Nurses' Genetic/Genomics Competencies when Medication Therapy is Guided by Pharmacogenetic Testing: Children with Mental Health Disorders as an Exemplar

Cynthia A. Prows, MSN, CNS, FAAN
Shannon N. Saldaña, PharmD, MS, BCPP

There is considerable variability in the effectiveness and toxicity of psychotropics used to treat mental health disorders in children and adolescents. Pharmacogenetic (PG) testing is beginning to be used to decrease the time it takes to reach therapeutic response and decrease the occurrence of adverse drug reactions in children and adolescents treated with psychotropics. This article reviews the pharmacogenetics literature and uses a clinical scenario to illustrate the essential genetic/genomics competencies pediatric nurses need to meet when providing care to patients whose medication therapy is being guided by PG testing.

Key words: Pharmacogenetics; Drug response; Nursing; Nurses' role; Mental health; Psychotropics

THE PURPOSES OF this article are to review basic information about pharmacogenetics and to illustrate nurses' expected genetic/genomic competencies when medication therapy is guided by pharmacogenetic (PG) testing. The American Nurses Association and the National Human Genome Research Institute of the National Institutes of Health, with a consensus panel of leaders from nearly 50 organizations have published *Essential Nursing Competencies and Curricula Guidelines for Genetics and Genomics* (Jenkins & Calzone, 2007). The American Psychiatric Nurses Association and the Society of Pediatric Nurses are 2 of the original 47 organizations that endorsed the document. It describes the minimal genetic/genomic competencies for all registered nurses, regardless of level of academic preparation, practice setting, or specialty. The competencies highlighted in this paper, as they apply to the use of PG testing in clinical settings, are the following:

- Assesses clients' knowledge, perceptions, and response to genetic and genomic information.
- Provides clients with interpretation of selective genetic and genomic information or services.
- Provides clients with credible, accurate, appropriate, and current genetic and genomic information, resources, services, and/or technologies that facilitate decision making.
- Evaluates impact and effectiveness of genetic and genomic technology, information, interventions, and treatments on clients' outcome (Consensus Panel on Genetic/Genomic Nursing Competencies, 2006; pp. 12–13).

At the authors' institution, PG testing is being used by clinicians to select psychotropic medications and to adjust dosing based on a patient's genotype for the purpose of improving drug safety and effectiveness for patients. There is a wide range of available

From the Division of Patient Services, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; Division of Human Genetics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; Pediatric Pharmacology Research Unit, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; Division of Pharmacy, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH.

Corresponding author: Cynthia A. Prows, MSN, CNS, FAAN. E-mail: cindy.prows@cchmc.org

0882-5963/$ - see front matter

doi:10.1016/j.pedn.2008.02.033

therapies, including psychotropic medications (e.g., antidepressants, antipsychotics, psychostimulants, and nonstimulants for attention-deficit/hyperactivity disorder) to treat mental health disorders (Scharf & Williams, 2006). However, the selection and dosing of psychotropic medications are inexact and can lead to toxic effects or prolonged suffering due to the ineffectiveness of the selected medication. A clinical scenario comparing two patient examples is used to illustrate differences in patient responses to a medication, use of PG testing in the clinical setting, and nurses' implementation of select genetic/genomic competencies. The cases are followed by a literature review of the topics.

Clinical scenario. Jim and David were both prescribed fluoxetine, took their medication as prescribed, weighed 49 kg and 53 kg, respectively (within the 25th–50th percentiles) and were not taking any other medications. Their responses to fluoxetine were quite different.

Jim, a 14-year-old adolescent with depression, returned to his psychiatric nurse practitioner, Ms. Johnson, three weeks after starting fluoxetine. Jim showed no signs of improvement and stated the medication was worthless. Ms. Johnson increased the dose at the visit and further increased the dose at a subsequent appointment. After six weeks of treatment Jim's depression was not relieved. He was refusing to go to school, skipping soccer practices and refusing to return calls or e-mails from concerned friends. His mother reported all he wanted to do was sleep. During counseling, Jim admitted he was thinking about ways to end his life.

Ms. Johnson referred Jim for inpatient treatment where psychiatrists routinely ordered PG testing for all patients newly admitted to the unit. Jim's nurse on the unit gave his parents written information about the test and explained how the results would be used to adjust Jim's medication therapy. (See Appendix for content of handout available at authors' medical center.) Jim's PG test results were available two days later. The report indicated that based on his genotype he was predicted to be a CYP2D6 ultra rapid metabolizer and a CYP2C19 extensive metabolizer.

Ms. Johnson called Jim's mother and briefly explained the test results and how knowing the results would change his plan of care. "Jim's genetic test result shows that he has extra copies of a gene called CYP2D6. This causes his body to make more CYP2D6 enzyme than most people so he breaks down normal doses of fluoxetine before the medicine has time to work. Since higher doses have already been tried and were not successful, a different antidepressant has been ordered for him. The medication is called escitalopram. It relies on a different enzyme called CYP2C19. Jim has the expected number of copies of the CYP2C19 gene and the laboratory did not detect any changes in these genes that sometimes make it difficult for the body to use escitalopram. This medication will be started today, and Jim will be closely monitored over the next several days. Please make an appointment in the clinic within a week after he is discharged because he might still need some adjustments to his medication dose."

Ms. Johnson also treated David, a 15-year-old patient with depression. He was prescribed the same initial dose of fluoxetine as Jim. After taking the medication for almost three weeks, David experienced significant side effects, including inability to sleep at night, agitation, and anger outbursts. When David returned to the mental health clinic with his parents, the clinic nurse obtained David's interim history and expectations for the visit. When David described the unpleasant effects of the medication the nurse knew Ms. Johnson would likely consider changing David's medication. She also considered a very recent staff inservice about a new pharmacogenetics service at the hospital. She explained to David and his parents that finding the right medication to treat depression can be a difficult process because not everyone responds the same way. She then shared what she recently learned about PG testing and asked David's parents if they would like to learn more about the test from Ms. Johnson. David's parents were interested but David was reluctant as he had a bad experience with phlebotomy in the past. The nurse reassured him it was possible to do the test by gently scraping the inside of his cheek with a special brush. David stated that would be okay. The nurse also gave them a sheet containing information about the purpose, potential benefits, and limitations of the test to read while waiting for Ms. Johnson.

After the clinic nurse talked with David, Ms. Johnson further explained the purpose, potential benefits and limitations of a PG test for two genes that produce drug metabolizing enzymes primarily involved in antidepressant metabolism. David and his mother agreed with Ms. Johnson that the results could be helpful. Ms. Johnson was able to see David one week later, at which time she discussed the test results with David and