

Exercise for chronic stroke survivors: A policy perspective

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Abstract—Evidence is growing on the efficacy of exercise models for improving multiple domains of physiological health and fitness in people with chronic stroke. The Adaptive Physical Activity exercise program in Italy illustrates how geographic dispersion can increase access to such programs. A partnership between local agencies of the Veterans Health Administration and Administration on Aging suggests ways to increase access to exercise programs for veterans and other citizens with chronic stroke in the United States. The use of a structure-process-outcome framework is suggested to facilitate exchange between international research teams regarding development of evolving stroke exercise models.

Key words: chronic disease, community-based programs, exercise models, health promotion, international best practice, older adult, rehabilitation, research framework, stroke, translational research.

INTRODUCTION

Insight is increasing into the physiological mechanisms activated through exercise rehabilitation in chronic stroke, and evidence is mounting on the efficacy of exercise models for improving cardiovascular health and physical fitness [1–3]. Benefits for bone health [4], ambulatory function [2,5–6], and depression and social isolation associated with stroke [7] have also been reported. From a policy perspective, the news that therapeutic exercise models for chronic stroke led to improved

health outcomes in multiple domains highlights the potential for reductions in healthcare use and costs for treating stroke (**Figure**). Stroke is a leading cause of disability and death in the United States [8]. Stroke-related medical costs in the United States are estimated to be around \$58 billion in 2006 [9], and the total cost of ischemic stroke between 2005 and 2050 is projected to exceed \$2.2 trillion [10]. In addition to societal costs, for people and families living with chronic stroke, personal costs are also significant [11–12]. Stroke-related impairments reduce mobility and foster a sedentary lifestyle that has been associated with further functional decline [13–14], social isolation, and depression [15–16].

The urgency in identifying and testing innovative strategies that have the potential to improve health outcomes and reduce costs for chronic stroke is driven by the demographics of an aging population—approximately

Abbreviations: AoA = Administration on Aging; APA = Adaptive Physical Activity; AUSL 11 = Local Health Authority 11 (Empoli, Italy); GRECC = Geriatric Research, Education, and Clinical Center; ICF = International Classification of Function, Disability and Health; ISS = Istituto Superiore di Sanità; NIH = National Institutes of Health; OoA = Office on Aging; VHA = Veterans Health Administration; WHO = World Health Organization.

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DOI: 10.1682/JRRD.2007.02.0027

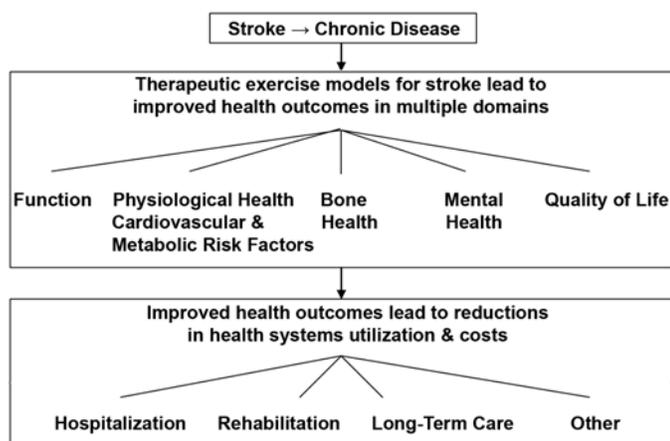


Figure.
Potential impact of therapeutic exercise models for chronic stroke.

three-quarters of a million people in the United States experience a stroke each year and this number is expected to double over the next 50 years as our population ages [17]. With chronic illness accounting for 78 percent of national health expenditures [18], disease management has become a focus for cost containment [19] and Medicare demonstrations [20]. The World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention, citing strong scientific evidence regarding the benefits of exercise in reducing the risks of chronic disease, have urged that physical activity programs be considered integral to the prevention and management of chronic disease [21–22].

This article considers how exercise models for chronic stroke might be translated into community-based programs to provide geographic access for stroke survivors. In addition, we discuss the need for a common research framework to evaluate the outcomes of community-based stroke exercise models and suggest sample variables for such a framework.

TRANSLATING EXERCISE MODELS INTO COMMUNITY-BASED ACCESS—ITALIAN ADAPTIVE PHYSICAL ACTIVITY PROGRAM

A key question from a policy perspective is how to translate growing evidence on the potential of exercise in chronic stroke rehabilitation into an effective network of services for stroke survivors. In this context, the experi-

ence of Local Health Authority 11 (AUSL 11) in Empoli, Italy, can be useful. In the Italian health system, local health authorities such as Empoli's AUSL 11 receive a fixed budget to provide or pay for the services required by a geographically defined population.* Italy has one of the oldest populations among developed countries. With a population of 221,787 in Empoli, 22 percent are over age 65.* The considerable financial pressure associated with chronic disease has encouraged leadership in Empoli's AUSL 11 to develop and implement the Adaptive Physical Activity (APA) program, an innovative model using exercise for chronic disease prevention and management. In just over three years, APA has been extended to serve over 2,300 people with one of four chronic conditions (back pain, flexed posture, Parkinson disease, and stroke); in January 2007, 168 classes were operating at 54 activity sites. To our knowledge, this network constitutes the largest community-based exercise program in the world established specifically for chronic disease prevention and management.

Another article in this issue by Macko et al. reports methods and findings from the pilot safety study for the stroke APA program. In the pilot, prospective participants were assessed pre-APA with repeated baseline measurements to establish the stability of their neurological status, and then assessed again less than 1 week post-APA training. Assessment instruments used in the Italian study included the Motricity Index, 6-minute walk, Berg Balance test, Short Physical Performance Battery, Barthel Index, Lawton Instrumental Activities of Daily Living Scale, Stroke Impact Scale, Mini-Mental State Examination, and Geriatric Depression Scale. For a full discussion of the APA pilot, please refer to the article, "Adaptive physical activity improves mobility function and quality of life in chronic hemiparesis," on page 323 of this issue [2].

Dr. Francesco Benvenuti, Director of the Department of Rehabilitation and Frailties, AUSL 11, reports that over 200 people now participate in 17 stroke APA classes.† Stroke APA participants attend classes three times a week in community gymnasiums. Physical therapists from AUSL 11 train the gymnasium instructors in protocols for

*Dr. Donato Papini, AUSL 11, Empoli, Italy. Personal communication, 2002.

†Dr. Francesco Benvenuti, Director of the Department of Rehabilitation and Frailties, AUSL 11. Personal communication, January 29, 2007.

the stroke APA and regularly observe stroke APA classes being conducted in local gymnasiums to ensure treatment fidelity. General practitioners in Empoli refer stroke patients with medical clearance for participation. During the research pilot studies, a physician and physical therapists working for the health authority evaluated each referred subject to determine whether they met criteria for participation in the research study and to obtain baseline and follow-up data. However, if Empoli residents have approval from their personal physician, they can participate in the local APA program even if they do not meet criteria to participate in a stroke APA research study.

APA programs are held during the day, at “off hours” in the local gymnasiums. This strategy has enabled the health authority to keep prices low and to obtain wide geographic dispersion for gymnasiums (thereby reducing travel time). AUSL 11 established this plan to facilitate general access to the community exercise program, in which people pay for themselves and must arrange their own transportation. Interaction among participants also reduces social isolation and reinforces continuing adherence to the exercise program.

COLLABORATION BETWEEN VETERANS HEALTH ADMINISTRATION AND OFFICE ON AGING OFFERS AN OPTION FOR TRANSLATING APA INTO U.S. CONTEXT

The APA program was implemented in Empoli as part of a translational research initiative under an international agreement between the National Institutes of Health (NIH) in the United States and its counterpart, the Istituto Superiore di Sanità (ISS), in Italy. The Veterans Health Administration (VHA) Rehabilitation Research and Development Center of Excellence in Exercise and Robotics for Neurological Disorders in Baltimore, Maryland, provided technical assistance in design and evaluation of the Empoli stroke APA program.

The Center of Excellence in Baltimore is linked to one of the 21 national VHA Geriatric Research, Education, and Clinical Centers (GRECCs). GRECCs were initiated by the VHA in the mid-1970s as a research and dissemination strategy “to focus attention on the aging veteran population, to increase the basic knowledge of aging, to transmit that knowledge to healthcare providers, and to improve the quality of care to the aged.” Part of the mission of a GRECC is transporting successful mod-

els of care into widespread practice in the VHA system as well as the wider community [23].

The contribution that VHA investment in research and translation makes to a high-quality, low-cost health system for veterans is growing in recognition. The VHA runs the largest healthcare system in the United States, with over 1,400 hospitals, community-based outpatient clinics, and nursing homes [24]. For the past 6 years, VHA hospitals have scored higher than private facilities on the University of Michigan’s American Consumer Satisfaction Index, and the VHA recently received Harvard University’s Innovation in American Government Award. Veteran eligibility is based on placement into one of eight priority groups [24].

Those of us from the VHA who observed the success of the Italian APA program have been compelled to consider how the VHA might facilitate development of a similar community-based network in the United States. Widespread geographic distribution of stroke exercise programs is needed to facilitate access for all veterans—indeed, for all Americans. One promising option involves partnerships between the VHA, the Administration on Aging (AoA), and their respective local affiliates.

The overarching mission of the AoA is to develop a comprehensive, coordinated, cost-effective system of long-term care that allows the elderly to remain in their homes and communities as long as possible. Specifically, AoA provides preventive health services that disseminate information on the importance of physical activity, proper nutrition, and active social engagement in preventing chronic disease. Established through passage of the Older Americans Act of 1965, the AoA carries out its mission through a national network of public and private organizations. As part of a Federal, state, local, and tribal partnership called the National Network on Aging, 7 million elderly are served through 56 State Units on Aging and 655 Area Agencies on Aging. A major priority is to help the elderly stay active and healthy. To meet this goal, AoA supports the development of programs that help the elderly adopt and maintain physically active lifestyles. Particular emphasis is on applying research findings to community systems and developing and testing new models that benefit the elderly and their caregivers. AoA services are typically provided in local senior centers [25].

APA PILOT FEASIBILITY PROJECT PLANNED FOR MARYLAND

In Maryland, where the population is around 5 million with 11.3 percent age 65 and over [26], 112 senior centers statewide are operated by the Maryland Office on Aging (OoA) in conjunction with 24 local counties [27]. We approached the OoA in Howard County, Maryland, to ascertain interest in piloting a stroke APA program similar to the one in Empoli. The Howard County OoA was selected because innovative county leadership had already demonstrated an openness to learning from international models and a commitment to implementing empirically grounded practices in chronic disease management [28]. Interestingly, the population size of Howard County is very similar to that of Empoli, although the percentage of people age 65 and over is very different (7.5% in Howard County [26] versus 22% in Empoli^{*}).

In October 2006, a team from the Baltimore GRECC, the Howard County OoA, and the NIH made a site visit to see the APA program in Empoli.[†] The team spent a week in Empoli reviewing data from the community studies, observing classes, and talking with medical leadership, physical therapists, local gym instructors, and participants. The conclusions reached by the research team were positive.[‡]

^{*}Dr. Donato Papini, AUSL 11, Empoli, Italy. Personal communication, 2002.

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Howard County has nine senior and/or “Senior Plus” centers. Senior Plus centers offer programming specifically for the frail elderly, with activities (including exercise programs) supervised by professional staff and adapted to an individual’s level of ability. Cost to participants is established with a sliding payment scale based on ability to pay. At one senior center, a stroke support group meets every other week. A community feasibility study for a stroke APA program in two Howard County senior centers is planned for 2008. Plans are also under way to extend the stroke APA program to a VHA community-based outpatient clinic.

FACILITATING MODEL DEVELOPMENT: NEED FOR COMMON FRAMEWORK

Along with illustrating how geographic access can be extended to community-based chronic stroke exercise programs, the APA case study serves as one example of the range of high-quality stroke research programs currently occurring worldwide. The cultural and healthcare settings, program staff, protocols, and outcome goals vary widely across these sites, even for programs within single countries [29–31]. To facilitate the comparison of sites and the development of evidence-based policies, researchers need to assess and describe their programs with greater precision [32], using a consistent framework and standardized outcomes.

Donabedian’s structure-process-outcome model may serve as one such framework that assists in the comparison of programs. This model defines structure as the healthcare or rehabilitation setting and care “instrumentalities” [33, p. 694]. Process refers to the treatment practices and procedures, including the coordination and acceptability of the care. Outcomes may be conceptualized “in terms of recovery, restoration of function and of survival” [33, p. 692].

[‡]Starr Sowers, Director of Howard County Senior Centers, gave the following assessment: “We can get this going without special equipment, and we know that APA is safe and gets results. We have people who have been in the community 10 to 15 years with stroke. APA is consistent with our objectives of encouraging self-management, self-actualization, and independence for people aging with chronic diseases. Our goal is to put the client at the center of a web of support services that enables them to maintain independence in the community as long as possible.” (stroke APA planning meeting, Howard County, Maryland, January 17, 2007).

The WHO International Classification of Functioning, Disability and Health (ICF) adds social participation as a critical outcome, defining the three types of outcomes as body structure/function, activities, and participation [34–36]. For policy purposes, health services use and costs are also important outcomes [37]. The **Table** provides sample variables to be considered in the formation of structure-process-outcome models of chronic stroke exercise programs.

Attention to outcome measures is particularly important for policy development. More than 20 stroke-specific standardized assessment tools correspond to the ICF [34–36]. Although they measure many similar ideas, each instrument has its own psychometric strengths and weaknesses [34–36,38] and each “functional outcome measure is its own separate yardstick”; i.e., separate instruments measuring similar concepts are not necessarily comparable [39, p. 340]. Researchers who wish to inform health policy and promote the community implementation of successful research programs should carefully select standardized outcome measures that are appropriate across international sites and, to the extent feasible, rep-

resent the full range of outcomes listed in the **Table**. In addition, further discussion between policy analysts and stroke researchers is critical to creating a set of recommended core measures from among the 20 major instruments that would represent the components of the ICF and that could easily be implemented in culturally distinct research settings [40].

CONCLUSIONS

Networks of effective community-based exercise programs for chronic stroke can potentially improve health outcomes while reducing annual healthcare costs by playing a vital role in chronic disease prevention and management for an aging population. The stroke APA program in Italy demonstrates the feasibility and efficacy of such a network. However, widespread geographic dispersion of exercise facilities is a precondition, and access is considered a key factor in the success of the Italian APA program.

Table.

Sample structure-process-outcome variables in chronic stroke exercise model.

Structure Variables	Process Variables	Outcome Variables
Number of participants.	Program characteristics, including detailed protocol, social reinforcement mechanisms, and use of “homework.”	Body structure/function, including metabolic physical fitness and mental status.
Participants’ demographic characteristics, including age, sex, ethnicity, type of stroke, comorbidities, previous stroke history and disability, length of time from previous stroke, other exercise participation, functional level at time of program entry, social support, and self-efficacy beliefs.	Instructor characteristics, including motivational techniques.	Activities, including balance and motor skills and activities of daily living.
Facility characteristics, including public vs private, community vs hospital, travel time, means of travel, and additional services provided in facility.	Timing of assessments.	Participation, including instrumental activities of daily living, social participation, and quality of life.
Program characteristics, including equipment used, time of day offered, classes per week.	Coordination with primary care providers or chronic care management system.	Health services use and costs, including hospital, primary and specialty care, and pharmacy use.
Instructor characteristics, including training and experience with stroke patients.	Additional services offered to program participants, including social services and diet- or disease-management classes.	Program costs, including participant fees, instructor and equipment costs, facility charges, and transportation expenses. Adverse outcomes, including overall fatality rate and falls or injuries during program participation.

VHA facilities—hospitals, community-based outpatient centers, and nursing homes—offer possible sites for stroke exercise programs but additional community penetration is needed. To expand access, the VHA needs partners at the local community level to promote and provide programs such as the stroke APA.

The partnership described previously, between local affiliates of the VHA and the AoA, represents an important step in translating research findings on exercise benefits for people with chronic stroke into community-based networks in the United States to extend access to all veterans—indeed, to all citizens—living with chronic stroke.

The use of structure-process-outcome models in discussions of chronic stroke exercise research would help provide the systematic details required for policy analyses and program implementation across locations. The increasing evidence that both the structure and process of stroke rehabilitation correlate with health outcomes suggests that such details may critically influence the successful translation of research into international practice [41].

ACKNOWLEDGMENTS

We would like to thank the John E. Fogarty International Center and the Center for Medical Rehabilitation Research of the NIH for their support. We would also like to acknowledge our collaborators at the OoA in Howard County, Maryland, especially Phyllis Madachy and Starr Sowers, and our Italian collaborators and colleagues with the ISS in Rome, Italy, especially Velio Macellari, and at AUSL 11, Empoli, Italy, especially Francesco Benvenuti, MD; Alessandro Reggiani; Enrico Rocatto, MD; and Antonia Taviani, MD.

This material was based on work supported in part by Center of Excellence in Exercise and Robotics for Neurological Disorders, “Translational research for task-oriented exercise in chronic stroke,” grant B-3688R, as well as resources and facilities at the Baltimore GRECC, the Exercise and Robotics Center for Excellence, the Claude D. Pepper Older Americans Independence Center, and the University of Maryland, Baltimore County.

The authors have declared that no competing interests exist.

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Submitted for publication February 5, 2007. Accepted in revised form June 26, 2007.