AGING AND WELL-BEING: PHYSICAL ACTIVITY AND PERSONAL AGENCY

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University of Illinois – Chicago, Institute for Health Research and Policy, Distinguished Lecture, April 22, 2010
Lecture Overview

- Aging in America
- Aging and Physical Activity
- Physical activity and Well-Being/QOL
- Social Cognitive Theory: Self-Efficacy
- Self-Efficacy Links to Physical, Mental, and Cognitive Health Status
- Closing Remarks
Aging in America

- "For the rest of human history, there are going to be more old people than young..."

Joel Cohen, Professor of Population Sciences, Rockefeller and Columbia Universities
Worldwide Growth in Over 65s Due to Boomer Generation

Exhibit 5: The pace of aging will accelerate.

Total number of persons age 65 or older, by age group, 1900 to 2050, in millions

Note: Data for the years 2000 to 2050 are middle-series projections of the population. Reference population: These data refer to the resident population. Source: U.S. Census Bureau, Decennial Census Data and Population Projections.
Baby Boomers Turn Sixty...

Don't trust anyone over eighty.

Time is on my side.

1968 Peace!

2006 Can I get some peace and quiet??

I'd like to score some drugs... I mean, get my prescription refilled.

Turn this off!

Pharm Hours 9am-5p
Proportion of 50-Year-Old Men and Women Who Survive To Age 90 and Older, U.S.
“See, the problem with doing things to prolong your life is that all the extra years come at the end, when you’re old.”
Physical Activity and Aging

- Walking in the US population:
  - 20% never walk
  - 46% walk occasionally
  - 34% walk regularly (30+ min/day, 5+ days/wk)

Percentage of people age 45 and over who reported engaging in regular leisure time physical activity, by age group, 1997-2002

Note: Data are based on 2-year averages. "Regular leisure time physical activity" is defined as "engaging in light-moderate leisure time physical activity for greater than or equal to 30 minutes at a frequency greater than or equal to 5 times per week, or engaging in vigorous leisure time physical activity for greater than or equal to 20 minutes at a frequency greater than or equal to 3 times per week."

Reference population: These data refer to the civilian noninstitutionalized population.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.
Wyatt et al. (2005). *MSSE*
7 million Americans aged 65 and older need assistance with some basic ADL
- Insufficient PA
- Living longer but not necessarily better lives
- Increased susceptibility to chronic health conditions
- Result is functional disability, reduced health status, depression, social isolation etc.
- Compromised Quality of Life
Defining Quality of Life

- Multiple definitions and measures (300+)

- Biomedical and Behavioral Medicine Perspective

- Health-Related Quality of Life (HRQL)
  - Typically measures of health status (physical, mental, cognitive)
Defining Quality of Life

- QOL as a global construct – evolved from happiness and subjective well-being

- Subjective interpretation of whether needs, desires, goals, have been satisfied (Lawton, 1975, Frisch, 1998)

- QOL as Satisfaction with life
Living Longer and Living Better: The Role of Physical Activity

Physical Activity

Cognitive and Emotional Function

Social, Physical Recreational Function

Quality of Life
Does PA Influence QOL?

- Bize et al., (2007)
- McAuley & Morris (2007)
- Netz et al. (2005)
- Rejeski & Mihalko, (2001)
- McAuley & Elavsky (2005)
- Courneya (2001; 2003)
- Spirduso & Cronin (2001)
- Schechtman, Ory, et al. (2001)
Reviews suggest that:

- PA consistently related to QOL
- Relationship is weaker in older adults already functioning at or above norm
- Psychosocial factors may influence global QOL
- Personal agency as a mediating variable?
Beliefs in capabilities to successfully execute a course of action

Considered to be the key element or “active agent” in behavior change process

The most important pre-requisite for behavior change and behavioral outcomes
Key Sources of Efficacy Information

- Past performance accomplishments (mastery experiences)
- Vicarious experience (social modeling)
- Social persuasion
- Interpretation of affective and physiological states
Self-Efficacy Influences on Behavioral Components

- Overt Behavior (performance)
- Behavioral choice
- Effort Expenditure
- Persistence
- Physiological and Affective responses
Does self-efficacy play a role in the effects of physical activity on health status?

- Physical health status (functional limitations)
- Mental health status (depression and fatigue)
- Global QOL (mediating roles of HRQL)
- Cognitive health status (brain structure, cognitive function, and efficacy)
PA has a protective effect on functional limitations (Keysor, 2003)

Functional performance and functional limitation are not isomorphomic (Stewart, 2003)

Self-efficacy is a proximal outcome of physical activity that may mediate effects on functional performance and limitations
Physical Activity, Aging, and Functional Limitations (McAuley et al., 2006, 2007 JGPS, JAGS)

- 24 month prospective study of 249 older women

- Multiple indicators of
  - Physical Activity (PASE, CHAMPS)
  - Self-Efficacy (Exercise, Balance)
  - Functional Performance (Up-Go, Stairs, 7-m walk, obstacle walk)
  - Functional Limitation (LL-FDI – advance and basic lower extremity function, upper extremity function)
Relationships Between Physical Activity and Functional Performance and Limitations
How does self-efficacy modify these relationships?
Associations Among 24-Month Change in Model Constructs

Physical Activity

Balance Self-Efficacy

Exercise Self-Efficacy

Functional Performance

Functional Limitation

.12

.12

-.12

-.10

-.23

-.18

.30
Implications

Protective effect of physical activity on physical health status can be explained, in part, by self-efficacy levels.

Functional performance is a separate step in disablement process.

Lifestyle (PA) and Psychosocial (SE) factors implicated in functional limitations … these are modifiable!
Mental Health Status: The Case of Fatigue in Diseased Populations

- Prevalence of Fatigue in:
  - Breast cancer (BC) – 70-99%
  - Multiple sclerosis (MS) – 75-99%

- Compromises QOL

- Potential of physical activity to reduce fatigue via psychosocial pathways

- Depression
  - Related to both fatigue and physical activity

- Self-efficacy
  - Reciprocal relationship with physical activity behavior
  - Associated with both fatigue and depression independently
Hypothesized model:

PA = Physical Activity; SE = Self-efficacy; DEP = Depression

PA → SE → DEP → Fatigue
Sample and Measures

- **Study 1: Cross-sectional sample of BCS (N=192)**
  - Measures
    - Physical Activity: Godin Leisure Time Exercise Questionnaire (GLTEQ)
    - Self-efficacy: Roger’s Task Specific Self-efficacy for Exercise Scale
    - Depression: Center for Epidemiologic Studies Depression Scale (CES-D)
    - Fatigue: Functional Assessment of Cancer Therapy- Fatigue (FACT-F)

- **Study 2: 6 month longitudinal sample of persons with MS (N=292)**
  - Measures
    - Physical Activity: Actigraph accelerometer
    - Self-efficacy: Exercise Self-efficacy scale
    - Depression: Hospital Anxiety and Depression Scale (HADS)
    - Fatigue: Fatigue Severity Scale (FSS)
Results: Breast Cancer

\[ \chi^2 = 1.48, \text{ df } = 2, p = .45; \text{ SRMR } = 0.03, \text{ CFI } = 1.00 \]
Results: Multiple Sclerosis

\[ \chi^2 = 25.86, \text{ df} = 18, \quad p = 0.10; \quad \text{SRMR} = 0.01, \quad \text{CFI} = 0.99 \]
Implications

- Self-Efficacy mediates physical activity effects on mental health status
- Preliminary evidence for a psychosocial model of the PA-Fatigue association
- Importance of the primary “active agent” (self-efficacy) being modifiable
- Potential for disease-related fatigue being reduced by promoting physical activity
- Roles played by other correlates of fatigue (Cortisol, CRP, T-cell levels, body composition)?
Is HRQL a Pathway to Global QOL or Are They the Same Thing?

Are There Other Pathways to HRQL and QOL?

- Proximal and distal physical activity outcomes
- Self-efficacy as a potential mediator of PA effects on HRQL and QOL
Is HRQL a Pathway to Global QOL or Are They the Same Thing?

Pathways from PA to HRQL to QOL

PA → S-E → MHS → SWLS → PHS

Baseline:


24 months Changes

PA and QOL

- PA associated with HRQL and QOL
- Role of Proximal and Distal PA Outcomes
- Self-efficacy and HRQL as pathways from PA to global QOL
- Not clear how other aspects of function may play a role (e.g., social, cognitive)
Early epidemiological work suggests an association between higher levels of efficacy and maintenance of cognitive function (Berkman et al., 1993; Albert et al., 1995).

- Relatively crude measures of cognition and efficacy
- Increasing body of work linking fitness and brain structure and function
- Is self-efficacy independently associated with brain activity and cognitive function?
Aging and Cognitive Function: All Down Hill After 30!

Schaie, et al., 2004

Park et al., 2001
Physical activity and fitness have been implicated in improved cognitive function.

Equivocal literature

In humans, effects appear greater for particular types of function:

- Executive control – planning, scheduling, interference control, working memory, etc.

McAuley, et al., (2004): *Brain, Behavior & Immunity*
Exercise training improves cognitive function in older adults

Colcombe & Kramer, 2003
Fitness Training and Attentional Control

Colcombe et al. (2004). *Proceedings of the National Academy of Sciences*
This work generated a lot of press!

Our proudest moment?
Exercise and Brain Function

Saturday Night Live’s “Weekend Update”
Exercise and Brain Function

This Week, Researchers at the University of Illinois Reported that Exercise Improves Brain Function
Unfortunately, there are some exceptions...
Toward a Social Cognitive Neuroscience of Physical Activity

- Little efforts made to link efficacy, cognition, and brain in the context of physical activity and fitness
- Two questions
  - What are the contributions of efficacy and fitness to improvements in cognitive function brought about by exercise training?
  - What are the relationships among fitness, brain structure and “memory efficacy”?
Objectives

- To determine associations among brain structure (hippocampal volume), cognitive performance (spatial working memory), fitness, and “memory efficacy” (frequency of forgetting).
- Are other correlates of cognitive function (age, BMI, physical activity, education, sex) implicated in memory problems, are they simply “nuisance variables”, or sources of fitness?
BMI, Age, Sex, Physical Activity are determinants of fitness

Fitness is associated with brain health (greater integrity of the hippocampus)

Hippocampal volume in turn associated with better spatial memory and, in turn, lower frequency of forgetting

Path analysis within a covariance framework
Procedure and Measurements

- All assessments completed at baseline of a 12 month exercise intervention
- Sample
  - 165 older adults (\(M\) age = 66.14).
- Hippocampal volume
  - MRI and VBM analysis
- Spatial working memory (Greenwood et al., 2005)
- Frequency of forgetting (Zelinski & Gilewski, 2004)
- Body Mass Index (BMI)
- Physical activity
  - PASE (Washburn, Smith, Jette & Janney, 1993)
- Cardiorespiratory fitness
  - Physician supervised GXT
Spatial working memory task

1 sec  500 ms  3 sec  2 sec

Remember locations

Match or non-match

Erickson et al., 2009
$\chi^2 = 18.76, \text{ df} = 14, \text{ SRMR} = 0.04, \text{ CFI} = 0.98$
Conclusions

- Sex, physical activity, and BMI:
  - determinants of cardiorespiratory fitness rather
  - not nuisance variables
  - not directly related to memory
- Fitness has indirect effects on self-reported memory problems via hippocampal volume and spatial working memory
- First study to examine the proposed behavioral, physiological, brain structure, and cognitive influences on subjective memory complaints
If Frequency of Forgetting is “memory self-efficacy,” preliminary evidence to suggest a link from fitness and brain regions to efficacy

Are changes across time in these constructs related … watch this space

Question as to whether this is self-efficacy
Possible Pathways from Physical Activity to Quality of Life
Physical Activity

- Physical Function
- Psychosocial Function
- Cognitive Function

  - Physical Health Status
  - Mental Health Status
  - Quality of Life

McAuley & Morris, 2007
Acknowledgement

- National Institute on Aging Grant # AG18008, AG12113, AG20118, AG25667
- Khan Professorship in Applied Health Sciences
- Institute for Study of Aging
- Current and former graduate students and colleagues at UIUC