Sigma Theta Tau International's 29th International Nursing Research Congress

Clinical Utility of Pharmacogenomic Testing Among Nurse Anesthetists: A Mixed-Method Study

J. Dru Riddle, PhD, CRNA
School of Nurse Anesthesia, Texas Christian University, Fort Worth, TX, USA

Purpose: Pharmacogenomic testing (PGX) is useful in helping to predict and explain patient responsiveness to medication. Using genetic data, PGX examines the pharmacokinetic and pharmacodynamic aspects of drugs which helps predict drug responsiveness. In clinical practice, the use of pharmacogenomic testing has been shown to help reduce adverse drugs events and increase patient satisfaction with their healthcare. Prior to a clinical test being useful, it must have clinical utility. There is a gap in the literature about the perceived clinical utility of pharmacogenomic testing among anesthesia providers. The purpose of this study is to describe the multidimensional phenomenon of clinical utility among nurse anesthetists in clinical practice.

Methods: The CDC ACCE Model of Public Health Genomics framework guided this qualitative–quantitative sequential mixed–method study. Focused semi-structured interviews were used to formulate probes for a quantitative survey aimed at quantifying the perceptions of anesthesia providers about pharmacogenomic testing. Focused interviews of representative practicing nurse anesthetists were conducted to generate themes. These themes served as the foundation of questions in a quantitative survey aimed at quantifying the perceptions of clinical utility of PGX. NVivo software was employed and using multiple embedded case study methodology, qualitative data were first deductively then inductively coded and analyzed using cross-case synthesis methods. Probes were then developed for the quantitative survey which was distributed electronically with the REDCap survey management system to all practicing nurse anesthetists in the United States. Fourteen questions were based on a 10-point Likert scale and results were analyzed using factor analysis with maximum likelihood extraction. Using SPSS for Mac v. 22, strength of relationships as a measure of sampling adequacy was determined using the Kaiser-Meyer-Olkin (KMO) test to evaluate significant correlations were sufficient for factor analysis. To facilitate interpretation, factors were rotated using the Direct Oblimin technique and following extraction, Horn's parallel analysis was carried out to confirm the number of factors extracted sufficiently loaded and minimal residual remained.

Results: Seven themes emerged from the qualitative portion. Nurse anesthetists lacked knowledge and understanding of PGX, there is a perceived lack of facilities to perform PGX, nurse anesthetists have limited access to PGX platforms, economic implications are seen as a barrier, ELSI implications are poorly understood, the technology itself is seen as very complex, and PGX is perceived as useful in preventing or avoiding complications in clinical anesthesia care. Results from 325 survey responses were analyzed. The mean age was 48 years with 44% male and 56% female respondents practicing primarily in community hospitals. KMO test for sampling adequacy was 0.850 which indicated patterns of correlations were compact and sufficient to reveal distinct and reliable factors. Factor analysis resulted in three factors: benefit, knowledge, and concerns. Horn's parallel analysis confirmed the number of factors.

Conclusion: Although outcomes data indicate PGX can help predict outcomes, anesthesia providers do not have enough knowledge and have concerns about the ethical implications of pharmacogenomic testing. The use of PGX technology to support prescriptive decision making among anesthesia providers has not been established. Results of this study show providers lack knowledge necessary to use PGX in clinical practice. Additionally, providers expressed concerns about cost and ELSI implications of genetic testing. There is a perception among providers that PGX would help avoid adverse drug events and reduce side effects, however, the idea that PGX results are too complex is a barrier to clinical uptake.

Title:

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Keywords:
clinical utility, mixed-method and pharmacogenomic testing

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Abstract Summary:

Pharmacogenomic testing offer a unique opportunity to personalize care for individual patients. Although testing is widely available, uptake in the clinical setting is slow. This study explores why pharmacogenomic testing is not widely used among nurse anesthetists in clinical practice.

Content Outline:

I. Introduction

i. Pharmacogenomic testing (PGX) was developed to improve patient outcomes to prescribed medications
ii. PGX uses genetic information to help determine drug responsivenes
iii. Uptake of PGX is slow
iv. Aim is to describe multidimensional phenomena of clinical utility as define by the CDC ACCE framework

II. Theoretical Framework

i. CDC ACCE Model of Public Health Genomics
    i. Analytic validity
    ii. Clinical validity
    iii. Clinical utility
    iv. ELSI
ii. Clinical utility paradigm grounded this study

III. Methods

i. Qualitative-quantitative sequential mixed-method
    i. Qualitative first
        i. Focused interviews
        ii. Developed probes
        iii. Thematic analysis
    ii. Quantitative second
        i. Survey items based on qualitative themes
        ii. Quantified perceptions of nurse anesthetists related to PGX
        iii. Factor analysis
    iii. Analysis

i. Qualitative
    i. Multiple embedded case study methodology
    ii. Deductive followed by inductive coding using constant comparison
ii. Quantitative
    i. Themes from qualitative analysis used to establish survey items
    ii. Two questions per item
    iii. Factor analysis using maximum likelihood extraction
    iv. Horn's parallel analysis to confirm

IV. Results

i. Seven themes emerged
    i. Understanding and knowledge about PGX
    ii. Lack of facilities to conduct testing
    iii. Limited access to PGX
    iv. Economic implications
    v. ELSI implications
    vi. Complexity of technology as a barrier
    vii. PGX would help avoid complications
ii. Three factors
    i. Benefit
    ii. Knowledge
    iii. Concerns
iii. Conclusion
    i. PGX is rarely used in nurse anesthesia practice
        i. Primarily due to provider knowledge
    ii. PGX lacks clinical utility
    iii. Interventions aims at increasing knowledge are necessary for clinical utility of PGX

First Primary Presenting Author
Primary Presenting Author
J. Dru Riddle, PhD, CRNA
Texas Christian University
School of Nurse Anesthesia
Assistant Professor, Director Center for Translational Research
Fort Worth TX
USA

Professional Experience: PhD in pharmacogenomics DNP in evidence based practice, evidence synthesis CRNA certification with 16 years of experience in nurse anesthesia practice Assistant Professor of Professional Practice School of Nurse Anesthesia
Author Summary: Dru is a Certified Registered Nurse Anesthetist teaching and practicing in Fort Worth, Texas USA. He holds a PhD in pharmacogenomics and a DNP in evidence synthesis. His background in high-risk OB anesthesia, rural anesthesia care, meta-analysis, and research in pharmacognomics related to anesthesia care.