

# AN APPROACH TO CLINICAL DATA MANAGEMENT FOR THE DOCTOR OF NURSING PRACTICE CURRICULUM

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Strong data management skills are essential to doctor of nursing practice (DNP) education and necessary for DNP practice. Completion of the DNP scholarly project requires application of these skills to understand and address a complex practice, process, or systems problem; develop, implement, and monitor an innovative evidence-based intervention to address that problem; and evaluate the outcomes. The purposes of this paper were to describe the demand and context for clinical data management (CDM) within the DNP curriculum; provide an overview of CDM content; describe the process for content delivery; propose a set of course objectives; and describe initial successes and challenges. A two-pronged approach of consultation and a CDM course were developed. Students who participated in this approach were more likely to create and implement an evaluation plan; apply techniques for data cleansing and manipulation; apply concepts of sample size determination using power analysis; use exploratory data analysis techniques to understand population attributes and sampling bias; apply techniques to adjust for bias; apply statistical significance testing; and present project results in a meaningful way. On the basis of this evaluation, CDM has evolved from an elective to a required course integrated in a thread that crosses the entire curriculum. (Index words: Clinical data management; Doctor of nursing practice; Curriculum development; Data analysis) *J Prof Nurs* 30:56–62, 2014. © 2014 Elsevier Inc. All rights reserved.

SINCE THE INCEPTION of the doctor of nursing practice (DNP) degree, a fundamental understanding has evolved within the profession that the DNP is designed for innovation rather than discovery. As a result, curricula focus not on research methodologies but on processes that will help the DNP to innovate in practice using evidence-based methodologies designed to improve health care quality, safety, efficiency, delivery, and accessibility (American Association of Colleges of Nursing [AACN], 2006). However, because the distinction between the PhD and the DNP has traditionally focused on “academia/research” versus “practice/research application,” DNP programs may be downplaying the need for

strong data management skills and knowledge within the curriculum (Algase, 2010; AACN, 2006; Webber, 2008).

The purposes of this paper were to describe the demand and context for clinical data management (CDM) within the DNP curriculum; provide an overview of CDM content; describe the process for content delivery; propose a set of course objectives; and describe our initial successes and challenges with implementation.

## Background

It is generally accepted that the role of the practicing DNP includes translating evidence into practice on a systems, large-scale level, with the result being improvement in quality of health-related outcomes (AACN, 2006; Munding, Starck, Hathaway, Shaver, & Woods, 2009). The very use of the word improvement connotes understanding of how to *define, measure, analyze, and demonstrate* improvement. All require an understanding of data management techniques.

Within the core competencies outlined by AACN (2006) lie multiple content areas that require data management knowledge and skills such as quality improvement, program evaluation, cost and clinical

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effectiveness evaluation, translational science, epidemiology, biostatistics, economics, financial management, risk management, population health management, prevention management, and designing, selecting, and using data collection systems. While AACN makes clear that DNP students are not required to demonstrate all competency requirements, one competency for all areas is strong data management knowledge and skills.

Typical DNP curricula offer three to six credits of statistics and/or research focused on analytic methods for advancing evidence-based practice (Mundinger et al., 2009; Wall, Novak, & Wilkerson, 2005). Content for these courses likely include critical appraisal of existing literature to identify and address a practice problem with emphasis on the skills necessary to evaluate rigor, design, and analysis of relevant research. However, the work of the DNP requires analytical and methodological skills and knowledge well beyond the ability to appraise existing literature. DNPs are faced with the challenges of answering data-driven clinical questions using pre-existing data sets within complex collection systems, which are often collected for purposes other than designing, implementing, and evaluating evidence-based changes in practice. In addition, DNP project evaluation commonly uses observational study techniques that require complex statistical methods to eliminate sampling biases that would be negated using controls in randomized clinical trials (Austin, 2011).

Table 1 displays the similarities between data management processes in three of the DNP domains and compares them to data management processes in the non-DNP domain of knowledge-generating interventional research, which falls within the domain of the doctor of philosophy. As a reference, standard textbooks in each of these domains were used to describe the several key data management functions performed in each, which include data collection, cleaning, manipulation, statistical analysis, and reporting (Rondel, Varley, & Webb, 2000). The first domain is the identification, stratification, and assessment of populations of interest. In this domain, complex algorithms using various integrated data sources are used to identify patients with certain conditions; predictive models may be developed to understand determinants of adverse outcomes such as hospitalizations; and a risk level can be assigned to individual patients for stratification into appropriate intervention intensity (Gordis, 2009; Nash, Reifsnnyder, Fabius, & Pracilio, 2011). The second domain is the ongoing management of programs and quality improvement activities where reports are developed to monitor key indicators such as program eligibility, enrollment, and engagement; patient lab and other clinical values; adverse events such as hospitalizations; quality measures; and costs (Bialek, Moran, & Duffy, 2009). In the third domain, outcomes evaluation, a comprehensive evaluation is performed to determine whether programs and interventions have met the original aims determined during the planning phase (Kleinpell, 2001; Nolan & Mock, 2000). Compared to the non-DNP research domain, the data

management processes under the DNP domains require more complexity with data cleaning and manipulation as well as different statistical techniques to adjust for the bias associated with the lack of control inherent in nonrandomized control designs.

Because of the unique knowledge and skills necessary to manage data in these three domains, we created a two-pronged approach to provide each DNP student with individualized support. The first prong, consultation, was designed to develop the skills required to meet the goals and demands of individual DNP capstone projects and was provided 1:1 for each student. After a year of consultations, the faculty recognized improvement in the quality of evaluations conducted as well as findings reported but identified the need to revise the curriculum. As a result, the second prong was developed. A CDM course focusing on strategies, procedures, and knowledge application to promote quality data management for evidence-based translation projects was added to the curriculum.

### Frameworks for CDM

Data management processes are often covered in nursing texts that focus on research methods, outcomes measurement, evidence-based practice, and evaluation methods. Research texts typically focus on the design and methods of research studies and, as such, describe a process of data collection and analysis that acts upon data collected in a tightly controlled environment with minimal management needs (Polit & Hungler, 1999). Likewise, the outcomes measurement and evidence-based practice process touches on topics such as “analyzing the data” or “measuring the outcome,” but it does not go into the detail necessary to manage complex data sets that are often created for purposes other than research or outcomes measurement (Nolan & Mock, 2000).

Practicing DNPs need preparation to work within complex health care delivery systems to improve the quality, delivery, efficiency, and accessibility of health care services. A framework for data management within these complex organizations with disparate data collection systems requires a detailed process that includes designing feasible evaluative measures; acquiring data from multiple nonintegrated data collection systems; cleaning and manipulating data; analyzing outcomes; and reporting results.

Although the ideal framework for this process does not yet exist, there is increasing literature available that addresses data management for quality improvement purposes. For instance, a process of data quality control has been proposed to ensure the accuracy of data collection as well as analysis and reporting in which four phases are described: project design, data collection, data management, and data analysis (Needham et al., 2009). In addition, frameworks for CDM have been developed in the pharmaceutical industry, but these are more applicable to the rigor of randomized control clinical trials (Rondel et al., 2000). The CDM course content that we have developed incorporates concepts from the research, evaluation, outcomes measurement, and quality improvement methods literature.

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