A Plan for Preeminence for Purdue Pharmacy

Lilly Endowment, Inc. Grant
Since the beginning of Purdue’s pharmacy program in 1884, we have benefited from many different partnerships. None has had a greater impact on our program than the generous partnership with the Lilly Endowment, Inc. Through its strategic investment in the College of Pharmacy in 2006, the Endowment has made a remarkable difference in our College and enabled us to have a far-reaching impact through improving the delivery of health care in Indiana, our nation, and into select places around the globe. The pages that follow highlight some of the key advances that have arisen as a result of this support.

The Endowment’s investment in our program served as a catalyst for the formation of new partnerships in select initiatives. Several individuals added to the funds provided by the endowment to create named endowed chairs for the recruitment of leading faculty. The Hooks Drug Foundation invested in creating an endowment to support a community pharmacy residency/fellowship. Several corporations partnered with us to create new community pharmacy residencies that would assist in training community pharmacy leaders who will improve the safe and effective use of medications. In addition, over 180 community pharmacies have joined our practice-based research network, Rx-SafeNet. Among the most rewarding partnerships has been that with the Veterans Administration, which has enabled us to improve patient safety in the delivery of health care for veterans across our nation. These partnerships are as much a fruit of the Endowment’s investment as are the specific initiatives funded through the grant.

We are immeasurably grateful for the confidence shown by the Endowment through their investment in the Purdue College of Pharmacy. We believe that the highlights in the pages that follow give evidence that this confidence is well placed.

Hail Purdue!

Craig K. Svensson
Dean of the College of Pharmacy
Purdue University
The goal of the Lilly Endowment, Inc. grant to the College of Pharmacy was to support a series of initiatives that would assist the pharmacy program at Purdue University to become the preeminent program in the country. By focusing on various aspects of discovery, learning, and engagement, the Endowment has enabled us to work toward our vision of improving the utilization of the most widely accessible health care professionals (pharmacists), impacting health care delivery in the State of Indiana and nationwide, developing new therapeutic approaches for the treatment of cancer, improving pharmaceutical manufacturing, and promoting economic development through new technology. We believe that the support from the Endowment has assisted our program in marching toward that lofty goal. Not only has the Endowment increased the impact and visibility of our College, it has contributed to the impact of pharmacy on health care delivery, improving the health of Hoosiers and beyond in the process.

**Discovery** An important component of our Discovery initiative was the provision of seed funds for pilot projects in the initiative areas of medication safety, counterfeit medications, optimization of drug manufacturing, and cancer therapeutics.

**Learning** The focus of our Learning initiative was to develop a model for the engagement of community pharmacists in the prevention, detection, and management of adverse drug reactions. This was accomplished through the recruitment of faculty as well as the establishment of postgraduate training opportunities.

**Engagement** With the goal of preventing significant medication error events in Indiana health care institutions, the Engagement initiative resulted in the creation of the Center for Medication Safety Advancement. Through this initiative, we have improved patient safety in Veterans Administration Medical Centers across the country and addressed several critical safety issues in Indiana health care institutions.
Among the activities supported by the Endowment are seed grants to initiate new research projects in the areas of medication safety, counterfeit medications, optimization of drug manufacturing, and cancer therapeutics. The intent of these seed grants is to support exploratory studies that will demonstrate proof of concept and allow faculty members to generate data needed to be successful in obtaining long-term grant funding for the project. The following is a sampling of some of the exciting research opportunities made possible through the Endowment.

- **45** Publications
- **114** Presentations & Invited Lectures (17 presented internationally)
- **15** Additional Grants Funded
- **10** Copyrights & Patents
- **12** Residencies
- **15** Graduate Fellowships
- **14** Undergraduate Summer Research Fellowships
- **8** Internships
Dr. Yoon Yeo, Associate Professor of Industrial and Physical Pharmacy, applies nanoparticle targeted delivery approaches to improve cancer therapy. Her research team has developed a new biocompatible chitosan derivative (a compound found in crustaceans) that can serve as a shield for the surface of nanocarriers. This shield prevents random interactions with normal tissues as it circulates in the blood. Once the carrier arrives at tumor cells, whose pH is slightly lower than normal cells, the chitosan derivative coating will assume positive charges and allow the carriers to interact with tumor cells and deliver anticancer therapeutics.

An Endowment seed grant helped Dr. Yeo to obtain three National Institutes of Health (NIH) grants over the years. The first R21 grant funded in 2009 focused on developing polymeric nanoparticles with pH-sensitive surface and confirming the proof of concept. The R01 grant that was funded in 2014 aims to test how the pH-sensitive nanoparticles can increase drug delivery to solid tumors when combined with focused irradiation. The R21 grant, most recently funded in 2015, will study biological activities of chitosan derivatives, which were originally developed for nanoparticle modification but later found to have anti-inflammatory effects.

“I want to find a way to help patients in a way that has not been possible due to the lack of proper delivery systems. One research goal is to find a way of treating tumors with metastatic potential—a true killer of cancer patients. The success of this research depends on how we make use of specific biological and chemical markers that distinguished the tumor cells from the innocent bystanders.

We are developing polymeric nanoparticles for target-specific chemotherapy. For increasing drug delivery to tumors in a target-specific manner, we program nanoparticles with a new biomaterial that changes charges according to the pH. Solid tumors tend to develop acidic environment due to their unique nature of growth. Our strategy takes advantage of the pH difference to instruct the nanoparticles where they are supposed to act.” – Dr. Yoon Yeo

Dr. James Tisdale, Professor of Pharmacy Practice, and his colleagues worked on a project which involved the development of a computer-automated safety alert to inform clinicians of the risk for a potentially fatal arrhythmia when certain medications were prescribed. Prior to the development of this alert, there was no mechanism by which clinicians could readily assess the level of risk for a given patient receiving a suspected medication. The results of the study showed that this safety alert reduced the risk of an ECG abnormality known as QT interval prolongation (a marker of arrhythmia risk) by 35% in two cardiac care units at Indiana University (IU) Health Methodist Hospital in Indianapolis. This alert has now been incorporated into patient care hospital-wide at IU Health Methodist Hospital and plans are in place to implement the alert at other IU Health Hospitals.
Dr. Arun Ghosh, Ian P. Rothwell Distinguished Professor of Chemistry and Medicinal Chemistry, and his colleagues with expertise in the synthesis of anticancer agents, design of photoactive nanocarriers, and mouse tumor models, pooled their efforts to develop a novel therapy that combines targeted delivery with thermally enhanced drug action to combat ovarian cancer. Overall, the combination therapy provides avenues for circumventing problems associated with drug resistance. His approach is being evaluated against SKOv3 cells, an ovarian cancer cell line with high metastatic potential.

Dr. Tonglei Li, Allen Chao Chair in Industrial and Physical Pharmacy, used his seed grant for a project that bridged between pharmaceutical manufacturing and the use of nanotechnology to improve the delivery of cancer drugs. Since many anticancer drugs do not dissolve in water, carrier chemicals are commonly used to prepare the drugs for delivery, but their usage leads to disappointedly detrimental effects and can worsen the systemic toxicities of chemotherapy. Linking the drug and carrier in some carrier designs requires multistep processes and specialized fabrication techniques, making manufacturing of these drugs extremely challenging. His team has developed carrier-free drug delivery systems for use with cancer drugs. The concept is to formulate a cancer drug directly as very small (nanosized) crystalline particles, and then the nanocrystals can be administered directly through intravenous injection. The results have proven the feasibility of this approach for treating cancer. His lab is currently working on developing scaling-up methods for nanocrystal production to translate the formulation method into clinical applications.

The research of Dr. Lynne Taylor, Professor of Industrial and Physical Pharmacy, seeks to understand the critical role of moisture content in the stability of manufactured drugs and the rationale for formulating new drugs in order to optimize development and maximize shelf life. The long-term goal of the research is to evaluate the influence of both temperature and relative humidity on chemical stability in order to be able to understand which excipients are most problematic and to predict and improve shelf life to avoid conditions where chemical degradation is promoted.

A quick, interactive survey taken on an iPad could help pharmacists and patients better use their brief time together to catch and eliminate harmful drug side effects. Dr. Matthew Murawski, Associate Professor of Pharmacy Administration, has developed new technology to identify patients in need of an intervention to manage adverse drug reactions. His patented “ADDRESS Application (ADverse Drug Reaction/Event Screening System),” which can be used on a tablet PC or iPad, presents patients with a five-question survey that catches up to 60% of all known medication-related side effects.
Dr. Elizabeth Topp, Dane O. Kildsig Chair in the Department of Industrial and Physical Pharmacy, is the principal investigator for a grant issued by the National Institute of Standards and Technology (NIST). This is a consortium that is a direct result from the seed grant she received through the Endowment, and it has led to the highest level of extra funding that has come as a result of the program.

“Lilly seed grant support was crucial to the success of our NIST AMTech proposal,” says Dr. Topp. “In 2013, Dr. Alina Alexeenko of Purdue's College of Engineering and I were awarded a Lilly seed grant in the area of pharmaceutical manufacturing. The seed grant helped us establish a productive collaboration and acquire preliminary data. That was very helpful as we began to reach out to industry with the idea of forming a consortium.”

Purdue University, in concert with an expert panel of members from the field of lyophilization (freeze-drying), will establish the new Advanced Lyophilization Technology Consortium (ALTC) to develop a technology roadmap that will identify critical challenges and strategies for innovation for the food and pharmaceutical manufacturing industries. The NIST grant will last two years, totaling $453,623.

With increasing threat of offshore activity and rising labor costs, the U.S. food and pharmaceutical manufacturing industry risks losing more than $30 billion. Addressing manufacturing deficiencies is essential to the health and growth of this important U.S. industry. Every American household depends on food and pharmaceuticals on some level. Fine-tuning the lyophilization manufacturing process to make it safer and more profitable is what this project is all about. The result of the consortium will be essential to developing innovative strategies for using lyophilization to improve the safety, quality, and profitability of the U.S. food and pharmaceutical industries.

Food and pharmaceutical products such as protein drugs, vaccines, fruits, and probiotic cultures would not be commercially viable without lyophilization. However, lyophilization is a time-consuming and costly manufacturing process. The project is vital to advancing lyophilization, ensuring its proper and safe regulation, and developing state-of-the-art equipment and best practices. “Ultimately,” says Dr. Topp, “we envision that this consortium will lead to other industry-led efforts in food and pharmaceutical manufacturing and to a nationwide network of innovation centers for these sectors.”
Addressing Counterfeit Medications

Counterfeit medications are an egregious problem that can adversely affect both human health and the economy, and the Purdue College of Pharmacy has developed methods that can detect the presence of counterfeit medications in order to prevent such adulterated products from reaching patients. You can read here about how we are applying Raman spectroscopy to detect counterfeit medications, as well as how paper analytical devices (PADs) are being used globally on page 19.

**Raman Spectroscopy Detection**

Dr. Koho Kwon, a Postdoctoral Fellow working under the direction of Dr. Lynne Taylor in the Department of Industrial and Physical Pharmacy, used seed grants to focus on developing advanced methods for detection of counterfeit drug products. He was able to apply Raman spectroscopy to detect and characterize counterfeit tablets.

Raman spectroscopy enables a chemical “fingerprint” to be obtained from a tablet. By comparing this fingerprint to the fingerprint of a genuine tablet, it is possible to quickly identify fake tablets and to determine if they contain no drug, the wrong drug, or an incorrect amount of the drug. Initial studies on genuine and counterfeit Cialis® tablets showed the utility of this approach and tablets were classified into different groups based on their similarity to the genuine product. These exciting preliminary studies were compiled into a case study which will appear as a book chapter in the forthcoming book *Infrared and Raman Spectroscopy in Forensic Science*.

Dr. Kwon’s results were also used to provide preliminary data for a grant proposal to the United States Pharmacopeia (USP) for a USP fellowship award. The USP research priority areas include the detection of counterfeit medications through excipient characterization. He was successful in being awarded this highly competitive fellowship, thanks in large part to the substantial preliminary results presented in the proposal, derived from research supported by the Endowment. The research continues, focusing on using advanced Raman spectroscopic methods including tablet imaging and mapping, as well as chemometric methods of data process, to identify counterfeit tablets and packaging.
The Purdue College of Pharmacy has been able to create endowed chairs, recruit faculty, and establish several postgraduate and undergraduate training opportunities that enhance our Learning initiative, all made possible by the initial funding from the Endowment, which in turn leveraged additional support from matching donors.

**Endowed Chairs**

**Dane O. Kildsig Chair in Industrial and Physical Pharmacy**  
Dr. Elizabeth Topp (July 2009)

**Medication Safety Chair**  
Dr. Michael Murray (March 2010)

**Allen Chao Chair in Industrial and Physical Pharmacy**  
Dr. Tonglei Li (May 2012)

**The Martha and Fred Borch Chair in Cancer Therapeutics**  
(to be appointed)
Dr. Richard Borch, Professor Emeritus of Medicinal Chemistry and Molecular Pharmacology, and his wife, Anne, gave a total of $920,000 anonymously in 2010 and 2012 to support graduate students and a chair in cancer therapeutics. They allowed the College of Pharmacy to reveal their identities upon Dr. Borch's retirement in 2014. Of the Borches’ donations, $800,000 was combined with $1.25 million from the Lilly Endowment grant to create The Martha and Fred Borch Chair in Cancer Therapeutics in honor of Dr. Borch's mother, who died of cancer at a young age, and father, who was a friend of past Purdue President Frederick L. Hovde. The chair will enable the College to retain or recruit a top scientist in the area of cancer therapeutics in the Department of Medicinal Chemistry and Molecular Pharmacology. In combination with President Mitch Daniels’ drug discovery initiative, Purdue’s National Cancer Institute-designated cancer center, the Medicinal Chemistry and Molecular Pharmacology Department’s strength in discovery and design of new drugs, and talented cancer researchers throughout the university, the chair will position Purdue to make significant contributions to the treatment of cancer.

“In the College of Pharmacy, research on diseases and discovery of potential treatments is a top priority, and Purdue has a broad cancer research effort with deep strengths. My hope is that this chair will bolster an already premier department at a first-class cancer research institution and will lead to the development of treatments that revolutionize care for the next generation of cancer patients.”

– Dr. Richard Borch
Fellowship, Residencies & Undergraduate Training

- Fellowship in Medication Safety*
- Global Health Residency
- Graduate Fellowship
- Hook Drug Foundation Community Practice Research Fellowship – This two-year program that combines an MS in Pharmacy Practice with an area of concentration in Medication Safety is one of only 10 programs nationally to become successfully peer reviewed by the American College of Clinical Pharmacy.
- International Medication Safety Fellowship
- Migliaccio/Pfizer Fellowship – Provides an annual fellowship for a graduate student focused in pharmaceutical manufacturing
- Purdue-affiliated PGY-1 Community Pharmacy Residencies*
- Postgraduate Residency in Medication Safety
- Undergraduate Research Fellowship
- Undergraduate Research – 5 of the 8 undergraduate students who have been supported through the grant for a research experience have subsequently enrolled in graduate school at Purdue or elsewhere

* Read more about these under Combined Initiatives on page 17.

International Medication Safety Fellowship

The International Medication Safety Fellowship was established in 2012 to establish a sustainable partnership with a medication safety leader outside of the U.S. The goal of the international fellowship program is to promote learning and sharing with a medication safety leader that will build a sustainable partnership and establish improved medication use systems far beyond the borders of Indiana.

“Having worked in Kenya, a resource-constrained setting where most of the focus is on the provision of basic health care services, I had not grasped the importance of medication safety practices and value it adds to the health care provision.

My experience as a medication safety fellow was an eye-opener and a great inspiration. In my one-month rotation at the Center for Medication Safety Advancement (CMSA), I was privileged to visit different hospitals and observe their systems. In Kenya, systems for ensuring medication safety are not in place; we focus mainly on the problem after it has occurred. After my rotation in CMSA, I have identified several areas in our hospital that are potential sources for medication errors and where possible, we have worked out ways of improvement. I have also given proposals to the hospital management for areas we can improve.

The International Medication Safety Fellowship site visit empowered and motivated me in improving our medication processes. With the support from the Purdue Kenya Program pharmacy team, CMSA, and the hospital management, I hope to establish a dedicated multidisciplinary team for the hospital in Kenya to ensure safe medication use.”

Celia Chema Ngetich
2012 International Medication Safety Fellow
Moi Teaching and Referral Hospital in Eldoret, Kenya
Prior to the support of the Endowment, there was no visible presence of medication safety at the Purdue College of Pharmacy. The focus of the Engagement initiative was the creation of the Pharmacy Technical Assistance Program (PharmaTAP) launched in 2007. The maturation of our diverse programs in medication safety, however, resulted in a decision to align the varied programs under a newly created Center for Medication Safety Advancement (CMSA) in March 2010. CMSA represents a unique and exciting opportunity to focus the mission and vision towards innovative safe medication use practices.

The Endowment funding provided the College the opportunity to develop systems to reduce medication errors, prevent and manage adverse drug events, and promote safe medication use practices. CMSA, now a self-sustaining entity supported fully through extramural funding, is committed to serving the citizens of Indiana, the nation, and the world through enhancing the discovery of safe medication use practices and delivering this knowledge to all who may benefit.

Innovation and collaboration at CMSA between faculty, staff, and students will link actionable discovery to entrepreneurial delivery, ultimately helping achieve a vision of making safe medication use common practice. Since its inception, CMSA remains true to its mission of taking proven research from the laboratory to the bedside, saving lives that would otherwise be lost to serious adverse events.
“CMSA has been able to grow into a sustainable organization dedicated to improving safe medication use, positively impacting the lives of countless patients around the world. Without question, the most significant and foundational reason for this success is the generosity of the Lilly Endowment and our shared vision for making safe medication use common practice.”

**Dr. Kyle Hultgren**  
Director, Center for Medication Safety Advancement

“Managing medications in the ambulatory setting can be extremely complex tasks for both patients and health care providers. I am truly passionate about the initiatives I have the opportunity to be involved in at the College that aim to improve the quality and safety of medication use in this setting. I truly believe that our efforts to integrate innovations in community pharmacy research (Rx-SafeNet), practice opportunities (IMMP), and education (affiliated residencies and fellowships) is unique and has made an impact on learners, pharmacists, patients, and others in our state.”

**Dr. Margie Snyder**  
Director of Community Pharmacy Programs, CMSA
CMSA Appointments

- Center for Medication Safety Advancement Director - Kyle Hultgren, PharmD (June 2008)
- Center for Medication Safety Advancement Co-Director & Network Director, Rx-SafeNet - Margie Snyder, PharmD, MPH (July 2009); title changed to Director of Community Pharmacy Programs (2013)
- Medication Safety Chair - Michael Murray, PharmD, MPH (March 2010)
- Center for Medication Safety Advancement Associate Director - John Hertig, PharmD, MS (September 2011)
- Project Manager, Community Pharmacy Medication Safety Initiatives & Network Manager, IMMP - Tammy Fox, RPh (January 2012)
- Chief Safety Performance and Improvement Officer & Education Program Manager - Cathy Scott, CPHQ (November 2012)
- CMSA Senior Project Manager - Dan Degnan, PharmD, MS (April 2013)
- Project Manager, Community Pharmacy Research & Network Manager, Rx-SafeNet - Mary Ann Kozak, DrPH (October 2013)
- CMSA Office Manager - Lisa Roark (April 2014)
- CMSA Project Manager - Chelsea Leeper, PharmD, MBA (May 2015)

CMSA Highlights

- CMSA was invited to attend and present both an original research poster and two lectures at the 8th Annual Clinical Microsystems Festival in Jonkoping, Sweden.
- The Indiana Hospital Association (IHA) is the second largest Hospital Engagement Networks (HEN) in the U.S. HEN was formed in response to the national Partnership for Patients initiative, a substantial national grant targeting a 40% reduction in patient harm and a 20% reduction in hospital readmissions. Recognizing our significant work, IHA partnered with CMSA to target two HEN objectives: adverse drug events and readmissions.
- CMSA has developed a first-of-its-kind tablet-based simulation exercise to teach safe medication use practices to both students and current practitioners in a safe digital environment.
- Over 10,000 medical professionals have received live training from CMSA staff and partners on process improvement methodologies and safe medication use practices.
- CMSA has established a multi-year partnership with the Veterans Administration (VA) to develop training and live technical assistance in creating a culture of improvement targeting high quality veteran care.

CMSA is proud to highlight the following initiatives that have been developed as a direct result of its creation to help carry out its medication safety mission.

Medication Safety Research Network of Indiana

The Medication Safety Research Network of Indiana (Rx-SafeNet) is a practice-based research network (PBRN) of community pharmacies located throughout the State of Indiana. The mission of Rx-SafeNet is to improve medication safety and advance community pharmacy practice in Indiana through the conduct and dissemination of collaborative, patient-centered, practice-based research. Rx-SafeNet aims to advance the optimal use of medications through our engagement with community pharmacies with a focus on enhancing medication safety among ambulatory patients. Established in 2010, Rx-SafeNet is administered by CMSA and is registered as an affiliate PBRN with the Agency for Healthcare Research and Quality (AHRQ) of the U.S. Department of Health and Human Services. Currently, approximately 180 community pharmacies in Indiana have joined Rx-SafeNet, which represents about 15% of all community pharmacies in the State.
Indiana Medication Management Partnership  CMSA has collaborated with the Indiana Pharmacists Alliance (IPA) to establish the Indiana Medication Management Partnership (IMMP), which aims to become a statewide network of pharmacists and pharmacies located throughout Indiana created with the goal of facilitating the provision of medication therapy management (MTM) services for patients. IMMP seeks to provide high value, patient-centered MTM services to optimize medication use and improve health outcomes. IMMP is an Associate Member of the National Medication Management Collaborative.

SafeRx Database of Adverse Drug Events  In 2014, the Food and Drug Administration (FDA) made millions of adverse drug event (ADE) reports publicly available online through their open FDA web portal. Beginning with this large data set, CMSA has partnered with the Purdue University Rosen Center for Advanced Computing to build an infrastructure to display and ask questions of this data in a useful manner. Furthermore, CMSA and the Rosen Center aim to add at least three more large global databases of a similar nature throughout the course of 2015. With millions of diverse data sets from around the world and the capability of running complex search criteria, CMSA aims to uncover new insights into the nature of ADEs and work to counter their root causes.

Medication Management Technology  A new survey and implementation tool were developed by CMSA to understand the expectations of hospital staff during a transition period of implementing a bar-code medication administration system. This tool has since been adapted for use in the implementation of any medication management technology.

Medication Safety and Informatics Course  CMSA has taken the lead in developing the first core course in the Doctor of Pharmacy curriculum focused entirely on medication safety and informatics. The course was first offered in Fall 2014 with the intention of introducing different teaching methodologies. Students get to put their hands on a topic and see what they can learn from interacting with their peers to better understand what is being taught. CMSA developed a series of simulations or games that can be used in a variety of settings for audiences as small as a few people to engaging crowds of over 500, with results showing the highest retention scores upon administration of post-tests. Finally, students were assessed through their ability to present a root cause analysis of an actual adverse event and how they proposed to improve the system to prevent future errors.

Continuing Education  CMSA has launched a new continuing education program to expand the number of health professionals educated in medication safety. Our Medication Safety Certificate Program is a comprehensive introduction to medication safety concepts and tools that meet the standards of the medical, pharmacy, and nursing accrediting bodies. This on-demand webinar series allows convenient access to recorded content about relevant medication safety topics. Participants, who will earn a Certificate of Completion, are actively involved in creating a culture of safety that focuses on systems redesign as well as outcomes for meeting patient needs. Topics include: background on safety; prescribing, transcribing, dispensing, and administration errors; and RCA/FMEA/process improvement.

Teaching Safety by Simulating the Medication Use Process  CMSA has been working in a multidisciplinary partnership to create a tablet computer based simulation that will place users in a lifelike situation whereby they must safely dispense and administer medications to patients. Simulation can serve as a tool in creating authentic experiences for individuals to practice their skills in a safe virtual environment in a real-time setting. Virtual environments can also include components of team interactions, stressors, and confounding variables that are representative of the fluid work environment in a health care setting. Ultimately, we aim to link skills learned in the simulation experience to those utilized on a daily basis in the acute care setting through the development of a common medication safety dashboard. Simulation has already shown some excellent results in many health care settings. We aim to contribute yet another tool for developing competent professionals in safe medication use practices.

Partnership with Industry  Beginning in early 2014, CMSA has significantly grown its partnerships with the pharmaceutical manufacturing industry. We have initiated investigational work on high risk medications and delivery devices, various medical devices and their interactions with medications, as well as looked at formulations of older medications that may be leading to confusing administration practices for patients. These have been excellent partnerships as it enables CMSA to offer up our expertise on safe medication use practices before these medications ever reach patients.
As part of our outreach to improve medication safety in community pharmacies, the support of the Endowment has given the Purdue College of Pharmacy the leverage to partner with organizations throughout Indiana. Our collaboration with the Veterans Administration, Indiana Pharmacists Alliance, Food and Drug Administration, and community pharmacies allows us to further our medication safety mission.

Veterans Administration Partnership
The Center for Medication Safety Advancement (CMSA) has partnered with the Veterans Administration to author and provide Systems Redesign training and program facilitation to their employees across the country. Since the inception of this program in 2009, hundreds of sessions conducted for staff representing all 50 states have trained over 5,000 professionals.

Indiana Medication Management Partnership
As described earlier in this report, CMSA has also collaborated with the Indiana Pharmacists Alliance (IPA) to establish the Indiana Medication Management Partnership (IMMP), which aims to become a statewide pharmacist practice network that supports pharmacist-provided patient care services in community/ambulatory settings.
**Purdue-affiliated PGY-1 Community Pharmacy Residencies**
The Endowment has supported residency accreditation, residency research projects, resident travel and professional development, residency recruitment activities, and preceptor development for five PGY-1 community pharmacy residencies affiliated with Purdue. All residencies are fully accredited or in the process of being accredited by the American Society of Health Systems Pharmacists (ASHP), the sole accreditor for postgraduate residencies in pharmacy.

We are proud to partner with the following pharmacies:
- Dr. Aziz Pharmacy
- Fagen Pharmacy
- Kroger Pharmacy
- Mathes Pharmacy
- Walgreens Pharmacy

**Dr. Nikki Moore**, a 2012 Community Pharmacy Resident, identified an unaddressed issue of growing concern—how can we educate patients about safe use of their medications when their primary language is not English? She and her colleagues worked on assessing how Spanish speaking patients in southern Indiana obtain their drug information and how readily they understand information in the forms provided. Her work has been published with the goal of providing a framework for safe medication use in this growing population of Hoosiers.

**Medication Safety Fellowship**
CMSA has partnered with the Food and Drug Administration (FDA) and Eli Lilly & Company to create a two-year fellowship program in Medication Safety. The goal of the program is to enhance pharmacists’ knowledge, expertise, and abilities in medication safety while introducing them to many career avenues of government, pharmaceutical industry, and academia which utilize their skill set. Fellows will rotate through practice sites including the FDA Office of Surveillance and Epidemiology Medication Errors and Pharmacovigilance Divisions, Eli Lilly & Company in Pharmacovigilance and Global Safety, and CMSA.

**Dr. Katelyn Brown** received her Doctor of Pharmacy degree from the Purdue College of Pharmacy in 2013. She is completing a post-doctoral fellowship in Medication Safety. She began her fellowship working with CMSA and Lilly. Her projects with CMSA included teaching Purdue College of Pharmacy students, collaborative work with the Indiana Hospital Association and Indianapolis Coalition for Patient Safety, and research in ensuring safe use of insulin pen utilization. While at Lilly, she served as a Surveillance Scientist in Global Patient Safety where she performed pharmacovigilance activities for various compounds. She is currently completing a nine-month assignment at the Office of Surveillance and Epidemiology at the FDA.

Upon completion of her fellowship in June 2015, Dr. Brown has accepted a position with Eli Lilly as a Diabetes Real World Outcomes Consultant. This role serves as the link between Lilly employees that are in the field talking to payers, the researchers in health outcomes at Lilly, and the brand teams (designing clinical trials and making decisions on what molecules to push forward). This position is responsible for making sure all stakeholders are aligned and understand what customers need/want.

“CMSA is passionate about preventing harm associated with medications and medication errors. Our research in insulin pen safety is one example of that passion in action. The insulin pen has provided several advantages over the syringe and vial method in treating people with diabetes. Despite advantages like controlling dose variability, reducing the risk of hypoglycemia, and improving the ease of use for patients, disadvantages also have been identified. Of primary concern are numerous reports over the past five years of health care professionals reusing insulin pens on multiple patients, thereby exposing patients to possible transmission of bloodborne pathogens such as HIV and hepatitis. CMSA has partnered with the Institute for Safe Medication Practices and BD Medical to conduct research regarding the safe use of insulin pens in multiple settings. Our goal in providing education nationwide to help others learn from our research is to prevent patients from experiencing this tragic medication error.

During my time in this program I have not only learned about improving medication safety and quality, but I have been able to apply the skills and knowledge I have gained from one rotation to another. I am grateful for this unique experience.”

**Dr. Katelyn Brown**
Medication Safety Fellow, 2013-2015
Global Impact

A preeminent program must have a global presence and impact. Our collaborations with the medical schools at Indiana University, Duke University, and Brown University in Eldoret, Kenya, provide the framework for medication safety initiatives in a resource-constrained environment. We have leveraged the resources of this program to launch learning and discovery initiatives with the support of the Endowment. This has also allowed us to develop a new relationship with the University of Notre Dame as a global outreach partner. Through these efforts, the impact of the support of the Endowment has reached beyond the State of Indiana and borders of our country into sub-Saharan Africa.

Global Health Residency

A global health residency provides a unique training environment for improving medication safety in a resource-constrained environment. Purdue already has the most progressive global outreach of any pharmacy program in the nation, and the establishment of this residency has clearly defined us as the leader in terms of providing a global platform for the training of U.S. pharmacists.

The focus of this program is to provide patient care in a variety of pharmacist-run programs in the resource-constrained setting of Kenya, while training clinical pharmacists who can develop and deliver sustainable health care worldwide. Residents are held responsible and accountable for acquiring the following outcome competencies: managing/improving the medication-use process; providing evidence-based, patient-centered medication therapy management with interdisciplinary teams; demonstrating project management skills; providing medication and practice-related education/training; and utilizing medical informatics. Clinical and research areas include HIV/AIDS, diabetes, anticoagulation, primary health care, informatics, and pharmacovigilance.

The funding from the Lilly Endowment has helped create an entirely new cadre of highly qualified pharmacy leaders that would have never existed without the Endowment’s forward thinking support. The Endowment’s support of this novel program in Kenya has not only directly helped the professional careers of the participants but more importantly has led to a paradigm shift in the health care infrastructure that will benefit patients in these settings for many years to come.
**Paper Analytical Devices** The Purdue Kenya Partnership (PKP) is working to address counterfeit medications and improve the quality of care that Kenyan patients receive. The standard method for testing counterfeit medications is the use of high performance liquid chromatography (HPLC), a technology that is not readily available in this resource-constrained setting. PKP is excited to introduce paper analytical devices (PADs) as an alternative method.

PADs are test cards that can quickly determine whether a drug tablet contains the correct medicines. These inexpensive tests costs less than $0.25 to make and are easy to use. They don’t require power, chemicals, solvents, or any expensive instruments, so they can be deployed rapidly at large scale wherever a problem with pharmaceutical quality is suspected. These little test cards could change the balance of power between sellers and buyers. Right now, most buyers have to trust what the seller tells them about the quality of the pharmaceuticals they purchase. Unscrupulous manufacturers and distributors know that there is little chance that their medicines will be screened in a lab. These paper test cards don’t need a lab, and they will enable people all over the world to quickly detect low quality medicines and remove them from the market.

“Counterfeits or substandard drugs are a global issue, but the impact is felt most in developing countries,” says Dr. Mercy Maina, Global Health Resident. “The PAD is a device for the millions in developing countries to fight back against poor quality drugs. The PAD might be the size of a card, but its impact on patient safety is huge.”

Through the partnership between Purdue University, the University of Notre Dame, and the Moi Teaching and Referral Hospital, we have been implementing this novel counterfeit detection strategy throughout western Kenya and have been able to successfully integrate this into the anti-counterfeiting activities of the Kenyan Pharmacy and Poison’s Board. As we continue to gain more experience with this novel technology and build more local infrastructure to validate the results of the PADs, we are hoping to build a replicable model for substandard medication detection that can be introduced throughout the developing world.

“The point of care substandard medication detection device introduced through the support of the Lilly Endowment helps to level the playing field by incorporating a low cost detection device that can help detect substandard medications before they are able to cause harm to patients. This technology has the potential to permanently alter the marketplace for medications in low and middle income countries (LMIC) by facilitating large scale assessment of medication quality with an easy to use point of care tool. It is technologies like this that speak directly to the barriers billions of people face all over the world. We are now trying to introduce this life-saving technology in as many LMIC settings as possible to continue to expand the benefits to additional populations.”

**Dr. Sonak Pastakia**
Associate Professor of Pharmacy Practice Director, Purdue Kenya Partnership
Diabetes Care Program  What started as a vital life-saving donation to immediately save the lives of thousands of patients with insulin dependent diabetes in western Kenya has grown into one of the largest, most comprehensive, and most innovative diabetes care programs in the entire world. From its humble beginnings, the Academic Model Providing Access to Healthcare (AMPATH) Diabetes Program now provides home based screening for diabetes, uninterrupted medication supplies (stockouts were experienced more than 50% of the time), a full complement of previously unavailable laboratory tests (including HbA1cs), a recently published cell phone based self-monitored blood glucose program (leads to a 30% reduction in HbA1cs after three months), an international gestational diabetes partnership incorporating partners from India and the United Kingdom, and an award winning portable care delivery model customized for rural populations. This last initiative, entitled BIGPIC (Bridging Income Generation through Provision of Incentives for Care) is now being considered for implementation in Tanzania, the urban slums of Nairobi, and one of the largest diabetes care providers in India. Within this initiative, a more patient-centric model has been introduced which provides portable care alongside microfinance groups to remove the many barriers patients face when trying to access care in ministry of health facilities. This model has introduced new economic opportunities while simultaneously helping patients achieve unprecedented clinical gains. Patients with hypertension experienced a 30 mmHg drop in systolic blood pressure after just nine months of group care within this model.

Through the many accolades the Purdue Kenya Partnership has earned for their diabetes work alongside local Kenyan partners, we have been able to expand the reach of this program from the initial thousands of patients receiving Lilly sponsored insulin to many millions more throughout the developing world by creating sustainable strategies customized for rural populations. As we continue to introduce highly impactful care strategies, we look forward to continuing to advance the gains of the Lilly Endowment’s initial investment in our program to additional populations throughout both the developing and developed world.

Patient EE’s story is representative of the struggle so many of our patients face on a daily basis. EE is employed as a driver, transporting many of the essential aspects of HIV care for AMPATH. His recent diagnosis of diabetes had threatened his very livelihood as the insidious complications of diabetes were starting to set in and prevent him from performing his job responsibilities.

At enrollment into our cell phone based glucometer pilot program in rural Africa, EE had an HbA1c of >14%, random blood sugars above 400mg/dL, and the side effects of persistent hyperglycemia. In just three months of care, EE’s HbA1c was reduced by more than 40% of its initial value (now 8.9%) and he is now symptom free. EE’s story is just one of the many stories that represent the potential impact of the care and support being provided for patients with diabetes. There are currently over 700 patients who participate in the glucometer program.
Approximately 12,000 square feet of ground level space in the Robert E. Heine Pharmacy Building has been and will continue to be renovated. The space was divided into a number of small laboratories and had not been renovated in the past 40 years since its original construction. It is difficult to describe the remarkable improvement in the space for our faculty, students, and postdoctoral fellows with the renovation supported by the Lilly Endowment.

“The renovation has already helped us recruit two excellent new faculty members and will be a drawing card in our ongoing efforts to recruit the best faculty and students. Our unique pharmaceutical manufacturing facility has already attracted interest from the pharmaceutical industry and potential collaborators,” comments Dr. Topp, Dane O. Kildsig Chair in Industrial and Physical Pharmacy. “The renovation has given the department new excitement, new collaborations, and new opportunities—so very much more than bricks and mortar.”

“Facilities Enhancement

“The renovated space on the ground floor of the pharmacy building provided an excellent venue for our Molecular Basis of Manufacturing lab. It allowed three groups of students to carry out a wide range of manufacturing experiences including wet granulation, roller compaction, extrusion spheronization, and tableting. The new Piccola tablet press was particularly useful to teach the students the effects of compression force on tablet hardness, friability, dissolution, and disintegration. The new facilities and air handling also illustrated the importance of HVAC in modern pharmaceutical manufacturing.”

Dr. Stephen Byrn
Charles B. Jordan Professor
Department of Industrial and Physical Pharmacy
We trust that this report has provided a picture of the tremendous impact of the support from the Lilly Endowment, Inc. on our Purdue College of Pharmacy. Without the support of the Endowment none of the initiatives described would have been launched and we would not be having the magnitude of impact described herein on the health of the citizens of our fine State of Indiana and beyond our borders. Opportunities exist today that were not in place when the grant was written in 2006. Your support has been truly transformative for our program. Thank you.