



CENTER FOR NURSING RESEARCH

RESEARCH AREAS OF EXCELLENCE

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INTRODUCTION

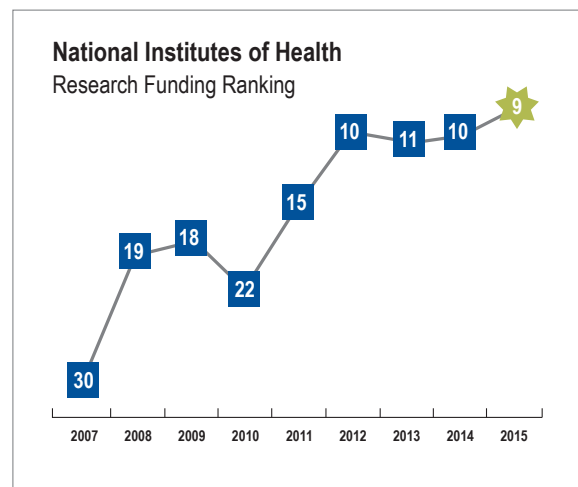
As a leader among top research-intensive nursing schools, the Duke University School of Nursing (DUSON) was ranked ninth among schools receiving funding from the National Institutes of Health (NIH) in 2015. DUSON is now undertaking major changes in order to make ever-greater research contributions on its way to becoming an even more highly ranked school. September 2015 saw the appointment of a new associate dean of research affairs and the redesignation of the Office for Research Administration as the Center for Nursing Research. In January 2016, DUSON launched a strategic planning initiative focused on research that included key measures to solidify its rapid ascent as a preeminent institution committed to nursing science and its translation to policy and best practice.

DUSON RESEARCH MISSION: To lead and accelerate nursing science and its translation

Opportunities for growth come at a time when nursing research at DUSON ranks higher than ever: ninth nationally with \$4.8 million in annual funding. A listing of recent extramural research grants can be found in Table 1 on pages 12-15. Fundamental to achieving continued growth in financial support is the creation of research communities that promote connectivity and partnership at DUSON, Duke Health, and other schools and centers at Duke and beyond. These collaborative relationships are essential to address the most pressing health care questions from numerous perspectives.

DUSON researchers are leaders who will train future nurses in the development and translation of knowledge to improve the health of individuals, families, and communities. This impetus will accelerate nursing science that will significantly improve health and health care. Through engagement of diverse faculty, staff, and student populations, fresh ideas and perspectives will emerge to shape novel, innovative, and relevant research questions. Immersive student experiences are a cornerstone of the research infrastructure that is designed to encourage critical thinking and inventive problem solving. New learning environments provide the catalyst for exchange and interaction that prohibit exclusivity and help to shape the next generation of nurse-scientists.

Our mission is to create the knowledge necessary to develop solutions to society's most challenging problems. We focus on improving the quality of health care and the quality of life and health outcomes for individuals, families, and communities. Research include observational studies that inform the design of interventions and system changes that ultimately are effective, cost-effective, and responsive to the needs and health outcomes of varied populations, contexts, and sociocultural backgrounds. They can also be intervention/experimental studies designed to test effective behavioral interventions to improve health and increase quality of life in those living with illness. Other studies will capture pioneering methodologies and analytics to answer cutting-edge questions. Research initiatives at DUSON provide opportunities for partnerships and collaborations among individuals with multifaceted expertise and experience and emphasize interdisciplinary team science.



The DUSON 2016 Strategic Planning Initiative developed specific goals for the research mission. They are listed in the table below.

DUSON RESEARCH GOALS
Develop a supportive infrastructure to position DUSON as a sustained leader in nursing science and its translation.
Recruit and retain outstanding research faculty, staff, students, and trainees.
Focus on targeted research areas of excellence for growth and investment.
Promote and accelerate DUSON research, innovation, and accomplishments.
Diversify DUSON's research portfolio and funding sources.

FOUR RESEARCH AREAS OF EXCELLENCE

The Strategic Planning Initiative Steering Committee developed four focus areas of research excellence. These areas include:

- **Clinical Innovation**
- **Population Health and Chronic Illness**
- **Precision Health**
- **Methods and Analytics**

Each of these areas provide a platform for building research profiles and connectivity within a scientific community. DUSON researchers will use resources from each to augment their expertise. Essential underpinnings of these areas include the exploration of science across the age continuum and the quest for knowledge that must be explored in populations both well and ill.

The research areas of excellence will support the overall synergy of research initiatives at DUSON. They build on existing faculty strengths and future potential, and they are conceptually broad to allow multiple opportunities for researchers to develop and grow collaborative partnerships; and will guide recruitment efforts of researchers. Faculty may participate in the activities of all four areas during the evolution of their research programs.

The Steering Committee established criteria and guiding principles to evaluate the importance of each area, which are listed below.

- **Build on existing DUSON strengths (faculty expertise, infrastructure, and administrative capacity).**
- **Differentiate DUSON; drive reputation and visibility.**
- **Align with Duke University and Duke Health research strengths and priorities.**
- **Offer funding potential and/or alignment with funding priorities.**
- **Provide opportunities to significantly impact health and health care.**

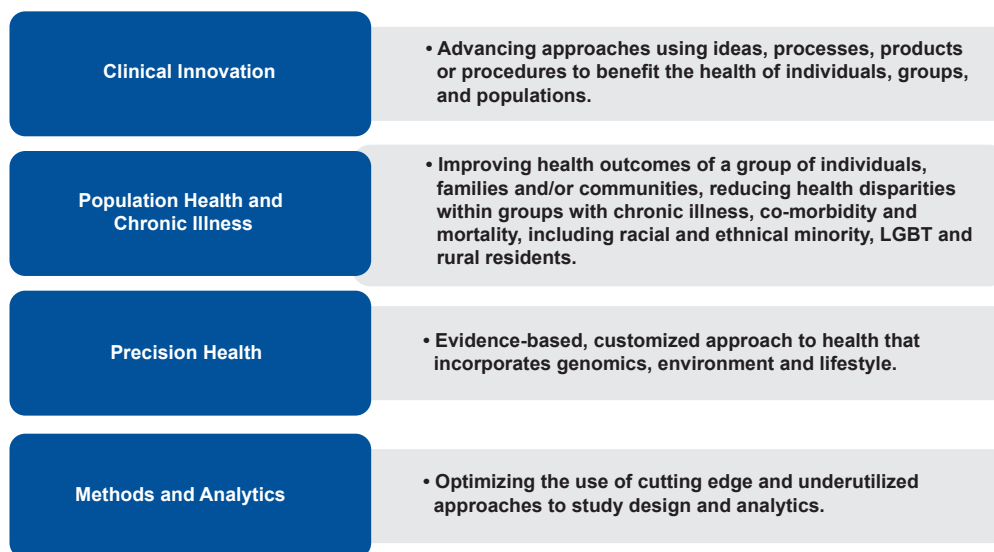
GUIDING PRINCIPLES

The guiding principles allow the faculty to focus their efforts, build and sustain teams with individuals within DUSON and across Duke Health and the larger Duke University. In addition, these principles also:

- Provide conceptual organization for research at DUSON.
- Promote the advancement of nursing science, from prevention to palliative care, to optimize the health of individuals, families, and communities.
- Prioritize resource investments.
- Foster collaboration and partnerships among DUSON research faculty and external researchers.
- Increase visibility of DUSON research expertise.
- Foster funding opportunities based on DUSON research expertise.

RESEARCH AREAS OF EXCELLENCE

A brief overview of the four research areas of excellence is presented below; each area is discussed in detail in the following sections.



CLINICAL INNOVATION

Clinical innovations include the implementation of new models of care, devices, and technologies, as well as methods of interactions between patients and medical personnel that produce cost-effective improvements in clinical health outcomes that may be disseminated. In order to substantively advance the quality of health care, we must consider alternative types of care and care delivery. These include the efficacy of nurse-led clinics, the expansion of connectivity, and the subsequent integration of health care delivery within and outside clinics via existing and emerging technologies (e.g., mobile apps, wearable sensors, and other e-health technologies). It is vital to evaluate these innovations for feasibility, safety, and efficacy of clinical outcomes. These aims require us to create and reward a culture of innovation that allows DUSON researchers to: (1) freely think as designers, where non-optimal initial findings are accepted as a positive step toward novel solutions; and (2) collaborate within interdisciplinary teams with diverse perspectives to solve significant problems. Consider the philosophy of IDEO, an award-winning global design firm in Silicon Valley. It asserts that successful innovation is at the center of three primary areas: the needs of the people or a human-centered approach; the feasibility or possibilities of technology; and viability or requirements for business success. Interdisciplinary teams make it possible to iterate and reiterate the design process to address these three primary attributes of successful design and innovation. This research area of excellence is under the direction of Dr. Eun-Ok Im, a leading nurse scientist who is a methodologist and theorist in international cross-cultural women's health.

Existing expertise. Clinical innovation includes the exploration of technology as well as processes or procedural approaches designed to benefit individuals, groups, and populations. This area builds on: existing DUSON expertise in patient-centered care models, health information technology products, and interventions (mHealth, wearable sensors, e-health, and virtual environments); extensive DUSON experience in human-centered design and human factors; and innovative simulation methods used to teach anesthesia students clinical skills. A new Health Innovation Lab (HIL) under the direction of Dr. Ryan Shaw has been approved to foster interdisciplinary collaborations to test solutions to health care problems. Dr. Shaw is working on a project with Duke's Pratt School of Engineering to test the use of robots in health care, a major focus of HIL in 2017. Other HIL projects include: telepresence robots, RFID-radiofrequency technology, 3-D printing, Google Glass, Apple HealthKit, and Oculus Rift. Researchers in clinical innovation at DUSON, funded by NIH, are conducting studies in virtual environments to improve self-management of type 2 Diabetes (PIs: Dr. Constance Johnson and Dr. Allison Vorderstrasse); in mobile technology for tobacco cessation (PI: Dr. Devon Noonan); and on mHealth in weight loss (PI: Dr. Shaw). Dr. Tracey Yap has been awarded an NIH R01 grant to determine whether repositioning frequency can be extended for nursing home residents who are low, moderate, and high risk for pressure ulcer development. This team also will determine how changes in medical severity interact with changes in risk level and repositioning schedule to predict pressure ulcer development.

Gaps in knowledge and skills. We need expertise to guide us in design and interdisciplinary teamwork. Recently, Nature devoted an entire issue (September 16, 2015) to interdisciplinary research and why it matters. A major challenge that arises when working in interdisciplinary teams regards the need to improve communication across disciplines. DUSON lacks this expertise as well as knowledge of innovative design. We also need to better understand various new technologies and how they might serve our patients.

Five-year goals.

- Facilitate interdisciplinary research (among the schools and departments of nursing, medicine, engineering, computer science, business, and Duke Health) in clinical innovation to develop new models of care.
- Incorporate new technologies within care; develop new methods of patient interaction.
- Enhance education simulation and use of technologies to improve cost-effective patient care. This research area will support the spectrum from discovery to improved patient care by facilitating collaboration among interdisciplinary researchers, funding pilot grants, supporting federal grant applications, and assisting in the delivery of innovative, successful projects to market.

Our specific short-term goals are to:

- Educate DUSON researchers on innovation processes through consultation with design and innovation firms as well as the Duke Institute for Health Innovation (DIHI).
- Develop an RFP early in year one and fund pilot projects to facilitate application for federal or industry grant funding by the end of year two.
- Facilitate the delivery of successful ideas to market and assist investigators of successful grants to apply for further funding through NIH's Small Business Technology Transfer (STTR) funding mechanism.
- Develop an annual summer workshop in year three to showcase our expertise in clinical innovation.
- Promote use of Health Innovation Lab through interdisciplinary projects.
- Develop an advisory council of community leaders, innovation leaders and consultants, researchers in clinical innovation, and practicing clinicians.
- Develop an education and simulation collaborative to promote the use of advanced technologies in education research-especially related to interprofessional education initiatives.
- Create a postdoctoral fellowship in clinical innovation open to providers and researchers in health care.

Need for resources and skills. There is significant funding potential in this area. For example, innovation is one of five main focus areas outlined in the National Institute of Nursing Research's (NINR) strategic plan. NINR emphasizes that innovative technologies are crucial to advance health care and nursing science, and the area is essential to personalized care for patients, families, clinicians, and communities. However, there are many other potential funding sources such as the Agency for Healthcare Research and Quality, the National Library of Medicine, industry, venture capital funds, and so-called "angel" investors, to name a few. This area offers DUSON tremendous potential to provide national leadership through its interdisciplinary work with other Duke schools and centers. Interdisciplinary research is key to solving health care problems as it capitalizes on the strengths of diverse disciplines with different theories and specialized knowledge to solve specific aspects of a problem. However, we need training in human-centered design thinking that informs researchers of the possibilities of technology and how to incorporate it in population and patient care; this includes being mindful of dissemination and requirements for business success should innovations prove feasible, effective, and cost-effective.

POPULATION HEALTH AND CHRONIC ILLNESS

The prevention/minimization of adverse effects of chronic illness fit the call of nursing and nursing science (American Nurses Association, 2010). To this end, population health addresses challenges from disease prevention to palliative care — the entire range of factors that determine health and health outcomes for individuals, families, and communities sharing certain characteristics such as race, ethnicity, rural residency, or membership in specific groups. The development of new, innovative interventions for chronically ill individuals contributes to improved population health. This includes work in areas that encompass and are consistent with DUSON's commitment to diversity and inclusiveness. As such, these research values translate into actions that will contribute to the eradication of health disparities.

Existing expertise. The prevention and enhanced treatment of chronic illness is a shared responsibility that facilitates population health. Population health and chronic illness researchers at DUSON are collaborating with scholars from other disciplines to discover determinants that significantly influence health and health outcomes of the chronically ill. For example, an interdisciplinary team led by Dr. Elizabeth Merwin recently received funding from NIH (through the National Institute on Minority Health and Health Disparities) to investigate the effects of disability and comorbid mental illness in disabled persons under age 65 who qualify for Medicare. This team is examining self-care capacity, its relationship to health status, and selected illness trajectories and health outcomes over a fourteen-year period. The study considers community capacity to support health, quality of health care, and intersecting effects of gender, race, and rurality. Another study funded by NIH (through NINR) focuses on improving health for older women living with HIV and the related issue of stigma (PI: Dr. Michael Relf).

A P-30 center grant funded by NINR (Drs. Sharron Docherty and Chip Bailey) brings nursing and interdisciplinary collaborators to advance the knowledge base of symptom science pertaining to the development of adaptive changes and interventions to improve care for those with cognitive and affective symptoms. A DUSON researcher (Dr. Sophia Smith) funded by DIHI is exploring innovations to influence health changes that cancer may cause in patients. This study is designed to reduce cancer-related pain, promote health care utilization, and improve patient-provider communication via a Web-based education program. The study curriculum teaches coping skills to cancer patients in a Web-based environment group setting. This research emphasizes that while populations may have no control over diagnosis, strategies to adapt and live with disease vibrantly demonstrate the importance of population health and chronic illness. Dr. Eun-Ok Im is recently funded by the NCI on her technology-based information/education and coaching/support program that is culturally tailored for Asian American breast cancer survivors. Despite few studies on Asian American breast cancer survivors, it is well known that these women shoulder unnecessary burden of breast cancer because they rarely complain about symptoms or pain, delay seeking help, and rarely ask or get support due to their cultural values and beliefs and language barriers.

A DUSON study supported by a Duke Clinical and Translational Science Awards training grant is determining the influence of multiple chronic conditions in elderly patients with hip fractures (PI: Dr. Michael Cary). Clusters of multiple chronic conditions identified in Medicare claims files will be evaluated for their link to hospital readmissions. This study will provide significant insight into determinants of health and outcomes in this patient population.

At DUSON, significant outcomes of population health and chronic illness research include the provision of supporting evidence of strategies that improve health system practices while paving the way for future health policy change. For example, a recently funded study between collaborators at DUSON and Duke Health evaluates the influence of a doctorally prepared, advanced nurse-practitioner model of care on outcomes of chronically ill heart-failure patients (PIs: Dr. Margaret Bowers and Dr. Marilyn Hockenberry). This two-year study will guide future evaluation of other nurse-led models of care to support continued efforts toward policy transformation for advanced practice providers. Dr. Paula Tanabe has received an NIH U01 grant to implement and evaluate a co-management model of care for persons with sickle cell disease in central North Carolina. This study will identify patient, provider, health care organization, and community barriers to sickle cell disease co-management.

Gaps in knowledge. Population health examines health consequences for a group of persons and explains distribution of outcomes of the entire cluster (Kindig and Stoddart, 2003). The population can be described in numerous ways including the geographic location, type of health center, insurance coverage, professionals caring for patients, demographic characteristics as well as individuals with similar health conditions (Washington, Coye and Boulware, 2016). Importantly, rather than consider health a state of being, this approach considers health a capacity or resource. This concept contemplates phenotypic and genotypic characteristics as well as social, economic, educational, and work environments that contribute to the complex interplay that determines health. Due to this complexity, there is a need for more extensive investigation. Within population health and chronic illness research, DUSON investigators believe there is more to health than just health care; they focus on exploring gaps in understanding. A nursing environment rich in the evidence-based practice paradigm allows these well-positioned scholars to explore new determinants of health, their associations, and the usefulness of innovations to improve health and health outcomes.

Five-year goals. The population health and chronic illness research area of excellence is designed to support: research partnerships among interdisciplinary researchers; funding for pilot grants; and submission of federal and nonfederal grant applications. This area is also charged with advocacy for population health at Duke and beyond, including the issue of health disparities. The specific goals for the population health and chronic illness research area of excellence are listed below.

- Educate DUSON researchers and students on population health and the role of nurses to keep people healthy.
- Promote Duke partnerships for collaborative interdisciplinary research participation focused on: chronic diseases with high quality-of-life burden (e.g., hypertension and diabetes); health disparities impacting communities; and the evaluation of unique models of care that can significantly impact population health.
- Develop a yearly RFP to fund collaborative pilot projects to facilitate grant applications for research in the following areas: (1) care for high-need patients with chronic disease; (2) specific determinants such as health that influence quality of life; and (3) innovative models of care that move population health collaboration toward decreasing years of life lost while minimizing morbidity.
- Explore funding opportunities for support to continue supplementing the growth of innovative, interdisciplinary research partnerships throughout Duke.
- Develop a postdoctoral fellowship in population health open to providers and researchers in health care.

Need for resources and skills. What do nurses do best? They examine health changes and approaches that enhance the capacity of individuals to adjust to these changes, as well as to meet the challenges created by chronic illness. With the resources requested in the strategic planning budget, DUSON research on population health and chronic illness will produce significant changes that can have dramatic effects on the patients and populations in our care.

PRECISION HEALTH

Precision health capitalizes on advances in technologies and their increasing prevalence in genomics and digital health. We use the term *health* rather than *medicine*, *nursing*, or *health care* in this focus area because we emphasize interdisciplinary study and the use of precision technologies and approaches to help individuals (and thereby, populations) achieve greater health and well-being. Dr. Allison Vorderstrasse will serve as lead for this Research Area of Excellence.

Existing expertise. Some of DUSON's expertise and research is focused on disease. For example, DUSON researchers are currently funded by NINR to determine biomarkers and genomic markers associated with: (1) survival in coronary disease (Dr. Jennifer Dungan); and (2) trajectories of injury and recovery in pediatric traumatic brain injury (Dr. Karin Reuter-Rice). Others are evaluating genomic contributions to symptoms of chronic conditions such as pediatric cancer (Dr. Hockenberry). Implementation of genomic applications in chronic disease is also being studied to determine its clinical utility (Dr. Vorderstrasse). Proposed studies include the use of the microbiome to define and monitor neonatal responses to the acute care environment (Dr. Debra Brandon), and environmental exposures such as head trauma that may cause a physiological, measurable, clinically relevant response that has utility for patient care (Drs. Reuter-Rice and Shaw). Although these projects aim to provide data that can be generalized or further validated at the population level, they also can determine how these characteristics will enhance the health of individuals affected by these conditions.

Gaps in knowledge. As the field of precision medicine is exploding, including national initiatives like the Precision Medicine Initiative[®], we and others have given much thought to the roles of nursing generally and DUSON specifically in this area. Nurses have been called to action, including to: practice appropriate personalized and genomic enhanced care; conduct research in disease biology, risk assessment, treatment efficacy, safety and self-management; improve infrastructure to combine genomic and other data types; and advocate for equal access to precision care (Williams et al., 2016; Vorderstrasse, Dungan, and Hammer, 2014). We have established strong collaborative connections in precision medicine, most notably with the Duke Center for Applied Genomics & Precision Medicine at the Duke University School of Medicine. This connection is exemplified by the roles our faculty play there (executive team members, leaders of subcommittees such as mHealth, and affiliated faculty), as well as by the scientific work resulting from these collaborations, including multiple grants and manuscripts. However, one may wonder what unique role nursing and DUSON will play in this highly interdisciplinary field and important, timely area of research. Areas of strength we intend to further develop and enhance collaborations around include:

Phenotyping: Nurses are highly skilled at assessing the necessary parameters for accurate phenotyping, including symptoms, physical assessment, psychosocial, and behavioral factors. DUSON also has experts in informatics who create efficient ways to use digital health, including mHealth and the electronic medical record (EMR) to collect, aggregate, and analyze these data.

Translation – Bringing Precision Health to the Community: DUSON researchers and clinicians are uniquely engaged and prepared to move precision health research to the T4 translational phase. From education to community engagement and clinic- and community-based research, our experts are ideally suited to help implement clinical innovations and disseminate and explain benefits and processes related to precision health in the broader community.

Individual and Clinical Decision Making Based on Real-Time and Genomic/Biomarker Data: The health care system has generally struggled with clinical utility, effectiveness, and implementation of decision making based on the increasing genomic, biomarker, and real-time patient data that can be collected using various technologies. As these grow in use and their potential for aggregation and processing with sophisticated data analytics and artificial intelligence becomes a reality, our health care system must prepare to employ this information in meaningful ways. Nurses in implementation science and those utilizing their full scope of practice could be on the front lines to interpret this data and triage it with patients to truly enhance health and well-being.

Five-year goals. The five-year goals for the precision health research area of excellence are listed below.

- Enhance the development of DUSON faculty and raise awareness of the potential for precision health approaches to their research areas.
- Increase DUSON collaborative research in precision health as evidenced by an increase in grant submissions in this area.
- Develop an annual RFP for collaborative precision health research to support preliminary or pilot work that leads to larger external grant submissions and funded research.
- Increase awareness of potential external collaborators and actual funded and other collaborative activities involving DUSON faculty and interdisciplinary team members in precision health.

Need for resources and skills. We cannot implement this ongoing vision of precision health in research or the broader community without overlapping expertise at DUSON in focus areas such as population health and clinical innovation. Also, analysis of complex and multifactorial data used in precision health will require statistical and analytical expertise from the methods and analytics research area. Additional collaborations that are being established or enhanced include ones with Duke's Pratt School of Engineering (MedX initiative), DIHI, the Duke Clinical Research Institute, and others.

Our faculty must develop more specialized skills and knowledge pertaining to precision health research. This would involve workshops or programs: for example, the NINR Precision Medicine Workshop in summer 2016 or other similar opportunities. Recruitment of faculty at middle to senior levels who have research expertise in precision health that complements existing DUSON skills would support this expanding work as well. Moreover, additional expertise is needed in data analytics, machine learning, and implementation of precision health strategies in communities or clinical settings.

Funding to support preliminary work, particularly to establish new collaborations among DUSON faculty in precision health research and across the Duke campus, would help generate new teams and expand expertise. These small grants would likely lead to larger external funding opportunities for ongoing precision health research.

METHODS AND ANALYTICS

Nursing sciences are multifaceted. Nursing scientists face increasing challenges to address research questions regarding not only basic, clinical, and translational issues but also diverse biological, psychological, and social sciences. Therefore, traditional research methods and analytics, such as randomized clinical trials (RCTs) and linear models on small data, fail to meet the needs of such challenges. This gap motivated Grady and McIlvane (2016) to list "research methodology/measurement" as one of the focal areas in nursing science, along with other traditional ones such as symptom management, acute and chronic illness, infant and maternal health, quality of life, global health, and policy, among others. In addition to optimizing underutilized methods and analytics, it is imperative to develop new ones. The research area of excellence in methods and analytics will be led by Dr. Wei Pan, associate professor and director of the Research Design and Statistics Core in DUSON, who is nationally known methodologist in causal inference and propensity score analysis.

In alignment with DUSON's strategic planning and the mission of the newly created Center for Nursing Research to "increase the capacity and scope for nursing researchers in DUSON and Duke Health Nursing," a new research area of excellence on methods and analytics will promote their use in research design and complex data analysis. It will also initiate investigation into the development of such methods themselves that are applicable to nursing science inquiries. These activities will raise the quality of our nursing research and make it more competitive in the funding marketplace.

We have preliminarily identified three focal areas of advanced, pioneering methods and analytics to tackle issues related to research design and data analysis. Specifically, we will focus on sequential multiple assignment randomized trials (SMART) and propensity score methods to address design issues related to sequencing of intervention strategies and causal inference, respectively, as well as big data visualization and analytics to address analytical issues. It is worth noting that these three focal areas may change over time to better fit future situations and needs.

As an extension of RCTs, SMART design provides innovative and potentially cost-effective methods to study dynamic treatment regimens or strategies that increase the ability to more finely target or tailor personalized treatment approaches (Collins, Murphy, and Strecher, 2007). When RCTs are not feasible, thus limiting ability to make causal inferences about intervention effects, propensity score methods can approximate RCTs by reducing selection bias in non-RCTs; this enhances the validity of causal inference from non-RCTs (Pan and Bai, 2015). To respond to NIH's Big Data to Knowledge (BD2K) initiative, big data visualization and analytics provide knowledge regarding information that often exists in the EHR or is collected intensively with physiological instruments.

Existing expertise. DUSON faculty, especially those in the Research Design and Statistics Core, have expertise in propensity score methods as well as working knowledge of SMART design and big data visualization. For example, Dr. Pan has published and presented many scholarly papers on propensity score methods. He has also organized and taught numerous professional development courses on this subject at national conventions of major professional associations. In addition, he edited a book on propensity score methods, *Propensity Score Analysis: Fundamentals and Developments*. Dr. Qing Yang, another faculty statistician in the Research Design and Statistics Core, has expertise in survival analysis and has recently focused on SMART design. In spring 2016, she led the Research Design and Statistics Core to win DUSON's "Shark Pool Contest" (in which faculty researchers competed for project funding from a panel of judge-investors) to promote the use of SMART design in nursing research. A summer 2016 workshop helped Dr. Yang to better master this innovative design. Two other faculty members, Dr. Isaac Lipkus and Dr. Sophia Smith, have also taken initial efforts to utilize SMART design in their grant applications relevant to cancer survivorship. As for big data visualization, Dr. Sharron Docherty participated in a "boot camp" on the subject sponsored by NINR; she used data visualization techniques for her R01 on trajectories of decision making for infants' complex life-threatening conditions.

Gaps in knowledge. We need to bridge the gap in knowledge of big data analytics and strengthen our mastery of SMART design and big data visualization.

Five-year goals. Our five-year goal is to become a hub of methodological excellence. To achieve this goal, we plan to: (1) engage more DUSON faculty researchers to utilize advanced and cutting-edge methods and analytics in their grant applications and research; (2) invite nationally renowned experts in SMART design and big data analytics as methodological consultants; (3) leverage the two faculty statisticians in the Research Design and Statistics Core for methodological research with help from three doctoral- and master's-level staff statisticians for "routine" analyses; and (4) collaborate with faculty researchers and statisticians at other nursing and health care schools and organizations to advance nursing science.

As a first step, we will use the "Shark Pool Contest" award to promote the further use of SMART design. We proposed to implement a three-phase plan to promote SMART design: (1) invite nationally leading experts in SMART design to give workshops to faculty researchers to promote the power of these designs in tailoring better treatments and to teach mastery of these methods; (2) offer presentations on how SMART design can benefit nursing researchers by using research examples from Dr. Lipkus' and Dr. Smith's projects; and (3) provide individual consultations and think-tank meetings for faculty researchers with ideas or questions. The goal is to help our scholars incorporate this emerging design in grant applications and to increase the likelihood that they will obtain external funding.

In similar fashion, we will emphasize training of faculty researchers in other approaches such as propensity score methods and big data visualization and analytics. Pilot funds will be provided and focused on supporting these new approaches. We will establish small methodological grant calls for faculty researchers to apply advanced, groundbreaking methods and analytics to their pilot data. This will both increase their relevant expertise and provide preliminary data for R-level grant applications featuring fully developed data analysis using such methods and analytics. We will also establish a summer institute to offer training courses in this area and collaborate with faculty researchers and statisticians in other nursing and health care schools and organizations. We envision that after five years, DUSON will be considered a leader in this field.

Need for resources and skills. To enhance our knowledge of SMART design and big data visualization, and to learn about big data analytics, we need funds to attend workshops and invite nationally renowned consultants in these areas to Duke. Furthermore, to enhance our faculty's national reputation in these areas, we need sufficient protected time to conduct research and write grants for these projects.

Existing research. We currently have one applied R01 grant (PIs: Dr. Johnson and Dr. Vorderstrasse) using big data visualization techniques. We do not have any funded methodological research grants at present.

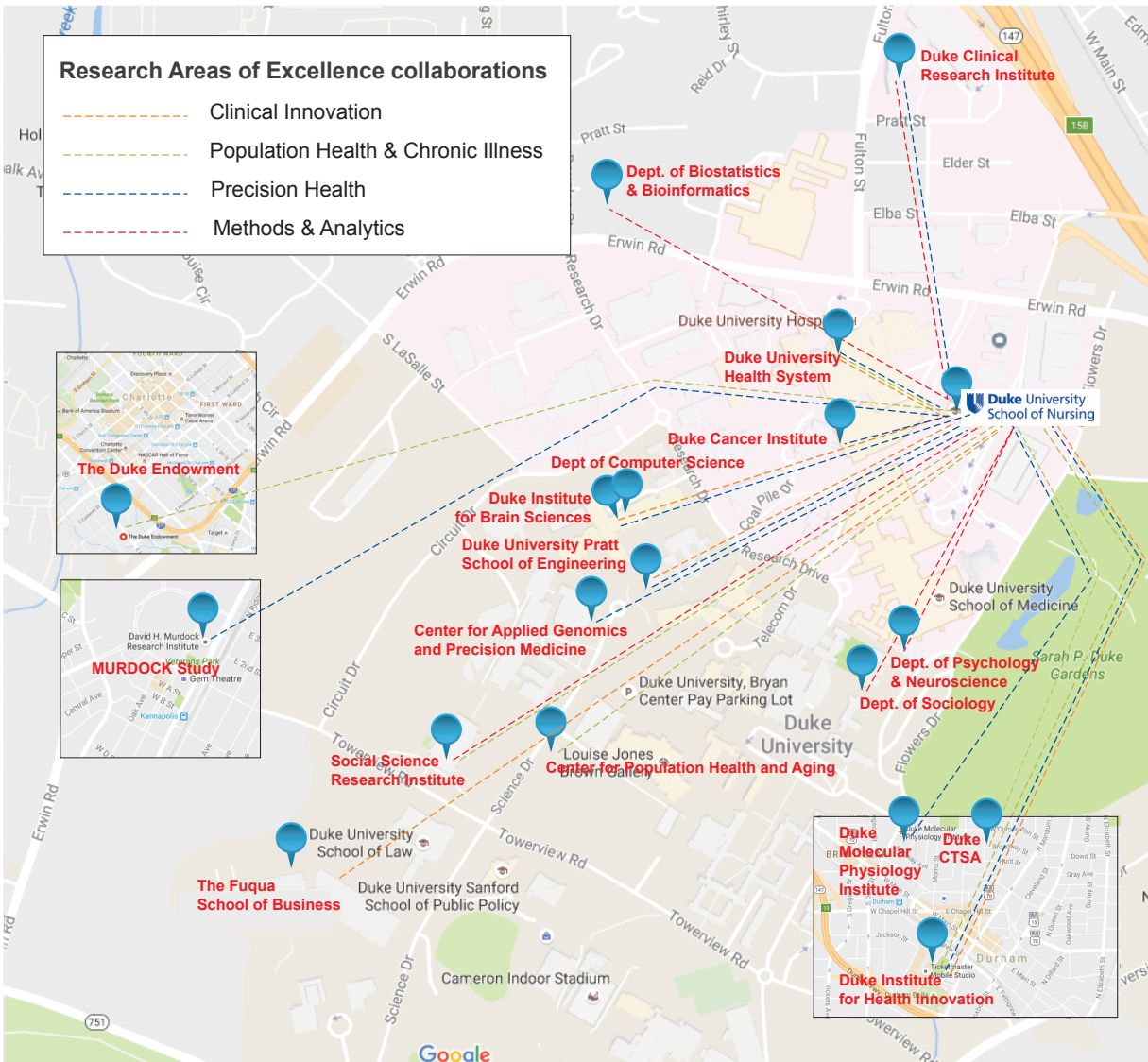
SYNERGY AMONG THE RESEARCH AREAS OF EXCELLENCE

Synergy among these research areas of excellence maximizes our ultimate goal to improve the health of patients, populations, and communities by designing interventions that are cost-effective, disseminable, and effective in addressing existing challenges from prevention to palliative care. To this end, both the population health and precision health research areas identify and reciprocally inform at various levels of analyses what to target for intervention; these include populations, communities, and factors that influence health outcomes (e.g., lifestyle risk factors, psychosocial variables, physiological processes, socioeconomic factors, and policy). Ideally, intervention efficacy is highest when approaches used best fit the characteristics and needs of the target population within an existing system; that is, when interventions are targeted and especially tailored. The research areas of clinical innovation and methods and analytics will tailor our approaches to address existing needs and challenges. The former will do so by exploring new models of health care while integrating novel and cutting edge technologies that assist in data collection and storage, intervention delivery, and processes of information exchange and communication. Meanwhile the Methods and Analytics research area refines our methods of tailoring via applications of dynamic design models (e.g., adaptive designs) that explore treatment and/or intervention strategies to generate maximal positive outcomes given the characteristics of the target and context along with statistical sophistication that allows causal statements of strategies used. Conclusions will produce feedback on each research area of excellence to refine existing knowledge and dissemination of approaches.

Synergy among the four areas of research excellence will be aided by the strategies listed below.

- Leaders of each research area of excellence will meet frequently to discuss thematic research issues that bridge the areas.
- Call for pilot study grant applicants to bridge at least two of the areas in their projects.
- Invite external speakers to interpret their findings or content in ways that bridge the areas.
- Invite DUSON faculty to give presentations on workshops they have attended and apply new knowledge to two or more areas.
- Ask DUSON faculty and collaborators to think strategically about how their research programs and questions can best bridge all four areas. (External consultants will assist in this effort).
- In the next four years, propose at least one program project or center grant that combines researcher expertise in the areas.

The map below represents a sampling of current Research Areas of Excellence collaborations at Duke.



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