

California State University, San Bernardino

CSUSB ScholarWorks

Q2S Enhancing Pedagogy

Winter 3-1-2020

The Diffusion of Artificial Intelligence/Machine Learning Methods and Data Analytics into an Undergraduate Nursing Research Course

Mary Anne Schultz
mschultz@csusb.edu

Follow this and additional works at: <https://scholarworks.lib.csusb.edu/q2sep>



Part of the [Education Commons](#), [Medicinal Chemistry and Pharmaceutics Commons](#), [Medicine and Health Sciences Commons](#), [Other Pharmacology, Toxicology and Environmental Health Commons](#), [Physiology Commons](#), and the [Social and Behavioral Sciences Commons](#)

Recommended Citation

Schultz, M. A. (2020). The Diffusion of Artificial Intelligence/Machine Learning Methods and Data Analytics into an Undergraduate Nursing Research Course, CSUSB Q2S Enhancement Project, California State University, San Bernardino, CA Department of Nursing

This Course Outline / Syllabus is brought to you for free and open access by CSUSB ScholarWorks. It has been accepted for inclusion in Q2S Enhancing Pedagogy by an authorized administrator of CSUSB ScholarWorks. For more information, please contact scholarworks@csusb.edu.

Title: The Diffusion of Artificial Intelligence/Machine Learning Methods and Data Analytics into an Undergraduate Nursing Research Course

Abstract: The project is the adoption of principles of Artificial Intelligence (AI)/Machine Learning and Data Analytics into a traditional nursing research (hypothesis testing) course. Necessitated by the recent entrance of “Big Data” use in health care, there is an urgent need to inject an understanding of the AI/ML techniques necessary to extract, organize and derive meaning from this huge amount of evidence in clinical decision-making. In fact, our department recently approved the adoption of Precision Health (PH) (the clinical use of the plethora of highly-individualized data in health & medical decisions) principles into six undergraduate courses, NURS 4222 (Nursing Research & Evidence-Based Practice) being one of them. The conversion to semesters affords a great opportunity to truly transform the course by blending in this additional necessary content that the graduate nurse is expected to apply. Faculty who are preparing to teach new matters related to “precise care” should avail themselves of gray literature searching, professional networking and incubation to replace, or at least supplement, traditional sources and sourcing such as texts and scholarly literature. These sources were applied creatively in this sample module entitled “Big Data & Evidence-Based Practice”. It is anticipated that our students, by extension and through sharing, our faculty, will develop the knowledge, skill and attitude (KSAs) desirable to adapt to this scientific renaissance known as Precision Health.

Program Outcome (new): Apply the nursing process to provide ethical, patient-centered, holistic, culturally sensitive, and **precise** care, health promotion, and disease and injury prevention to individuals, families, communities, and populations across the lifespan, including care of acute and chronic health conditions and during public health disasters.

Course Layout, One Module: Big Data & Evidence-Based Practice
Using Personally-Generated Health Data (PGHD) & The Electronic Health Record as Exemplar

Week/Objectives	Topics	Activities	Assignments
<p><u>Week 1, Session 1:</u></p> <ol style="list-style-type: none"> 1. Describe the status of PGHD relative to the EHR 2. Critique the clinical usefulness of selected health apps 3. Describe heterogeneous treatment effects in one’s own terms 4. Describe what is mean by individual vs aggregate level data in a context of Precision Health 	<p>Symptom Science, Precision Health, the flawed assumption of homogeneity in traditional science*, Data Granularity</p>	<p>Lecture/Discussion</p> <p>Pre-test</p>	<p>Critique of apps for seniors, or population of choice e.g., Nimble</p> <p><u>Executive Summary:</u></p> <p>Caring for the Individual Patient (NAM, 2018)</p>

			NACNR Overview of NINR Symptom Science Webinar
CLO: Describe the relationship of nursing theory, research, evidence-based practice, and quality improvement, and data analytics .			
<u>Week 1, Session 2:</u> 1. Articulate an understanding of algorithms, nursing care processes & robotics 2. Describe the “five Vs” of health care data which contributes to outcomes 3. Describe components & advantages of EHRs 4 .Describe what is meant by standardized terminology in the EHR	What is “Big Data”? Custom data for consumer/patient CDS--how is it related to nursing science? Uniformity of terms & structured data in EHRs	Lecture/Discussion, Pair/Share Exercises,	Descriptive exercises: -Rothman index -“Big Data” -The “Five Vs” <u>Ch 14</u> McConigle & Mastrian
CLO: Describe the research process (traditional & data analytical approaches) from development of the research question through dissemination of findings.			
<u>Week 2, Session 1:</u> 1. Describe the relationship between AI/ML data & EBP 2. Imagine “the hospital of the future” from the patient data point of view 3. IoT, IoMt, devices & Precision Medicine/Health 4. Articulate limitations of CDS within the EHR	Interdisciplinary knowledge & skills transfer: chronicity, “compressed morbidity” & promote health, NINR & Symptom Science	Lecture/Discussion	Short written account of PGHD (systems, EHR, environmental) Patient Flight Path Short Clip NINR Symptom Sci
CLO: Describe the relationship of nursing theory, research, evidence-based practice, and quality improvement, and data analytics .			
<u>Week 2, Session 2:</u> 1. Describe the hope, the hype, the promise & the peril of AI in nursing science 2. List findings of select governmental & private reports and/or initiatives (NAM Report on AI) 3. The NIH <i>All of Us</i> Initiative 4. ANA Healthy Nurse, Healthy Nation (HNNH)	Data Granularity: data on individual to population levels Gartner Hype Cycle NINR & Technology	Lecture/Discussion, Pair/Share Exercises Post Test	Short summary of select government reports, nursing implications Articles: Bresnick, NINR Technology ANA HNNH Brief
CLO: Demonstrate information literacy skills for retrieval, organization, levelling and evaluation of evidence.			

Abbreviated Resource List

Ahmed, M., Kent, D., Paulus, J. & Whicher, D. (2018). Caring for the Individual Patient. Washington, DC: National Academy of Medicine.

ANA (2019). Healthy Nurse Healthy Nation Year Two Highlights. Retrieved:
https://www.healthynursehealthynation.org/globalassets/all-images-view-with-media/about/2019-hnhn_highlights.pdf.

Bresnick, J. (2016). How will Internet of Things Devices Impact Precision Medicine? Health IT Analytics (May 16, edition),
<https://healthitanalytics.com/news/how-will-internet-of-things-devices-impact-precision-medicine>.

CCST9047 Students (n.d.). Patient Flight Path Analysis: A Localized Solution for Hong Kong. Retrieved March 1, 2020:
<https://www.facebook.com/watch/?v=426310164477848>. CCST9047 Students (n.d.).

Jakucs, C. (n.d.). Precision health is the wave of the future. Retrieved from: <https://resources.nurse.com/diversity-in-nursing-precision-health>

Matheny, M., Israni, S. T., Auerbach, A., Beam, A., Bleicher, P. , Chen, J....Wiens, J. (2019). Artificial Intelligence in Health Care: The Hope, The Hype, The Promise, The Peril. Washington, D. C.: National Academy of Medicine.

McConigle, D. & Mastrian, K. (2018). Nursing Informatics and the Foundation of Knowledge. Burlington, MA: Jones & Bartlett. ISBN: 9781284121247

NACNR Overview of NINR Symptom Science and Precision Health Portfolio, May, 2019.
<https://www.youtube.com/watch?v=bSPF3v5dWRA>.

NINR (2016). Symptom Science: Promoting Personalized Health Strategy (p. 10). The NINR Strategic Plan: Advancing Science, Improving Lives. Retrieved from: https://www.ninr.nih.gov/sites/files/docs/NINR_StratPlan2016_reduced.pdf

NINR (2016) Technology to Improve Health (p. 33). The NINR Strategic Plan: Advancing Science, Improving Lives. Retrieved from: https://www.ninr.nih.gov/sites/files/docs/NINR_StratPlan2016_reduced.pdf.

Course Learning Outcomes:

1. Describe **the** relationship of nursing theory, research, evidence-based practice, and quality improvement, **and data analytics**.
2. Compare and contrast the roles of baccalaureate-prepared, master's-prepared, and doctorally-prepared nurses in research and evidence-based practice.
3. Describe the research process (**traditional & data analytical approaches**) from development of the research question through dissemination of findings.
4. Discuss common research designs, both quantitative and qualitative, sampling, measurement, data collection, and data analysis methods.
5. Discuss ethical principles and legal/regulatory requirements pertinent to research, especially with human subjects.
6. Demonstrate ability to critique individual qualitative and quantitative research reports.
7. Demonstrate information literacy skills for retrieval, **organization, levelling and evaluation** of evidence.
8. Describe the evidence-based practice process from development of the clinical question through appraisal of evidence and implications for practice change.
9. Demonstrate beginning competence in the EBP process from clinical question **formation** through judging implications of a body of evidence for practice change.

Topical Course Outline

Quantitative research

- Philosophical perspectives
- Common methods **elements/components** including research questions, hypotheses, independent and dependent variables, sampling, data collection, measurement, and data analysis approaches: descriptive, correlational, quasi-experimental, and experimental
- Sample size, **sampling**, and power analysis, **other aspects of adequacy**
- Measurement theory **and application**
- Statistical tests appropriate for selected research questions/designs
- Reliability and validity of quantitative research
- Elements of a critique of a quantitative research report

Evidence-Based Practice (EBP)

- EBP as a professional imperative
- Relationship between EBP and quality improvement
- Importance of translational research and outcomes research to EBP
- EBP process, including formulation of the clinical question, literature search, critical review/appraisal of evidence, decision re: strength of evidence for practice change

- Types of **Hierarchy of evidence within traditional science (hypothesis-testing) models**: expert opinion, case reports, practice guidelines, systematic reviews, meta-analyses, meta-syntheses, RCTs
- Strategies for conducting a literature search
- Tools for appraising a body of evidence, including a table of evidence
- Challenges and barriers to implementation of evidence-based practice changes, **implementation science models**
- **Artificial Intelligence/Machine Learning (AI/ML), Precision Health & the Internet of Medical Things (IoMT)**
- **The roles and functions of Data Engineer, Data Scientist, Subject Matter Expert and others on the AI/ML/Precision Health team**
- **Differentiation of the AI/ML functions of data extraction, data manipulation, data analysis in information and knowledge generation across the health care research enterprise**
- **The revolutionary and disruptive nature of the entrance of Big Data and AI into health care in an historical context-- relationship to demand for care that is precise**
- **Data Science and Data Analytics tools/methods e.g. neural networks, ArcGIS, neurocomputing, pattern recognition, data mining, natural language processing (NLP) and Data Viz**
- **Data impact from social media analytics, semantic analytics, sentiment analysis and PGHD (personally-generated health data) upon health and wellness**
- **Ethical and legal considerations in the use of Big Data, e.g. best practices in data governance and data provenance, user protections of health data and breach prevention**

Usha Menon PhD RN FAAN Definition of Precision Health (NINR video)

“In precision health, we’re not just talking genetics and genetic testing and their influence with regards to a patient’s risk for developing diseases and how a patient responds to medications—we’re also considering where a patient works and lives, what they eat, their hobbies and how they play, their culture, and how these social determinants affect their health risks and health goals”.

Keywords: Artificial Intelligence, Big Data, Health Care, Nursing, Precision Health