Physical Fitness, Cognitive Function, and Health-Related Quality of Life in Older Adults

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It has been suggested that physical and cognitive functions are associated with health-related quality of life (HRQL). Previous work examining the relationship between physical ability and HRQL is equivocal, and information about cognitive function in relation to HRQL is largely restricted to people with cognitive impairments. We investigated the relationships of physical ability and cognitive performance to HRQL in 44 older adults (72–93 years). The results suggest significant relationships between the endurance item of the AAHPERD test and the physical mobility and pain components of HRQL and between AAHPERD agility scores and the physical mobility component of HRQL. Visual simple-reaction time and the backward digit-span memory test were found to be related to physical mobility. The subject-performed-tasks memory test was related to the social component of HRQL. These data support the use of the AAHPERD test for characterizing physical ability of older adults as it relates to HRQL and identify specific cognitive support measures that reflect the relationship between cognition and HRQL in older adults.

Key Words: physical fitness, cognition, quality of life

Reducing the impact of diseases and conditions that affect functional ability has become an important objective for geriatric wellness and health care programs. The societal implications of reducing morbidity include the potential economic benefits associated with minimizing the need for dependent-care services. Equally compelling, however, is the potential these programs might have for maximizing health-related quality of life (HRQL) for individuals throughout their lives.

The term HRQL was introduced by Kaplan and Bush in 1982 in an attempt to distinguish quality-of-life aspects that appear to be influenced by health status from other quality-of-life issues that are not necessarily related to health (e.g., climate, living environment, economic status, availability of resources). Since that time several definitions for HRQL have emerged, including that of Wenger and Furberg (1990), who suggest that HRQL involves

those attributes valued by patients, including: resultant comfort or sense of well-being; the extent to which they are able to maintain reasonable physical,
emotional, and intellectual function; and the degree to which they retain their ability to participate in valued activities with the family, in the workplace, and in the community. (p. 336)

HRQL is purported to reflect, to some degree, the functional effects of chronic diseases (e.g., osteoporosis, cardiopulmonary disease) and consequent therapies as perceived by the patient (Schipper, Clinch, & Powell, 1990). However, the relationship between disease morbidity and HRQL is complex. Previous research among older populations has demonstrated significant differences between individuals' appraisals of their own well-being and objective measures of their health status (Shumaker, Anderson, & Czajkowsk, 1990). Therefore, measures of HRQL appear to provide unique and valuable information regarding the outcomes of senior health care programs, beyond what can be inferred from health status alone.

Attempts to quantitate HRQL have led to the development of various multidimensional models, many of which portray HRQL as encompassing issues such as perceived levels of pain, physical ability or impairment, social satisfaction, sleep quality, and emotional well-being. One such model is described in the Nottingham Health Profile (NHP; Hunt & McKenna, 1989). This instrument proposes the following six components of HRQL: level of pain, energy level, emotional state, quality of sleep, social isolation, and physical mobility. The NHP is useful for assessing HRQL in the "old" and "old-old" (75–84 and 85–99 years of age, respectively), in that it is easy to administer, is not specific to any particular disease or condition, and has been validated for measuring perceived health status in older (65+ years) participants ranging from the healthy and physically fit to those with varying degrees of chronic and disabling diseases and conditions (Hunt et al., 1980).

Health-related quality of life appears to be not only multidimensional but also multicausal, to the extent that perceived health appears to be related to several individual characteristics. Included in these are levels of physical activity and physical fitness. Physical activity has been linked to a reduction in morbidity and lower mortality rates in many populations (Kannel, Belanger, D’Agostino, & Israel, 1986; Morris et al., 1973; Paffenbarger & Hale, 1975; Paffenbarger, Wing, & Hyde, 1978; for a brief review see the U.S. Dept. of Health & Human Services, 1996), and several studies have demonstrated a positive relationship between physical activity and HRQL in the elderly (Hawkins & Duncan, 1991; McMurdo & Burnett, 1992; McMurdo & Rennie, 1993; Morey, Crowley, Robbins, Cowper, & Sullivan, 1994; Ruuskanen & Ruoppila, 1995; for a review see McAuley & Rudolph, 1995).

Data regarding HRQL and physical fitness levels, however, are not nearly as abundant. Large epidemiologic studies reflect a weaker association between physical fitness and morbidity than is observed for physical activity and disease presence (Blair et al., 1995; Sandvik et al., 1993), and the results of the few studies that have evaluated physical fitness and HRQL are equivocal. Grimby, Grimby, Frandin, and Wiklund (1992) were able to demonstrate significant relationships between walking speed and both perceived energy and physical mobility scores from the NHP for 76-year-old men and relationships between walking speed and pain, physical mobility, and energy in 76-year-old women. Furthermore, Morey et al. and King, Taylor, and Haskell (1993) were able to demonstrate an association
between exercise-induced improvements in cardiorespiratory function and well-being. However, other studies have failed to detect such a relationship in either healthy (MacRae et al., 1996) or diseased (Aursnes & Midtbo, 1994; Sjoland, Wiklund, Caidahl, Albertsson, & Herlitz, 1995) older adults. It should also be noted that, of the studies mentioned above, only those of Grimby et al. and MacRae et al. (mean participant age = 81) reflect data from an "old" population.

One of the reasons for the surprisingly small number of studies examining physical fitness and HRQL relationships in the elderly is that the measurement of physical fitness in this population is problematic. Traditional tests of physical fitness, such as symptom-limited graded exercise tests, are often difficult to administer across a wide range of functional abilities, and they might not be relevant to an older individual's ability to perform activities of daily life (ADLs). A more thorough discussion of the issues regarding fitness assessment in the elderly can be found in Rikli and Jones (1997).

As an alternative, physical function tests designed to reflect competence at performing ADLs have been developed. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) has developed and validated a battery of tests for assessing physical functional ability in adults over 60 years of age (Osness et al., 1996). This battery of tests includes measures of body composition, flexibility, agility/balance, coordination, muscular strength and endurance, and cardiorespiratory endurance. To date, the relationship between performance on the AAHPERD test items and measures of HRQL has not been reported; therefore, one purpose of this investigation was to determine whether, among a group of "old" and "old-old" participants, performance on the AAHPERD test items would be related to HRQL as measured by the NHP. It was a hypothesis of this investigation that several significant correlations would exist between performance on the AAHPERD items and NHP scores. In particular, it was expected that the performance on AAHPERD items involving timed walking tasks (agility/balance and endurance) would be related to perceived pain, mobility, and energy. Such findings would be consistent with the observations of Grimby et al. (1992).

Another domain of functional ability that appears to be related to HRQL is that of cognition. Most studies addressing the relationship between cognitive function and self-reported quality of life in older adults have involved populations with overt signs and symptoms of cognitive impairment, such as individuals with a history of cerebrovascular accidents and those with dementia. Yet, even in the absence of disease, age appears to be associated with a decrease in the performance of cognitive support processes such as processing speed and working memory (for a review, see Spirduso, 1994). Available data, though limited, suggest that among the general population of older adults, cognitive performance is related to perceived well-being (Duke University, 1978; Milligan, Powell, Harley, & Furchtgott, 1984). Therefore, it was an additional purpose of this investigation to identify the domains of HRQL that might be influenced by cognitive support processes among older adults.

Thus, the primary foci of this investigation were the examination of relationships between (a) physical fitness (AAHPERD test) and HRQL (NHP) and (b) cognitive support (processing speed and working memory) and HRQL.
Methods

PARTICIPANTS

Fifty-two residents of a continuing-care retirement community (CCRC) responded to an invitation to participate in this study. Of these 52 participants, 6 dropped out and 2 were hospitalized for problems unrelated to the investigation. Therefore, data are reported for 44 participants, who consented to participate in a variety of tests designed to measure physical fitness, cognitive support, and HRQL. The age range of the participants was 72–93 years. Of the 44 participants, 33 were independent-living residents of the CCRC, and the other 11 resided in an “assisted-living” environment. Thirty-six of the participants were women and eight were men; all were White. The majority reported a history of educational experience at the collegiate level or higher.

PROCEDURES

All tests were conducted at the CCRC. Participants were tested on two separate occasions, approximately 2 weeks apart. During the first visit, informed consent was obtained and the participants’ health and physical activity histories were obtained via interview. In some instances, medical records were obtained for further clarification. Next, participants were asked to complete the HRQL questionnaire and to perform a series of cognitive tasks. Finally, visual acuity was appraised using a standard eye chart read from 20 ft. Participants were allowed to use corrective lenses. Auditory acuity was not measured; however, the health screening involved self-report of auditory and visual function. On the second testing date, participants performed the battery of field tests of physical fitness.

INSTRUMENTATION

Health-Related Quality of Life. The Nottingham Health Profile (NHP) (Hunt & McKenna, 1989) was used to assess HRQL. In the NHP, a series of yes-or-no questions is asked to survey each participant’s perception of his or her current health as it relates to performing activities of daily living. Each question is weighted in accordance with its potential to reflect participant perceptions regarding level of pain, energy level, emotional state, quality of sleep, social isolation, and physical mobility. The validity of this tool has been established across a wide variety of populations, and one particular study of the general population of adults aged 19 to 85 (Hunt, McEwen, & McKenna, 1985) revealed a gradient of NHP scores in relation to age. The reliability of this test has been reported to range from .75 to .88 (Hunt, McKenna, & Williams, 1981). The NHP often provides a nonnormal distribution of scores; consequently, nonparametric methods were employed for testing hypotheses involving the NHP.

Classification of Disease State. Each participant was asked to complete the health-status questionnaire (Howley & Franks, 1992), which was administered via interview. In some cases the participant’s medical history was examined for history of cardiovascular disease, significant orthopedic problems, and neurologic disorders.
Any other chronic diseases and conditions were described as "other." The following categories were then used to describe the types of diseases: CV, orthopedic/neurologic, both, or none. Furthermore, because many older individuals suffer from multiple medical complications, all participants were classified by number of comorbidities (0, 1, 2–3, or >3).

**Physical Fitness Field Tests.** The AAHPERD physical function test for adults over 60 (Osness et al., 1996) was used to measure physical fitness. This battery of field tests includes measures of flexibility, muscular strength and endurance, agility/balance, coordination, aerobic endurance, and ponderal index. These test items have been validated for use in older adults, and each item has demonstrated acceptable test–retest reliability, with correlation coefficients reported in the range of $r = .82$ to 0.98 (Osness et al., 1996). In addition, moderate to high interclass reliability has been reported for those items with which standard laboratory comparisons exist (e.g., $r = .59$ to .82; Osness et al., 1996).

The flexibility test is the standard sit-and-reach test wherein the participants are seated with their heels placed 12 in. apart on a line perpendicular to a measuring tape. The tape is oriented so that the participant's heels are at the 25-in. mark, and the 0-in. mark is proximal to the participant. The participants are asked to reach with both hands as far along the measuring tape as they comfortably can while keeping both knees straight. The score is the tape-measure mark reached for the best of three trials.

The muscular strength and endurance task requires women participants to lift a 4-lb object and men participants to lift an 8-lb object, using a biceps curl motion, as many times as possible in 30 s. As suggested by AAHPERD, the 4-lb object for women was a 1-gallon plastic milk jug containing one-half gallon of water, whereas the men lifted a full gallon jug.

For the agility task, participants started from a seated position and were asked to rise from the chair, walk around a cone located 6 ft to the left of and 5 ft behind the chair, return to the seat and sit down, stand again, walk around a cone 6 ft to the right of and 5 ft behind the chair, return to the seat and sit down, and then repeat the entire procedure. The participants were given two trials, and the raw score represents the faster of the two.

The coordination test involved moving three 12-oz soda cans, using the dominant hand. The cans were placed on a table, top-side-up and on a line indicated by a 30-in. length of masking tape. The cans were 10 in. from one another. The participants were seated at the table with the line of cans well within their grasp. The participants then performed two trials in which they were asked to place each can top-side-down in a space adjacent to its original position but 5 in. closer to the next can on the line. Then the participants returned the cans to their original top-side-up position. Each trial consisted of performing these movements twice, and the raw score reflects the faster of the two trials.

The aerobic endurance test was an 880-yd walk for time.

The ponderal index is a height–weight ratio and serves as an index of body composition. AAHPERD provides a set of standardized instructions, which were read to the participants in preparation for the performance of the test items. (For a more comprehensive discussion of the AAHPERD test items, see Osness et al., 1996.)
Cognitive Function. The forward-backward digit span test (FBDS; Wechsler, 1955) and the subject-performed-tasks test (SPTS; Dick, Kean, & Sands, 1980) were used as measures of working memory. The former requires participants to repeat strings of integers of various lengths in order (forward digit span, or FDS), and then to repeat strings of integers in reverse order (backward digit span, or BDS). The FBDS score is a composite of the FDS and BDS scores. This particular test is a subcomponent of the Wechsler Adult Intelligence Survey, which was introduced in 1955 (Wechsler, 1955). The reliability of this test has been well documented. Among the earliest studies supporting its use as a measure of memory was that of Karson, Pool, and Freud (1957), who reported reliability coefficients from the original data sets to be in the range of $r = .69$ to $.82$.

The SPTS requires the participants to manipulate 10 common household objects and, shortly thereafter, to recall each of these objects and the manner in which it was manipulated. Reliability data for this particular inventory are not currently available.

Finally, simple reaction-time (SRT) tasks, in which participants responded to both audio and visual cues by depressing a designated key on a standard keypad, were used as measures of processing speed. The participants responded to two sets of 25 visual cues and two sets of 25 auditory cues. The order of these tests was counterbalanced, and the median reaction times were used as the scores for auditory and visual SRTs.

DATA ANALYSIS

The six components of the NHP (pain, energy, emotion, sleep, social isolation, and physical mobility) are, for the purpose of this investigation, considered to be relatively independent outcome variables, but the six AAHPERD physical fitness ability tests represent potentially overlapping constructs. Similarly, the six cognitive support items are likely to be overlapping predictors of HRQL. Therefore, wherever scores from the physical fitness or cognitive support items were examined, the alpha level for statistical significance was adjusted according to the Bonferroni procedure.

Relationships Among Variables. Correlations between the NHP and the measures of physical fitness and cognitive function scores for all 44 participants were examined using Spearman rank-order correlation. In examining the relationships of the NHP components to the six tests of physical fitness and then to the six tests of cognitive support, the alphas were adjusted to $p < .0083$. Although it was not a primary objective of this investigation to report relationships between the cognitive and physical fitness scores, Pearson interclass correlation coefficients are also reported. For these analyses, the Bonferroni technique for making multiple comparisons was used to adjust the alpha to $p < .0014$ (36 simultaneous comparisons).

Disease-Related Differences. In order to provide some control for the potential influence of disease state on HRQL, the data from the NHP (pain, energy, emotion, sleep, social isolation, and physical mobility) were analyzed using chi-squared tests to determine between-group differences with respect to type and number of comorbidities. Alpha was set a priori at $p < .05$. 
Results

DESCRIPTIVE STATISTICS

The mean scores and standard deviations for the NHP components and for the physical and cognitive function measures for all 44 participants are presented in Table 1.

DISEASE-RELATED DIFFERENCES

The chi-squared tests revealed no differences in perceived health status between any groups according to type or number of comorbidities ($\chi^2 = 2.36$ and $2.58$, respectively).

RELATIONSHIPS AMONG VARIABLES

Spearman rank-order correlation revealed several statistically significant relationships between the scores of the NHP and scores on the physical fitness and cognitive

Table 1 Descriptive Statistics for the NHP, AAHPERD, and Cognitive Support Items

<table>
<thead>
<tr>
<th></th>
<th>M ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 44 participants)</td>
</tr>
<tr>
<td>NHP items</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>81.5 ± 4.4</td>
</tr>
<tr>
<td>Energy</td>
<td>12.4 ± 26.9</td>
</tr>
<tr>
<td>Pain</td>
<td>9.2 ± 17.3</td>
</tr>
<tr>
<td>Emotion</td>
<td>22.9 ± 35.6</td>
</tr>
<tr>
<td>Sleep</td>
<td>27.2 ± 50.7</td>
</tr>
<tr>
<td>Social isolation</td>
<td>15.6 ± 40.2</td>
</tr>
<tr>
<td>AAHPERD items</td>
<td></td>
</tr>
<tr>
<td>Physical mobility</td>
<td>28.8 ± 61.3</td>
</tr>
<tr>
<td>Ponderal index</td>
<td>12.0 ± 0.7</td>
</tr>
<tr>
<td>Flexibility</td>
<td>22.2 ± 4.3</td>
</tr>
<tr>
<td>Agility/balance</td>
<td>56.0 ± 42.4</td>
</tr>
<tr>
<td>Strength</td>
<td>14.8 ± 3.6</td>
</tr>
<tr>
<td>Coordination</td>
<td>20.1 ± 15.9</td>
</tr>
<tr>
<td>Endurance</td>
<td>751.7 ± 280.0</td>
</tr>
<tr>
<td>Cognitive tests</td>
<td></td>
</tr>
<tr>
<td>FDS</td>
<td>6.1 ± 1.3</td>
</tr>
<tr>
<td>BDS</td>
<td>4.2 ± 0.9</td>
</tr>
<tr>
<td>Total FBDS</td>
<td>10.3 ± 1.9</td>
</tr>
<tr>
<td>SPTS</td>
<td>7.1 ± 1.6</td>
</tr>
<tr>
<td>Visual SRT</td>
<td>406.1 ± 61.9</td>
</tr>
<tr>
<td>Audio SRT</td>
<td>295.8 ± 75.2</td>
</tr>
</tbody>
</table>
test batteries (Tables 2 and 3). The physical mobility component of the NHP was associated with better performance on visual SRT (corrected $\pi = .52$), BDS (corrected $\pi = -.52$), agility/balance (corrected $\pi = .47$), and aerobic endurance (corrected $\pi = .60$). These relationships were all in a direction suggesting that better performance on each of these tasks was associated with better perceived physical mobility.

The aerobic endurance scores were related to pain (corrected $\pi = .63$); the faster the participants were able to complete the 880-yd walk, the lower their perceived level of pain. The BDS scores were inversely related to the sleep component of the NHP, indicating that better performance on this cognitive task was related to higher perceived quality of sleep. Finally, the social isolation scores

**Table 2  Relationships Between AAHPERD Physical Fitness Items and NHP Components**

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Pain</th>
<th>Emotion</th>
<th>Sleep</th>
<th>Social isolation</th>
<th>Physical mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderal index</td>
<td>.19</td>
<td>.17</td>
<td>-.13</td>
<td>.09</td>
<td>-.11</td>
<td>-.10</td>
</tr>
<tr>
<td>Flexibility</td>
<td>-.35*</td>
<td>-.30</td>
<td>.26</td>
<td>-.34</td>
<td>-.26</td>
<td>-.32</td>
</tr>
<tr>
<td>Agility/balance</td>
<td>.05</td>
<td>.30</td>
<td>-.02</td>
<td>.25</td>
<td>.33</td>
<td>.47**</td>
</tr>
<tr>
<td>Strength</td>
<td>-.01</td>
<td>-.03</td>
<td>.09</td>
<td>-.23</td>
<td>-.12</td>
<td>-.06</td>
</tr>
<tr>
<td>Coordination</td>
<td>.11</td>
<td>-.15</td>
<td>-.08</td>
<td>.06</td>
<td>.17</td>
<td>.12</td>
</tr>
<tr>
<td>Endurance</td>
<td>.23</td>
<td>.63**</td>
<td>-.02</td>
<td>.34</td>
<td>.39*</td>
<td>.60**</td>
</tr>
</tbody>
</table>

*Note. Values are Spearman rank-order correlation coefficients.


gp < .05, **p < .0083.

**Table 3  Relationships Between Selected Cognitive Support Items and NHP Components**

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Pain</th>
<th>Emotion</th>
<th>Sleep</th>
<th>Social isolation</th>
<th>Physical mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDS</td>
<td>-.21</td>
<td>-.31</td>
<td>.05</td>
<td>.22</td>
<td>-.29</td>
<td>-.25</td>
</tr>
<tr>
<td>BDS</td>
<td>-.28</td>
<td>-.44*</td>
<td>.10</td>
<td>-.49**</td>
<td>-.29</td>
<td>-.52**</td>
</tr>
<tr>
<td>Total FBDS</td>
<td>-.26</td>
<td>-.36*</td>
<td>.12</td>
<td>-.38*</td>
<td>-.32</td>
<td>-.42*</td>
</tr>
<tr>
<td>SPTS</td>
<td>-.14</td>
<td>-.31</td>
<td>-.41*</td>
<td>-.02</td>
<td>-.52**</td>
<td>-.23</td>
</tr>
<tr>
<td>Visual SRT</td>
<td>.14</td>
<td>.27</td>
<td>-.01</td>
<td>.30</td>
<td>.35</td>
<td>-.52**</td>
</tr>
<tr>
<td>Audio SRT</td>
<td>-.08</td>
<td>.27</td>
<td>-.11</td>
<td>.24</td>
<td>.26</td>
<td>.25</td>
</tr>
</tbody>
</table>

*Note. Values are Spearman rank-order correlation coefficients.

*p < .05, **p < .0083.
Table 4  Relationships Between AAHPERD Test Items and Selected Cognitive Measures

<table>
<thead>
<tr>
<th>Ponderal index</th>
<th>Flexibility</th>
<th>Agility</th>
<th>Strength</th>
<th>Coordination</th>
<th>Endurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDS</td>
<td>-.22</td>
<td>.26</td>
<td>-.17</td>
<td>.15</td>
<td>-.26</td>
</tr>
<tr>
<td>BDS</td>
<td>-.29</td>
<td>.31</td>
<td>-.37*</td>
<td>.27</td>
<td>-.35*</td>
</tr>
<tr>
<td>Total FBDS</td>
<td>-.28</td>
<td>.32</td>
<td>-.29</td>
<td>.23</td>
<td>.33</td>
</tr>
<tr>
<td>SPTS</td>
<td>-.33</td>
<td>.15</td>
<td>-.49*</td>
<td>.05</td>
<td>-.42*</td>
</tr>
<tr>
<td>Visual SRT</td>
<td>.22</td>
<td>.38</td>
<td>.58**</td>
<td>.001</td>
<td>.55**</td>
</tr>
<tr>
<td>Audio SRT</td>
<td>.26</td>
<td>.27</td>
<td>.41*</td>
<td>.09</td>
<td>.40*</td>
</tr>
</tbody>
</table>

*Note. Values are Pearson interclass correlation coefficients.
*p < .05. **p < .0014.

from the NHP were inversely related to the scores on the SPTS (corrected π = -.52), suggesting that better performance on the SPTS was associated with less social isolation.

Pearson correlations were used to examine relationships between the physical fitness items and cognitive function. The results of this analysis indicate that performance on the visual SRT correlated with agility/balance and coordination scores (r = .58 and .55, respectively; p < .0014). Both of these relationships suggest that a shorter time to complete the agility/balance and coordination tasks was associated with faster processing speed. The Pearson interclass correlation coefficients are presented in Table 4.

Discussion

The focus of our investigation was to examine the extent to which measures of physical fitness and cognitive function are related to HRQL in a group of older adults. The scores on the NHP were generally similar to those previously reported for individuals over age 65 (Hunt, McKenna, & Williams, 1981). However, in our study, the mean score for energy was lower (12.4 vs. 22.0) and the means for the physical mobility and emotional components were somewhat higher (28.8 vs. 14.0 and 22.9 vs. 10.0, respectively) than those reported for 65+-year-olds by Hunt et al. (1981). As expected, the NHP data were positively skewed, with scores of zero as the mode for most components.

Of particular interest in this study is the finding that HRQL was not related to the presence of comorbidities. There were no reported differences in HRQL between groups according to either type or number of chronic diseases or conditions. This stands in contrast to the results of Hunt et al. (1980), who found differences in NHP scores according to presence of various disease states. The lack of significant associations in this regard, however, should be interpreted cautiously. Every participant in this study responded to an invitation to participate in the
investigation, with the understanding that physical activity assessment was involved. This may have led to some self-selection bias to the extent that nonrespondents might represent people whose perception of health is poor, particularly with regard to physical mobility, energy, and pain. Furthermore, whereas data from the Framingham study have suggested that 87% of those over the age of 65 can walk half a mile (Jette & Branch, 1981), 42 of the 44 participants (96%) in this study were capable of performing the AAHPERD tasks without complications. Moreover, most of the scores on the AAHPERD test items fell in the “average” range according to the published age-matched norms (Osness et al., 1996), suggesting that most of the participants in this study were not significantly physically impaired.

Nonetheless, our study did reveal several interesting relationships between HRQL and physical and cognitive function. With regard to physical function (Table 2), the performance on the 880-yd endurance task was most strongly related to HRQL. The scores for this item were correlated with the pain and physical mobility components of the NHP. In addition, the relationship between the endurance scores and the NHP social component scores was close to significant (corrected r = .39, p = .03). The agility/balance scores also predicted perceived physical mobility. To some extent, then, these data support the use of the AAHPERD physical fitness test for older adults, inasmuch as the endurance and agility/balance items appeared to predict HRQL. The presence of significant relationships between the fitness items and perceived health is consistent with the findings of Grimby et al. (1992), who reported relationships between walking speed and both pain and physical mobility in 76-year-old men and women. Grimby et al. also reported a relationship between walking speed and energy among women, but, despite the fact that the majority of the participants in this study were women, our data do not reveal a statistically significant relationship in this area.

Previous research examining physical fitness–HRQL relationships has been inconsistent. A major factor behind this lack of consistency has been the wide variety of physical fitness measures employed. The use of laboratory measures of fitness (e.g., VO\textsubscript{2}max testing) in the elderly has been criticized because these “maximal effort” tasks are difficult to administer reliably and might not discriminate well across the rather broad continuum of functional ability that exists in this population (Rikli & Jones, 1997). ADL-based tests of physical fitness might be more appropriate for assessing the relationship between fitness and HRQL. The well-recognized model of the “disability process” (see Figure 1; Verbrugge & Jette, 1994) suggests that individual quality-of-life issues lie to the right of disability, and that disability itself is defined by the extent to which problems with functional limitations present themselves in an individual’s social environment. Therefore, it is reasonable to suggest that ADL-based fitness tests will more closely measure disability than traditional laboratory measures, which are perhaps better defined as indexes of functional limitation. If this is indeed the case, one would also expect ADL-based tests of disability to more closely relate to HRQL than would the laboratory measures of functional limitation.

Despite the presence of significant associations between some physical fitness items and HRQL, it was somewhat surprising to observe a lack of association between other physical fitness items and the NHP scores. Specifically, we had hypothesized that strength scores would be associated with physical mobility and energy scores, and that flexibility would correlate with pain. It is possible that these
field tests are not sensitive measures of these physical fitness constructs. Indeed, the AAHPERD strength and flexibility items have been criticized because they are each specific to only one aspect of their respective domains. That is to say that the strength item is a measure of biceps strength and endurance, and the flexibility item is specific to hamstring and low-back flexibility only. Therefore, these items might be less useful for characterizing physical fitness as it relates to HRQL in older individuals.

Significant relationships were also observed between the scores on the cognitive tasks and certain components of the NHP. The working memory data reveal that scores on the backward component of the FBDS were significantly associated with sleep and physical mobility and were close to significant in their relationship to pain ($p = .015$). Neither the scores from the forward component of the FBDS nor those from the total FBDS, however, demonstrated a significant correlation with any component of the NHP. In addition, the scores from the SPTS correlated well with social scores and approached a significant relationship with the scores for perceived emotion ($p = .02$). Finally, processing speed as measured by visual SRT was related to the physical mobility component of the NHP. These data, then, support the hypothesis that cognitive scores are related to HRQL in a group of relatively healthy and at least somewhat independent older participants. In general, these findings support previous studies that have identified relationships between cognitive performance and subjective ratings of health (Duke University, 1978; Milligan et al., 1984).

With regard to memory, it is apparent that the SPTS and the BDS are unique and somewhat independent with regard to their ability to relate memory to HRQL. It could be hypothesized that the BDS is related to physical aspects of HRQL (e.g., mobility, pain) but that the SPTS (which examines the accuracy with which participants can recall manipulating common household objects such as rubber bands, paper clips, clothespins, matches, etc.) evaluates memory as it relates to functioning in a social context and might therefore be a better predictor of social and emotional aspects of HRQL. With regard to processing speed, the relationship between visual SRT and physical mobility is also consistent with the majority of previous studies that have examined the relationships of physical fitness and reaction time in older participants (Hart, 1981; Sherwood & Selder, 1979; Spirduso, 1975; Spirduso & Clifford, 1978). Our data also suggest that the physical mobility component of HRQL is most greatly affected by age-related declines in processing speed.
Testing for relationships between physical and cognitive function measures was not the primary aim of this investigation; however, it should be mentioned that there were some significant associations in this area (Table 3). Specifically, visual SRT was found to be associated with scores on the AAHPERD agility/balance and coordination items, supporting a relationship between speed of processing and performance of physical fitness tasks. As mentioned above, these results are consistent with previous observational research relating physical fitness and reaction times in older participants (Hart, 1981; Sherwood & Selder, 1979; Spirduso, 1975; Spirduso & Clifford, 1978).

In summary, this study investigated the relationships between functional ability and cognitive performance and HRQL. Our data suggest significant relationships between scores from the endurance item of the AAHPERD test battery and the physical mobility and pain components of HRQL and a relationship between the AAHPERD agility scores and the physical mobility component of HRQL. Regarding cognitive performance items, visual simple-reaction time was found to be related to physical mobility, as was the backward digit span memory test. In addition, the subject-performed-tasks memory test was related to the social component of HRQL. These data support the use of the AAHPERD test for characterizing physical functional ability as it relates to HRQL in older adults, and they identify specific cognitive support measures that reflect the relationship between cognition and HRQL in this population.

References


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