Presentation Objectives

- Brief review of history of development of nursing scholarship
- Discussion of current priorities for nursing scholarship
- Review of select research activities related to nursing research priorities
- Discussion of what’s ahead – At least my best guess

Historical Perspective

“Look back to where you have been, for a clue to where you are going”

Florence Nightingale 1820-1910: A “Cliché”?

The pioneer of nursing

The woman with the lamp

In watching diseases... the thing which strikes the observer most forcibly is this, that the symptoms or the sufferings generally considered to be inevitable and incident to the disease are very often not symptoms of the disease at all, but of something quite different—of the want of fresh air, or of light, or of warmth, or of quiet, or of cleanliness, or of punctuality and care in the administration of diet, of each or of all of these.

Florence Nightingale, Notes on Nursing

[Nursing] has been limited to signify little more than the administration of medicines and the application of poultices. It ought to signify the proper use of fresh air, light, warmth, cleanliness, quiet, and the proper selection and administration of diet—all at the least expense of vital power to the patient.

Florence Nightingale, Notes on Nursing
Nightingale: The first statistician

- Developed the "polar area diagram" to dramatize the needless deaths caused by unsanitary conditions and the need for reform.
- Revolutionized the idea that social phenomena could be objectively measured and subjected to mathematical analysis.
- She was an innovator in the collection, tabulation, interpretation, and graphical display of descriptive statistics.

Cynthia Audain, Agnes Scott College, Class of 1988

100 years later...

Federal Government support for Nursing Research

- 1946:
  - Division of Nursing established within the Office of the Surgeon General, Public Health Service
- 1955:
  - First extramural nursing research program established in the Research Grants and Fellowship Branch of the Division of Nursing Resources, Bureau of Medical Services
  - NIH establishes the Nursing Research Study Section within the Division of Research Grants to review growing volume of grants.

Nursing Research at NIH

- April 16, 1986 – National Center for Nursing Research is established at NIH – Initial budget: $16 million
- June 14 1993 – NCNR is elevated to an NIH institute: The National Institute for Nursing Research is established
- 2007 budget: over $136 million

Major funding agencies for health related research

- US Department of Health and Human Services
  - National Institutes of Health (NIH) – With multiple institutes
  - Health Resources and Services Administration (HRSA)
  - Agency for Healthcare Research and Quality (AHRQ)
  - Centers for Disease Control and Prevention (CDC)
- Associations (American Heart Association, Alzheimer’s Association)
- Foundations (Robert Wood Johnson; John A. Hartford)
Health Resources and Services Administration (HRSA)

- **Vision:** Optimal health for all, supported by a health care system that assures access to comprehensive, culturally competent care
- **Mission:** Provide national leadership, program resources and services needed to improve access to comprehensive, culturally competent care

Agency for Healthcare Research and Quality

- **Mission:** To improve the quality, safety, efficiency and effectiveness of health care in America
- **2010 Budget Request:**
  - $251,750,000 increase in request for funding of Patient Centered Health Research
  - $25,000,000 decrease in funding for patient safety

National Institute for Nursing Research: Mission

To promote and improve health of individuals, families, communities and populations.

NINR supports and conducts clinical and basic research and research training on health and illness across the lifespan

National Institute for Nursing Research: Research Focus

- Preventing, delaying onset, and slowing progression of disease and disability including:
  - Health promotion and disease prevention
  - Improving quality of life
  - Eliminating health disparities
  - Addressing end of life issues
National Institute for Nursing Research: Research Strategies

- Integration of biological and behavioral sciences
- Employment of new technologies to research questions
- Improving research methods
- Developing future scientists

Research Strategy #1: Integrating Biological and Behavioral Science

- Define relationships between behavior and biology
- Implement behavioral interventions to achieve biological outcomes
- Intervene in biological processes to influence behavior

Biobehavioral research targets include

- Health promotion
- Disease progression
- Treatment decision making
- Ethical issues related to research participation
- Development of behavioral measures
- Identification of biological markers

Beyond understanding the priorities of funding agencies, you also need fresh, creative, and novel ideas

The most exciting phrase to hear in science, the one that heralds the most discoveries, is not: 'Eureka!' (I found it!), but: 'That's funny'

Isaac Asimov

Exercise Interventions to Improve Outcomes in Patients with Peripheral Arterial Disease
Background

- Peripheral arterial disease (PAD) is a progressive atherosclerotic disease, affecting over 8 million Americans.
- Symptoms of PAD are related to insufficient arterial blood flow, which results in debilitating, activity-induced, ischemic pain (claudication).
- Associated with major limitations in mobility and physical functioning, and decreased quality of life.
- Efficacy of treadmill training to improve walking distance in patients with claudication is well established.

What is the mechanism of improvement in walking distance?

- Local conditioning effect – changes in muscle metabolism stimulated by exercising specific muscles affected by limited blood flow.
- Systemic effect – changes in central cardiovascular conditioning and/or vascular function, leading to improved walking ability.
- Current prevalent paradigm is that inducing skeletal muscle ischemia during exercise is necessary to obtain benefit.

What about upper body exercise?

- Aerobic upper body exercise (arm ergometry) as an exercise alternative:
  - Pain-free and therefore may be better-tolerated.
  - Has potential systemic benefits for the lower extremity arterial system.
  - Doesn't create ischemia during exercise.
  - Exercise intensity is not limited by symptoms, but by level of cardiovascular conditioning.

Conceptual Framework

- Pathophysiological Changes: Claudication
- Cardiovascular: Coronary, peripheral, etc.
- Inflammation: Local, systemic
- Endothelial dysfunction
- Health and Functional Consequences
- Walking ability
- Functional status
- Quality of life
- Mood

Physiological Outcomes with Aerobic Training
- Functional outcomes
- Arm ergometry
- Treadmill walking
- Central and peripheral markers

Pilot Study #1

- Exercise Training for Claudication (ETC) Study:
  - To determine the relative efficacy of supervised treadmill training or arm ergometry alone, or in combination, versus 'usual care' in patients with claudication.
  - (Funding: American Heart Association Scientist Development Grant)
Subjects with lifestyle-limiting claudication pain

Exercise Training for Claudication (ETC) Study

- Pain free walking distance (PFWD) at 12 Weeks
- Maximal walking distance (MWD) at 12 weeks

**Study Procedures**

1. Informed Consent, Medical History
   - 2-3 weeks
2. Graded CP treadmill test #1
   - Screening Visit 1
3. Supervised Exercise
   - 3 sessions/wk
4. Graded CP treadmill test #2
   - Randomization
   - Exercise Training
   - 12 week Follow-up
5. Informed Consent, Medical History
   - 2-3 weeks
6. Graded CP treadmill test
   - 24 week Follow-up

**Exercise Groups**

- Supervised in the exercise laboratory 3 times/week for 12 weeks
- Sessions 70 minutes in length, 5 minutes warm-up, 60 minutes of exercise, 5 minutes cool down
- Volume of exercise designed to be similar in each exercise group
- Recording of daily exercise outside supervised setting

**Mean pain free walking distance**

- Baseline
- 12 Week*
- 24 Week*

*12 and 24 week values adjusted for baseline PFWD and unsupervised exercise
**p<.05 Arm ergometry versus control

**Mean maximal walking distance**

- Baseline
- 12 Week*
- 24 Week*

*12 and 24 week values adjusted for baseline MWD and unsupervised exercise
**p<.05 versus control (all exercise groups @ 12 weeks, arm ergometry & treadmill @ 24 weeks
**Pilot Study #2**

- Upper Extremity Aerobic Training for Severe Claudication and Critical Limb Ischemia
- To determine the effect of supervised arm ergometry to improve exercise capability, foot tissue oxygenation, walking ability in patients with severe claudication or ischemic rest pain (Funded by AHC Faculty Development Grant; Densford/Hartford Clinical Scholar Program)

**Background**

- Patients with severe PAD are often unable to engage in walking exercise due to activity-induced ischemic pain
- Blood flow can be severely limited such that transitioning from a seated to a supine position can cause a decrease in the tissue oxygenation of the foot (TcPO2), and thus ischemic rest pain
- The ETC Study demonstrated that arm ergometry improved walking distance in patients with mild to moderate claudication
- The efficacy of arm ergometry had not been demonstrated in PAD patients with more severe disease

**Participants**

- Inclusion Criteria
  - Resting ankle-brachial index (ABI) <0.5
  - Severe claudication or ischemic rest pain
  - Immediate revascularization not required or was not an option
  - No medical contraindications for exercise

**Study Procedures**

1-2 weeks

- Screening Visit
- Informed Consent, Medical History, ABI

3 sessions/wk

- Baseline Visit
- Walking test
- Exercise Training

12 week Follow-up

- Graded CP Arm Ergometry test
  - TcPO2 seated, standing, during arm exercise

**Change Before and After 12 Weeks of Exercise Training (n=7)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline Median (Range)</th>
<th>12 Weeks Median (Range)</th>
<th>Change: Median (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking Dist. (meters)</td>
<td>677.5 (662.2-814.6)</td>
<td>184.6 (69.9-288.6)</td>
<td>492.9 (218.8 to 1484.4)* Z=-3.4; p&lt;0.02</td>
</tr>
<tr>
<td>Upper Body Exercise Time</td>
<td>54.7 (9.0-21.4)</td>
<td>13.2 (22.8-27.6)</td>
<td>41.5 (3.5 to 9.0)*      Z=-2.4; p=0.02</td>
</tr>
<tr>
<td>Supine TcPO2 (mmHg)</td>
<td>28.0 (31-70)</td>
<td>58.0 (139-96)</td>
<td>30.0 (16-96)*           Z=-2.2; p=0.03</td>
</tr>
<tr>
<td>Resting Systolic BP</td>
<td>139 (105-194)</td>
<td>124 (100-140)</td>
<td>15 (1-54)*              Z=-1.36; p=0.18</td>
</tr>
</tbody>
</table>

**Case Study**

- 85 Year old white male presented with a history of severe claudication after 10 steps of walking and intermittent ischemic rest pain at night.

- Risk factors
  - 75 pack year smoking history
  - dyslipidemia
  - hypertension

- Medical history
  - Prior bilateral peripheral revascularization
  - Coronary artery bypass grafting.
  - Baseline right ABI= 0.44; left ABI=0.72.
Post-Exercise Training Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline to 12 week Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise Time</td>
<td>9 minutes (100%)</td>
</tr>
<tr>
<td>Walking Distance</td>
<td>107.2 meters (100%)</td>
</tr>
<tr>
<td>Change in TCpO2 Seated to Supine</td>
<td>-60 mmHg (-60 to 0)</td>
</tr>
</tbody>
</table>

Conclusions

• Both aerobic arm and walking exercise are effective in improving symptoms in patients with claudication
• Aerobic arm exercise is feasible and may be better tolerated in some patients with severe peripheral arterial disease
• Aerobic arm exercise may offer an exciting new approach for exercise in this population whose claudication limits their ability to exercise
• Further research is needed to better understand the mechanisms of improvement with exercise training and to develop optimal exercise interventions

EXercise Training to Reduce Claudication: Arm ERgometry versus Treadmill Walking:

R01 HL090854-01A1
PI: Diane Treat-Jacobson
Funded by NHLBI: 9/15/09-4/30/13

A Pilot Study of Cycling Exercise and Wound Healing in Diabetic ESRD Patients

PI: Patricia Painter, Ph.D., FACSM, UMN
Co-I: Amy Williams, M.D., Mayo Clinic
Co-I: Cindy Felty, R.N., Mayo Clinic
Co-I: Diane Treat-Jacobson, R.N., Ph.D

Background: The Problem

• Over 50% of patients with end stage renal disease (ESRD) in the U.S. have Diabetes Mellitus
• There is a 63% mortality rate over 2 years following amputation in patients with ESRD
• The problem of diabetic foot ulcer and lower extremity amputation is a major concern in patients with ESRD
Hypothesis

- Since cardiovascular exercise increases blood flow and oxygenation to the working muscles.
- It is, thus, reasonable to hypothesize that non-weight bearing exercise such as leg cycling may increase blood flow and thus improve oxygenation and healing of ischemic foot ulcers.

Specific Aims

1. To determine if patients with ESRD secondary to diabetes with ischemic foot ulcers can complete a 12 week program of cycling during the hemodialysis treatment.
2. To determine if changes in ischemic foot ulcer size can be detected in diabetic ESRD patients over 12 weeks of cycling exercise.
3. To determine if changes in physiological measures of oxygenation and perfusion can be detected in diabetic ESRD patients with ischemic foot ulcers over 12 weeks of cycling exercise.

Research Strategy #2: Adopting, Adapting, and Generating New Technologies

- Technologies will have an increasing role in scientific advances.
- New technology can help improve self-management, improve long-term symptom monitoring, increase application of telehealth, support design and testing of interactive web-based and wireless interventions to improve self-management and caregiver support.

Anxiety Self-Management for Patients Receiving Mechanical Ventilatory Support (NINR-funded R01)

PI: Linda Chlan, PhD, RN

Synopsis

- Patients who are on mechanical ventilators describe feelings of anxiety, fear, loneliness, even terror, as well as physical pain and difficulty breathing.
- This study is testing the effectiveness of music as a way for ICU patients on ventilators to alleviate stress.
- Exploring whether patients who are able to listen to music of their own choice, whenever they wish, have less stress and anxiety and are able to leave the ICU sooner than patients on ventilators who do not listen to music.
- Serendipitous findings are leading to new research directions.

Research Strategy #3: Improving Methods

- Development of biological and behavioral measures to:
  - Diagnose
  - Assess disease progression
  - Evaluate adherence and self-management
  - Evaluate treatment effects
- Development of common measures
- Sharing measures and methods used with diverse populations
- Meta-analyses, data pooling
- This requires collaboration of interdisciplinary teams.
Research Strategy #3: Improving Methods

- Promote utilization of multiple-level of analyses
  - Allow for varied types of data collection
  - Multiple analytic strategies
- Reflects the maturation of our field
- We recognize that the analytic strategies developed for use in basic science, pharmaceutical trials or large population-based epidemiological studies may not be sufficient for patient oriented clinical research.
- We have the opportunity to lead here!

“The real voyage of discovery consists not in seeking new landscapes but in having new eyes.”

Marcel Proust

Patterns of Pain Response following Exercise Training for Claudication

Outcome Measurement

- Graded, symptom-limited treadmill test
  - Start at 2mph, 0% grade
  - Increase 3.5% every 3 minutes up to 10.5% grade
  - Then increase speed by .5 mph every 3 minutes
- Claudication pain severity assessed every 30 seconds using claudication scale:
  - 0 (no pain) to 5 (maximal pain)

Outcome Assessment

- Walking distance and claudication pain are reassessed during treadmill exercise testing within 1 week of completion of training program using the claudication pain scale
  - Pain-free walking distance (PFWD) (1 of 5)
  - Maximal walking distance (MWD) (5 of 5)

Claudication Scale

<table>
<thead>
<tr>
<th>Pain Rating</th>
<th>Description</th>
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<tbody>
<tr>
<td>5</td>
<td>Severe Pain (can go no longer)</td>
</tr>
<tr>
<td>4</td>
<td>Moderate Pain</td>
</tr>
<tr>
<td>3</td>
<td>Onset of Pain (mild)</td>
</tr>
<tr>
<td>2</td>
<td>No Pain</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
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</tbody>
</table>
**Group versus individual response to an intervention**

- Describing the average response of the group gives information about overall status
- Important when determining the best strategies for a population
  
  However...
- Limiting analysis to descriptions of the group as a whole may miss different patterns of change
- Understanding of individual patterns of response may facilitate individualized interventions

**Interpreting Patterns of Change in Claudication Pain**

**Increased time walking with moderately severe pain**

**Delay in onset of pain**
**Summary**

- Patients with claudication have different patterns of change in pain escalation during walking in response to both ischemic (treadmill walking) and non-ischemic (arm ergometry) exercise training.
- Some of these patterns of change may be related to whether the stimulus for improvement is systemic versus local.
- Individuals in the treadmill walking group showed greater variability in patterns of response, which may be influenced by factors such as pain tolerance or baseline levels of disability.
- Better understanding of individual differences in response to exercise training and the predictors of these patterns could lead to more effective individualized treatment plans and better patient outcomes.

**Areas of Research Emphasis**

**Promoting Health and Preventing Disease**

- Biomarkers to assess disease risk and response to treatment
- Biobehavioral methods, measures, and intervention strategies to optimize health
- Factors that influence decision-making related to positive behavior change
- Individual and family interventions to sustain health-promoting behaviors
- Interventions with community-based approaches

**Improving Quality of Life**

- Self-management
  - Self-identification of symptoms
  - Self-promotion of healthy lifestyle choices
  - Define behaviors that promote adherence to treatment for complex acute and chronic illness
  - Evaluate factors that impact independence and self-care in long term care settings
  - Identify strategies for self-management and promotion of personal health in chronic disease and disability
Improving Quality of Life

- Symptom management
  - Delineate causative mechanisms underlying symptoms
  - Improve recognition of symptoms
  - Develop interventions that improve patient response and adaptation to symptoms
  - Design strategies to improve management of symptoms
  - Develop strategies for assessment and intervention to improve health-related quality of life in persons with chronic or life-threatening illnesses

- Caregiving
  - Design interventions aimed at improving physiological and cognitive function in long-term care residents
  - Develop interventions to improve quality of caregiving
  - Evaluate factors that impact quality of life of informal caregivers and recipients.
  - Identify factors that improve transition from one setting to another
  - Develop models for first responders

Eliminating Health Disparities

- Elucidate mechanisms underlying disparities and design interventions to eliminate them
- Design culturally appropriate interventions to communicate risks and susceptibility to at-risk populations
- Develop strategies to reduce long term adverse consequences of poor maternal and reproductive health in minorities and underserved populations

Setting Direction for End-of-Life Research

- Identify factors that influence and develop strategies to improve decision-making and treatment strategies at the end of life
- Develop interventions to improve palliative care and enhance quality of life for the dying patient
- Support development of informatics tools that will facilitate the integration and analysis of data from end-of-life studies

What does the future hold?

How can we best position ourselves for the next decade
Societal Trends

- Aging population
- Increase in chronic conditions at younger ages
  - These are conditions that can often be managed by the things that we do best
- Obesity epidemic, fueled by diet and sedentary lifestyle
- Extended life expectancy, leading to a critical need to address end of life issues
- Need to change the way we deliver health care

Nursing Scholarship in the next decade and beyond

- Will reflect the priorities of the funding agencies
- Patient-centered (family, community)
- Interdisciplinary – with the benefit of multiple perspectives to identify creative strategies to address complex problems
- Will be focused on disease prevention and health promotion and management of chronic conditions
- Develop new models of care
- Address end of life issues

We must continue to develop and disseminate our nursing science

- Disseminate our knowledge across disciplines
- We cannot limit our dialogue to those who already agree with us – we cannot only talk amongst ourselves
- We need to be able to communicate our ideas and perspectives to our colleagues in other disciplines so that they can understand and appreciate them.
- We need to be at the table

From Research to Practice to Policy

- Promote the link between knowledge developed and implementation into practice and policy
- Disseminate our knowledge so that effective therapies and care strategies are recognized and reimbursed

We as a society need to be better at promoting health, disease prevention and effective management of chronic conditions, including mental health conditions

We will continue to develop better ways to do that

We as a society need to develop new models that provide seamless, patient-centered, efficient, less expensive, effective care

We should develop strategies to test new models of care
We as a society need to more effectively manage end-of-life care and decision making in both long-term care and acute care settings. We are better equipped than any other discipline to lead this critical endeavor.

This is our opportunity. We are challenged to lead the advancement of health care through the next decade and beyond. We should accept the challenge.