



The National Institutes of Health/National Institutes of Nursing Research intramural research program and the development of the National Institutes of Health Symptom Science Model

Ann K. Cashion, PhD, RN^{a,*}, Patricia A. Grady, PhD, RN^b

^aDivision of Intramural Research, National Institute of Nursing Research, National Institutes of Health, Bethesda, MD

^bNational Institute of Nursing Research, National Institutes of Health, Bethesda, MD

ARTICLE INFO

Article history:

Received 23 February 2015

Accepted 1 March 2015

Available online 7 March 2015

Keywords:

Biomarkers

Genotype

Model

Phenotype

Research

Symptom science

ABSTRACT

The National Institute of Nursing Research (NINR) intramural research program conducts basic and biobehavioral symptom science research and provides training opportunities to the next generation of scientists. Recently, the NINR developed the Symptom Science Model to guide research. The model begins by identifying a complex symptom, which is then characterized into a phenotype with biological and clinical data, followed by the application of genomic and other discovery methodologies to illuminate targets for therapeutic and clinical interventions. Using the Symptom Science Model, the intramural program organizes and implements biobehavioral, symptom management, and tissue injury research. The model is also used as a framework for training and career development opportunities including on-campus trainings and research fellowship. The scientific goal of the intramural program is to enhance patient outcomes including health-related quality of life. Achieving this goal requires a long-term vision, continued resource investments, and a commitment to mentoring our next generation of scientists.

Cite this article: Cashion, A. K., & Grady, P. A. (2015, AUGUST). The National Institutes of Health/National Institutes of Nursing Research intramural research program and the development of the National Institutes of Health Symptom Science Model. *Nursing Outlook*, 63(4), 484-487. <http://dx.doi.org/10.1016/j.outlook.2015.03.001>.

Introduction

With training and expertise in both clinical and research enterprises, nurse scientists occupy a unique and fundamental position in health research. At the National Institutes of Health (NIH), an intramural research program (IRP) was established within the National Institute of Nursing Research (NINR) to conduct basic and biobehavioral symptom science

research in an environment that provides training for the next generation of nurse scientists in symptom science. The NINR-IRP undertakes leading-edge research to determine the underlying behavioral and molecular mechanisms of symptoms associated with a variety of disorders. The overall goal of the program is the development of novel clinical interventions to alleviate these symptoms. Recently, NINR scientists developed a new model, the National Institutes of Health Symptom Science Model (NIH-

* Corresponding author: Ann K. Cashion, 3 Center Dr, RM 5E26, Bethesda, MD 20892.

E-mail address: Ann.cashion@nih.gov (A.K. Cashion).

0029-6554/\$ - see front matter Published by Elsevier Inc.

<http://dx.doi.org/10.1016/j.outlook.2015.03.001>

SSM), to provide direction and focus to the research conducted within the NINR-IRP with the potential to inform scientific communities within the NIH and in the extramural research enterprise. The purpose of this article is to provide an overall scientific framework using the NIH-SSM, briefly describe how the research and training programs within the NINR-IRP use the model, and suggest ways that research investigators can use the model to move symptom science research forward.

The NIH-SSM

In the NINR-IRP, scientists conduct symptom science research through a disease agnostic lens. They have expertise in quantifying subjective symptom experiences and measuring the biologic, physiologic, and “omic” underpinnings of the symptoms and sequelae common to health conditions and their treatments. This expertise is critical to continued scientific progress and innovation because novel discoveries require the integration of behavioral and biologic data and the development of models to predict, treat, and manage the symptoms of diseases and treatments. One such model, the NIH-SSM (Figure 1), was developed to guide research in symptom science, initially within the NINR-IRP but with broader application to symptom science across the NIH and extramural research communities. The model describes an investigative sequence for symptom science, beginning with a complex symptom, sequelae, or cluster of symptoms, which can then be

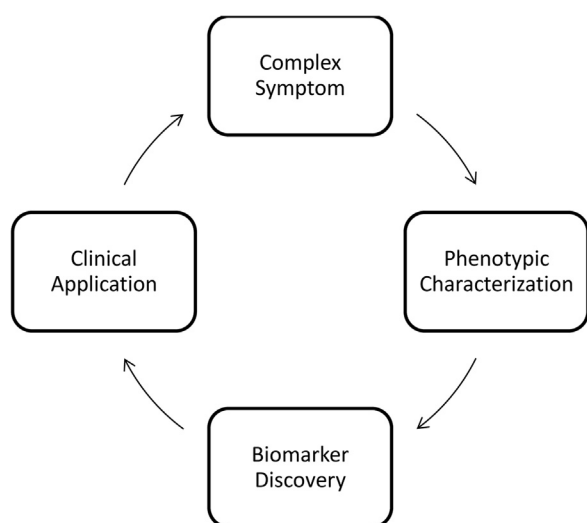


Figure 1 – The NIH-SSM. The NIH-SSM was developed to guide research. It begins with the presentation of a symptom; the symptom undergoes phenotypic characterization; then biomarkers are identified; and this ultimately leads to clinical applications, resulting in symptom reduction and improvement.

characterized into a phenotype with biological and clinical data followed by the application of genomic and other discovery methodologies to illuminate targets for therapeutic and clinical interventions.

For example, a kidney transplant recipient may present with extreme weight gain after transplantation. Knowing that weight gain can lead to such adverse outcomes as diabetes, hypertension, cardiovascular disease, or further deterioration of renal function, health care providers may be interested in developing and tailoring interventions to predict, prevent, and/or treat weight gain in this patient population. To phenotype post-transplant weight gain, researchers can gather clinical and biomarker data such as longitudinal measures of weight, related metabolic markers, and standardized reports on behavioral and mental health conditions such as depression, which have been previously linked to weight gain. The emerging phenotype(s) would then be examined through conducting biologic, physiologic, and “omic” analyses to refine the discovery of biomarkers, pathways, and conditions that predict or protect against post-transplant weight gain. Finally, the “omic” data, in combination with clinical and behavioral information, ultimately lead to informed clinical applications and precision medicine for symptom reduction, improvement, and prevention. In the NINR-IRP, this model is currently being used to guide research as well as to provide a framework for science training programs.

Science and Organization of the NINR-IRP

The multitude of symptoms associated with a single illness or, in many cases, occurring with comorbid illnesses or conditions often compromise or govern the lived experience of individuals suffering from these conditions. Nursing science, with its foundational link to the lived experiences of individuals, provides a unique scientific perspective into both the clinical and biologic features of symptoms and sequelae. This expertise is critical to continued scientific progress toward innovation in symptom science. In recent years, scientists in the NINR-IRP have been successfully using what would become the essential components of the NIH-SSM; guiding productive research in the area of symptom science; using complex phenotypes; and illustrating how to use “omic” methods to predict at-risk groups, monitor treatment, and guide interventions.¹ In the NINR-IRP, scientists are actively engaged in conducting symptom research, with expertise in quantification of both the experiences and expressions of symptoms and sequelae common to a

¹ Council for Advancing Nursing Science in the Fall of 2014, “Combining Complex Phenotypes with Genomics/Proteomics to Predict and Improve Patient Symptoms.” Note: This article is a result of the original presentation.

broad variety of conditions and treatments. Specifically, NINR-IRP scientists are dedicated to conducting research on the molecular and behavioral mechanisms underlying symptoms, recognizing that environmental influences, such as behavior, lifestyle, and diet, can impact individual outcomes.

The NINR-IRP is organized into three program areas focusing on biobehavioral research, symptom management research, and tissue injury research. Each research program organizes and implements its research using the NIH-SSM. The support provided by the NINR-IRP structure, the leading-edge resources of the NIH, and the clinical-science expertise of the NINR-IRP scientists provide an ideal combination to examine the impact of individual genetic variability inherent in symptoms associated with conditions such as cancer-related fatigue, digestive disorders, post-traumatic stress, and traumatic brain injury. The ultimate scientific goal of the NINR-IRP is to enhance patient outcomes including health-related quality of life. Achieving this goal requires a long-term vision, continued resource investments, and a commitment to mentoring our next generation of scientists.

NINR Intramural Training

The NINR-IRP provides scientific leadership and intensive research training to enhance the biologic, physiologic, and “omics” research enterprise and success of the nurse scientist workforce of the future. The NINR provides intramural research training for nurse scientists at all stages of their careers to strengthen the scientific foundation and basis for clinical practice. The NINR-IRP offers training and career development opportunities through NIH on-campus trainings, research fellowship, and career development awards. The NINR-IRP offers a place for a diversity of nurse scientists to develop and continue building cutting-edge research skills, refining their application within the NIH-SSM.

The on-campus training programs include the NINR Symptom Methodologies Boot Camps, the Summer Genetics Institute, the Graduate Partnerships Program, and research fellowships at a variety of pre- and postgraduate levels. In its 4-year history, the boot camps have provided over 250 graduate students, faculty, and clinicians from 50 institutions around the nation with a foundation in research methodologies focusing on symptoms such as pain, fatigue, and sleep. In 2014, the focus was on “big data in symptoms research.” The methodologies include measurement, treatment, genetics, and laboratory experiences. Another research training opportunity on the NIH Bethesda campus is the annual Summer Genetics Institute, a month-long intensive program of laboratory and classroom instruction aimed at building molecular genetics expertise for use in biobehavioral research and clinical practice. More than 300 alumni

from the 15 Summer Genetics Institute programs are now advancing genetics and genomics research, integrating new knowledge into nursing school and other curricula, and helping shape the policies and clinical practices of the emerging field of personalized medicine.

The NINR-IRP offers research fellows, across the continuum of academic training, with opportunities to develop and refine their symptom science research skills within the framework of the NIH-SSM. The NINR Graduate Partnerships Program provides an exceptional opportunity for students who are enrolled in any PhD program in nursing across the nation to complete dissertation research here at the NIH campus (Engler, Austin, & Grady, 2014). The goal of this 2- to 3-year doctoral fellowship program is, in partnership with their university, to train promising doctoral students in the foundational basic and clinical symptom science research skills that are needed by the next generation of nurse scientists to ultimately conduct research using the NIH-SSM. For those who have completed their doctoral degrees, the NINR-IRP offers a place to continue building cutting-edge research skills, under the mentorship of an NINR investigator, and refining their application within the NIH-SSM. For individuals who are in between their undergraduate and graduate degrees and have had their bachelor’s degree for less than 2 years, the NINR provides the opportunity to conduct research in a real-world setting with an outstanding investigator serving as mentor. In addition to the Post-baccalaureate Institutional Research Training Award, the NINR also supports the Technical Institutional Research Training Award for those individuals who hold a master’s degree and are interested in learning the most advanced techniques for basic and/or applied biomedical research. The NINR also supports the Minority Faculty-Student Partnership Traineeship in Biotechnology Program, which was developed to address the underrepresentation of minorities in research science, biotechnology, and medical careers. It provides training in the latest principles and techniques in biotechnology for faculty and students from historically black colleges and universities, Hispanic-serving institutions, and Indian tribal colleges or universities.

The benefits of learning and experiencing the science conducted within the NINR-IRP extend beyond the scientists and fellows because many of these training program graduates subsequently return to the extramural community as university faculty in nursing programs across the country. These scientists are increasing the research intensity and capacity of schools of nursing, serving as role models to future nurse scientists and as educators and mentors in laboratory and clinical research arenas. Furthermore, these NINR-IRP “alumni” serve as ambassadors of symptom science and the NIH-SSM to scientific programs in nursing and allied enterprises across the nation.

In summary, the NINR-IRP supports leading-edge research to understand the underlying mechanisms of symptoms associated with a variety of disorders and to develop clinical interventions to alleviate these symptoms. To guide the NINR-IRP the NIH-SSM was developed, providing a framework to incorporate phenotypic and well as “omic” data when designing interventions to treat and manage illnesses. Over the next decade, the NINR-IRP is poised to expand and sustain a unique and vibrant program of innovative symptom science research and training that will provide leadership to the scientific community. The focus will be to develop and evaluate novel interventions to manage symptoms and thereby reduce the burden of symptoms and mitigate their impact on health and well-being. The overall goal is to develop a scientific workforce that is innovative, diverse, and able to lead the future of nursing science to improve health outcomes through advances in symptom science.

Acknowledgment

This project was supported by funding from the National Institute of Nursing Research (NINR), National Institutes of Health (NIH, Grant number ZIANR000030). The authors wish to thank NINR Division of Intramural Research scientists, Drs. Leorey Saligan, Wendy Henderson, and Jessica Gill, for their insight into the development of the NIH Symptom Science Model and as well as Dr. Rebecca Hawes, for editorial assistance.

REFERENCE

Engler, M. B., Austin, J. K., & Grady, P. (2014). The National Institute of Nursing Research Graduate Partnerships Program (NINR-GPP): An opportunity for PhD students. *Nursing Outlook*, 62(6), 469–474. <http://dx.doi.org/10.1016/j.outlook.2014.08.009>.