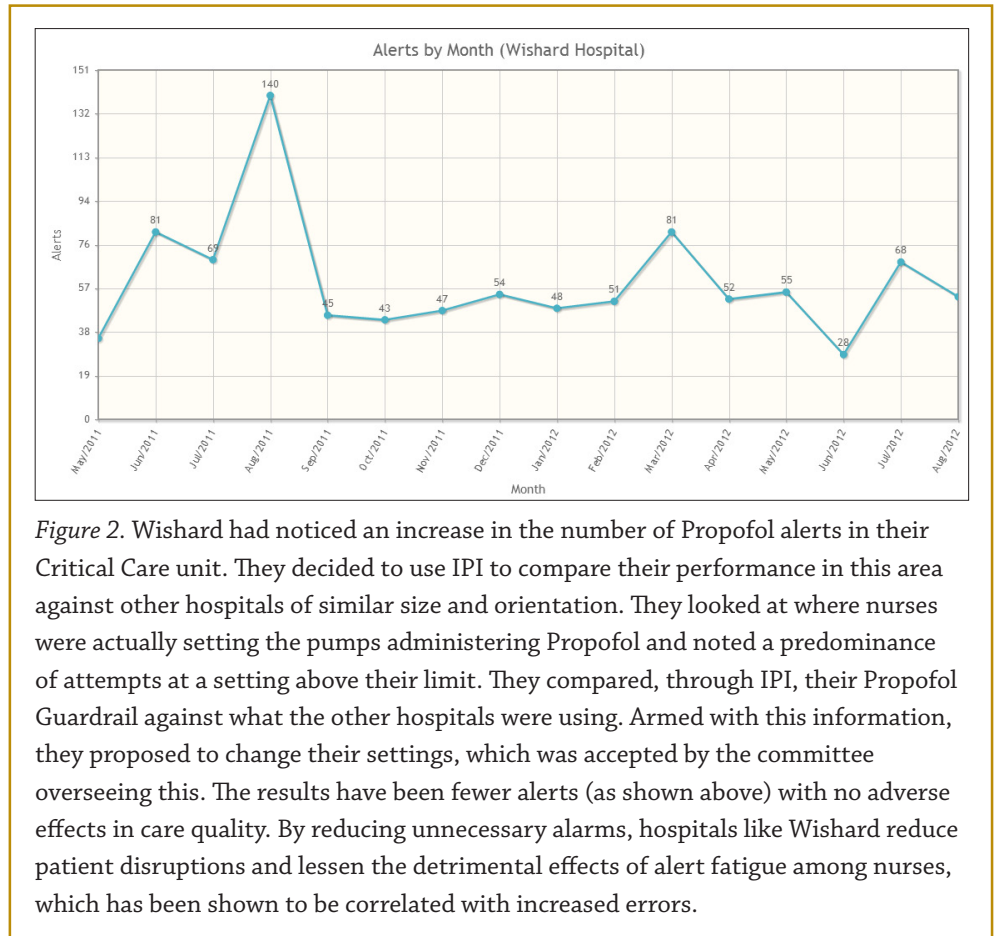
Consortium.

The Infusion Pump Informatics (IPI) system launched in 2008 as a data-driven project designed to enable deeper, more helpful analyses of IV infusion pump data among two pilot hospitals in the Indianapolis Coalition for Patient Safety. Since then, the project has expanded both in scope and in participation, although the goal of improving patient safety remains top of mind. The IPI system now includes 13 hospital systems across 4 states, two major pump manufacturers, and more than 40 participating pharmacists, nurses, and medication safety officers (see figure 3). In addition to new hospital systems joining the group, new hospitals from within existing member systems are joining.

The system has grown in its capabilities, adding pivot charts, and comparisons to meet analytic support requested by participating clinicians. Analysis charts, investigative reports (drill down to specific issues), and pivot charts continue to be the most popular features.
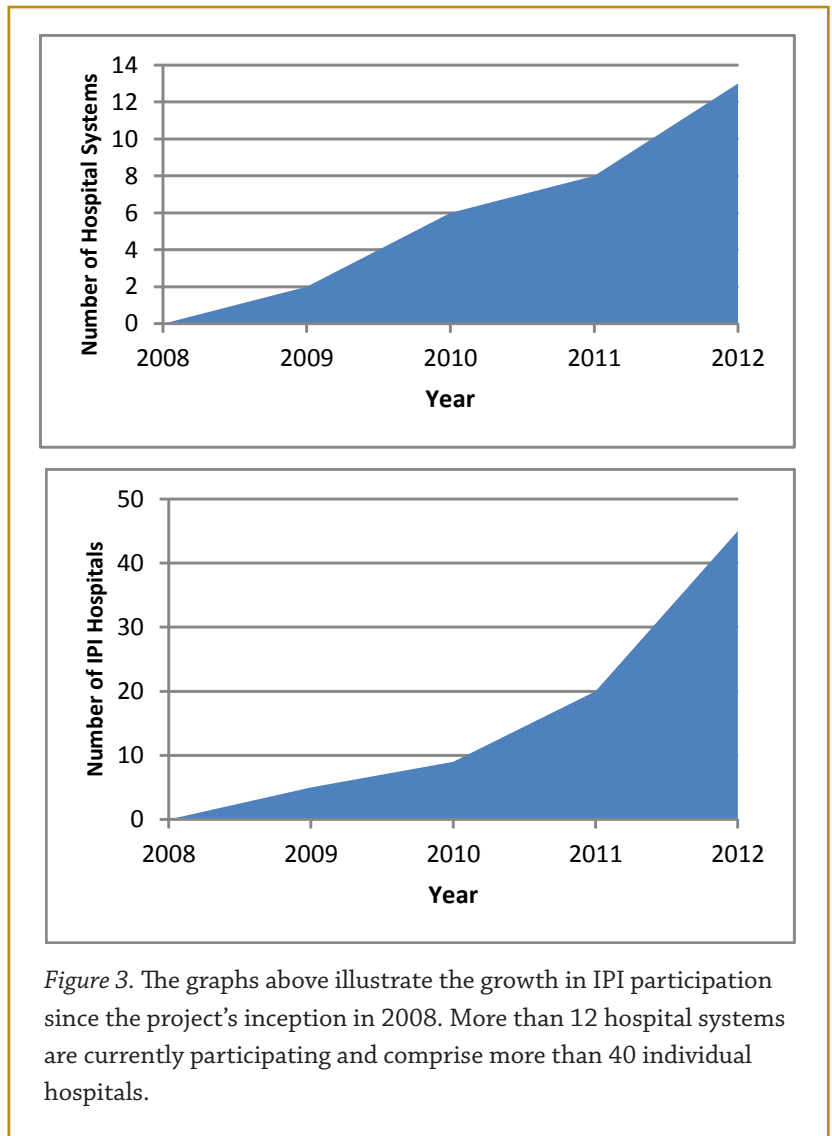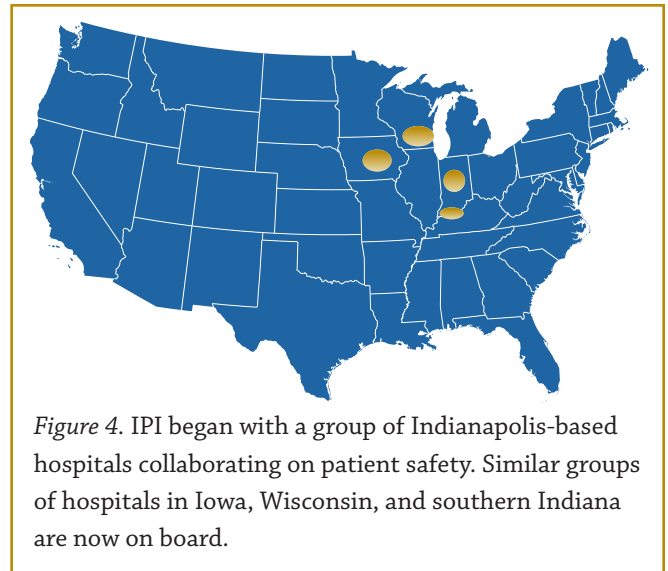

Figure 3. The graphs above illustrate the growth in IPI participation since the project's inception in 2008. More than 12 hospital systems are currently participating and comprise more than 40 individual hospitals.

A news release issued in July (included at the end of this report) provided both recognition for the work of the current group and a publicity boost for the system; however, participant growth is also attributable to word of mouth, as pharmacists recruit colleagues in neighboring systems (see figure 4). The Indianapolis model for strong regional collaboration to improve patient safety is being replicated. The IPI community now includes three additional regional collaborations all supported by IPI and located in regions of Iowa, Wisconsin, and southern Indiana. This highlights not only the value of the IPI work to a variety of systems, but also reinforces the notion of collaboration instead of competition with respect to patient safety.

This participant growth has also led to IPI participants establishing the group and its conferences as a place for professional and knowledge development. Participants hold online and offline discussions on issues of medication administration safety based on data available through the IPI project. Smaller institutions joining the group are able to benefit from the experience and staff size of the larger systems.

Figure 4. IPI began with a group of Indianapolis-based hospitals collaborating on patient safety. Similar groups of hospitals in Iowa, Wisconsin, and southern Indiana are now on board.

"I have used the in-depth analytical data generated by the system to focus on problem prone areas at Witham Hospital. Furthermore, I have used the networking opportunities with other users to align and collaborate to determine best practice models."
— Joe Bitner, Director of Pharmacy, Witham Memorial Hospital, Lebanon, IN

Readmissions

Project summary: RCHE's readmissions research draws on primary data from hospital partners in Tampa, Florida, and Indianapolis, Indiana. The data includes all patients of all ages at acute care and specialty hospitals in the partner systems. The project establishes descriptive readmissions profiles for the participating hospitals and systems, and seeks to create a predictive model of all-cause readmissions. The analysis includes the three diagnoses currently monitored by CMS, as well as a broader array of conditions that may be targets for advanced case management. The project also considers how readmissions may be related to or influenced by ambulatory-care sensitive conditions and healthcare-acquired infections, two other key targets for reduction.

Research partners: BayCare Health System, St. Vincent Health, Wishard Health Services.

Dissemination partners (in progress): The Joint Commission, Healthcare Systems Engineering Alliance.

This October, the reality of readmissions penalties became clear, as more than 1,400 hospitals nationwide were hit with CMS reimbursement penalties as high as one percent. Over the next two years, the maximum penalty will rise to three percent, costing hospitals potentially millions of dollars and necessitating changes to reduce readmissions.

One of RCHE's pilot partners in its readmissions work, BayCare Health System in Tampa, Florida, is partnering with RCHE to translate the completed research on readmissions into practice through the joint development of a decision model.

Decision modeling

In order for the output of a predictive model to be of value, it has to impact decision-making. To this end, we formally model a discharge planner's discharge intervention problem.

Objectives — In making discharge decisions, several factors influence a decision-makers objective function. These include total patient needs, utilization/cost, service quality, external penalties, and patient satisfaction.

Alternatives — The interventions at the disposal of a discharge planner each have varying efficacies and costs. Both the intervention efficacy literature and a hospital's idiosyncratic information inform these parameters, which are essential for solving for optimal risk classes and discharge plans. We use a multiplicative model of intervention efficacy, with an additive assumption when evaluating multiple intervention plans.

Optimization — The solution to the decision problem as currently modeled can be represented as a set of risk classes and corresponding optimal intervention plans.

Intervention	Efficacy	Cost ($\discharge)
Social Worker Home Visitation	0.30	$250
Front-Loaded Home Healthcare	0.20	$200
...		
National initiative	0.15	$125

Table 1. Example of an evaluation of interventions, efficacy, and cost per discharge as determined through decision modeling.

The research has yielded a predictive model that uses administrative billing data to develop a risk of 30-day readmission. In various validation tests, the c-statistic has been at least .70, which is at least as strong as other models currently being tested by other researchers nationwide. RCHE is using this predicted patient risk to assist clinicians in deciding which types of post-discharge care may be most helpful to patients. This decision support combines information of cost and efficacy of different discharge plans with a patient's risk for readmission.

The decision model is not intended to replace clinical judgment; it is designed to prompt the consideration of available resources that might be beneficial. It is hoped that providing this information will both increase the use of helpful interventions to reduce readmissions. By drawing on a constantly changing set of interventions, it also enables a hospital system to launch new resources for reducing readmissions and integrate them into practice. Feedback from BayCare during the test implementation will allow the team to revise the app to better serve the end users.

There's an app for that

After developing, testing, and validating a predictive model for determining those at highest risk of a 30-day readmission, the team chose to deploy it as an application. Feedback from partners in the upcoming weeks will determine whether it is desktop- or smartphone-based.

"To increase the use of a decision support tool, we need to break down as many logistical barriers as possible," said Ken Musselman, RCHE Strategic Collaboration Director. "Whether on a desktop or smartphone, we believe that we can make an app that is powerful enough to quickly process this level of data and provide immediate, useful suggestions."

A Purdue IT team will help develop the app based on a design from the research team. Construction is slated to begin before year end.

The figure below illustrates the types of data pulled into the model for assessment of a patient's risk. Interventions are then recommended commensurate with that risk.
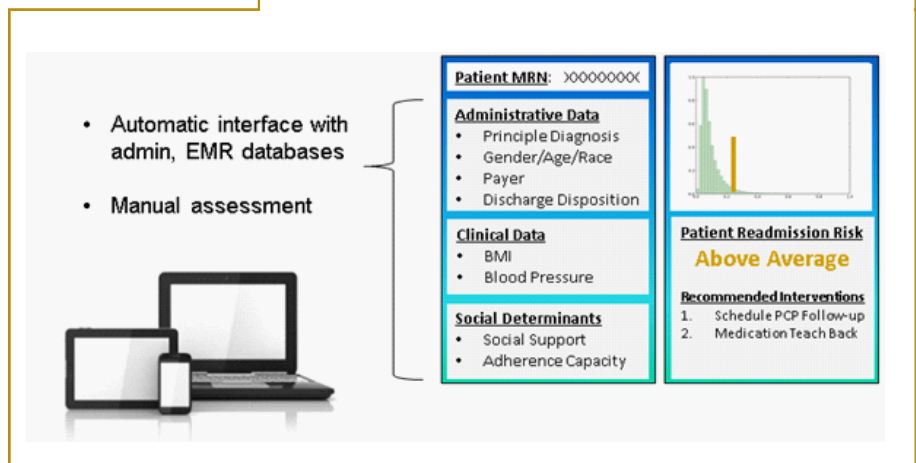
Advancing research dissemination and impact

Project summary: The center launched CatalyzeCare, a collaborative online environment for transforming healthcare delivery in 2010. Built on Purdue's powerful HubZero framework, CatalyzeCare's features surpass a traditional website by allowing users to both read and contribute to the site content. A key component of the CatalyzeCare hub is its communities feature, which addresses the need for collaborative spaces for geographically dispersed partners and research teams to meet, discuss, and review information. As part of the recently granted supplement funding, the center plans to use the hub to examine the development of knowledge communities to promote healthcare delivery transformation.

Based on feedback from center researchers and dissemination partners, RCHE is actively pursuing key upgrades to CatalyzeCare. Developing an online environment where geographically distributed researchers could store sensitive data while collaborating on projects would present a tremendous step forward in healthcare delivery research capabilities. Combinations of data, such as age, address, birthdate, etc., that are essential to answering certain research questions are considered protected health information (PHI) under HIPAA. While RCHE maintains a secure server for researchers on campus to conduct this sensitive data work, the center sees the need to expand this capability to include researchers and partners off campus. The upgrade will begin with a hardware, software, and organizational policy assessment. Changes will be based on those assessments.

Healthcare Systems Engineering Alliance (HSEA)

This fall, the HSEA was relaunched with a new charter and group page on CatalyzeCare. The association now includes nearly 50 members from universities across the U.S. and Canada. Officer elections were held in October.

HSEA will focus on promoting education and research in healthcare systems engineering. RCHE also considers HSEA a dissemination partner.

HSEA Officers

Board Member	Affiliation	Role	Term
Ronald Rardin	University of Arkansas	Chairperson	2012–14
Jose Zayas-Castro	University of South Florida	Board member	2012–15
Cerry Klein	University of Missouri	Board member	2012–15
Amy Cohn	University of Michigan	Board member	2012–14
Sharon Johnson	Worcester Polytechnic Institute	Board member	2012–14
Mike Carter	University of Toronto	Board member	2012–13
Andy Banerjee	Texas A&M	Board member	2012–13
Ken Musselman	Purdue University	Board member Webmaster	NA

HSEA Members

Arizona State University, McGill University-CREATE Program , Dalhousie University, George Mason University, Georgia Institute of Technology, HEC Montreal, Kansas State University, Lehigh University , Louisiana State University, Mississippi State University, Missouri University of Science and Technology, Montana State University, New Jersey Institute of Technology, New Mexico State University, North Carolina A&T , North Carolina State University, Northwestern University, Ohio State University, Ohio University, Oregon State University, Purdue University, Rochester Institute of Technology, San Jose State University, SUNY Buffalo, Texas A&M University, University of Arkansas, University of Calgary, University of Central Florida, University of Houston, University of Louisville, University of Massachusetts, University of Michigan, University of Minnesota, University of Missouri, University of Rhode Island, University of San Diego, University of South Florida, University of Tennessee, University of Texas at Arlington, University of Texas at El Paso, University of Toronto, Virginia Tech University, Wayne State University, Western Michigan University, Worcester Polytechnic Institute, Youngstown State University.

Speakers

Guest speakers provide RCHE faculty with alternate perspectives on research questions and experience in new or different subject areas. They represent the center's continued commitment to supporting faculty knowledge development in a variety of areas within healthcare delivery. This fall, the center welcomed the following speakers:

Allen Vaida, PharmD, FASHP
Executive Vice President, Institute for Safe Medication Practices
The Wizard Behind the Curtain: Maximizing the Safe Use of "Smart Pumps"

Linda Aiken, PhD, FAAN, FRCN, RN
The Claire Fagin Leadership Professor in Nursing
Director, Center for Health Outcomes and Research, University of Pennsylvania
Linking Patient Outcomes to Nurse Education, Staffing, and Work Environment

This spring, RCHE looks forward to welcoming:

David Kindig, MD, PhD
Professor emeritus, Emeritus Vice-Chancellor for Health Sciences, University of Wisconsin
Co-PI, Robert Wood Johnson MATCH Project
Co-Director, RWJF Health and Society Scholars Program

RCHE Speaker Series

The RCHE Speaker Series gives RCHE faculty an opportunity to present their latest work and research interests. This fall's speakers were:

Azza Ahmed, Assistant Professor of Nursing, Purdue University
Interactive web-based breastfeeding monitoring system: Feasibility, usability, and acceptability

Ruchith Fernando, HubZero Developer and Computer Science Graduate Student, Purdue University
Development of Infusion Pump Informatics

Uri Kartoun, Industrial Engineering, Ben-Gurion University, Israel
Machine learning in healthcare

Lingsong Zhang, Assistant Professor of Statistics, Purdue University
Predictive modeling for readmissions

Brandon Pope, Assistant Research Scientist, School of Industrial Engineering, Purdue University

Publications, presentations, and awards

Publications

Bharmal, Murtuza F., Seema Dedhiya, Bruce A. Craig, Michael Weiner, Marc Rosenman, Laura P. Sands, Ankita Modi, Caroline Doebbeling, Joseph Thomas III. Incremental Dementia-Related Expenditures in a Medicaid Population. *The American Journal of Geriatric Psychiatry*, 20 (1): 73 -83.

Chen, A. M. H., Yehle, K. S., Plake, K. S., Murawski, M. M., & Mason, H. L. (2011). Health Literacy and Self-care of Patients With Heart Failure. *Journal of Cardiovascular Nursing*, 26(6), 446-451.

Daggy, Joanne K., Joseph Thomas III, Bruce A Craig. Modeling Correlated Healthcare Costs. Expert Review of *Pharmacoeconomics & Pharmacoeconomics Outcomes Research*, February 2011, 11 (10): 101 – 111.

DeCrane, S. K., Culp, K. R., Wakefield, B. J. (2011). Twelve-Month mortality among delirium subtypes. *Clinical Nursing Research*, 20(4), 404-421.

DeCrane, S. K., Sands, L., Ashland, M., Lim, E., Tsai, T. L., Paul, S., Leung, J. M. (2011). Factors associated with recovery from early postoperative delirium. *Journal of PeriAnesthesia Nursing*, 26(4), 231-241.

DePalma, G., Xu, H., Covinsky, K. E., Craig, B. A., Stallard, E., Thomas, J., & Sands, L. P. (2012). Hospital Readmission Among Older Adults Who Return Home With Unmet Need for ADL Disability. *The Gerontologist*.

Dutta, M. (2012). *Communication social change: Structure, culture, agency*. Taylor & Francis.

Franks, M. M., Hemphill, R. C., Seidel, A. J., Stephens, M. A. P., Rook, K. S., & Salem, J. K. (2012). Setbacks in diet adherence and emotional distress: A study of older patients with type 2 diabetes and their spouses. *Aging & Mental Health*, 16(7), 902-910.

Franks, M. M., Sahin, Z. S., Seidel, A. J., Shields, C. G., Oates, S. K., & Boushey, C. J. (2012). Table for two: Diabetes distress and diet-related interactions of married patients with diabetes and their spouses. *Families, Systems, & Health*, 30(2), 154.

Franks, M. M., Shields, C. G., Lim, E., Sands, L. P., Mobley, S., & Boushey, C. J. (2012). I Will If You Will Similarity in Married Partners' Readiness to Change Health Risk Behaviors. *Health Education & Behavior*, 39(3), 324-331.

Feng, L. N. Kong, and M. Lawley, "Capacity Planning for Publicly Funded Community Based Long-Term Care Services," 2011. In Community-Based Operations Research, M. P. Johnson, ed. *International Series in Operations Research and Management Science*, Vol. 167. Springer.

Hunte, H. E. R. (2011). Association Between Perceived Interpersonal Everyday Discrimination and Waist Circumference Over a 9-Year Period in the Midlife Development in the United States Cohort Study. *American Journal of Epidemiology*, 173(11), 1232-1239.

Hunte, H. E. R., & Barry, A. E. (2012). Perceived Discrimination and DSM-IV-Based Alcohol and Illicit Drug Use Disorders. *American Journal of Public Health*.

Iida, M., Stephens, M. A. P., Franks, M. M., & Rook, K. S. (2012). Daily symptoms, distress and interaction quality among couples coping with type 2 diabetes. *Journal of Social and Personal Relationships.*

Jacob, M., Cange, C., Packer, R., & Wachs, J. (2012). Intention, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room. *Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications*. In L. Alvarez, M. Mejail, L. Gomez & J. Jacobo (Eds.), (Vol. 7441, pp. 220-227): Springer Berlin / Heidelberg.

Jacob, M., Li, Y.-T., Akingba, G., & Wachs, J. (2012). Gestonurse: a robotic surgical nurse for handling surgical instruments in the operating room. *Journal of Robotic Surgery*, 6(1), 53-63.

Jiang, H., Wachs, J., & Duerstock, B. (2012). Facilitated Gesture Recognition Based Interfaces for People with Upper Extremity Physical Impairments. *Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications.* In L. Alvarez, M. Mejail, L. Gomez & J. Jacobo (Eds.), (Vol. 7441, pp. 228-235): Springer Berlin / Heidelberg.

Khan, C. M., Stephens, M. A. P., Franks, M. M., Rook, K. S., & Salem, J. K. (2012). Influences of Spousal Support and Control on Diabetes Management Through Physical Activity. *Health Psychology* (June 18, 2012).

Kwon, B. c., Dong, Z., Yehle, K., Plake, K. S., Yahiro, L. M., Kranz, S., & Yi, J. S. (2012). "Food for the Heart: Lessons Learned while Designing a Visual Decision Support System for Patients with Coronary Heart Disease." In W. K. Gavriel Salvendy (Ed.), *Advances in Human Aspects of Healthcare* (pp. 70-78): CRC Press.

Leung, J. M., Tsai, T. L., Sands, L. P. Preoperative frailty in older surgical patients is associated with early postoperative delirium. *Anesthesia and Analgesia*, 112(5):1199-1201, 2011.

Noureldin, M., Plake, K. S., Morrow, D. G., Tu, W., Wu, J., & Murray, M. D. (2012). Effect of Health Literacy on Drug Adherence in Patients with Heart Failure. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy,* 32(9), 819-826.

Nuti, L. A., Lawley, M., Turkcan, A., Tian, Z., Zhang, L., Chang, K., . . . Sands, L. P. (2012). No-shows to primary care appointments: subsequent acute care utilization among diabetic patients. *BMC Health Services Research*, 12(1), 304.

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Schutte, D., Reed, D. A., DeCrane, S. K., Ersig, A. (2011). Saitohin and APOE polymorphisms influence cognition and function in persons with advanced Alzheimer disease. *Dementia and Geriatric Cognitive Disorders*, 32(2), 94-102.

Seidel, A. J., Franks, M. M., Stephens, M. A. P., & Rook, K. S. (2012). Spouse Control and Type 2 Diabetes Management: Moderating Effects of Dyadic Expectations for Spouse Involvement. *Family Relations*, 61(4), 698-709.

Shields, C. G., Finley, M. A., & Chawla, N. (2012). Couple and family interventions in health problems. *Journal of Marital and Family Therapy*, 38(1), 265-280.

Shippee, Tetyana Pylypiv, Kenneth F. Ferraro, and Roland J. Thorpe, Jr. 2011. Racial Disparity in Access to Cardiac Intensive Care over 20 Years. *Ethnicity and Health* 16:145-165.

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Smith, C. T., Chen, A. M. H., Plake, K. S., & Nash, C. L. (2012). Evaluation of the Impact of a Diabetes Education Curriculum for School Personnel on Disease Knowledge and Confidence in Caring for Students. *Journal of School Health*, 82(10), 449-456.

Stephens, M. A. P., Franks, M. M., Rook, K. S., Iida, M., Hemphill, R. C., & Salem, J. K. (2012). Spouses' Attempts to Regulate Day-to-Day Dietary Adherence Among Patients With Type 2 Diabetes. *Health Psychology* (October 1, 2012).

Turkcan, A., Zeng, B., Lawley, M., Chemotherapy Operations Planning and Scheduling. *IIE Transactions on Healthcare Systems Engineering*, February 2011.

Takahashi, P. Y., Pecina, J. L., Upatising, B., Chaudhry, R., Shah, N. D., Van Houten, H., . . . Hanson, G. J. (2012). A randomized controlled trial of telemonitoring in older adults with multiple health issues to prevent hospitalizations and emergency department visits. *Archives of Internal Medicine.*

Wachs, J. P., Jacob, M., Li, Y.-T., & Akingba, G. (2012). Does a robotic scrub nurse improve economy of movements? *SPIE Proceedings*, 8316 (February 13, 2012).

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Zhang, L., & Lin, X. (2011). Some considerations of classification for high dimension low-sample size data. *Statistical Methods in Medical Research*.

Zhang, L., & Zhu, Z. (2012). Spatial Multiresolution Cluster Detection Method.

Presentations

DeCrane, Susan. *Sigma Theta Tau International*: "Electronic Medical Record Documentation of Delirium and Injuries in Postoperative Arthroplasty Patients". (Poster Presentation) Brisbane, Australia, July 2012.

DeCrane, Susan. *St. Vincent Health Research Symposium*: "Confusion, Injuries, and Length-of-Stay in Postoperative Arthroplasty Patients" June, 2012.

DeCrane, Susan. *Midwest Nursing Research Society* (MNRS) . "Pain Management Interventions and Delirium in Postoperative Older Adults" (Competitive Symposia) Dearborn, Michigan, April 2012.

DeCrane, Susan. *Purdue University Health and Human Sciences Research Day*. "Twelve-Month Mortality Following Delirium Events in Long Term Care Older Adults" November, 2011.

DeCrane, Susan. *Gerontological Society of America* (GSA) . "Strategies for Statistical Analysis of Missing Data" (Podium Presentation, Methods Section), Boston, Massachusetts, November 2011.

DeCrane, Susan. *Midwest Nursing Research Society* (MNRS) . "Fall Outcomes Following Delirium Events in Long-Term Care Older Adults" (Conference Poster), Columbus, Ohio, March 2011.

Musselman, Ken and Cody Mullen. "Readmissions." Institute of Industrial Engineers. Orlando, FL. May 2012.

Musselman, Ken. "A Hub Infrastructure to Reduce Infusion Pump Medication Errors in Hospitals." INFORMS. Phoenix, Ariz. October 14, 2012.

Pope, Brandon. "Prediction, Non-Clinical Factors and Intervention in Unnecessary Hospital Readmissions." INFORMS. Phoenix, Ariz. October 14, 2012.

Pope, Brandon. "Hospital efficiency." June 6-9, 2012.

Witz, Steven. "Healthcare Reform's Impact on the Delivery Care System: Opportunities and Challenges." *Aspen Institute Regional Summit*. Indianapolis, IN, October 2011.

Witz, Steven. "Healthcare Costs and the Mounting Federal Deficit." *The Concord Coalition*. West Lafayette, IN, April 2012.
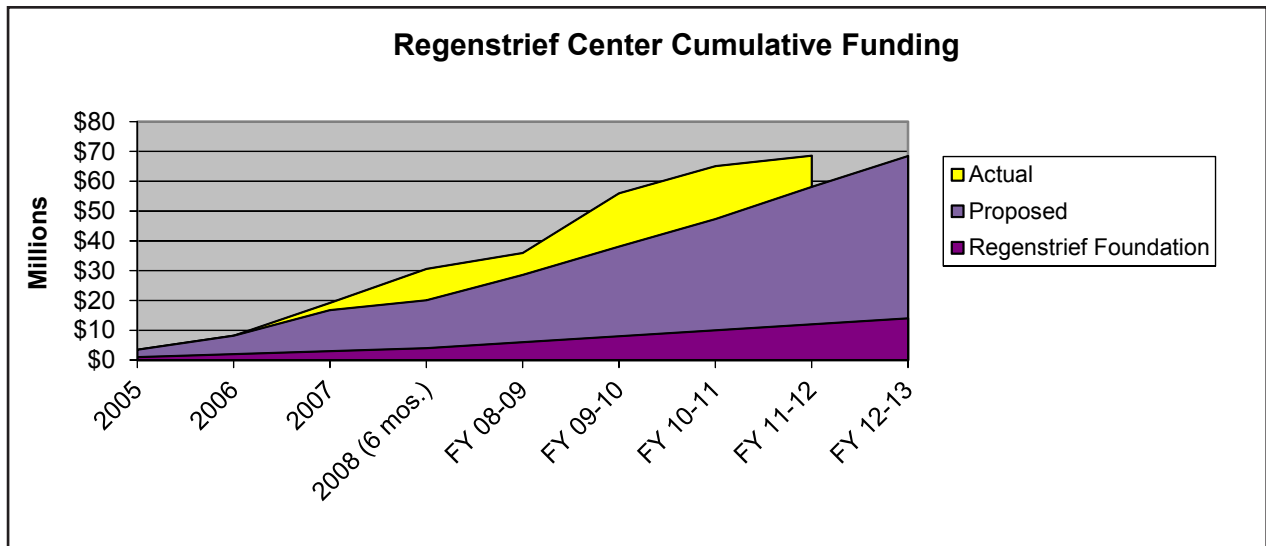

Awards

Julie Goonewardene was elected to the American Medical Association Board of Directors for a four year term. RCHE was pleased to support her candidacy.
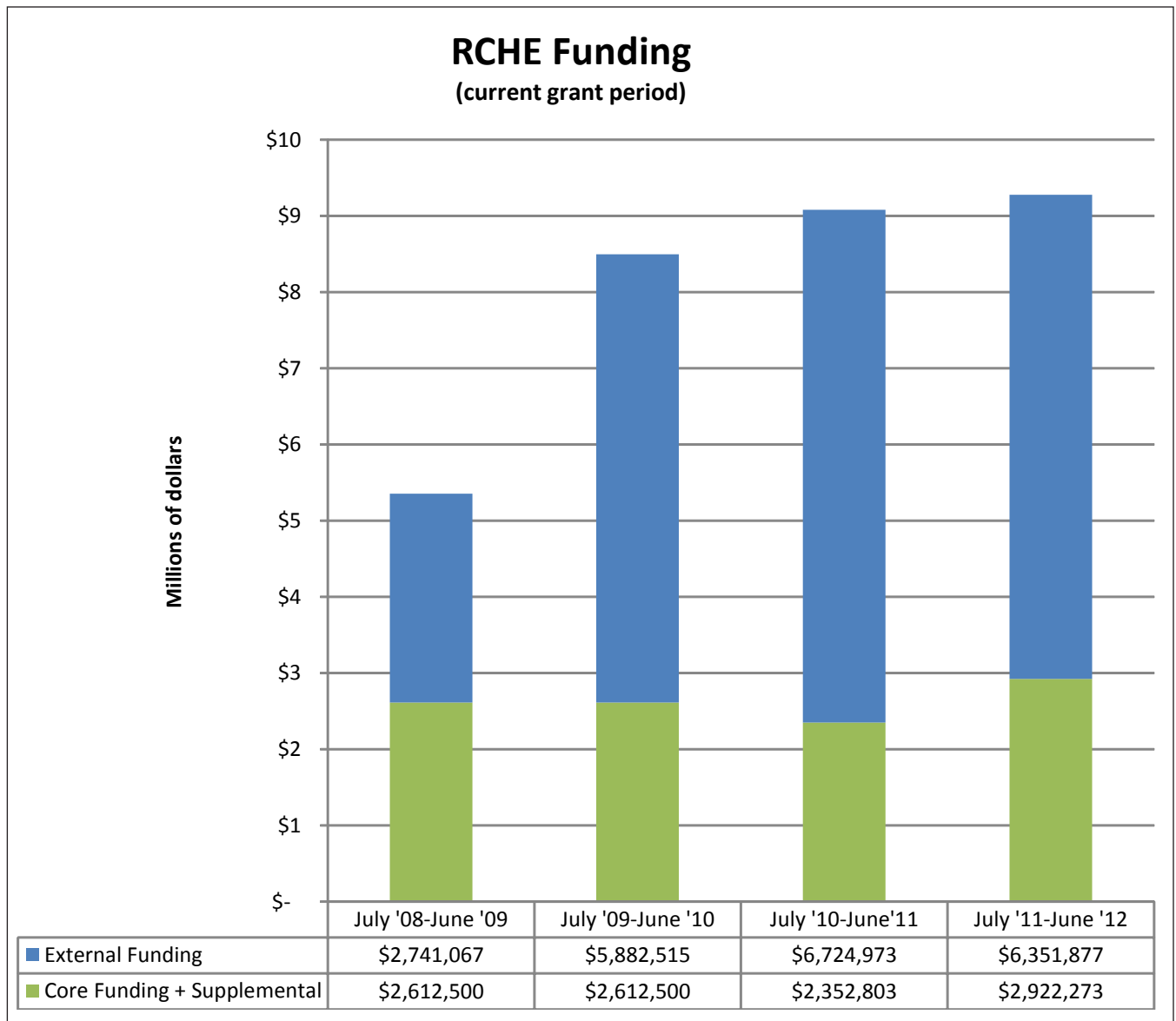
Financials

Significant granting organizations in 2011–12:

- NIH National Institute on Aging
- NIH Community Health Engagement Program
- Pfizer Inc.

Regenstrief Center Cumulative Funding

Legend:
- Actual
- Proposed
- Regenstrief Foundation

Y-axis: Millions — $80, $70, $60, $50, $40, $30, $20, $10, $0

X-axis: 2005, 2006, 2007, 2008 (6 mos.), FY 08-09, FY 09-10, FY 10-11, FY 11-12, FY 12-13

This graph illustrates the center's core funding (dark purple), amount of leveraged funding committed to (magenta), and amount of leveraged funding actually generated (yellow). As of June 2012, RCHE has not only achieved but exceeded the amount of leveraged funding from external sources it committed to in the 2008 center funding renewal contract.

RCHE Funding
(current grant period)

	July '08-June '09	July '09-June '10	July '10-June'11	July '11-June '12
External Funding	$2,741,067	$5,882,515	$6,724,973	$6,351,877
Core Funding + Supplemental	$2,612,500	$2,612,500	$2,352,803	$2,922,273

Millions of dollars

This graph illustrates the amount of funding provided by the foundation and the amount generated by RCHE and its researchers through external support available each fiscal year during the current core funding period (2008–2013).

Regenstrief launches hospital research community to improve infusion pump drug-delivery system

July 17, 2012

WEST LAFAYETTE, Ind. - A Purdue University research center is working with major Midwestern hospitals to establish safety standards for infusion pumps, which have become commonplace in the past decade for administering drugs to patients.

The Regenstrief Center for Healthcare Engineering, a Discovery Park center focused on improving health-care delivery, has partnered with hospitals in Indiana, Iowa, Illinois, Nebraska and Wisconsin to launch the Infusion Pump Informatics Community at Purdue. Through its Web-based tool, users can easily share analysis, data reporting and best practices for what are known as "smart pumps."

Participating hospitals are Community Health Network, Franciscan St. Francis Health, Wishard Health Services, Indiana University Health and St. Vincent Health, the Roudebush Veterans Medical Center, and St. Vincent Health, all based in Indianapolis; Witham Health Services, based in Lebanon, Ind.; University of Iowa Hospitals and Clinics in Iowa City; University of Wisconsin Health & Clinics in Madison; and Nebraska Medical Center in Omaha.

Bill Malloy, clinical pharmacy coordinator at Roudebush Veterans Medical Center in Indianapolis, emphasizes a point during a meeting of the Infusion Pump Informatics Community. Roudebush is one of several hospital systems from across the nation participating in the Purdue-led group to help establish safety standards for infusion pumps. (Purdue University photo/Phillip Fiorini)

"Infusion pumps present benefits and risks. They have allowed for a greater level of control, accuracy and precision in drug delivery, thereby reducing medication errors and contributing to improvements in patient care," says Steve Witz, director of the Regenstrief Center for Healthcare Engineering at Purdue.

"At the same time, infusion pumps have been associated with safety problems. We believe that Purdue's Regenstrief Center can help bring together key players in hospitals to address this national concern by putting research into practice."

Infusion pumps offer a variety of designs to intravenously deliver nutrition, fluids and drugs like pain medications, insulin and cancer treatments. Today, an estimated 2 million infusion pumps are in hospitals and clinics and thousands more are used by patients in their homes.

The pumps come with a programmable computer to control the rate and volume of medication flow, which can vary depending on the patient's illness, weight, age and other factors. A doctor, nurse or other health-care worker enters information on the infusion pump's keypad.

Despite their advantages, the FDA reports that infusion pumps were linked to more than 56,000 adverse event reports from 2005-2009, including at least 500 deaths.

Cindy Gaston, at right, senior clinical pharmacist for the University of Wisconsin Hospital & Clinics in Madison, discusses the importance of safety standards for the use of infusion pumps at a meeting of the Infusion Pump Informatics Community, while Jim Young, quality assurance/ process improvement pharmacist at Wishard in Indianapolis, listens. (Purdue University photo/ Phillip Fiorini)

Cindy Gaston, senior clinical pharmacist for the University of Wisconsin Hospital & Clinics in Madison, says the Purdue-led community has been helpful in sparking discussion from hospital personnel in different environments who have diverse experiences and different vantage points.

"We're all human, and we make mistakes," Gaston says. "When we're programming numbers into a pump, we can make an error. Many times, those errors won't cause patient harm, but it can be one or two times that it does cause severe patient harm, ultimately resulting in death.

"If we can prevent those deaths and improve our use of infusion pumps, it's a very worthwhile project that Purdue is leading."

In 2010 the U.S. Food and Drug Administration released guidelines designed to improve safety as part of its Infusion Pump Improvement Initiative, which proposed stricter regulation of pumps and cited software defects, user interface issues and mechanical or electrical failures as main causes of adverse events.

Infusion pump manufacturers say most problems stem from a nurse or health-care worker accidentally entering the wrong data. But the FDA and hospital officials say the deaths and injuries were because of engineering and design defects of the devices.

That was the driving force behind Regenstrief's efforts to create the group to examine the problems with smart pumps and find solutions.

Beverly Vermace, parental infusion device coordinator and a registered nurse at the University of Iowa Hospitals and Clinics, says the Purdue network has allowed her hospital system to work through existing hurdles encountered with the use of smart pumps while being proactive in avoiding potential hurdles learned from other hospitals.

"With all health-care technology, we cannot remove the human element," Vermace says. "Technology needs to be designed to allow the clinician to do safe patient care. When that happens, patient outcomes will improve."

A team led by Ann Christine Catlin, a research scientist in Purdue's Rosen Center for Advanced Computing, developed the Web-based tool called the Infusion Pump Informatics System.
The initiative uses Purdue's innovative HUBzero website platform to host the tool, tutorials, Q&A forums, and other educational and research resources, all accessible via a Web page.

Jim Young, quality assurance/process improvement pharmacist at Wishard, says that through the group led by Purdue, hospitals can share individual processes for getting a better understanding about how to set guidelines and limits for dosages and concentrations of medication.

Young, whose hospital system began using wireless infusion pumps in 2010, says pharmacists can learn a lot about their proper use by talking to the nurses and vice versa.

"The interaction with this community is helping us improve that communication process to make sure we can give our patients the best possible care," he says. "We're writing the textbook here through the interactions with this community of hospitals."

Vermace at the University of Iowa Hospitals and Clinics says the community also provides a form of encouragement for hospital administrators and staff who know other hospitals have similar issues and are committed to find solutions.

"We get good ideas such as what has worked from the lessons learned, why pharmacists and nurses must work together more effectively," she says. "Another advantage is the rapid response to questions asked and immediate contact with people with a shared experience."

Kathy Rapala is now vice president of clinical risk management at Aurora Health Care in Wisconsin. She first began looking into ways to address the infusion pump problem for hospital staff while pursuing her doctorate of nursing practice at Purdue in 2008.

Through the Indianapolis Coalition for Patient Safety, she submitted a grant to Cardinal Health with the vision of linking the smart pump databases of the Indianapolis hospitals.

"It's exciting when an idea takes off," Rapala says. "To work with data on one platform with diverse organizations is a great step forward in understanding a device and the interaction with the care environment. The learning environment that Purdue has created around the data platform will further that understanding and research."

Community participants say they are convinced a continued focus on this national patient safety issue, building on the research and data collection under way at Purdue, will give hospitals the necessary tools to improve use of infusion pumps, spark ideas to improve the use of guardrails on the devices, minimize alerts and grow their acceptance.

"The stakes are high," Wishard's Young says. "This community established by Purdue's Regenstrief Center and involving these many hospitals is helping us improve our patient safety measures and saving lives."

The Indianapolis-based Regenstrief Foundation provided $3 million to launch the Regenstrief Center in 2005 and awarded an additional $11 million grant in April 2008 to expand and extend its partnership. The foundation's work supports the legacy of Sam Regenstrief's vision: The continued improvement of the health-care delivery system.

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