Technological Advances in Psychiatric Nursing

An update

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KEYWORDS

• Brain imaging technology • Health information technology • Pharmacogenetics
• Telepsychiatry • Computer based psychiatric interventions

KEY POINTS

- Brain imaging, genetics, and information technology are areas within which considerable knowledge is being generated that can be applied to psychiatric nursing.
- Several technologies have been used to explore brain functioning as a result of psychiatric symptoms and hypothesized treatment interventions.
- Pharmacogenetics supports exploration of personalized medication treatment; however, at this time it is limited to understanding the genetics associated with the metabolism of psychiatric drugs and genetic contributions to easily measured effects, for example, metabolic changes.
- Health information technology (HIT) has potential to provide better measures and assessment of quality outcomes in psychiatric care and to explore innovative methods to provide psychiatric treatment over the Internet or using other types of applications. Although there are issues of expense and privacy for mental health providers, the creative use of HIT may address the critical workforce limitations.

INTRODUCTION

Traditionally, mental health and psychiatric care has made minimal use of technology. A little more than a decade ago, the technological advances that affected modern mental health nursing were described.[1] These advances highlighted the wonders of brain scanning that gave information without waiting for autopsy results, the emerging efforts of genetic explorations that held hope for creating more targeted treatments for mental illness, and the creative manipulations of medications to improve effectiveness

This article is an update of an article previously published in Nursing Clinics of North America, Volume 38, Issue 1, March 2003.
Disclosure Statement: None.
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Nurs Clin N Am 51 (2016) 151–160
http://dx.doi.org/10.1016/j.cnur.2016.01.001 **nursing.theclinics.com**
0029-6465/16/$ – see front matter

and diminish unpleasant side effects. Since the publication of the original article, several technological advances have changed health care and have stimulated ideas for improving treatment of people with mental illness. These advances include the successful sequencing of the human genome concurrent with the publication of the original article, the first iPhone in 2007 (C.A. Bostrom, personal communication, 2015), and the extensive implementation of electronic health records (EHRs) and other health information technologies.

UPDATE ON TECHNOLOGIES DESCRIBED IN THE ORIGINAL ARTICLE

Brain Scans/Imaging Technologies

Several neuroimaging technologies have been used for at least the past 2 decades to increase understanding of brain changes that occur with mental illness and its treatment. Prior to the use of these technologies, autopsies were the main method of examining brain structures. The problems with autopsies, however, were the difficulty determining the history of the disease and its treatment prior to an individual's death and the inability to determine concurrent information about behavior and brain function because the subject was no longer alive. On the other hand, neuroimaging techniques can be used with full knowledge of an individual's illness history, treatment history, and current state of illness and symptoms. These techniques have led to much clearer knowledge of which behaviors and behavioral deficits are connected to brain structures and activity. Neuroimaging is used for both research and clinical assessment.

Structural neuroimaging techniques include CT and MRI scanning. With CT and MRI scans, clinicians and researchers can examine the brain for changes in structure and for brain lesions. CT scans use x-rays to create a series of gray-scale pictures of the brain, with structures absorbing the most x-rays appearing the lightest (bone) and those absorbing the least appearing the darkest (cerebrospinal fluid). The gray matter and white matter of the brain are the most difficult to distinguish on CT scans. With MRIs, an image is created when the magnetic field in the MRI aligns the protons inside atoms in the brain and uses radio waves to disrupt the alignment and then measure the radio waves emitted by the protons as they return to alignment.[2] This results in a 3-D image that more clearly distinguishes the white matter and gray matter of the brain.

Functional imaging includes PET scans, single-photon emission CT (SPECT), and functional MRI (fMRI) scanning. PET scans create stunning colorful pictures of the brain showing overactivity or underactivity in brain regions based on glucose consumption and cerebral blood flow while the brain is at rest or while an individual does tasks. With SPECT, structural images created by the functioning of regional cerebral blood flow show deviations from symmetry (individuals essentially serve as their own controls) that can indicate pathology and distinguish among possible diagnoses with symptoms that are difficult to distinguish, for example, dementias.[3] An fMRI uses the magnetic field in a slightly different way from the MRI.[2] With an fMRI, the magnetic field takes advantage of the iron within oxygen-rich blood that rushes to an area in the brain activated by some task or stimulus. This results in an image of functional brain activity. fMRIs have become beneficial for research on brain function and behavior, such as anxiety, social functioning, dyslexia, and addictions.[2]

There are both benefits and challenges to using these scanning methodologies. The obvious benefits are their noninvasive methods that produce information to increase understanding of the normal brain and the impact of mental illness. That said, the equipment used for many of these scans can be intimidating. For MRIs in particular, an individual is required to lie very still in a tube that can feel claustrophobic while