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## CENTENNIAL SYMPOSIUM PAPER

# Functional Motor Skills Measurements in Older Adults: Implications for Home Care Service Delivery<sup>1</sup>

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**ABSTRACT.** The maintenance of motor skills is critical to the preservation of the independence of older adults. Because subjective differences have been observed, selected motor skills of older adults attending the Slippery Rock University Elderhostel (EH) and the Senior Centers (SC) of Butler County, PA, were compared. While no differences were identified between Elderhostel and Senior Center participants on the measurements of flexibility, card sorting, penny pick-up and coordination, statistical differences did emerge for grip strength, arm curl, and agility. The Elderhostel participants were significantly better than Senior Center participants in the motor skills associated with strength, balance, and agility. These data have implications for therapists, administrators, and other care providers conducting home care programs for older adults.

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## INTRODUCTION

The acquisition and maintenance of motor skills are critical to the preservation of an independent lifestyle and quality of life for individuals who are over the age of 60 years (Rikli and Edwards 1991). Berger and Hecht (1989) have implied that the interrelationship among declining strength, lack of motor skills proficiency, decreased endurance, and aging/sedentary lifestyle results in an "old feeling." Several investigators have reported that a life experience of habitual physical activity results in maintaining motor skills at a high level (Clarkson and Kroll 1978, Rikli and Busch 1986, Winningham et al. 1990). The study of motor skill maintenance is clouded by the heterogeneity of the aging population resulting from such factors as general life experience, genetic predisposition, personal commitment to positive health behaviors, and health and accident experience. Feldman (1991) indicates that the gender, socioeconomic class, race, nationality, level of education, and learning styles of older adults also result in the heterogeneity of their selection of recreational and lifelong educational activities. Participation in the Elderhostel Program reflects a commitment of older adults to a lifestyle of education, travel, and activity engagement that challenges society's stereotypical norms of aging (Berger and Hecht 1989). Few studies are found in the literature that have examined the various factors thought to be causal of the heterogeneity, and few have attempted to examine the motor skills of older adults relative to their self-selected educational/recreational activity. The purpose of the present study was to compare selected motor skills of older adult volunteers participating in Slippery Rock University Elderhostel (EH) and the programs of the Area Agency on Aging/Lutheran Service Society Senior Centers (SC) of Butler County, PA.

## Subjects

Elderhostel is a nationally coordinated and locally conducted educational program for adults over the age of 60 years. The primary mission of Elderhostel is to provide older adults with short term academic programs at educational institutions around the world. Participants in the Slippery Rock Elderhostel (Table 1) came from across the United States. The participants

TABLE 1

*Senior Center/Elderhostel participants' means and standard deviations of selected physical characteristics.*

	Sex	Senior Center	Elderhostel
AGE (yrs.)	F	72.5+6.4	66.3+4.5
	M	73.2+6.9	69.2+4.4
WEIGHT (lbs.)	F	142.9+29.7	148.0+22.1
	M	179.1+26.3	178.9+28.0
HEIGHT (in.)	F	63.4+3.1	63.7+2.2
	M	69.1+2.9	69.6+3.2

Elderhostel females  $N = 71$ ; Senior Center Females  $N = 45$ .  
Elderhostel males  $N = 36$ ; Senior Center males  $N = 33$ .

in the senior centers lived in Butler County, PA, and regularly attended one of the six senior centers' programs. The physical characteristics of the subjects are shown in Table 1.

The average age of the Elderhostel volunteers was somewhat younger than that of the Senior Centers participants. Over half of both groups were between the ages of 65 and 75 years. Thirteen of the Senior Center members were over the age of 80 years (the oldest was 94), while the oldest EH subject was 77 years old.

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## Procedures

Subjects were asked to sign the informed consent form. After the signing of the forms and completion of the health survey, all tests were conducted at the senior centers or at the facility used for Elderhostel on the campus of Slippery Rock University.

Strength, flexibility, agility, and eye-hand coordination were assessed using four items from the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) Functional Fitness Test for Older Adults developed by the Council on Adult Development and Aging of the American Alliance for Health, Physical Education, Recreation and Dance (Osness 1989a, Clark 1989). Flexibility was quantified using the traditional "sit and reach" test. The heels of the subject were placed at the 25 inch mark of a ruler. The subject's agility assessment required the subject to rise from a chair, negotiate a figure-eight obstacle course, return to the chair, sit down, rise again from the chair and repeat the course. The score was the number of seconds to complete the trial. Arm strength measurement required the subject to sit in a straight back, armless chair. The nondominant arm was resting in the lap, while the dominant arm hung free and relaxed to the side of the chair. A four-pound weight for females or eight-pound weight for males was placed in the dominant hand. The subject was instructed to complete as many curls of the weight as possible in 30 seconds. The number of repetitions in 30 seconds was the subject's score. In the eye-hand coordination, the subject was instructed to turn over three soda cans onto a target, and then turn the cans right side up onto their original placement. One trial was composed of two passes of manipulation of the cans. The subject's score was the number of seconds to complete the trial.

In addition to the above test items, the following were assessed: hand grip, card sort, and the penny pick-up. The subject's score for the card sorting was the number of cards sorted into a black or red pile in 30 seconds. Like the card sorting, the scoring for the penny pick-up was the number of pennies placed in a box in 30 seconds. Grip strength was scored in kilograms using a grip dynamometer.

The analysis of covariance was used to test for statistical differences among the various means (Snedecor and Cochran 1976).

## RESULTS

The age of subject was covaried because the measured motor skills were age dependent.

Significant differences were not found between the group means for card sort, penny pick-up, coordination, and flexibility (Table 2). For hand grip strength, agility, and arm strength (Tables 3,4,5), the Elderhostel participants' performances were significantly better than those of the senior center participants.

## DISCUSSION

The means of agility, flexibility, arm strength, and coordination for both groups were within the item ranges presented by Clark (1989). While non-significant differences were observed between the groups relative to psychomotor skills involving the speed and perception of fine motor movements, it appears that the differential in strength measurements between the groups as demonstrated by the means of grip strength (29%) and arm strength (26.9%) are associated with the 23.2% differential in agility. These differences remained after the effect of age was accounted for by the analysis of covariance. Therefore, the Elderhostel participants possess a constellation of motor skill function that differentiates their functional ability from that of the senior center participants.

Although the relationship of superior limb strength decline with increasing age may not be linear with that of the inferior limb, Stamford (1988) reported that the rate of leg strength loss among the elderly is greater than that of hand grip strength. A similar 30% decline in isokinetic leg strength with increasing age has been reported (Gandee et al. 1989). The present study confirms a relationship of superior limb strength with inferior limb strength and body balance as reflected by agility measures. These data, obtained from field instrumentation, also tend to confirm the strength decline established by earlier investigators using laboratory equipment (Vandervoort et al. 1986, Clarkson and Dedrick 1988, Vandervoort et al. 1990).

Osness (1989b) maintains that the level of physical function impacts upon the physiological, psychological, and sociological aspects of older adults. Harris (1977) suggests that functional level also influences one's self-image, concepts of personal security, assertiveness, and feeling of well-being. Maslow's (1962) concept of self-

TABLE 2

*Senior Center/Elderhostel participants' means and standard deviations of selected motor skills.*

Motor Skill	N	Senior Center	N	Elderhostel	Significant
Grip Strength (kg.)	98	22.5+9.2	73	31.7+12.9	<.01
Card Sort (#card)	100	29.8+7.4	66	29.2+6.6	n.s.
Penny pickup (#penny)	100	15.2+3.4	78	16.3+3.8	n.s.
Flexibility (in.)	63	28.8+4.3	75	24.3+5.0	n.s.
Agility (sec.)	99	27.6+6.4	74	22.4+5.3	<.01
Arm Strength (rep.)	98	20.9+5.6	76	28.6+6.1	<.01
Coordination (sec.)	101	12.4+6.4	77	11.2+2.01	n.s.

actualization provides a model for understanding the interaction of physiological, sociological, and psychological needs that manifest in the individual's well-being. At the apex of the self-actualization model are found the needs of the ego involving independence, self-respect, personal competence, and control of one's future (Shephard 1978). Muscular strength is of importance to the individual's activities of daily living, walking, stair climbing, etc. (Biegel 1984), and the loss of muscular strength, endurance, and movement efficiency contribute to the individual's perception of personal competence and self-efficacy (Whitbourne 1985). Self-efficacy is the concept that the individual believes that he/she can execute a given task, and denotes a feeling of competency. Although socioeconomic class, gender, level of education, and socialization skills may be among the factors that differentiate between Elderhostel participants and senior center members, muscular strength and associated movement efficiency are subtle and are vital contributing factors in the older individual's decision to enroll in and experiences the challenges of the Elderhostel programs or limit one's activities to the senior center where the environment is known and somewhat controlled.

TABLE 3

*Summary of analysis of covariance  
Senior Center vs. Elderhostel older adults grip strength.*

Source	Sum of Squares Adjusted	Degrees of Freedom	Mean of Squares Adjusted	F
Between	2460.797	1	2460.797	17.600
Within	23489.402	168	138.818	
Total	25950.199	170		

Because there is no requirement for elaborate equipment and facilities while meeting the criteria for a field testing instrumentation (Osness 1989a), the AAHPERD Functional Fitness Test for Older Adults provides a test battery for service providers to systematically assess motor skills among aging individuals. Valuable feedback is provided to: 1) establish the individual's functional status; 2) compare motor skill levels between individuals and groups; and 3) provide a benchmark for aging individuals seeking

TABLE 4

*Summary of analysis of covariance Senior Center vs. Elderhostel  
older adults agility.*

Source	Sum of Squares Adjusted	Degrees of Freedom	Mean of Source Adjusted	F
Between	466.156	1	426.156	13.334
Within	5273.337	165	31.960	
Total	5699.493	165		

to advance their functional status through physical activity (Clark 1989). This battery is also of value to service providers in motivating older adults to maintain their motor skills and remain physically active. In the home, senior apartment complex, or senior center, a much clearer view of the older adult's physical capacity and condition is at hand for individuals concerned with the maintenance of an independent life-style among older adults.

TABLE 5

*Summary of analysis of covariance Senior Center vs. Elderhostel  
older adults arm strength.*

Source	Sum of Squares Adjusted	Degrees of Freedom	Mean of Source Adjusted	F
Between	1865.77	1	1865.77	53.98
Within	5807.66	168	34.56	
Total	7643.43	170		

It is the continued maintenance of motor skill proficiency that will shift the focus of the public's perception and acceptance of the elderly from one of frailty to one of their independence, capacities, and capabilities (Gandee et al. 1991). Often the landscape of aging is viewed through the limited binoculars of the mind, and only the burden of the medicalization of aging, fear, frailty, disease, dependence, and long-term care facilities comes into focus (Birren 1991). The productive aging of millions of older adults never comes to the consciousness. It is the creative achievement of older adults in all endeavors, sports, art, dance, theater, and science that manifests their identity and validation to themselves and the public (Ebersole and Hess 1990, Riker and Myers 1990, Simonton 1990, Viney et al. 1989, Perlmutter 1990).

During the next century the number of older adults will increase in an unprecedented manner creating a population segment of such magnitude that society will be required to respond much more effectively and positively than it has in the past. It has been too easy to ignore this population segment. Birren's concepts (1991) of the third quarter of life offers many opportunities for scientists and scholars in many disciplines to explore the varied frontiers of this life stage. Models for such exploration were presented at the American Association of Retired Persons Conference, 9-10 October 1990, "Resourceful Aging: Today and Tomorrow." In this manner, scientists, scholars, and service providers will be able to contribute constructively to an improved quality of life for older adults. (Gandee et al. 1991).

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