Scientific Advances Shaping the Future Roles of Oncology Nurses

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Objectives: *To discuss the recent scientific advances that influence current oncology care and explore the implications of these advances for the future of oncology nursing.*

Data Sources: *Current nursing, medical and basic science literature; Clinicaltrials.gov.*

Conclusion: *The future of oncology care will be influenced by an aging population and increasing number of patients diagnosed with cancer. The advancements in molecular sequencing will lead to more clinical trials, targeted therapies, and treatment decisions based on the genetic makeup of both the patient and the tumor. Nurses must stay current with an ever changing array of targeted therapies and developing science. Nurses will influence cancer care quality, value, cost, and patient satisfaction.*

Implications for Nursing Practice: *It is critical for oncology nurses and nursing organizations to engage with all oncology care stakeholders in identifying the future needs of oncology patients and the environment in which care will be delivered. Nurses themselves must identify the roles that will be needed to ensure a workforce that is adequate in number and well trained to meet the future challenges of care delivery.*

Key Words: *Precision medicine, genetic mutations, targeted therapy, future oncology care.*

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Cancer is the second leading cause of death in the United States[1] and one of two persons born today will be diagnosed with cancer in their lifetime.[2] Although there will be an estimated 1,685,210 new cancer cases diagnosed and 595,690 cancer deaths in 2016,[2] survival rates are improving. In 1975, only 49% of patients survived more than 5 years after diagnosis; today this percentage has increased to

66%.[3] It is expected that there will be at least a 45% increase in older persons needing cancer care by 2030.[4]

There have been amazing advances in cancer care in the last two decades. Genomic testing has opened the doors for development of a number of new targeted drugs with the mechanism of action focused on specific genetic aberrations (abnormalities) associated with certain cancers.[5] Analysis of the patient's genomic signature is now incorporated into an increasing number of oncology standard-of-care practices. In the last few years, several new treatments have been developed for cancers that previously had few or no effective treatment options.

A number of oncology organizations and stakeholders are analyzing the current and future state of oncology care and making recommendations. Quality, value, cost, and patient satisfaction are the key drivers of future cancer care. Nurses who specialize in caring for patients with cancer have contributed to new developments in genomics and cancer treatment. Oncology nurses in all levels of practice will continue to contribute to the delivery of high-quality, cost-effective cancer care.

Scientific Advances

A number of scientific advances in the past decade have contributed to an ever changing oncology care environment. Advances in information technology allow data aggregation, analysis and dissemination to occur rapidly. Subsequently, results of clinical trials enter the clinical arena sooner than ever before and the evolution of precision medicine continues to develop at an unprecedented rate. By being familiar with many of these advances, the oncology nurse is in a pivotal position to help advance the science, serve as a resource to patients, and provide input regarding the effectiveness of new agents.

Precision Medicine

Molecularly targeted therapy is a term that was coined in the early 1990s to describe treatment with drugs that worked at the molecular level, such as trastuzumab and rituximab. Increasing numbers of targeted therapies, those drugs that "target" a particular genetic mutation or pathway to interfere with cancer growth, were tested in clinical trials and approved by the US Food and Drug Administration (FDA). These targeted therapies were aimed at tailoring cancer treatment to the patient's individual characteristics and eventually became known as *personalized medicine*. This "one size fits all" approach has now been replaced by an even more advanced treatment approach termed *precision medicine* that is based on the genetic characteristics of both the tumor and the patient.[6]

During the past decade, researchers have identified a number of actionable mutations that provide a target for the action of the drug with unprecedented anti-cancer activity.[7] In the past 2 years, the FDA has approved 28 new treatments (10 in 2014, 18 in 2015), bringing the total of approved cancer treatments to 188.[8] There are currently more than 800 medicines and vaccines in cancer clinical trials; 73% have been suggested to have the potential to be personalized medicines.[9] In addition, there have been a number of treatment advances for certain types of cancers that previously did not have any treatment options or only options with limited effectiveness.

In 2005, the next generation of gene-sequencing advances emerged, allowing scientists the ability to detect a large number of genomic aberrations (base mutations, insertion and deletion mapping, copy number alterations, and rearrangements) with a higher sensitivity, in a shorter time, and at decreased costs.[10] Most large institutions now have molecular screening programs in which the patient's tumor (cancer genome) is sequenced and potential actionable aberrations are documented to treat the patient with a targeted drug matched to their specific tumor. The genomic sequencing advances have guided new standard-of-care treatments for patients diagnosed with lung cancer, melanoma, or hematologic malignancies and clinical trials for other diseases.

Targeted Therapies

Targeted therapies, the individual drugs that target specific genetic aberrations, are used in precision medicine. Standard-of-care treatment is now routinely guided by the results of molecular analysis for a number of cancers (see Table 1). For example, patients with non-small cell lung cancer (NSCLC) are routinely tested with a molecular panel at diagnosis. Ten percent of white patients and 40% of Asian patients with NSCLC are epidermal growth factor receptor (EGFR)-positive and respond to anti-EGFR therapy. Two tyrosine kinase inhibitor (TKI) drugs, exlotinib[11] and afatinib,[12] are now standard of care for patients with EGFR+ NSCLC. Approximately 5% of patients with NSCLC are anaplastic lymphoma kinase (ALK)+ and may benefit from treatment with crizotinib.[13]