

## Genetics and Genomics Nursing Has Arrived!

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Welcome to the new Genetics & Genomics feature. Since the completion of the Human Genome Project in 2003 (Collins, Morgan, & Patrinos, 2003), information targeting genetics and genomics or their products has become a mainstay in cancer care. Genetics and genomics are beginning to show usefulness for risk assessment of multiple inherited cancers, direction for screening and surveillance guidelines, prevention needs for families at high risk for certain cancers, treatment guidelines (germline and tumor based), and prognosis for a growing group of cancers. In addition to single-gene heritable cancer syndromes, genomics and epigenetics have been found to play an important role in the development and phenotypic expression of cancer. Epigenetics is the study of changes in gene function that are heritable. However, no change occurs in the DNA sequence; epigenetics explains how the gene is expressed (National Human Genome Research Institute, n.d.).

The future of oncology care is embracing tools such as miRNA (microRNA) and siRNA (small interfering RNA), small RNA molecules involved in silencing genes, which have implications for disease development and treatment (Carthew & Sontheimer, 2009). Personalized medicine is being used with genetic testing of tumors and germline genes to direct treatment. Finally, genetics and genomics knowledge also leads to ethical, legal, and social issues still to be identified and addressed. The Genetic Information Nondiscrimination Act (GINA) was signed into law in 2008 and provides protection from genetic discrimination (Lea, 2010). GINA is just the beginning, revealing a new depth of areas that need to be addressed within genetics and genomics.

### Genomics and Cancer Care

Many recent and exciting research findings may dramatically change cancer care. The goal of the Cancer Genome Atlas Network is to perform a comprehensive genomic analysis of each cancer type. The Cancer Genome Atlas Network (2012c) identified four distinct types of breast cancer, which may explain why treatment is not always effective. One has basal-type cells similar to serous ovarian cancer, which may indicate the need to treat those breast cancers with ovarian cancer drugs. Another comprehensive study (Cancer Genome Atlas Network, 2012a) examined the genetics of squamous cell lung cancer. A high mutation rate was reported, with potential targeted genes or pathways identified. The same type of genomic analysis was performed on colon and rectal cancer tumors (Cancer Genome Atlas Network, 2012b), again identifying potential targeted genes or pathways. As the Cancer Genome Atlas Network continues genomic analyses of breast, lung, and colorectal cancers and completes analyses on all other cancer types, cancer therapy will become more targeted and a cure may be identified. Oncology nurses need to stay up-to-date with these new findings, as they may dramatically change treatment.

### Pharmacogenomics

Pharmacogenomics is another rapidly growing field of research. By identifying metabolic pathways specific to each drug and identifying mutations in the metabolic pathways of individual patients, appropriate drug selection and titration unique to patients' tumors can be provided. As targeted agents are developed, new side effects also will be identified. Oncology nurses need to understand the mechanism of these new drugs, identify

side effects, assess effectiveness, manage symptoms, and educate patients.

### Nurse Competencies in Genetics and Genomics

The Institute of Medicine (2011) has stated that nurses should practice to the full extent of their education and training. Nursing curriculum is constantly in flux to reflect current health issues and technological advancements. The American Association of Colleges of Nursing ([AACN], 2008, 2011) guidelines have been revised at both the bachelor's and master's levels to reflect the relevance of genetics in patient care. The essential genetic and genomic competencies needed by nurses in all settings have been defined through consensus panel reports for generalist and graduate levels of education (American Nurses Association, 2009; Greco, Tinley, & Seibert, 2012).

The essential competencies (AACN, 2008) for all nurses include knowledge and understanding of genetics and genomics. The specific skills include (a) collect a patient health history that includes genetic, environmental, and genomic influences; (b) construct a three-generation pedigree; (c) identify patients at risk for heritable syndromes; (d) identify ethical, legal, and social issues related to genomics; (e) facilitate appropriate referrals; (f) educate patients regarding genetics and genomics; (g) identify credible information (e.g., helpful Web sites, evidence-based genetic testing); (h) understand implications of identified risk; (i) educate patients regarding appropriate screening; (j) be a resource for patients; and (k) advocate for patients. Oncology nurses now are challenged to learn about genetics and genomics, as well as integrate that knowledge into their specialty practice.

This column will include in-depth information beyond the baseline competencies. Oncology nurses who are