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ScienceDirect
Nurs Outlook 63 (2015) 484–487
Nursing Outlook
www.nursingoutlook.org

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

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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-

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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 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.

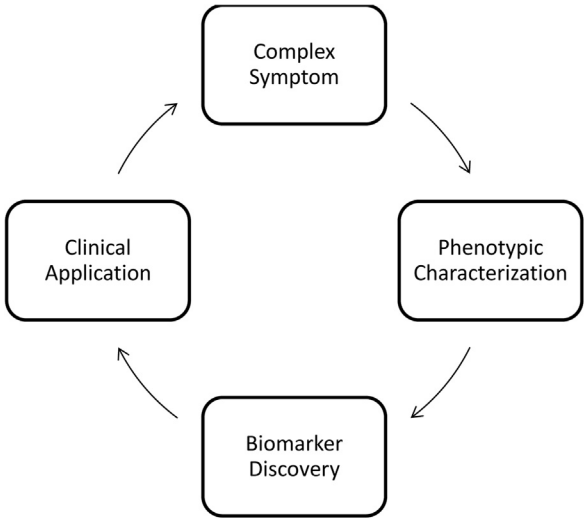

Figure 1 – The NIH-SSM. The NIH-SSM was developed to guide research. It begins with the presentation of a symptom; the symptom undergoes phenotypic characterization; then biomarkers are identified; and this ultimately leads to clinical applications, resulting in symptom reduction and improvement.

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.