Informing a Genomic Education Model: Outcomes of a Curricular Integration for Nurse Practitioner Students

Trina Walker, DNP, APRN, FNPC-C, Theresa Jizba, DNP, AGACNP-BC, ACHPN

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Nurses are the largest group of healthcare professionals in the United States with over 5.7 million practicing, including nearly 400,000 nurse practitioners (NPs), playing a crucial role in holistic, patient-centered care (American Association of Nurse Practitioners, 2023; National Council of State Boards of Nursing, 2024). To enhance the quality and safety of care, patient-centered care must incorporate genomic data (Fu et al., 2020; Quality and Safety Education for Nurses Institute, 2013).

Unfortunately, most nurse and NP programs lack genomic education, largely because many faculty educators received their training before genomics became integral to healthcare, leading to hesitation in including it in the curricula (Kurnat-Thoma et al., 2021; Thomas, 2023). This gap in genomic literacy limits NPs' ability to engage in safe prescribing practices and effectively communicate important test results (Connors et al., 2022; Fulton & Calzone, 2023; Powell et al., 2011).

Genomics is critical across patient assessment, diagnosis, management, and evaluation (Calzone et al., 2024). Building on the Faculty Champion initiative, Team-Based Learning (TBL) offers a collaborative strategy to enhance genomic literacy (Jenkins & Calzone, 2014; Michaelsen et al., 2008). TBL emphasizes active, student-centered learning, improving knowledge application and retention through facilitation rather than traditional lectures (Burgess, 2020; Michaelsen et al., 2008). Expanding TBL in NP programs can bridge critical genomic competency gaps, leading to better genomic education in nursing and fostering safer, more informed care.

PRELIMINARY WORK

Faculty assessed NP students' baseline genomic knowledge using the validated Genomic Nursing Concept Inventory (GNCI), a 31-item tool measuring essential genetic and genomic concepts for competent care (Ward et al., 2014; Parviainen et al., 2023). Students' median baseline score was 55%, consistent with recent findings among graduate nurses (Connors et al., 2022). Subcategory analysis showed the highest scores in inheritance (75%) and mutations (65%) and the lowest in basic genetics and genomic healthcare (55%).

With faculty-student collaboration and expert support, this project aimed to develop and implement a model to integrate genomic content into NP curricula, improving genomic literacy and clinical application while addressing gaps in faculty capacity to teach genomics.

METHODS

Over 12 months, two TBL sessions with interactive clinical application activities and a presentation from a genomics expert in clinical practice were placed into the advanced

FIGURE 1. Student Self-Evaluation of Genomic Competency (n = 21)

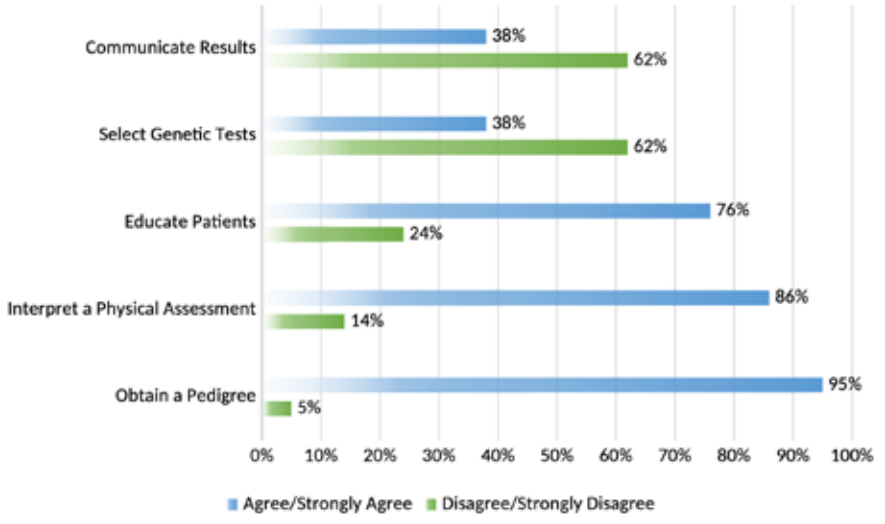
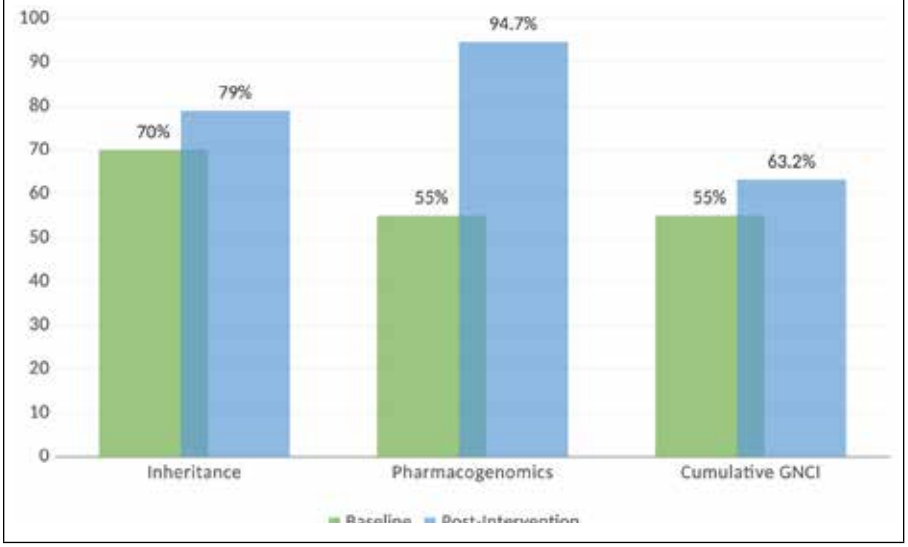


FIGURE 2. Pre- and Post-Intervention Genomic Nursing Concept Inventory Results (n = 29)



health assessment course and the first two practicums for NP students in a Doctor of Nursing Practice program at a single institution.

TBL: Inheritance Patterns

During the advanced health assessment course, a TBL focused on inheritance patterns expanded on existing course content focused on obtaining a detailed family history and accurately interpreting inheritance patterns, bolstering what students learned about obtaining the information and supplementing it with what family history means and how it impacts patient care moving forward – from preventative to palliative care. Students constructed pedigrees from case scenarios using appropriate symbols, identified probands, inheritance patterns, probability of disease inheritance, and how these impacted patients in the cases (Walker, et al., 2024).

Expert Lecture: Identifying the Zebra

Following advanced health assessment focused on typical physical exam findings, their first practicum introduces unexpected exam findings through direct clinical experiences. To provide a foundation and broaden their diagnostic capabilities, an expert lecture by a family nurse practitioner dual certified as a genetic counselor presented information about how the physical exam can inform the identification of common genetic disorders and when genetic testing or referral may be necessary. Afterward, students rated their confidence in communicating results, selecting tests, educating patients, interpreting the physical exam, and obtaining a pedigree.

TBL: Pharmacogenomics

The second practicum broadens the understanding of managing complex diseases, including the ability to provide quality and safe prescribing practices. This TBL focused on the impact of pharmacogenomics, both as a genetic test and as an overall concept (identification of a phenotype), on clinical practice. They explored and interpreted pharmacogenomic testing results using pharmacogenomic-specific clinical resources and developed management plans from case scenarios.

RESULTS

Student (n = 21) perceptions of their perceived genomic competency were higher in the areas covered by the two TBLs and the expert lecture. They remained drastically lower in concepts not emphasized in this project (Figure 1). Post-intervention, the GNCI scores (n=29) showed

a modest improvement from a median of 55% to 63.2% (Figure 2). When analyzed by questions mapped to learning outcomes from the implemented activities, knowledge scores also increased. The median percentage of questions mapped to the inheritance TBL improved from 70% to 79%, and those mapped to the PGx TBL improved more dramatically, from 55% to 94.7% (Figure 2).

Faculty of the courses impacted by the genomic interventions voiced overall satisfaction and a positive experience. While they appreciated and valued the need for genomics, they remained hesitant in their ability to sustain these activities without continued expert guidance.

DISCUSSION

Student confidence was high in gathering a genomic-focused patient history and physical exam, while counseling on genetic testing and communicating results remained low; an expected finding given students limited clinical experience of fewer than 100 hours. Nevertheless, exposure to these topics should better prepare students to develop these skills in clinical practice.

This project's use of TBL aimed to provide a supportive structure for faculty. While TBL pedagogy shifts faculty into a facilitator role (Burgess, 2020), many instructors felt hesitant to lead genomics-focused activities due to lingering concerns about their own content knowledge. Greater emphasis on faculty development and support is essential throughout the design and implementation of these activities.

CONCLUSION

This project highlights the urgent need for genomic education within nursing curricula to address significant gaps in genomics-informed NP practice. Implementing TBL strategies and expert-led lectures demonstrated promising results, showing notable improvements in this project's targeted areas, and demonstrating the effectiveness of the TBL methodology in bridging knowledge gaps. Persistent faculty reluctance emphasizes the necessity of continuous support to ensure the successful integration of genomics across the curriculum. By empowering both students and faculty through collaborative learning and expert guidance, this model establishes a solid foundation for preparing NPs to provide safe, high-quality, and genomics-informed care in an evolving healthcare landscape.

Authors' Affiliations: Assistant Professor (Dr. Walker), College of Nursing, Creighton University, Omaha, NE; Assistant Professor (Dr. Jizba), College of Nursing, Creighton University, Omaha, NE

Corresponding author: Dr. Jizba, Creighton University, 2500 California Plaza, Omaha, NE, 68178, TheresaJizba@Creighton.edu

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