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Precision Health: Emerging Science for Nursing Research

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The Council for the Advancement of Nursing Science (CANS) held its biennial State of the Science Conference in September 2018. The conference focused on Precision Health, an emerging science with critical implications for nursing research, practice, and education. These comments summarize the planning and proceedings of the conference, introduce the articles in this special issue focused on precision health, and discuss implications for nursing science.

The Program Committee's first challenge was to agree on a definition of precision health for the conference as there is some diversity of opinion. Initially, the literature referred to precision medicine with a focus on genetics. The Committee believed that this was too narrow, and expanded the definition of precision health to include additional factors. The Committee examined multiple definitions before reaching consensus on the following: Precision health is an emerging approach to individualizing health care. Precision health includes genomics and other physiological, psychological, environmental, and ethical factors that are central to the development and testing of individualized treatments and prevention strategies for persons, families, and communities.

Next, the Program Committee identified precision health content appropriate for advancing nursing science and potential speakers to address the broader implications of precision health for health care and nursing science. Three topics emerged as appropriate for the major plenary sessions: (a) an overview of the state of the science of precision health; (b) methodological implications related to precision health research; and, (c) ethical considerations in precision health. The Committee recognized that nurse scientists study physiological, psychological, environmental, and ethical factors that may now or in the future contribute to precision health. Therefore, the call for abstracts was broad, including areas such as bioinformatics, omics, symptom management, and social determinants.

A wealth of information was presented at the State of the Science conference, including the opening keynote by Patricia Brennan, PhD, RN, FACMI, FAAN, *Precision Health: Nursing's Mandate to Broaden the Question*; a keynote presentation by Ann Cashion, PhD, RN, FAAN entitled, *A Path to Clinically Relevant Precision Health Interventions: Emerging Omics Research Method*; and the final keynote presented by Wylie Burke, MD, PhD, entitled, *Genomics, Precision Medicine and Health Equity*. Three competitively selected synthesis papers provided state of the science findings related to specific precision health topics including epigenetic indicators of biologic age, patient-generated data, and the relationship between precision health and health equity. A panel presentation by the Council's Science Committee described the multiple ways of knowing related to precision health.

Speakers and participants at the conference discussed the definition of precision health and the implications of precision health for nursing science. Precision health was operationalized in several ways but appeared to focus on these three broad factors impacting an individual's health: (a) biology (e.g., genomics, transcriptomics, proteomics, and metabolomics); (b) environment (e.g., zip code); and (c) lifestyle (i.e., response to biology and the environment). A more recent definition, reflecting the ongoing development

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of the concept of precision health, is similar: "Precision health considers individual lifestyle, genetics, behaviors, and environment context and facilitates interventions aimed at helping individuals achieve well-being and optimal health" (Hickey et al., 2019, p. 2).

Additional sessions addressed challenges in obtaining funding and publishing papers related to precision health. Our nurse scientist colleagues presented studies that addressed big data, bioinformatics, predictive modeling, data sharing, biorepositories, common data elements, genomics, pharmacogenomics, metabolomics, microbiome, mobile health, symptom management, ethical issues, and other relevant precision health topics. This issue of *Nursing Outlook* includes articles that resulted from presentations at the CANS 2018 State of the Science conference.

The article by Dr. Elizabeth Corwin et al. titled *Ways of Knowing in Precision Health*is based on the presentation given at CANS 2018 by members of the CANS Science Committee. This article begins with a review of ways of knowing from Carper's (1978) paper: empirical, personal, ethical, and esthetic (Carper, 1978). Nurse scientists typically use empirical knowledge. However, precision health includes multiple sources of information and employs multiple ways of knowing (discovery) to improve health care. Tools and methods are described including; omics, sensors, geospatial data, and the use of mixed methods. For omics, two examples are presented; the first is the use of genomics to investigate factors contributing to high caregiver burden, and the second is the use of microbiome analyses of the oral, vaginal, and gut microbiome to identify risk factors for preterm birth. Sensors provide an example of the use of technology allowing nurse scientists to monitor behavior, biology, and environment as it happens. Examples such as the use of wrist actigraphs to measure motor activity are described. Geospatial approaches allow researchers to study community characteristics and social determinates that might impact health. Studies of crime rates and gun violence using geospatial techniques are described. The discussion of mixed methods provides a vision that goes beyond the traditional use of a binary approach, typically used in nursing, defined as a combination of quantitative and qualitative data. Mixed methods can integrate design, methods, and data to answer questions. Corwin et al. included an example of a study focused on pediatric obesity, where omic, sensory, and geospatial data could be integrated to provide a better understanding of this significant health problem. The concluding discussion highlights the importance of nurse scientists integrating multiple tools and methods in their research as part of the emergence of precision health.

Dr. Wylie Burke's article, *Precision Medicine and Health Disparities: The Case of Pediatric Acute Lymphoblastic Leukemia*, uses racial differences observed in relapse rates of children with acute lymphoblastic leukemia (ALL) to highlight the need to incorporate multiple factors in precision medicine when studying disease outcomes. While the significant role of genetics in ALL is highlighted, other factors such as social determinants also contribute to precision health. An example is the care at St. Jude Children's Research Hospital. Nationally, African American children with ALL have a higher relapse rate, but there is no difference in relapse rates between African American children and European American children treated at St. Jude Hospital. The difference may be due to two aspects of care provided to all patients at St. Jude, all costs are covered for all patients and all receive intense case management-based follow-up care. This article highlights the need for transdisciplinary collaborative research to study the complex interactions among multiple factors that contribute to precision health.

A review of the literature on DNA methylation, *Patterns of DNA Methylation as an Indicator of Biological Aging: State of the Science and Future Direction in Precision Health Promotion,* was presented by Dr. Shannon Gillespie on behalf of her writing team. The purpose of the article was to review the literature surrounding epigenetic age as estimated by DNA methylation. This involves the addition or removal of methyl groups to DNA that can alter gene expression without changing the DNA sequence. Gene expression depends upon the DNA sequence that is inherited and chemical modifications to the code that can be inherited or acquired through exposures in the environment. These modifications alter the likelihood of a gene being transcribed and translated into a protein. This topic is especially timely to precision health since more and more studies are finding distinctions between chronological and biological aging, with biological aging providing more valuable therapeutic information. Gillespie et al. found that a number of algorithms estimate epigenetic age using DNA methylation markers, primarily among adults. Predictive biomarkers forecast the probability of response to a given treatment, allowing clinicians to stratify targeted preventive interventions and treatments according to individualized risk. One of the most interesting findings in the paper, and relevant to clinical practice, was that caloric restriction of approximately 12% over two years significantly slowed the rate of biological aging among nonobese adults aged 21 to 50 years (Belsky, Huffman, Pieper, Shalev, & Kraus, 2017). Hopefully, future findings will add support to the predictive value of phenotypic algorithms for risk of disease and death and aid in identifying antecedents to age acceleration. DNA methylation age, a biological reflection of interindividual variability in aging, holds significant potential as a useful parameter in disease prevention and treatment from a precision health perspective.

The synthesis paper, *Patient Generated Health Data Use in Clinical Practice: A Systematic Review*, is written by Dr. George Demiris et al. This paper synthesizes information from 21 research studies and reports on article quality, types of patient-generated health data collected, usability and satisfaction, patient-generated health data systems/applications, electronic health record

integration, and decisional support. The authors evaluate the impact of patient-generated health data on clinical practice and clinical decision-making. Patient-generated health data is defined as, "health-related data including health history, symptoms, biometric data, treatment history, lifestyle choices, and other information-created, recorded, gathered, or inferred by or from patients or their designees," (Shapiro, Johnston, Wald, & Mon, 2012, p. 2). Patients may use multiple ways to capture and track health data including web-based applications and wearable devices. Patient-generated health data provide a real-world picture of lifestyle behaviors in the individual's lived environment. Real-world, individualized data are critical for advancing precision health initiatives and improving health outcomes if this data can be assimilated into clinical decision support aids. Demiris et al. conclude that using patient-generated health data to inform clinical decision making is promising but is still in the early stages. Integration into the electronic medical record is limited. Studies evaluating the impact of patient-generated health data on clinical outcomes are now beginning to emerge. The findings from this systematic review identify wide gaps in knowledge related to using patient-generated health data in clinical practice and indicate that this is a fertile area of research for nurse scientists.

The relationship between precision health and health equity is complex. Precision health research has the potential to reduce or further exacerbate health disparities. Dr. Usha Menon and colleagues' paper, *Precision Health Research and Implementation Reviewed through Five Synergistic Principles*, addresses this complicated topic and provides context and guidance for nurse scientists to navigate the intersection of precision health and health equity. The authors use the five underlying principles of the ConNECT framework to accomplish this objective. The ConNECT framework couples behavioral medicine and health equity sciences to focus on targeted strategies to achieve health equity across the scientific continuum (discovery to dissemination) (Alcaraz et al., 2017). The five synergistic and actionable principles of the ConNECT framework include: (A) Integrating **CON**text: (b) Fostering a **N**orm of Inclusion: (c) Ensuring **E**quitable Diffusion of Innovations; (d) Harnessing **C**ommunication Technology; and (e) Prioritizing Specialized **T**raining. Each of these principles is explained in the manuscript through a precision health perspective and exemplars are provided for further clarification. For example, fostering a norm of inclusion when conducting precision health research will require intentionally inclusive methods for engaging and recruiting research participants. Precision health findings will only be applicable to study populations that participate in the research. Thus, diverse study populations, indicative of the norm of inclusion, will help promote health equity as the field of precision health continues to expand. This manuscript provides nurse scientists with straightforward principles, guidance, and context that can be used to design studies that promote health equity in precision health research.

Conclusion

Many important questions resulted from the conference including: Why are we talking about precision health? Why should we care about precision health? What is the role of nurses in precision health? We came to understand that precision health is not the same as personalized health. Precision health individualizes approaches to patient care by combining genetic, environmental, social, and psychological factors, often through big data analytics; it does not lead to treatments unique to one individual. For example, genetic testing may tell us what drug is best to treat a patient's illness, but the nurse knows that the patient is homeless, and homeless patients often cannot take daily oral medication as prescribed and, therefore, may need to come into the clinic for an alternative treatment such as monthly injections. Precision care has the ability to reduce health disparities. The future of precision health will likely involve data visualization, the mining of social media data, new learning systems, artificial intelligence, and ethical dilemmas. As seen in these articles, in many ways, the future is here.

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