Advancing Nursing Leadership through Research: Biobehavioral Science for Nursing into the 21st Century

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Dr. Kojima, Dr. Maehara, my fellow scientists, special guests and friends: I especially bring you greetings from the faculty at the University of Illinois College of Nursing where I have the honor of knowing emeritus professor, Dr. Virginia Ohlson - a person well known to nurses in Japan and she is attending this meeting. A special warm greeting to our UIC Japanese alumna. I also bring you greetings from the American Academy of Nursing, for which I sit on the Governing Council.

I wish to thank-you for the invitation to speak before the members of the Japan Academy of Nursing Science at the Third International Research Conference. You are to be commended for the energy and dedication to enhancing nursing knowledge through such an impressive conference. It is so important that all of us as scientists join together in the search for the best nursing practices to improve the health of all people. It is through the search for understandings of human health that we discover effective interventions to test and that we can advance nursing leadership for quality health care.

Innovation and Creativity in Nursing Science:

First, to talk about innovation and creativity, I will present a framework that I believe should guide a part of our “nursing science” as we enter the 21st century. Nursing science must provide the basis for our practice and in the United States some of our nursing practice opportunities are changing. The framework has an emphasis on understanding “person-environment fit” and could be called an “ecological” framework. It advances a view of human health-related phenomena as biobehavioral phenomena. Second, I will speak about the relationship of the framework to health-related behaviors and the concept of stress. Third, I will use sleep/wake research as an example to outline types of research and those favored by nursing scientists. My remarks about the science of nursing practice will be mostly related to “individual” health, that is “personal” health, and not much to the health of groups, that is “public” health or the science that is “healthcare delivery system” oriented, although these types are important also.

The Essence of Nursing Practice:

First, I would like to outline my thoughts about what nursing practice for “personal health” mainly includes. Nursing practice across health continuums incorpor-
rates:
- monitoring functional status (physical and mental)
- supporting activities of daily living and promoting improved functional status when medical treatments or injury have rendered people unable to care for themselves: feed, mobilize, breathe, eliminate
- reducing symptoms, e.g., sleeplessness, sleepiness, pain, fatigue, anorexia, nausea, vomiting, diarrhea, constipation, urinary frequency, incontinence, dyspnea, cognitive dysfunction, dysphoria, anxiety, activity disorder
- protecting tissues or promoting healing of injured tissue, e.g., wounds, bones, muscle, brain, lungs
- screening for disease/illness, e.g., cancer, heart disease, hypertension
- educating for preventing disease/illness disabilities or managing medical therapies
- guiding the modification of health/wellness behaviors to treat symptoms, promote health/wellness or reduce vulnerabilities
- manipulating the environment to reduce health/wellness risks, e.g., noise, light/dark, microbes, and work injury.

An Ecological Framework for the Biobehavioral Science of Nursing Practice:

Based on these major nursing practice elements, science that blends both biological and psychosocial understandings of human health behaviors (biobehavioral science) can best advance nursing practice for individual (personal) health. A biobehavioral approach fits well with an ecological framework. Such a framework emphasizes understanding the reciprocal nature of body and mind and that it is the integrative behaviors of individuals in relation to their environments that drives health status.

According to this framework, health/illness status or health-related phenomena are seen to be a function of various contributing factors that can be classed as either person or environment factors.

Person factors are internal to individuals and in the framework are labeled as vulnerability/resilience factors. They are what make a person vulnerable to disease/illness or resilient or resistant to disease/illness. Such factors are present within or “internal” to the individual and can be unmodifiable such as genetic composition, age, and gender or modifiable such as knowledge, attitude, information processing style, among others.

The other set of contributing factors includes those elements that are classified as external to individuals, that are part of the environment in which humans live and constitute risks that threaten health or can be delineated more positively as resources that protect one’s health, such as social support, microorganisms, noise, food availability that can improve health.

Through research we measure these contributing factors, often doing descriptive studies, using quantitative or qualitative methods to determine the nature of the contributing factors. Human beings are variable and the pattern of contributing factors may vary among individuals or groups. Rather than determining the “cause” of illness or disease, in nursing, we are more inclined to characterize what elements “contribute” to explaining the variability across individuals. Contributing factors can be a target for interventions, in order to improve, preserve or promote health status.

Continuing with this framework, health/illness status is or health-related phenome-
na are determined (clinically judged) by assessing indicators (data) which fall broadly into three types. One type of data includes indicators that are physiological in nature, that is, they are physically detected and represent some aspect of physicochemical functioning.

The second category of indicators is labeled "experiential". These are assessed by what people tell us. They include reported thoughts, emotions, symptoms, drives or sensations.

The third category involves those indicators that are "behavioral", that is, they are detected as actions that individuals perform within their environments. They can be assessed by self-report or by observation.

In biobehavioral research, it is important to think about using indicators that utilize all three of these categories. It is the measurement across these domains that constitute "biobehavioral science".

Example of using the framework:

A doctoral student with a critical care background, who worked with me, was interested in studying the effects of patterns of external cooling for the control of body temperature following acute injury or surgery. He conducted a laboratory study of healthy people to determine what different patterns of cooling did to blood pressure, heart rate and body temperature (physiological). In thinking through the science of nursing according to the ecological framework and the practice domains of "reducing symptoms" and "promoting comfort", we expanded measures of "status" during cooling to include experiential ones, that is, discomfort and suffering. As well, we added the behavioral measure of shivering. The importance of enlarging the scope of "outcome variables" that were studied is that one could later test whether the physiological outcomes in response to cooling could be modified by nursing interventions for the experiential factors (e.g., better emotional support, coaching and anticipatory guidance) and/or the behavioral factors (e.g., adjusting cooling speed to reduce shivering).

According to this framework, it is through collecting data on physiological, experiential and behavioral factors, that we are able to interpret status and detect any changes in status that are due to naturally or imposed changes in the contributing person or environment factors. We can think of therapeutics as altering person factors, environmental factors, the individual's processing status (responses) or some combination of these aspects.

The Importance of a Biobehavioral Approach: Behaviors as the Interface of Person and Environment —The Stress Concept

Placing an emphasis on a biobehavioral understanding of "personal health" nursing practice fits well with changes in the American health care system. In the United States, a new paradigm is emerging for which the "over-emphasis" on disease/illness diagnosis and treatment is being balanced by an emphasis on disease/illness prevention and health promotion. It is more and more obvious that it is the interface of individuals with their environments that determines health status. How individuals interact and "behave" accordingly can promote disease/illness or promote health. The understanding of this interface is conceptually referred to as "stress". The "behaviors" of interest have been termed "lifestyle behaviors". These behaviors are the behaviors of living, e.g.,
sleep/waking
eating/fasting
thinking/creating
locomoting/recreating - breathing, walking/running,
procreating-sexual

Changing lifestyle behaviors is increasingly seen as important to the potential for preventing disease.

In the past, large numbers of nurses have worked in hospitals, solely with ill people, and fewer have worked in public health position. A growing number now work as nurse practitioners in community agencies and individual practices. They diagnose and treat individuals with common health problems, manage people with stable chronic illness, but do large amounts of disease screening, and health education for health promotion. Much of this practice has to do with helping individuals adjust their lifestyle behaviors and reduce stress. Research related to this aspect emerges as important.

**Stress and Health:**

Stress arousal/activation refers to a psychophysiologic state seen when individuals recognize challenges within their environment. Stress arousal or activation can be assessed according to the ecological framework through physiological indicators, most typically autonomic nervous system hormones of catecholamines (epinephrine, norepinephrine, and cortisol); experiential indicators such as reported distress or tenseness; and behavioral indicators such as either aggression or withdrawal.

Stress arousal/activation is not in and of itself negative for health. Actually, it's necessary to survival and growth. However, it can have negative health consequences if it is invoked often or for long durations - when there is constant challenge or the abilities to dissipate it are weakened or over-ridden. It is the ability to dissipate stress that governs its health consequences.

Stress arousal/activation has been studied most in relation to ANS function. However, it is becoming increasingly recognized that the stress axis - that is the hypothalamic/pituitary/adrenal axis - is interactive with the immune system and with systems such as the reproductive system.

We know that when environmental events are out of the ordinary, they are linked to disease/illness or negative health outcomes. Major life events that are novel, emotionally intensive, or uncertain provoke increased probability of illness. Investigators have found in retrospective studies that life events cluster in a 2-year period preceding onset of TB, heart disease, skin disease, hernia, and pregnancy. Others have shown that mounting life change is directly associated with sudden cardiac death, time of MI, occurrence of fractures, pregnancy, occurrence of leukemia in children, and deteriorating academic performance. Prospective studies have shown increased risk of illness with known emotionally challenging conditions such as bereavement, losses of any type, migration, retirement, and status change.

Environment events that are characterized by uncertainty, unpredictability and lack of control are likely to lead to stress activation and ultimately pathology. Factors that have been associated with cancer susceptibility are being lonely, nonagressive, without close parental affiliation, bereavement, disruptive family relationships, social isolation, unemployment.
Having marginal status in society or disrupted important social relationships has been associated with illness. In the US, there is evidence that people in lower social classes experience more emotionally painful life changes and more illness. As well, emotional stress, low education, poor housing and unemployment or lower level jobs might contribute to illness because of lifestyle factors such as diet, exercise, smoking etc. Depressed people sleep less, exercise less, have poorer diets, smoke more, and use alcohol and drugs more.

Recent work has linked stress activation with effects in the immune system. As scientists have begun to develop methods to probe the immune system and to understand its function, an appreciation for its role in defending against disease became more prominent. This has led to an enlarged view of the important aspects of what is associated with disease or health. New science fields are emerging such as behavioral neurochemistry, psychoneuroimmunology, sociobiology and chronobiology.

Negative immune changes (immunosuppression) have been linked to distress, especially negative mood and with personality characteristics such as high power motivation, pessimistic style, denial or minimization of distress, and emotionally charged life events such as separation and divorce. For example, perceived availability of social support and acute exposure to stress elements like noise, light, movement or housing conditions can suppress antibody production. Nursing scientists have linked immune changes with childbirth stress and with noise in rats.

There are many observations that stressful life events and low social support play a role in the onset of autoimmune diseases such as rheumatoid arthritis, systemic lupus erythematosus (SLE), but the mediating physiological processes have not been investigated. For example, suppression of the immune system has been shown to occur in the first 2 months following death of the spouse in widowers. However, changes such as exercise levels, nutritional intake, sleep and drug use could influence.

**Foundational and Innovative Science -Sleep as an Example**

In this talk, I have been arguing that the study of behavior using a biobehavioral approach is foundational to nursing science. Within the study of behaviors, there are several types of research that can be done. I will use sleep science to illustrate the types of science that are done in general and those relevant to nursing scientists. These types of research are applicable to the study of other behaviors.

1. Basic science is the study of the biological pathways that underlie behavioral state change from waking (alert state) to sleeping. Few nursing researchers do basic science research.

2. Epidemiological-type science takes the form of studying sleep patterns and sleep pattern changes related to aging and context in population groups, particularly young, old, gender-, and ethnic-specific groups and during transitions. Some nurses engage in this type of research. For example Evans and Rodgers, (1994), Floyd (1993) as well as Rediehs, Reis, & Reason (1990) have studied older adults, Shaver, Giblin, Lentz & Lee (1988) ; Shaver, Giblin, & Paulson,
have described sleep in midlife women, Mahon (1995) and Yarcheski (1994) have studied pre-teen and teen-agers. The effects of menstrual cycle, pregnancy, shift-work on women has been reported by several investigators including; Campbell, 1986; Lee, Shaver, Giblin & Woods, 1990; Mead-Bennett, 1990; Lentz & Killien, 1991; Lee, 1992; Lee & Dejoseph, 1992; Evans, Dick & Clark, 1995; Waters & Lee, 1996.

3. Sleep as a contributing factor to disease/illness or symptoms is being increasingly recognized as important for study. My own research is an example. I am conducting a study of sleep in women who have fibromyalgia. In reviewing the science about what might be contributing to this disorder which is diagnosed by signs and symptoms of generalized muscle aching, tenderness/ pain at specific body points, overwhelming fatigue and perceived poor quality sleep. Some data indicate that Growth Hormone might be deficient (daytime measures). Growth hormone is trophic to muscle and helps the immune system. Other data indicate that sleep stability might be a problem, and also dysphoria (depressed affect). Our data indicated that early sleep is lighter and more fragmented compared to women without fibromyalgia. This has led us to study sleep using physiological (polysomnography) and experiential (self-report) measures, and measure hormone patterns and immune status during early sleep. We also assess self-reported exercise (behavioral), mood state and environmental stress factors.

4. Effects of disease/illness, symptoms, or stress conditions on sleep/wake patterns is a type of research that has received significant study by nurses. This has included the Effects of ICU noise (Topf, 1992; Topf & Davis, 1993; Topf, Bookman & Arcand, 1996); post abdominal surgery (Closs, 1992); post cardiac surgery (Knapp-Spooner & Yarcheski, 1992; Williamson, 1992; Redeker, Mason, Wykpisz & Glica, 1996; Schaefer, Swavely, Rothenberger, Hess & Williston, 1996; Simpson & Lee, 1996; Simpson, Lee & Cameron, 1996; Zimmerman, Nieveen, Barnason & Schmaderer, 1996); renal dialysis (Parker, 1996); chronic fatigue and fibromyalgia (Schaefer, 1995, Shaver, Lentz, Landis, Heitkemper, Woods & Buchwald, 1997); Parkinson’s Disease (Dowling, 1995); cancer (Sheely, 1996); HIV (Cohen, Ferrans, Vizgirda, Kunkle, & Cloninger, 1996); and hospitalized adults and children (Lane & Fontaine, 1992, Holditch-Davis, Barham, O’Hale, & Tucker, 1995; Corser, 1996).

5. Sleep/waking patterns as symptoms - sleeplessness (insomnia) (Shaver et al.), or sleepiness and sleep deprivation (Landis, & Whitney, 1997, Landis, Savage, Lentz & Brengelmann, 1998) had been studied by only a few nursing scientists.

6. Sleep-Related Disease/Illness conditions include sleep apnea and narcolepsy and are also studied by only a few nursing scientists (Rodgers & Rosenberg, 1990; Rogers & Aldrich, 1993, Rogers, Aldrich & Caruso, 1994; Cohen, Nehring, & Cloninger, 1996).

7. Sleep as a Therapeutic has been little studied although some work is currently being done to determine whether sleep
enhancement can improve recovery from cardiovascular episodes (Simpson, unpublished).

8. Therapeutics for Sleep Improvement such as the use of sleep enhancing behaviors, e.g. sleep hygiene, body warming, sleep restriction, and relaxation have been studied infrequently. Some work has been done in young hospitalized children (White, Williams, Alexander, Powell-Cope & Conlon, 1990); infants (Becker, Grunwald, Moorman & Stuhr, 1993), hospitalized adults (Williamson, 1992); and in older adults (Johnson, 1991a & b, 1993; Dowling, 1996).

For the most part, studies in sleep science done by nursing scientists are addressed to understanding sleep related to health and illness. The most sustained study done by nursing scientists is done on vulnerable populations, i.e., those that are acutely ill, chronically ill, suffering from sleep disorders for which behavioral treatments are prominent (e.g., insomnia, narcolepsy). Also are studies of people who are in high risk environments (e.g., hospitals, high stress factors).

Within these populations and environments, intervention studies that combine modifying behaviors (based on contributing factors) and controlling the environment are needed. Studies of dose-response features of interventions, titration of intervention, timing, individualized responses and the factors affecting behavioral choice and adherence are also crucial. We need combined physiological and experiential (perceptual) and behavioral measures to determine the effects of interventions.

Science into the 21st Century:

As we approach the 21st century, new vistas are opening for nursing practice. The interactions of individuals with their environments constitute an important determinant of health status. Living within our cultures, be they Japanese or American, increasingly presents challenges and constitutes stress conditions. Stress activation has psychological (mind) and physiological (body) dimensions leading to negative effects when the stress provocations are profound or prolonged. Our lifestyle choices around food, exercise, sleep/rest and sexuality can protect against or hasten negative health changes. Helping people to avoid or manage stress activation and engage in healthy behaviors is crucial to overall health status. In order for nursing practice to be influential in restoring, maintaining or promoting health, it would be well that our science is based on biobehavioral understandings. I believe that this can be a solid basis for much innovation and creativity as we strive to advance our nursing leadership through science.

Reference List

immunodeficiency virus. Holistic Nursing Practice, 10 (4), 33-43.
Mead-Bennett, E. (1990). The relationship of primigravid sleep experience and
select mood on the first postpartum day. J Obstetrical Gynecological Neonatal Nursing, 19 (2), 146-52.


