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ScienceDirect

Nurs Outlook 67 (2019) 302–310

Nursing Outlook

www.nursingoutlook.org

Precision health research and implementation reviewed through the conNECT framework

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ARTICLE INFO

Article history:
Received 6 February 2019
Received in revised form
13 May 2019
Accepted 23 May 2019
Available online May 30, 2019.

Keywords:
Precision health
Precision nursing science
Precision health research
Health equity

ABSTRACT

Background: Precision health is a population-based approach that incorporates big-data strategies to understand the complex interactions between biological, environmental, lifestyle, and psychosocial factors that influence health.
Purpose: A promising tool to facilitate precision health research and its dissemination is the ConNECT Framework.
Methods: Here, we discuss the relationship of the five broad and synergistic principles within the ConNECT Framework as they may apply to nursing science research: (1) Integrating Context, (2) Fostering a Norm of Inclusion, (3) Ensuring Equitable Diffusion of Innovations, (4) Harnessing Communication Technology, and (5) Prioritizing Specialized Training.
Discussion/Conclusion: The principles within this framework can be used by nurse scientists and educators to guide and disseminate precision health research.

Cite this article: Menon, U., Cohn, E., Downs, C.A., Gephart, S.M., & Redwine, L. (2019, July/August). Precision health research and implementation reviewed through the conNECT framework. Nurs Outlook, 67 (4), 302–310. https://doi.org/10.1016/j.outlook.2019.05.010.

Introduction

This paper is based on a symposium presented at the Council for the Advancement of Nursing Science conference in 2018. Precision medicine is a current buzz word with millions of dollars invested in innovative strategies to prevent and treat disease that are tailored to the individual. We posit that precision health is more encompassing than precision medicine, in that it extends beyond precision in prescriptive therapies or identifying genetic risks. Rather, it incorporates the understanding of complex interactions among the myriad factors that influence health and health outcomes of patients and families. Therefore, precision health is a population-based approach that includes incorporating big-data strategies to understand the complex interactions among biological, environmental, lifestyle, and psychosocial factors that influence health (Alcaraz et al., 2017; Menon et al., 2018; Neergaard, 2015).

Nurse researchers have focused for many years on patient-centered care but have only recently entered the arena of precision strategies for prevention and treatment. Nursing science is full of examples of research on patient-centered outcomes and tailored

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https://doi.org/10.1016/j.outlook.2019.05.010

and targeted interventions, and all contribute to a more contextually rich understanding of health. The significance of a comprehensive understanding of health is underscored by many studies showing that health inequities are protracted and engrained in the complex interactions among biological, environmental, lifestyle, and psychosocial factors (Alcaraz et al., 2017)—all of which overlap with the concept of providing precision health. As such, health equity, or optimal access and health outcomes for all, is closely aligned with precision health and incorporates a social justice view to understanding how human behavior influences health.

Due to the complexity of health and the multiple factors affecting health, including health inequities, a framework may be useful to facilitate and disseminate precision health research performed by nurse scientists. In the symposium, we presented an actionable framework to address health equity in precision health. The ConNECT Framework (Figure 1 in Alcaraz et al., 2017; Menon et al., 2018), is an actionable model that incorporates five broad, synergistic principles for use across the translational continuum as it relates to precision health. This framework grew out the work of the Health Equity Special Interest Group of the Society for Behavioral Medicine. Through robust discussion and extant literature, members of the Health Equity Special Interest Group evaluated the state of health equity efforts in behavioral medicine science and identified key opportunities to advance the field (Alcaraz et al., 2017). Five principles were developed that form the core of the ConNECT Framework, which could serve as a guide to integrating health equity within precision health research by nurse scientists. The ConNECT Framework is fairly new (published in 2017) and synthesizes an interdisciplinary perspective.

The five principles of ConNECT are as follows (Alcaraz et al., 2017):

1. Integrating **CON**text: focus on omics and systems biology.
2. Fostering a **N**orm of Inclusion: intentionally include groups usually left out of research.
3. Ensuring **E**quitable Diffusion of Innovations: deliberately disseminate findings that are accessible to all.
4. Harnessing **C**ommunication Technology: foster the use of technological innovations in ways that do not create more disparity.
5. Prioritizing Specialized **T**raining: provide formalized training in precision health science from undergraduate education and up.

This framework allows nurse scientists to consider the vital, present-day aspects of precision health: omics and systems biology, health equity, dissemination of innovations, communication technology, and prioritized and specialized training. Each ConNECT principle is discussed below within the context of precision health with examples and/or suggestions for nursing science.

Principle 1: Integrating Context

The first principle of the ConNECT Framework is the integration of context. The ability to apply a precision health approach is requisite upon big-data tools such as omics and systems biology, which have evolved alongside various philosophies of health. In fact, concepts underpinning traditional Chinese medicine provided a foundation for our early understanding of health, but these concepts were challenged, and our understanding of health has evolved in parallel with technological advances. Concepts of traditional Chinese medicine include a lore-like belief that disease results from an imbalance in two opposing yet complementary forces, yin and yang. The phenomena, such as human development and diseases, are represented by five elements—fire, earth, wood, metal, and water—that explain the functioning of the body and how it changes with disease (McClendon, 1934).

Technological advances have contributed to the evolution of the philosophy of health from its roots in traditional Chinese medicine to current paradigms underpinning precision health. For example, with the development of a reliable microscope, scientists could observe the effects of experimental conditions on a whole organism—Pasteur described the effects of anaerobic and aerobic conditions on yeast (Alba-Lois & Segal-Kischinevzky, 2010). This technological invention shifted the focus from the five elements to something more observable that affected the whole organism. As technologies became more sophisticated and scientific knowledge expanded, scientists were able to manipulate a system(s) and dissect on the molecular level. Crucial observations occurred during this era, such as the discovery of DNA and the development of chromatography, nuclear magnetic resonance, and polymerase chain reaction, which reformed our understanding of health (Mullis, 1990; Pray, 2008). With these advances, the philosophy of health began to shift toward health being viewed as a molecular phenomenon. Along with technological breakthroughs, our methodological abilities expanded, further transforming the fields of molecular biology and biochemistry. Indeed, these technologies, coupled with enhanced computational abilities and standardized databases, are foundational to the field of omics and have assisted in the movement toward the integration of whole systems biology, a fundamental component of precision health.

Omics, a field of study that aims to investigate the totality of the field, often forms the basis of precision health studies (Yadav, 2007). For example, proteomics, the large-scale study of the proteome (the entire complement of proteins), has been used in oncology to

identify therapeutic targets. Our understanding of molecular biology and its central dogma (that is, a gene is transcribed to RNA that is then translated to a protein that produces an effect) has facilitated omics-based approaches for finding potential biomarkers of disease, exposure, or response to treatments, as well as for tailoring individual therapies to impact health. In short, a focus on big data derived from these high-dimensional approaches has allowed for the integration of biological context (Principle 1) to achieving precision health. The first principle of the ConNECT Framework, the integration of context, also advocates for a greater emphasis on understanding the larger social and contextual influences that affect research participation. Such influences cannot be understood without being rooted in the historical context of exclusion from research, whether deliberate or inadvertent, leading to the second principle of the framework.

Principle 2: Fostering a Norm of Inclusion

Within the ConNECT Framework, the second principle dictates a practice to bring us closer to health equity within precision health and its use in the clinic (Alcaraz et al., 2017). Advancing precision health can be a double-edge sword—constructed and used proactively, it can be a tool to promote health equity and serve as an expression of our commitment to social justice. However, if precision health advances without forethought and planning, the discoveries, processes, and products may further divide us and exacerbate health disparities (Cohn, Henderson, & Appelbaum, 2017).

However, the United States has a long history of egregious acts and human suffering falsely perpetrated under the guise of "research" (Phillips & Grady, 2002). Starting in the 1880s with Eugenics (Joly, So, Saulnier, Dyke, 2016) and continuing through 1932 with Tuskegee (Cobie-Smith, 1999; McCarthy, 1994) and now the current publication and publicity of Henrietta Lacks (Nisbet & Fahy, 2013; Njoku, 2013), we have created a context in which there is significantly diminished trust of both scientists and research processes within minority communities (Halbert, McDonald, Vadaparampil, Rice, & Jefferson, 2016). This historical context cannot be ignored as we move forward with precision health research, and lessons learned must be integrated into research process and planning going forward.

Therefore, to adequately address Principle 2 (fostering inclusion), integrating context should recognize, acknowledge, and apologize for past injustices and devise and honor bidirectional approaches in future research opportunities (Halbert et al., 2016). Precision health has much to offer, including a better understanding of protective factors, a quantitative measure of environmental effects, and a deeper understanding of the role of epigenetics (Khoury, Gwinn, Glasgow, & Kramer, 2012), but the results of our work will only apply to those who participate (Alcaraz et al., 2017). As such, fostering inclusion calls for *intentionally inclusive* methods for engagement and recruitment in precision health research. Without a representative study population (or at least a study population that is reflective of the United States, for example), precision health researchers run the risk of exacerbating health disparities. For precision health studies to be both inclusive and diverse, various influential factors must be considered. Phenotype, genotype, environment, and social determinants all play critical roles (Cohn et al., 2017). With nursing science still in the early stages of developing big-data and large population-based research, there is tremendous capacity for the development of cohort studies, sharing databases, and core measures that embrace intentionally inclusive measures.

Minority and vulnerable populations are not the only groups excluded. We also face a long history of women being under-represented and, more recently, minority male populations being both under-represented in research and having significant health disparities (Pinsky et al., 2008). These historical trends bring forward even greater challenges related to inclusion for precision health scientists. The multidimensional representation of people in precision health research requires both genomic diversity and self-identification as being part of a minority or under-represented group. Regarding genomic diversity, researchers in precision health must make sense of genomic sequencing results and create databases that can discern pathologic variants from those within the expected range of variation and those of unknown significance. In addition, researchers must consider the self-identification of race and ethnicity, how one looks (phenotype), environmental factors that may influence one's health, and the social determinants related to how people were raised and those associated with how they live now.

Designing studies that foster inclusion (Principle 2) will require shifting our paradigm, our expectations, and our approach. Inclusive studies can empower participants to be engaged as partners in research and increase their trust, can deepen an understanding of cultural perspectives, strengthen the science, and increase generalizability (Caulfield et al., 2009; Fullerton, Knerr, & Burke, 2012; Kaye et al., 2012; Moodley & Singh, 2016; Yoshizawa et al., 2014). In addition, studies that foster inclusive community engagement can allow expectations of the research to be calibrated (Folayan, Oyedeji, & Fatusi, 2015) and can ultimately improve the health of communities (Cohn, Husamudeen, Larson, & Williams, 2015). Such community engagement would encompass not only participation in planning research but also in disseminating and applying findings and innovations, which is addressed in the third principle of the ConNECT Framework.

Principle 3: Ensuring Equitable Diffusion of Innovations

The third ConNECT principle refers to understanding barriers, facilitators, and diffusion of knowledge from precision health research, especially those concerning participation and implementation across minority and other underserved communities. Innovations are often solely disseminated in academic venues such as scientific journals, conferences, etc., with delayed or sometimes no translation to research participants or to the minority groups traditionally excluded from research. In the precision health arena and for Principle 4, we can continue to learn from past lessons and emphasize dissemination and implementation of evidence-based interventions for mainstream and marginalized populations. However, this would require challenging the prevailing paradigm that calls for a sequential approach in which we develop interventions for homogeneous groups and then subsequently conduct adaptations for other groups (if benefit is demonstrated) (Alcaraz et al., 2017). More recent advances in implementation science endorse the simultaneously development and testing of interventions for mainstream and marginalized groups (Brown et al., 2017; Curran, Bauer, Mittman, Pyne, & Stetler, 2012).

However, several challenges must be overcome before the equitable diffusion of results. First, no consensus presently exists for delineating criteria for aggregating or disaggregating populations when developing initial interventions (Michie, Yardley, West, Patrick, & Greaves, 2017). For example, when is a common intervention appropriate for diverse groups and when is it critical to desegregate populations or subgroups? In addition, there is little to no consensus on benefits and metrics for multisectoral stakeholders in community and nonacademic settings. As explained earlier, challenges at the community level include learned mistrust in the system, the historical precedent of institutional and interpersonal discrimination, worry about exploitation of bio-specimens, perceived threat of future discrimination (job, insurance, immigration), not perceiving relevance of findings to them/their settings, lack of resources (personnel, talent, funding) to implement evidence-based interventions, and competing life demands (Cohn et al., 2015; Folayan et al., 2015; Fullerton et al., 2012).

Nurse scientists, who are often closer to the "bedside" than many other disciplines, are in position to lead equitable diffusion efforts. Ecological models that understand the dynamic interrelations among various personal and environmental factors may be integrated into research study development from the start (Menon et al. 2011; Richard, Gauvin, & Raine, 2011). Already developed models, such as the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework, can be used for planning steps, process and outcome evaluations (RE-AIM, 2019). Another model, the Pragmatic-Explanatory Continuum Indicator Summary (PRECIS), which includes 10 different domains to differentiate between pragmatic and explanatory trials, can allow maximized diversity of the study population (PRECIS, 2015). With dissemination and/or implementation planning for the equitable diffusion of innovations (Principle 3), results can be returned to participants much earlier than the current norm—that is, allowing populations groups to benefit sooner from research findings. Dissemination and implementation plans should be considered from the inception of the research study rather than after publication of findings. Suggested strategies include using robust community-based participatory dissemination and implementation models and community-centered advisory boards.

Another important framework for implementation science is the Consolidated Framework for Implementation Research (CFIR) that was originally developed to design and/or evaluate an implementation study (CFIR, 2019). The CFIR provides a menu of constructs, from tested conceptual models, shown to be associated with effective implementation. Constructs included, for example, are from Rogers' (2003) Diffusion of Innovations Theory and Greenhalgh et al. (2005) significant collation of constructs based on a review of 500 published sources across 13 scientific disciplines (CFIR). The CFIR framework not only helps with design and evaluation but is a valuable tool for replication of implementation programs. A critical component of the diffusion is communication and leveraging the advantages of technology, leading to the fourth principle of the framework.

Principle 4: Harnessing Communication Technology

Principle 4 within the ConNECT Framework addresses the essential need of communication technologies to spread innovations so that equitable care can be achieved (Alcaraz et al., 2017). Technology platforms, including optimized electronic health records (EHRs) and eHealth and mHealth, can widen the reach within precision health research, and sophisticated tools from health information technology can subsequently diffuse health precision innovations to the community.

To achieve precision health, decisions need to account for genetic, phenotypic, and psychosocial data to apply rules to find patients that best fit "precision guidance." However, accounting for vast data within a brief clinical encounter taxes the edges of human capacity. One solution is to leverage technology to find similar patient groups through a technique called "patient similarity" matching. In turn, organizations can leverage cutting-edge technologies to find patients who are best suited to receive precision treatments (Parimbelli, Marini, Sacchi, & Bellazzi, 2018). An American Academy of Nursing panel has already recommended that funding agencies and policymakers foster

improvements in precision health quality and safety by prioritizing scaling technologies, including optimization of EHRs and better availability of clinical decision support (CDS) systems (Starkweather et al., 2018).

CDS means both bringing relevant knowledge to the time and place of decision making (Greenes et al., 2018) and providing clinicians with computer-generated clinical knowledge and patient-specific information that is filtered and presented at the appropriate point in workflow to enhance patient care (Teich, Osheroff, Pifer, Sittig, & Jenders, 2005). CDS has been proposed as a means to achieve equity and optimize the reach of precision health (Carney, 2014; Chang et al., 2018; Madhavan, Subramaniam, Brown, & Chen, 2018). Although the study of CDS for nursing (Dunn Lopez et al., 2017) is underdeveloped, CDS helps nurses to adhere to guideline-recommended care, improve processes, and heighten situational awareness. CDS has already been proposed as a solution to achieve precision health for critical care (Belard et al., 2017, 2018); diabetes care (Capobianco, 2017); breast cancer diagnostics and treatment targeting (Yoon, Davtyan, & van der Schaar, 2017); and improving care quality (Jenders, 2017).

CDS systems primarily use structured data from EHRs and apply "if-then" rules to fire based on specific instances. State-of-the-art technologies like artificial intelligence are being leveraged to apply contextual insights about the patient or the system to influence clinical decisions. Given the complexity of developing rules for precision health, CDS systems need to evolve in ways to share these more broadly but in scale so that more people can be reached.

Future EHR systems will support clinical decisions with both structured and unstructured data (i.e., from notes or images) from varied sources, including those from outside of the EHR. One strategy of next-generation CDS systems will be to leverage both the traditional rules-based approaches and artificial intelligence and machine learning to "learn" from both other patients in the data set and from a patient's own trend data. These next-generation CDS systems will consider both the episodes of care and the behind-the-scenes surveillance results, with rules generated and applied from both mechanisms (Hicks, Dunnenberger, Gumpper, Haidar, & Hoffman, 2016).

With regard to the scale in precision health, significant technology barriers must be considered, including (a) the high cost of creating CDS rules, (b) the cost of sequencing and gathering omics data, (c) the need to integrate and reason over data from multiple and varied sources, and (d) the sophistication of information technology systems to deliver the CDS for precision health. For example, to create CDS rules to guide genomic decisions (Mathias, Tarczy-Hornoch, & Shirts, 2016), a high number of sequenced patients per institution are needed to curtail expenses. Institutions may find it cost-prohibitive to sequence large numbers of patients, therefore, sharing CDS rules and infrastructures across institutions may be a less expensive option for a genomic CDS system (Mathias et al., 2016). In the context of cancer care, experts among cancer research consortiums could spread best practices for CDS system development (Madhavan et al., 2018). For more information on sharing CDS rules or systems, please see https://smarthealthit.org/.

As organizations seek to overcome barriers to equity and enable precision health to reach broad patient groups, variances in the quality and availability of omics CDS systems will need to be overcome. Applying standards and using scalable CDS options that work across systems may enable organizations to manage the high cost of CDS (Mathias et al., 2016). To allow nurses to conduct health precision research and provide precision care, systems will need to include nursing decisions and nursing care data. In addition to these considerations, the adoption and harnessing of communication technology (Principle 4) for precision health must anticipate regulatory obstacles and find ways to improve interoperability and include broader standardization (Hanna & Pantanowitz, 2017). Standardized training in nursing programs may well need to be prioritized for continued development of nurse scientists in precision health, leading to the fifth and final principle of the ConNECT Framework.

Principle 5: Prioritizing Specialized Training

The fifth principle of the ConNECT Framework is the consideration of specialized training and continuing education. Precision health is an evolving approach for disease prevention and treatment that takes into consideration individual variations in genes, environment, and lifestyle. Due to this evolving approach, health care personnel, including nurses, require up-to-date practice guidelines to care for patients and to engage in cutting-edge research (Dodson, 2017).

For providers to implement precision health research, education is needed across health care disciplines and health trajectories. For diseases that are caused by genetic factors and modifiable lifestyle and environmental factors, such as cancer, dementia, and cardiovascular disease, the health trajectory requires providers from primary prevention through acute and end-of-life care (Taplin et al., 2012). Providers must consider clinical risk factors, patient values and priorities, and patient and family member information to facilitate decisions concerning screenings, test results, treatment, and self-management choices (Vorderstrasse, Hammer, & Dungan, 2014; Williams et al., 2016). Providers must also organize efforts to meet the needs of other health care team members, patients, and families. It is critical that such opportunities be extended across socioeconomic status, including the underserved and minorities, and not limited only to those with access and education (Williams et al., 2016). A consequence of precision health care is improved survival rates, resulting in an increased need for chronic care, where nurses play a significant role.

Therefore, basic and continued nursing education require up-to-date knowledge regarding treatment and procedures to facilitate both acute and chronic care (Kessler, 2018), and thus, curriculum must consider these multilevel needs (Vorderstrasse et al., 2014). Continuing education in precision health care will allow nurses to remain current on testing, treatment, and continuation of care throughout the health care trajectory, thus providing nurses with the best information to ensure patient safety and positive outcomes.

Nursing is a crucial conduit between clinically meaningful genomic discoveries and their implementation into practice to advance health outcomes (Calzone et al., 2018). An interdisciplinary advisory panel has already recommended the inclusion of specialized genomics education for existing and future nursing personnel (Calzone et al., 2013). In practice, when genomics test results are received, advanced practice nurses should be able to understand and explain the tests, their validity, and the meaning of results to patients and their family members, including matters related to legal, ethical, and social concerns (Crawford, Foulds, Fenwick, Hallowell, & Lucassen, 2013).

As mentioned, precision health increasingly includes technology platforms such as eHealth and mHealth. In addition, nurses in personalized and precision health face increasing circumstances in which they must provide support, communication, and advocacy for patients surrounding advanced testing and care. Nurses have the principal responsibility of coordinating and delivering care and ensuring accuracy of treatments and medications (Gephart, Bristol, Dye, Finley, & Carrington, 2016). Nurses also require immediate accessibility to evidence-based information to make choices that ensure patient safety and positive outcomes (Stifter et al., 2018). Education can help providers understand the multilevel influences on health and health care interventions across the health care spectrum (Taplin et al., 2012). Therefore, for Principle 5 (Prioritizing Specialized Training), both specialized nursing education and training in information technology are needed to provide optimal patient care (Casarett, Harrold, Oldanie, Prince-Paul, & Teno, 2012).

Recommendations for Education and Training in Nursing

With the knowledge that genes, environment, and lifestyle underlay pathophysiology and are fundamental to health, nursing education should include study of these influences at all academic levels, throughout the education curriculum (Vorderstrasse et al., 2014), from basic to continuing education (Coleman et al., 2014) and advanced credentialing (McCormick & Calzone, 2017). Nurses are essential to the integration of genomics into health care (Calzone, Jenkins, Culp, & Badzek, 2018). Therefore, nurses need meaningful education in genetics and genomics so that they have the knowledge and skills to provide optimal care to patients and their families (Tonkin, Calzone, Jenkins, Lea, & Prows, 2011). Most programs in nursing are already laden with courses and requirements, and a single course in genomics is not sufficient. Therefore, assimilation of genetics into nursing curriculum courses is necessary (Guttmacher, Porteous, & McInerney, 2007; Prows, Tran, & Blosser, 2014). Within the undergraduate curriculum, courses should include general terms and knowledge about genetic testing and nurses should be able to refer patients to counselors to discuss genetic test results. Advanced practice nurse education with a specialization in genetics, should provide nurses with skills to review and synthesize scientific literature concerning testing and the health care needs within the milieu of the condition (Vorderstrasse et al., 2014).

Indeed, genetics and genomics competencies were established for nurses in 2006 and updated in 2008 (*Nursing Informatics: Scope and Standards of Practice*) (Competencies, 2009); these include knowledge of genetic risks derived from interactions among multiple genes and the environment and personalized treatments based on underlying genetics (Shuster, 2011). However, because of advancements in information and technology, continuing genomic education is vitally needed. The American Nurses Credentialing Center extended the work of the Genetic Nursing Credentialing Commission and established a certification in Advanced Genetics Nursing in the United States and globally. Another important need is targeting of ethnic minority nurses to optimize care for patients. The National Coalition of Ethnic Minority Organizations' foremost aim is to develop ethnic minority nurse leaders in areas of practice, education, research, and health policy. The National Coalition of Ethnic Minority Organizations endorses best nursing practice models to include genetics-genomics research and education to enhance the health of minority groups (Coleman et al., 2014).

Nurse scientists are in a natural position to contribute to precision health research, emerging from a metaparadigm philosophy of person–environment–health (Fawcett, 1984), which lends itself to a multilevel system of health. With advances in technology, increasing omics (e.g., metabolomics, proteomics, genomics, and transcriptomics) and other types of big data have elicited growing momentum in precision and personalized treatment and care (Founds, 2018). Indeed, nurse scientists are increasingly integrating omics measures for investigations of biobehavioral determinants of health (Ferranti, Grossmann, Starkweather, & Heitkemper, 2017). To cultivate this promising direction of research, the education of future nurse scientists necessitates a precision health and systems biology framework (Founds, 2018). This should be an integral part of the curriculum during undergraduate, graduate, doctoral, and post-doctoral programs. In 2011, the National Institute for Nursing Research released a strategic plan that included increased focus on determining biological

and genomic mechanisms, assimilating behavioral and biological sciences, and using technology to advance science related to health promotion, disease prevention, symptom management, and end-of-life care. Training programs that include genomics, technology, and big data can provide future research nurse scientists a foundation to conduct cutting-edge research (Henly et al., 2015) and enable translation of discoveries in areas of precision health into practice (Williams et al., 2016). Training programs should also comprise a component of mentoring, to ensure progression from theoretical training to scientific application (Alcaraz et al., 2017). The education of future nurse scientists means including a precision health and systems biology framework as a fundamental portion of the curriculum throughout all phases of education from undergraduate through postdoctoral training.

Conclusions

The ConNECT Framework provides a simple set of broad guidelines that allow for a comprehensive and contextually rich focus to guide precision health research and that can be integrated with existing frameworks (see Principle 3, for examples, of existing models). These five principles do not necessarily need to occur sequentially. For example, principles may be prioritized depending on the topic of study, its significance to population subgroups, historical context of exclusion, etc. We advocate that use of the ConNECT Framework by researchers at all stages will allow for better integration of the complexities that underpin human health, and facilitate the elimination of previous mindsets and/or insular thinking related to precision health. Indeed, the application of this framework in the early stages of team-oriented research is likely to reduce incremental progress and expedite the development of population-based, targeted interventions that can affect health and health policy. In summary, the ConNECT Framework offers a simple, practical lens to guide precision health research and its dissemination for highest impact in the general population.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgments

The authors thank Rasa Hamilton for editorial assistance, as well as Camille Jones and Gloria Roby for proofreading and formatting assistance.

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