THE RELATIONSHIP BETWEEN OBJECTIVE MEASURES AND SELF-REPORTS OF PHYSICAL FUNCTION IN INDIVIDUALS WITH THE LATE SEQUELAE OF POLIOMYELITIS

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ABSTRACT

The purpose of this study was to investigate the relationship between objective measures are self-reports of physical function in individuals with the late sequelae of poliomyelitis. Physical therapists often use exercise tests to assess an individual's level of physical function, as well as to guide exercise prescription and treatment planning. However, little is known about the relationship between an objective measurement of physical function based on an exercise test and an individual's self-report of his or her physical function, which can be assessed using questionnaires on health status. We, therefore, studied the interrelationships within and between two objective measures and two self-report measures of physical function in individuals with the late sequelae of poliomyelitis. A nonexperimental research design was used to correlate the objective measures with the two self-reports of physical function. The two objective measures of physical function were the 6-minute walk distance (6-MWD) and the cardiorespiratory conditioning index (CRCI) based on a steady-rate walking test. Self-reports of physical function were assessed using the physical dimension score of the Sickness Impact Profile (SIP) and the Short Form-36 (SF-36). Seventeen subjects (mean age 53.9 ± 7.2) were tested over three sessions and completed a total of three 6-MWD tests, a practice session of treadmill walking, a steady-rate walking test used to derive the CRCI, one SIP, and one SF-36 health status measure. The 6-MWD was found to be significantly correlated with both the physical dimension score of the SIP ($r=-0.57$; $p<0.05$) and the SF-36 ($r=0.67$; $p<0.05$). Significant correlations were also observed between the CRCI and the physical dimension score of the SIP ($r=-0.51$; $p<0.05$) and the SF-36 ($r=0.70$; $p<0.01$).

In addition, the two objective measures were significantly correlated ($r=0.51$; $p<0.05$) as were the two physical dimension scores of the SIP and the SF-36 ($r=-0.80$; $p<0.01$). The objective measures and health status measures selected for the present study proved to be useful in assessing individuals with the late sequelae of poliomyelitis. The use of the treadmill for the steady-rate walking test to derive the CRCI required individuals to have a high level of physical functioning. Whereas, the 6-MWD test was suitable for all of the subjects. In terms of the health status measures, the SIP portrayed the subjects as having a relatively high level of physical function. The SF-36 was observed to assess more physically demanding activities than the SIP and had a wider distribution of scores which may result in an increased sensitivity to detect change. Clinically, there is a definite role for the use of both objective measures and self-reports using health status measures. The appropriate selection and administration of both objective measures and self-reports in assessment as well as determining treatment outcomes in physical therapy are critical considerations.

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LIST OF TERMS

BMI - body mass index

BP - blood pressure

CRCI - cardiorespiratory conditioning index

EKG - electrocardiogram

HR - heart rate

SF-36 - Short Form-36

SIP - Sickness Impact Profile

6-MWD - 6-Minute Walk Distance

VO_2 - rate of oxygen consumption

VO_2max - maximum oxygen consumption

INTRODUCTION

OBJECTIVE OF THE STUDY

The objective of this study was to investigate the relationship between objective measures and self-reports of physical function in individuals with the late sequelae of poliomyelitis.

BACKGROUND

This section provides the background information relevant to assessing the relationship between objective measures and self-reports of physical function in individuals with the late sequelae of poliomyelitis. Physical function in this study is defined as the measure of cardiopulmonary fitness, muscle strength, balance, coordination, among other factors which enable an individual to perform tasks of physical mobility (Leidy, 1994; Winograd et al., 1994).

The two objective measures of physical function selected for the study were the 6-minute walk distance (6-MWD) and the cardiorespiratory conditioning index (CRCI) based on a steady-rate walking test. Self-reports of physical function were assessed using the scores from the physical dimension of two standardized health status measures, the Sickness Impact Profile (SIP) and the Short Form-36 (SF-36). Therefore, this section reviews the literature in the following areas: 1) the late sequelae of poliomyelitis; 2) submaximal exercise tests, including the 6-MWD test and the CRCI based on a steady-rate walking test; 3) health status measures, including the SIP and the SF-36; and 4) related studies investigating the relationship between objective measures and self-reports of physical function.

1. The Late Sequelae of Poliomyelitis

In the United States, poliomyelitis was the most common, acute, nonbacterial disease affecting the central nervous system in the first part of the twentieth century (Morens et al., 1991). Poliomyelitis is a single-stranded enterovirus. Three types of the virus have been identified. The virus penetrates the central nervous system and primarily targets the anterior horn cells in the spinal cord. However, damage has also been found in the dorsal root ganglia, specific brain stem centers, spinal sensory column, and occasionally in the cerebral cortex (Morens et al., 1991). Pathological changes occur within the neurons and this is accompanied by an inflammatory response which lasts approximately two weeks (Mc Lean, 1989). Some of the neurons are damaged and others are destroyed. With the death of anterior horn cells, there is Wallerian degeneration of the nerve axon which results in paresis or paralysis in the muscles supplied by those motor units.

After the infection has subsided, individuals with acute paralytic poliomyelitis recover varying degrees of motor function. Improvement usually begins soon after the acute infection. Sixty percent of recovery occurs within the first three months, 80% by six months, and there is minimal improvement thereafter (Price & Plum, 1978). There are three types of paralytic poliomyelitis, based on the site of involvement which include spinal poliomyelitis, bulbar poliomyelitis, and polioencephalitis. This study included those individuals who had spinal poliomyelitis, the most common of the three types, where the spinal motor neurons were affected.

There were a number of epidemics in the 1940's and 1950's and between 1951 and 1954 an average of 16, 315 cases were reported per year (Mc Lean, 1989). With the introduction of the inactivated Salk vaccine in 1955 and the live attenuated oral Sabin vaccine in 1959, there was a rapid decrease in the incidence of poliomyelitis (Jubelt & Cashman, 1987). Today there are fewer than 13 cases reported annually (Fischer, 1985).

Thirty to forty years following the acute illness, survivors of poliomyelitis are reporting new symptoms which are multisystemic in nature (Bradley et al., 1987; Halstead & Rossi, 1985). In the United States, it is estimated that there are 1.63 million persons who have had poliomyelitis and half of them have the late sequelae of the disease (Bruno, 1991). Common late effects include general fatigue, new joint and muscle pain, progressive weakness in muscles affected and supposedly unaffected by poliomyelitis, new respiratory difficulties, and an intolerance to cold (Agre et al., 1989; Halstead and Rossi, 1985, 1987). Other symptoms include muscle atrophy, fasciculations, sleep disorders, musculoskeletal problems (Birk, 1993; Jubelt & Cashman, 1987), and difficulties swallowing (Dean, 1991).

The late sequelae of poliomyelitis are believed to be a secondary condition that result over time in individuals with a residual motor impairment from paralytic poliomyelitis. A diagnosis of the late sequelae of poliomyelitis is made by excluding other medical, neurological, orthopedic, or psychiatric illnesses (Dalakas, 1995; Windebank et al., 1995). Criteria used in the diagnosis of the late sequelae of poliomyelitis include: 1) a confirmed history of poliomyelitis, 2) a partial or complete neurologic and functional recovery for at least 15 years, 3) the onset of two or more frequently cited health problems associated with the late sequelae of poliomyelitis, and 4) the exclusion of all other medical diagnoses (Dean, 1991; Halstead & Rossi, 1985, 1987).

The late sequelae of poliomyelitis primarily affects the individual's mobility because paresis is more common in the lower than in the upper extremities (Chetwynd et al., 1993). Cosgrove (1987) reported that decreased endurance was the most frequently reported complaint in individuals with the late sequelae of poliomyelitis. Halstead and Rossi (1985) in a survey of 539 individuals who had poliomyelitis reported that 85% had difficulty walking, 83% reported problems with stairs, and 63% experienced difficulties with transfers. Westbrook and Mc Dowell (1991), Einarsson and Grimby (1990), and Ramlow et al. (1992) reported similar findings.

To date, no therapeutic agent has been found to improve human neuronal and axonal degeneration, thus, the late effects of poliomyelitis have to be treated by a management approach (Bradley et al., 1987). Exercise is among one of several treatment approaches that is advocated. Whether exercise in this patient population can minimize or reverse the decline in function is an important issue (Agre, 1995). Thus, the rationale for exercise needs to be well defined and the appropriate tests need to be chosen.

Exercise can play an important role in the management of the late sequelae of poliomyelitis. It may serve as a means to: 1) maintain or increase muscle strength and endurance, 2) improve endurance capacity and enhance the utilization of oxygen centrally and peripherally, 3) improve the mechanical efficiency of movement, 4) reduce the symptoms of fatigue and weakness due to disuse, 5) reduce stress and anxiety associated with the onset of a new disability, and 6) improve a person's overall well-being (Agre, 1995; Dean, 1991).

2. Submaximal Exercise Testing

To assess physical function and prescribe exercise for individuals with chronic disabling conditions, physical therapists frequently use exercise testing. A maximal exercise test can provide a direct or indirect measurement of an individual's maximum oxygen consumption (VO_2max) and is the gold standard of exercise tests (Shephard, 1968). However, due to the maximal nature of the test, there are several limitations including the high motivation required by the individual, the special equipment, and trained staff. In addition, there is inherent risk in testing even healthy individuals (ACSM, 1995; Montoye et al., 1986; Ward et al., 1995).

In patients such as those with the late sequelae of poliomyelitis, a maximal test may be too strenuous and the multisystemic effects resulting from the late sequelae may predispose the individual to injury and overuse. It is also unlikely that with the coexisting factors of the late sequelae of poliomyelitis an individual is able to attain a true VO_2max. Jones et al. (1989) reported their subjects achieved a true maximal value. However, this was based on attaining only one of the three criteria. In situations where a maximal test is performed but the criteria for a true VO_2max are not met, the value is called a VO_2peak (Zeballos & Weisman, 1994). It has been reported that few individuals actually reach a true VO_2max and VO_2peak values are improperly reported as maximal values as seen in the study by Jones et al. (1989) (Zeballos & Weisman, 1994).

Submaximal tests have been developed as an alternative to maximal tests to make exercise tests more applicable to the general population (Shephard et al., 1968). These tests are typically used for healthy individuals to predict VO_2max. In the rehabilitation setting, such predictive tests have a role for providing an objective index of cardiopulmonary fitness for healthy individuals and athletes where maximal tests are neither indicated nor required. Traditionally, measuring VO_2max has been the purpose of an exercise test, however, a VO_2max provides little information about an individual's level of function. An objective measure of physical mobility or performance doing a physical task may be more relevant for a physical therapist (Dean & Ross, 1993). Consequently, submaximal tests that focus on function have been developed; these are termed functional performance tests. The 6-MWD test and the CRCI based on a steady-rate walking test are examples of functional performance tests and were selected for this study.

The 12-Minute Walk Distance (12-MWD) test and its derivative, the 6-MWD test are two types of functional performance tests that have been used as an objective measure of physical function. Walking tests have been found to provide a safe, reproducible, and highly acceptable means of measuring physical function in patient populations (Butland, 1982; Guyatt et al., 1985a; Mc Gavin et al., 1978).

The 12-MWD test was first introduced by Mc Gavin et al. (1976, 1978) as a measure of assessing physical function in individuals with chronic bronchitis. The total distance covered in 12 minutes is recorded and the individual is allowed to stop and rest. This test was modified from the 12 Minute Run test described by Cooper (1968) on healthy individuals. The 12-MWD test has been used primarily for patients with chronic obstructive pulmonary disease (COPD) (Alison & Anderson, 1981; Bernstein et al., 1994; Cockcroft et al., 1981; Jones et al., 1989; Leidy & Traver, 1995; Mc Gavin et al., 1976, 1978; Mungall & Hainsworth, 1979; Swinburn et al., 1985; Weaver & Narsavage, 1992).

Butland (1982) demonstrated that the 12-MWD test could be reduced to six minutes without affecting the validity of the test. The 6-MWD test has the advantage of being shorter and is easier for the subject to perform and the tester to administer. Guyatt et al. (1985a) introduced the 6-MWD test in individuals with heart failure. The 6-MWD test has been used in individuals with end-stage lung disease (Cahalin et al., 1995), chronic heart failure (Cahalin et al., 1996; Peeters & Mets, 1996), COPD (Anderson, 1995; Gosselink et al., 1996; Leidy, 1995; Mak et al., 1993), severely ill children (Nixon et al., 1996), and chronic renal failure (Fitts & Guthrie, 1995). Two practice tests have been advocated to obtain reproducible results (Butland, 1982; Guyatt et al., 1985a) and encouragement needs to be standardized (Guyatt et al., 1984).

The 6-MWD test and the 12-MWD test are simple tests that are inexpensive to administer and no formal training is required. Walking for a designated period of time corresponds to a functional activity used in daily activities and can be applied to healthy individuals and many patient populations. The use of a standard time rather than a predetermined distance provides a better test of endurance (Mc Gavin et al., 1976). The test allows the individual to set her or his own pace and stop if necessary. It has been found that the 12-MWD test was able to detect a change following an exercise program (Cockcroft et al., 1981). The 12-MWD test and the 6-MWD test have been found to be reliable and valid (Guyatt et al., 1985b; Mc Gavin et al., 1976; Mungall & Hainsworth, 1979). To date, these tests have not been used to assess physical performance in individuals with the late sequelae of poliomyelitis. Many individuals with the late sequelae of poliomyelitis have skeletal deformities resulting from limb malformations, contractures, denervation, or muscle imbalance (Price & Plum, 1978). Often orthoses and walking aids are prescribed to provide joint stability and improve efficiency of joint mechanics. The 6-MWD is a potentially useful objective measure of physical function in this population because an individual can use an orthoses or walking aid during the test.

The CRCI based on a steady-rate walking test is another type of a submaximal functional performance test that was selected for use in this study to provide an objective measure of physical function. This test uses a steady-rate walking protocol on a treadmill. After establishing a comfortable walking cadence, the individual walks for five minutes at a speed and grade on the treadmill that elicits a heart rate (HR) between 60 to 80% of predicted maximum. This workload assesses physical function that approximates a workload experienced by an individual in his or her daily activities. The test has been used with individuals who have the late sequelae of poliomyelitis (Dean & Ross, 1988, 1991, 1993) and with healthy individuals (Dean & Ross, in preparation). This test is reliable and the measurement of the CRCI based on a steady-rate walking test in individuals with the late sequelae of poliomyelitis can enhance the objective assessment of physical function (Dean & Ross, 1993). In addition, this test can be used to assess movement economy.

It was also of particular interest in the present study to investigate the correlation between the two objective measures of physical function, i.e. 6-MWD and the CRCI. Mc Gavin et al. (1976) reported a correlation of $r=0.52$ ($p<0.01$) between the 12-MWD test and VO_2max using a cycle ergometer in 29 subjects with chronic bronchitis. Guyatt et al. (1985a) investigated the relationship between the 6-MWD test and VO_2max on a cycle ergometer in persons with cardiac and respiratory disease. In the respiratory group the correlation was $r=0.42$ ($p<0.001$) and in the cardiac group was $r=0.57$ ($p<0.001$). The researchers suggested that the low correlations indicate that the walking test may measure something different than VO_2max, such as a person's ability to cope with physical activities of life as opposed to laboratory measures of physical function.

3. Health Status Measures

Measurement of health status is becoming an important focus in health care today. Since 1951, when the World Health Organization (WHO) defined health as a multidimensional concept that incorporates a physical, psychological, and social dimension, there has been a shift away from the medical model of health which was based primarily on the biological indicators of death, disease, and disability (Greenfield & Nelson, 1992). Today, there is an increased demand for using health status measures which evaluate an individual's physical, mental, and social functioning as well as other general health concepts. This change in the definition of health has resulted from the increased prevalence of individuals living with chronic disease due to the advances in medical knowledge and technology (Freeman et al., 1996; Thier, 1992). It has recently been recognized that the individual's perspective is central to monitoring medical outcomes (Ware & Sherbourne, 1992). Researchers and clinicians must integrate measures based on an individual's self-report (Editorial, 1997). Finally, a primary health care objective is cost-effectiveness. Health care constraints are demanding that procedures be effective and have clinically relevance (Thier, 1992). The measurement of outcomes using health status measures promotes the clinical relevance of procedures and interventions with respect to the individual's perspective rather than the health care professional's.

Health status measures assess an individual's perception of his or her health through the use of standardized self-reported questionnaires (Cress et al., 1995; Rubenstein et al., 1988). The reasons to assess health status have been outlined by Ware et al. (1981) and include: 1) measuring the efficiency or effectiveness of medical interventions, 2) assessing the quality of care, 3) estimating the needs of a population, 4) improving clinical decisions, and 5) understanding the causes and consequences of differences in health. In the physical therapy literature, measuring treatment effectiveness and improving clinical decision making are two professional priorities.

Instruments based on subjective data provide important information that is not available from objective physiologic measures. Subjective data are as reliable or even more reliable than many physiologic measures (Epstein, 1990). Health status measures provide a standardized format for collecting subjective data from an individual through self-report.

Health status measures can assess overall general health or evaluate the specific disease consequences of a given medical condition, and these two types are referred to as generic and disease-specific measures respectively (Patrick & Deyo, 1989). The advantages of using generic measures opposed to disease-specific measures are that generic measures allow a wider range of health concepts to be assessed, allow for comparison across various patient populations, and are more applicable to individuals who have multiple conditions (Barr, 1995; Patrick & Deyo, 1989).

Two generic measures that have been commonly used to assess health status are the Sickness Impact Profile and the Short Form-36 . Both of these questionnaires are either self-administered or given by an interviewer. They provide a self-report of an individual's physical, psychological, and social functioning as well as assessing other general health concepts. More specifically, the SIP contains 136 questions, covering 12 functional categories including ambulation, mobility, body care and movement, communication, alertness behavior, emotional behavior, social interaction, sleep and rest, eating, work, home management, and recreation and pastimes (Table 1). The categories can be grouped into a physical dimension, psychosocial dimension, and an overall score. The SIP was developed as a behaviorally based assessment of the impact of illness on everyday life. To date, the SIP has not been used for individuals with the late sequelae of poliomyelitis but it has been used to evaluate the health status of patients with other clinical conditions such as multiple sclerosis (Petajan et al., 1996), arthritis (Deyo et al., 1982), Parkinson's disease (Longstreth et al., 1992), chronic renal insufficiency (Harris et al., 1993), and in individuals with low back pain (Deyo, 1986). It has been used extensively in individuals with COPD (Graydon et al., 1995; Jones et al., 1989; Leidy,

TABLE 1

SICKNESS IMPACT PROFILE CATEGORIES

CATEGORY	ITEMS	DIMENSIONS
Ambulation	12	Physical
Mobility	10	Physical
Body Care & Movement	23	Physical
Communication	9	Psychosocial
Alertness Behavior	10	Psychosocial
Emotional Behavior	9	Psychosocial
Social Interaction	20	Psychosocial
Sleep & Rest	7	Independent
Eating	9	Independent
Work	9	Independent
Home Management	10	Independent
Recreation & Pastimes	8	Independent

1995; Leidy & Traver, 1995) and the Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT), a multi-site collaborative study (Buchner et al., 1993).

The SIP has well established reliability (Pollard et al., 1976) and validity (Bergner et al., 1976b). It has proved to be a useful instrument to measure the various domains of health status (de Bruin et al., 1992; Graydon et al., 1995; Guccione & Jette, 1990; Weinberger et al., 1991) as well as to evaluate the effectiveness of interventions (Hidding et al., 1994; Ott et al., 1983; Petjan et al., 1996).

The SF-36 is a generic health status measure that consists of 36 questions related to eight health concepts. These concepts include physical functioning, role limitations due to physical health, bodily pain, general health, vitality, social function, role limitations due to emotional problems, and mental health (Table 2). It is also possible to derive a physical dimension score and a mental dimension score. The SF-36 has been widely used in health care because it is short, taking only five minutes to complete, and it is comprehensive, containing multi-item measures that meet the minimum psychometric standards (Mc Horney et al., 1992; Ware & Sherbourne, 1992).

Since 1992, the SF-36 has been used in over 260 clinical studies involving 158 different medical conditions (Ware et al., 1993). To our knowledge, the SF-36 has not been used previously for individuals with the late sequelae of poliomyelitis but it has been used with other chronic conditions including multiple sclerosis (Freeman et al., 1996), Parkinson's disease (Jenkinson et al., 1995), COPD (Mahler & Mackowiak, 1995; Viramontes & O'Brien, 1994), arthritis (Matsen et al., 1995; Stucki et al., 1995) as well with the elderly population (Andresen et al., 1995; Lyons et al., 1994; Weinberger et al., 1991).

The SF-36, like the SIP has been documented to be a suitable instrument to assess an individual's health status in a wide range of clinical conditions (Jenkinson et al., 1995; Jette & Downing, 1994; Lyons et al., 1994; Mahler & Mackowiak, 1995; Matsen et al., 1995). It has also proven to be effective in documenting the effectiveness of treatment intervention (Stucki et al., 1995).

In addition to investigating how the two self-reports of physical function, assessed by the SIP and the SF-36, correlate with the objective measures, the 6-MWD and the CRCI based on a steady-rate walking test, we were interested in the correlation between the physical dimensions of the SIP and the SF-36. In the literature, the correlation between the SIP physical dimension and the SF-36 physical function scale have been reported to be high ($r=-0.67$ to $r=-0.78$) (Katz et al., 1992; Weinberger et al., 1991). The negative correlation is due to the different direction of scoring between the SIP and the SF-36. In the SIP a score of 0 indicates a perfect state of health, whereas with the SF-36 it is a score of 100. To date, no studies have reported the correlation between the physical dimension score of the SIP and the physical dimension score of the SF-36.

TABLE 2

SHORT FORM-36 SCALES

SCALE	QUESTIONS	ITEMS	DIMENSIONS
Physical Function	3a-3j	10	Physical
Role Limitations due to Physical Health	4a-4d	4	Physical
Bodily Pain	7, 8	2	Physical
General Health	1, 11a-11d	5	Physical
Vitality	9a, 9e, 9g, 9i	4	Mental
Social Function	6, 10	2	Mental
Role Limitations due to Emotional Problems	5a-5c	3	Mental
Mental Health	9b, 9c, 9d, 9f, 9h	5	Mental

However, in a study by Andresen et al. (1995) the physical dimension of the SIP was reported to have a correlation of $r=-0.39$ to the role limitations due to physical health and a correlation of $r=-0.33$ to general health, which are the principal components of the SF-36 physical dimension score.

Despite the widespread use of the SIP and the SF-36 in research studies, there are very few studies using these measures to assess an individual's health status or to evaluate the effectiveness of physical therapy. Research has found that health status measures were not frequently used by allied health care workers such as physical therapists, occupational therapists and respiratory therapists (Ohman et al., 1995). Ohman et al. (1995) reported that less than 20% of entry level programs in the allied health professions included instruction in health status measures. In physical therapy academic programs, the Quality of Well-Being questionnaire, the SIP, and the SF-36 were introduced in 5% or less of the programs surveyed. However, these measures have been found to be useful in physical therapy. Jette and Downing (1995) evaluated the health status of individuals entering a cardiac rehabilitation program and reported that health practitioners, such as physical therapists, should consider inclusion of standardized health status measures as part of a comprehensive evaluation.

4. Relationship Between Objective Measures and Self-Reports of Physical Function

An individual's self-reported level of function and their actual level of function appear to be an obvious relationship. However, the relationship between an individual's self-reported level of function and objective measures of physical function is not as clear (Linn et al., 1980). Despite the clinical usefulness of submaximal exercise tests in evaluating physical function in individuals with chronic disabling conditions, it is important to determine the relationship between these measures and standardized self-reports of health status in order to evaluate the effectiveness of physical therapy interventions.

The association between performance-based and self-reports of physical function has been well studied in the geriatric population (Cress et al., 1995; La Rue et al., 1979; Reuben et al., 1992; Sager et al., 1992; Young et al., 1995). The performance-based measures simulates a given activity. An individual is required to perform a specific task and is evaluated objectively using predetermined criteria which may include counting the number of repetitions or timing the activity (Guralnik et al., 1989). Numerous standardized physical function tests have been developed for the geriatric population including the Physical Performance Test (Reuben & Siu, 1990; Reuben et al., 1992), the Physical Performance and Mobility Examination (Winograd et al., 1994) and Tinetti Gait and Balance Measures (Tinetti et al., 1986). As well some studies use their own selected measures (Cress et al., 1995; Young et al., 1995). The self-reports are used to assess limitations leading to disability (Nagi, 1991) and in performing routine daily activities. These self-report measures have included generic health status measures such as the Short Form-20 in a study by Siu et al. (1993) and the physical dimension score of the SIP (Cress et al., 1995). In addition, function-specific self-report measures have been used including the Katz Activities of Daily Living (Katz et al., 1970) and a modified Rosow-Breslau scale (Rosow & Breslau, 1966).

Cress et al. (1995) studied a sample of 417 community-dwelling individuals and 200 nursing home residents aged 62 to 98 years. The physical performance measures included isometric grip strength, chair-stand time, balance measurements, and gait-speed measurement. Self-reports of physical function were assessed using the physical dimension score of the SIP. The investigators reported a significant difference between the community-dwelling residents and the nursing home residents ($p<0.0001$) in all variables except age and gender. There was a moderate correlation between the performance measures and the self-reports which ranged from $r=-0.194$ to $r=-0.625$ ($p<0.05$). Gait speed was the best predictor of perceived physical function. Young et al. (1995) also conducted a longitudinal study examining the relationship between performance-based and self-reported levels of function. Subjects included 3, 640 Japanese-American men over the age of 70. Physical function was assessed objectively, with ten physical tasks incorporating gait, balance, chair-stand time, grip-strength, and upper-body flexibility. Measures of self-report were obtained from a 17-item questionnaire. In addition, level of physical activity was assessed by self-report and recorded as an estimated daily energy expenditure. A linear relationship was observed between reported physical activity level and time to walk 10 feet ($t=-2.1$, $p=0.03$) and grip-strength ($t=9.5$, $p<0.01$). The investigators concluded that a combination of performance-based measures of physical function and self-report measures that are sensitive to change and have sufficient variability to test a range of function, provide the best assessment of physical function.

Other investigators have examined the relationship between objective ratings of general health by a physician and an individual's self-report of health. La Rue et al. (1979) reported that in 69 individuals over the age of 60 years, the objective rating of health based on medical examinations was significantly correlated with the individual's perception of health. This research supports the validity of self-report data as a measurement of health status. The investigators also recommended further investigation of the incorporation of self-reported ratings of health in clinical assessments. Linn et al. (1980) conducted a similar study. An objective rating of disability was assessed by a physician using a Rapid Disability Rating Scale and a Cumulative Illness Rating Scale and health status was also rated by the individual. The sample consisted of 174 individuals over the age of 65 from three different cultures [Anglo, black, and Hispanic (Cuban)]. In the combined sample, there was a correlation of $r=0.40$ ($p<0.01$) between the objective assessment of disability and self-report of health and a correlation of $r=0.37$ ($p<0.01$) with the objective measure of impairment and self-report of health. Self-assessed health also differed among the three cultures but the physician ratings did not discriminate among the cultures. Overall, it was concluded that an individual's self-report of health is an important factor that could augment objective assessments of physical impairment and disability.

Several studies have investigated the objective measures and subjective measures used in the present study. The patient populations assessed included persons with COPD and cardiac conditions using various objective physiological measures and the dimension scores of the SIP (Jones et al., 1989; Leidy & Traver, 1995). Jones et al. (1989) investigated the relationship between the SIP, lung spirometery, arterial oxygen saturation during exercise, and the 6-MWD test in 141 subjects with COPD. They reported a strong correlation ($r=-0.64$; $p<0.0001$) between the 6-MWD and the total SIP score. The 6-MWD had the highest significant correlation with the physical dimension score of the SIP but no values were reported. This test provided the best physiologic correlate with the total SIP score and the individual categories. Leidy and Traver (1995) investigated the extent to which physiologic impairment, physical symptoms, and psychological resources affect functional performance. The SIP was used to measure health status and the 12-MWD was used as a measure of physiologic impairment. There were 44 men and 45 women with COPD in the sample. Overall the 12-MWD was correlated with the total SIP score for both sexes ($r=-0.44$; $p<0.01$). There was a higher correlation with the physical dimension, $r=-0.49$ ($p<0.01$) than with the psychosocial dimension, $r=-0.22$ ($p<0.01$). The 12-MWD was reported to be a better clinical marker of function than pulmonary function.

Guyatt et al. (1985b) investigated the relationship between 6-MWD, performance on a progressive multistage exercise test on a cycle ergometer and disease-specific measures of function in 43 subjects with cardiac and respiratory disease. The disease-specific health status measures included the Baseline Dyspnea Index, Rand Instrument, Oxygen Cost Diagram, and the Specific Activity Scale. Overall the 6-MWD showed a good correlation with the disease-specific health status measures ranging from $r=0.47$ ($p<0.001$) to $r=0.59$ ($p<0.001$) and to the time to exhaustion based on a maximal cycle ergometery test, $r=0.58$ ($p<0.001$). However, the correlation between the cycle ergometer and responses to the questionnaires were not significant; $r=0.14$ ($p<0.50$) to $r=0.30$ ($p<0.07$).

There is an increased interest in the literature in the integration of health status measures into physical therapy assessments (Jette & Downing, 1994). Health status measures, such as the Katz ADL index and the Functional Status Questionnaire have been used to assess disability and handicap in individuals with the late sequelae of poliomyelitis (Einarsson & Grimby, 1990; Grimby & Jonsson, 1994). Few studies to date, however, have examined the relationship between objective measures used in the clinical setting and measures of health status based on questionnaires.

THEORETICAL BASIS FOR THIS STUDY

In this study, health is defined as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO, 1951). Health in this definition is viewed as a multidimensional concept which incorporates the impact of the disease processes on all aspects of an individual's life (Barr, 1995) and serves as a premise for this study. This view of health differs from the medical model of health, which is limited to the identification of characteristics of disease: etiology, pathology, and manifestations (WHO, 1980). The medical model is less effective in dealing with diseases that cannot be cured because it focuses on curing and not caring for individuals with chronic conditions (Granger, 1984). Contemporary health care needs to focus on the rehabilitation of individuals with chronic conditions with the goal of maximizing independence (Granger, 1984).

Two conceptual models which have served as the theoretical foundation for this multidimensional or rehabilitation approach to health care are the International Classifications of Impairments, Disabilities, and Handicaps (ICIDH) (WHO, 1980) and Nagi's (1991) model of disablement. Guccione et al. (1988) integrated both of these models and proposed a conceptual framework (Figure 1) to assess health status.

In this model, Guccione et al. (1988) defines the following terms:

> *Disease* is a pathological condition of the body that presents a group of characteristic signs and symptoms that

sets the condition apart as abnormal. A physician or other medical professional may intervene at this stage to diagnose and treat with the appropriate surgical or pharmacological intervention.

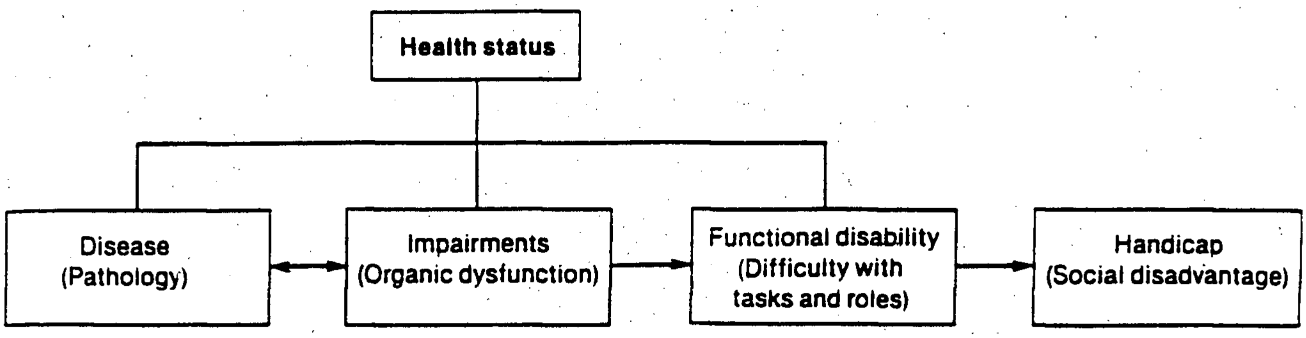
Impairment is any loss or abnormality of anatomic, physiologic or psychologic structure or function. It is seen as the natural consequence of pathology or disease. Physical therapy intervention will often be initiated at this level to deal with impairments of the neuromuscular, musculoskeletal, or cardiopulmonary systems.

Functional disability is the inability of an individual to function normally as the result of impairment. It incorporates physical, mental, affective, and social function.

Handicap is the social disadvantage for a given individual resulting from an impairment or disability that limits or prevents the fulfillment of a role or task that is considered normal (relative to age, sex, social, and cultural factors).

FIGURE 2

A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING HEALTH STATUS



Note. Adapted from "Functional Assessment" by A.A. Guccione, K.E. Cullen, & S.B. O'Sullivan (p. 220). In S.B. O'Sullivan and T.J. Schmitz, 1988, Physical Rehabilitation Assessment, Philadelphia: F.A. Davis Company.

This model outlines the broad spectrum of health from the cellular to the societal level. In the present study, an example of an objective measurement of physical function is an assessment of the compromised cardiopulmonary and musculoskeletal system, which is an impairment. Individuals with the late sequelae of poliomyelitis, however, identify numerous functional disabilities particularly related to mobility. To assess how the functional disabilities have an impact on an individual's life, self-report of health status can be used, e.g. the SIP or SF-36 health status measures. Physical therapists often assume that an intervention directed at the level of impairment will have a direct effect on the functional disability and the health status of an individual. However, an assessment only at the disease or impairment level is limiting and does not provide any information regarding the person's functional disability or health status (Barr, 1995; Jette & Downing, 1994). To assess the effectiveness of interventions directed at the impairment level, a standardized measure of health status, e.g. the SIP or the SF-36 must be incorporated to ensure that the interventions are having a positive effect on the function and health status of the individual.

Although the various components of health, i.e. physical, psychological, and social dimension, are distinct concepts, they are also interrelated (Jette & Downing, 1994; Ware et al., 1981). A physical therapy intervention may have a direct effect on one component of health status and indirect effects on the other dimensions. In chronic disorders such as the late sequelae of poliomyelitis, impairments in physical function may produce functional disabilities in psychological and social function. In this study, only the physical dimension of health was addressed. However, it is important to use a general health status measure as opposed to a measure specific to function, e.g. the Functional Mobility Assessment (Badke et al., 1993), or the Yale Physical Activity Survey (Dipetro et al., 1988), so the indirect effects on other dimensions of health care can be investigated in future studies.

HYPOTHESES AND AIMS OF THE STUDY

This study was designed to examine the relationship between objective measures and self-reports of physical function in individuals with the late sequelae of poliomyelitis. The objective measures of physical function include the 6-MWD and the CRCI based on a steady-rate walking test. The self-reports included the physical dimension score of the SIP and the SF-36 health status measures.

The hypotheses of this study were:

Hypothesis 1: Physical function as assessed by the 6-MWD is correlated with the physical dimension score of the SIP.

Hypothesis 2: Physical function as assessed by the 6-MWD is correlated with the physical dimension score of the SF-36.

Hypothesis 3: Physical function as assessed by the CRCI based on a steady-rate walking test is correlated with the physical dimension score of the SIP.

Hypothesis 4: Physical function as assessed by the CRCI based on a steady-rate walking test is correlated with the physical dimension score of the SF-36.

The aims of the study were:

1. to determine the usefulness of the 6-MWD test to assess physical function in individuals with the late sequelae of poliomyelitis.

2. to determine the usefulness of the CRCI based on a steady-rate walking test to assess physical function in individuals with the late sequelae of poliomyelitis.

3. to examine the relationship between the 6-MWD and the CRCI based on a steady-rate walking test.

4. to examine the relationship between the physical dimension score of the SIP and the SF-36.

METHODS

RESEARCH DESIGN

A descriptive, correlational study based on a nonexperimental research design was used to examine the relationship between objective measures and self-reports of physical function. Subjects attended three sessions, each lasting approximately two hours, within six weeks, over a six-month interval. A minimum of two days rest was required between sessions to allow for recovery and minimize any residual effects from the previous practice or test sessions. Questionnaires and requisite practice or exercise tests were randomized over subjects and alternated over sessions. In the first session, subjects completed a standardized medical history (Appendix A) and one practice session of each exercise test. The second session consisted of completing one health status measure, one practice exercise test, and one exercise test. In the third session, subjects completed one health status measure and one exercise test. Subjects completed a total of three 6-MWD tests (two practices and one final test), one practice session walking on a treadmill, one steady-rate walking test (on which to calculate the CRCI), one SIP questionnaire, and one SF-36 health status questionnaire.

SUBJECTS

Subjects were recruited from the Ergometric Performance Clinic/Laboratory at U.B.C. as well as from an advertisement published in a support group newsletter. The subjects were all ambulatory community dwellers in good health. The inclusion criteria for the study included: 1) individuals between the ages of 40 and 70 years who had a confirmed diagnosis of the late sequelae of poliomyelitis secondary to spinal poliomyelitis (Halstead & Rossi, 1985, 1987), 2) no medical conditions that precluded them from exercise testing, 3) the ability to walk on a treadmill with minimal hand support at a speed of at least 1 mile per hour (mph), and 4) the ability to achieve a physiologic steady- rate with a HR between 60% to 80% of age-predicted maximum. All subjects were required to give informed consent. Those subjects who could not read English sufficiently were excluded from participating in the study.

As outlined in the research proposal, the sample size was to be determined by doing a power analysis on preliminary data on ten subjects. On analysis acceptable statistical significance was found precluding the need for a power analysis. However, all subjects who were willing to participate in the study were included to maximize the sample size.

INSTRUMENTATION

6-Minute Walk Distance Test

The 6-MWD test was conducted on a graduated circuit in a hospital corridor. Instruments that were used included: 1) portable HR monitor, 2) a manual mercury sphygmomanometer, 3) tape measure, 4) a stop watch, 5) the Borg scale of perceived exertion (0-10) (Borg, 1970), and 6) a modified Borg scale for pain/discomfort (0-10).

All testing procedures were performed in a standardized manner according to Guyatt et al. (1985a), and the methods used at the Ergometric Performance Clinic/Laboratory (Dean & Ross, 1993). The corridor was marked at 0.5 meter (m) intervals.

Subjects had two practice sessions prior to testing for habituation (Butland, 1982; Guyatt et al., 1985a). In terms of reliability, a significant difference has been reported between the first and the third performance of the 6-MWD test. The coefficient of variation for the subjects over all of the tests was $\pm$ 8.2% and this was reduced to $\pm$ 4.2% in comparison to the results on subsequent trials if the first two tests were discarded (Mungall & Hainsworth, 1979). There is some discrepancy if one or two practice trials of the 6-MWD test need to be performed (Guyatt et al., 1984, 1985a; Mc Gavin 1976, 1978; Mungall & Hainsworth, 1979). Mc Gavin et al. (1976, 1978) found with the 12-MWD only one practice trial was needed. Guyatt et al. (1984, 1985a), in developing the 6-MWD stated two practice trials were required. For the present study, the 6-MWD test was followed according to the original study by Guyatt et al. (1984, 1985b) and two practice trials were conducted to minimize the practice effect and the third 6-MWD was taken as the test value (Guyatt et al., 1985a). The construct validity has been established based on a high correlation between 12-minute walk-run time and VO_2max measured on a treadmill (r=0.897) (Cooper, 1968).

CRCI Based on a Steady-Rate Walking Test

The instrumentation required for the steady-rate walking test included: 1) the Sensormedics treadmill, 2) a 3-lead electrocardiogram (EKG) (Hewett Packard 78353B), 3) a manual mercury sphygmomanometer, 4) a stop watch, 5) the Borg scale of perceived exertion (0-10) (Borg, 1970), and 6) a modified Borg scale for pain/discomfort (0-10).

All testing procedures were performed in a standardized manner according to the methods used at the Ergometric Performance Clinic/Laboratory to ensure the reliability and validity of the measures (Dean & Ross, 1993). The reliability of the CRCI based on a steady-rate walking test has been established (Dean & Ross, 1993). Prior to undergoing the test, subjects practiced walking on a treadmill at the speed and grade required for the test, in order to habituate (Dean et al., 1989).

The Sickness Impact Profile

The Sickness Impact Profile (Appendix B) provides a measure of health status and was originally designed to be used with various types and severities of medical conditions as well as in subjects with different demographic characteristics (Bergner et al., 1976b; de Bruin et al., 1992). It consists of 136 statements in 12 functional categories. Each statement is assigned a numeric value that reflects the degree of dysfunction. The categories can be further summed to form a physical dimension score, psychosocial dimension score, and an overall score. The physical dimension score combines ambulation, mobility, and body care and movement; the psychosocial combines emotional behavior, social interaction, alertness behavior, and communication; and the independent categories include sleep and rest, eating, work, home management, and recreation and pastimes (SIP, 1978). The questionnaire can be interviewer-administered, interviewer-delivered self-administered, and self-administered. It takes approximately 20 to 30 minutes to complete.

The SIP's reliability and validity have been well established (de Bruin et al., 1992). The test-retest reliability was found to be $r=0.87$ ($p<0.01$) when the questionnaire was self-administered (Bergner et al., 1981). In terms of the physical dimensions score, the test-retest reliability has been reported to range between $r=.87$ to $r=.95$ (Deyo et al., 1983, 1986). Interrater reliability was also high (Bergner et al., 1976a). Internal consistency of the SIP was $r=0.94$ measured by a Cronbach's coefficient alpha (Bergner et al., 1981).

Construct validity has been established by comparing the SIP ratings with both self-assessment and clinical assessments of sickness impact and behavioral dysfunction

(Bergner et al., 1981). Criterion validity has been demonstrated by correlating the SIP with objective clinical measures used in subjects having hip replacements, arthritis, and hyperthyroidism (Bergner et al., 1981). The correlations ranged from moderate (r= 0.41) to high (r=0.84) (Bergner et al., 1981). The physical dimension of the SIP has also been correlated (r=-.78) with the physical function scale of the SF-36 (Weinberger et al.,1991). Content validity was also acceptable (de Bruin et al., 1992).

The Short Form-36

The Short Form-36 (Appendix C) was originally designed to represent multi-dimensional health concepts and to measure a range of health states (Mc Horney et al., 1993). It consists of 36 items that measure health on eight dimensions including: 1) physical function, 2) role limitations due to physical health, 3) bodily pain, 4) general health, 5) vitality, 6) social functioning, 7) role limitations due to emotional problems, and 8) mental health. It can be self-administered, administered by telephone or by interview and requires 5 to 10 minutes to complete.

Reliability of the SF-36 has been established (Brazier et al., 1992: Mc Horney et al., 1994). A study by Brazier et al. (1992) assessed the internal consistency and the Cronbach's alpha coefficient in a mixed population of patients in the United Kingdom. The investigators reported the Cronbach's alpha for the eight scales to range from r=0.73 for social functioning to r=0.96 for role limitations due to physical health, with a median of r=0.95. All eight scales met the criterion of r>0.70 for the group comparisons. The minimum criterion for the individual comparisons is $r>0.90$ and all scales achieved this standard except bodily pain and social functioning. Test-retest reliability was also assessed following a two week period in the same study. The values ranged from $r=0.60$ for social functioning and $r=0.81$ for physical function, with a median value of $r=0.76$ (Brazier et al., 1992).

The construct validity was assessed by Mc Horney et al. (1993). All eight scales were able to differentiate the physical and psychiatric illnesses and discriminate between minor and major medical conditions. Another study by Lyons et al. (1994) demonstrated the construct validity of the SF-36 by observing that it was able to distinguish between men and women with and without markers of poor health. In terms of criterion validity, the scales were compared to other well standardized questionnaires which assessed the multidimensions of health. The correlations of the SF-36 physical function scale ranged between $r=0.60$ with the physical dimension of the shortened Arthritis Impact and Measurement Scales (sAIMS) and $r=-0.78$ with the physical dimension of the SIP (Ware et al., 1993). For the SF-36 mental health scale the correlations ranged between $r=0.51$ with the mental health scale of the DUKE Health Profile and $r=0.82$ with the sAIMS mental health scale. Finally, the content validity has also been established by describing the meaning and content of a high and low score for each of the eight scales.(Ware et al., 1993).

PROCEDURES

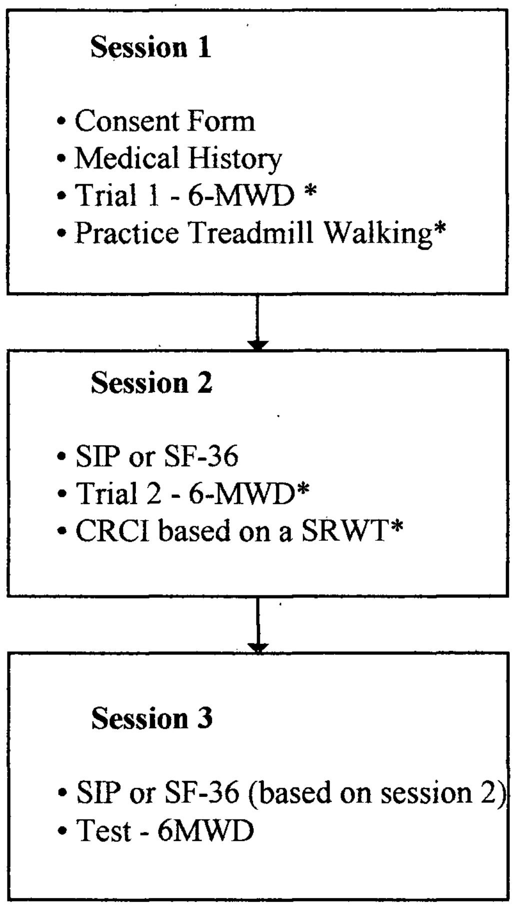
General Procedures

All subjects refrained from vigorous exercise the day before testing. Subjects were informed not to smoke, have any caffeinated beverages or a heavy meal three hours before testing, and to wear comfortable nonrestrictive clothing. The study was conducted at the Ergometric Performance Clinic/Laboratory on the third floor of the U.B.C. Health Sciences Center. Two investigators conducted or were present for the exercise testing.

A flow chart of the general experiment procedures is presented in Figure 2. In session one, the testing procedures were explained to the subjects and an orientation to the lab was provided. All subjects provided written consent to participate in the study. Ethics approval was provided by the U.B.C. Ethics Committee for Human Research. Subjects also completed a medical history (Appendix A) and height and weight were measured. Then subjects arbitrarily selected the order of the practice 6-MWD test and the practice session walking on the treadmill. In session two, subjects arbitrarily selected one of two health status measures. After completing the questionnaire, the subjects arbitrarily selected to do either a practice 6-MWD test or the steady-rate walking test used to derive the CRCI. The final session consisted of completing the remaining questionnaire and the 6-MWD test. A minimum of 20 minutes was provided between each exercise test. Subjects were offered a glass of water or juice and were instructed to rest between exercise tests. Each session lasted approximately two hours.

FIGURE 2

GENERAL EXPERIMENTAL PROCEDURE



LEGEND:

CRCI - cardiorespiratory conditioning index
6-MWD - 6-minute walk distance
SRWT - steady-rate walking test

* The order of the 6-MWD test and the CRCI based on a SRWT was randomized for each subject.

Specific Procedures

1. Testing

Exercise testing was performed in a standardized manner according to the procedures used in the Ergometric Performance Clinic/Laboratory at U.B.C. (Dean & Ross, 1993; Dean et al., 1989). All the testing sessions for each subject were carried out at approximately the same time of day to minimize and control for the effects of diurnal variations and fatigue that occur over the course of the day.

i. 6-Minute Walk Distance Test

Subjects were instructed to walk in a hospital corridor circuit. The specific instructions were "You are to walk up and down the corridor covering as much ground as you can in 6 minutes" (Guyatt et al., 1985a). They could walk at their own speed and were permitted to rest (Mc Gavin et al., 1976). Prior to starting the test, HR, blood pressure (BP), perceived exertion using the Borg scale, and pain/discomfort using the modified Borg scale were recorded for safety reasons. Heart rate was recorded each minute throughout the test and encouragement was given using standardized phrases, i.e., "good job" and "keep up the good work", every 30 seconds. At the end of six minutes, the subjects were instructed to "stop". The distance walked in six minutes was recorded and used for analysis. The criteria for test termination were: 1) any untoward exercise response (ACSM, 1995), and 2) the subject's desire to end the test.

ii. CRCI Based on a Steady-Rate Walking Test

A steady-rate walking test was performed as described by Dean and Ross (1993). Measures of HR, BP, rate of perceived exertion using the Borg scale, and pain/discomfort using a modified Borg scale were recorded at rest while sitting quietly, while standing quietly on the treadmill, and every 2 to 3 minutes while walking on the treadmill. The only measure needed for the test analysis was HR but the above mentioned variables as well as EKG were monitored for safety reasons.

The test protocol consisted of two minutes at walking 1 mph with increments of 0.5 mph every minute until a comfortable walking cadence was established. This cadence was defined as the fastest cadence the subject could walk without becoming unstable or needing more than two finger hand-rail support. A work rate that elicited a steady-rate HR between 60% to 80% of age-predicted maximum was required. If the target HR range was not established with level walking, the grade was increased by 2.5% increments each minute until the target range was achieved. Once a target HR range was achieved at a given workload, it was maintained for five minutes or until physiologic steady-rate criteria were met (Jones, 1988). Standardized encouragement phrases were given every 30 seconds. The steady-rate protocol was followed by a cool-down and postexercise recovery period. The criteria for test termination criteria were: 1) any untoward exercise response, 2) perceived exertion greater than 7 (very heavy) or pain/discomfort greater than 7 (very painful), 3) systolic BP greater than 180 mm Hg, and 4) the subject's desire to end the test (Dean & Ross, 1988).

iii. Sickness Impact Profile and the Short Form-36

The health status measures were self-administered. The co-investigator was present to answer any questions as per the specific instructions outlined in the user's manuals. For the SIP, the manual states that if individuals do not understand a question the co-investigator does not define or interpret statements. The subjects were reminded that it was his or her decision and the standardized phrase "we are interested in things that you are *sure* describe you today and are related to your state of health" was read aloud. The SF-36 was also self-administered to the subjects. If subjects asked for clarification on a particular question no interpretation of the question was given. The subjects were told to use their own interpretation and answer the questions on what they thought the question meant. If the subjects had difficulty answering the question the following predetermined phrase from the SF-36 manual (Ware et al., 1993) was read "I know that it may be hard for you to think this way, but which of these categories most closely expresses what you are thinking or feeling?".

Data Collection

1. 6-Minute Walk Distance Test

The total distance walked in six minutes was recorded in meters.

2. CRCI Based on a Steady-Rate Walking Test

During the steady-rate walking test, measures of HR were recorded for data analysis. The CRCI is based upon the relationship between the steady-rate HR and predicted rate of oxygen consumption (VO_2) for the given work rates (Mc Ardle et al., 1991). Specifically, the CRCI equals the estimated VO_2 (% predicted maximum) minus the predicted VO_2 (% predicted maximum) for the observed HR (% predicted age-predicted maximum). The oxygen used at the steady-rate work rate to calculate the estimated VO_2 (% predicted maximum) was determined from tables (ACSM, 1995). The HR (% predicted maximum) was calculated from 210 - (0.65)* age (Jones, 1988) and VO_2 (% predicted maximum) was determined for each individual based on the Canada Fitness Survey (1981). An example of the calculation is provided in Appendix D. The relationship between HR (% predicted maximum) and VO_2 (% predicted maximum) is based on the work of Saltin et al. (1968).

3. Score on the Sickness Impact Profile

The SIP was scored according to the procedures outlined in the user's manual. There are 136 statements. Subjects check off only those statements that describe or are related to their present state of health. A composite score can be obtained for the physical and psychosocial dimension in addition to an overall score. When all items are checked off the score is 100% indicating that an individual's condition fully impacts on her or his function whereas a score of 0% demonstrates no effect. Only the physical dimension consisting of 45 statements was used. The total score could range from 0 (high level of functioning) to 100 (low level of functioning).

4. Score on the Short Form-36

The SF-36 was scored according to the procedures outlined in the user's manual. There are 36 questions and the scores are summed, recalibrated, and transformed into a percentage score for each category. To calculate the physical dimension score, the eight scale values were transformed into standardized z-scores and aggregated according to the formulas provided in the SF-36 Physical and Mental Health Summary Scales: A User's Manual (Ware et al., 1993). The total score for the physical dimension could range from 73 (high level of functioning) to 8 (low level of functioning), with a mean of 50 and a standard deviation of ± 10 based on the United States general population.

DATA ANALYSIS

The data were analyzed using descriptive statistics to characterize the subjects. Pearson product moment correlations were used to examine the relationship between objective measures and self-reports of physical function. One way analysis of variance (ANOVA) was used to examine differences in 6-MWD during practice trials and the third test value. A Tukey's post hoc test was used to determine between mean differences. A paired t-test was used to compare HR's achieved in the two objective tests (6-MWD and CRCI based on a steady-rate walking test). The p value was set at $p<0.05$.

RESULTS

SUBJECT CHARACTERISTICS

A total of twenty-three subjects agreed to participate in the study and six were excluded. Four subjects did not meet the criterion of attaining a steady-rate HR between 60% to 80% of predicted maximum on the treadmill so they were excluded in the data analysis. Two subjects did not complete the final testing session due to an inability to complete the testing within the required time period because of other commitments.

A summary of the descriptive and demographic data of the 17 subjects who completed the study appears in Table 3. Of these, five were men and twelve were women. Overall the mean age and standard deviation was 53.9 ± 7.2 years. The average height of the subjects was 1.66 ± 0.10 m and the average weight of the subjects was 71.22 ± 11.33 kg. Body mass index was an average of 25.78 ± 4.02. In terms of mobility aids and devices, three subjects used ankle foot orthoses and none of the subjects required a mobility device.

All subjects had the late sequelae of poliomyelitis based on the diagnostic criteria (Dean, 1991; Halstead & Rossi, 1985, 1987) but otherwise were healthy. Four subjects were taking medication regularly, for long-standing conditions such as arthritis, thyroid, or high BP. No subjects were on any medications that would influence their exercise responses. One subject required an inhaler for asthma and he used it regularly before each testing session.

TABLE 3

SUBJECT CHARACTERISTICS

Subject	Gender	Age (years)	Height (m)	Weight (kg)	BMI	Onset Polio	Onset Sequelae
1	M	53	1.78	75.7	23.9	1946	1992
2	F	49	1.64	82.5	30.7	1947	1980
3	M	45	1.88	93.5	26.5	1952	1984
4	F	64	1.57	73.5	29.8	1954	1991
5	F	49	1.61	55.8	21.5	1952	1984
6	M	52	1.74	85.5	28.2	1948	1989
7	F	69	1.64	52.0	19.3	1954	1974
8	F	60	1.72	72.0	24.3	1948	1979
9	F	52	1.53	80.0	34.2	1948	1988
10	F	53	1.66	68.5	24.9	1954	1980
11	F	52	1.60	58.0	22.7	1951	1980
12	F	48	1.62	72.3	27.5	1952	1994
13	F	60	1.53	57.0	24.3	1953	1986
14	M	66	1.71	80.1	27.4	1931	1980
15	F	50	1.57	74.4	30.2	1947	1990
16	M	47	1.78	65.5	20.7	1951	1996
17	F	47	1.62	58.4	22.3	1952	1987
MEAN SD		53.9 7.2	1.66 0.10	71.22 11.33	25.78 4.02		

The exercise testing sessions were performed without any untoward events. No exercise test had to be terminated prematurely for any reason and none of the subjects experienced any problems during or following the exercise testing sessions. With respect to the health status measures, all subjects completed both the SIP and the SF-36. There were no missing data in either questionnaire. None of the subjects had any difficulty completing either the SIP of the SF-36 and clarification of the instructions was only provided twice as outlined as per the instruction manual.

CORRELATIONS BETWEEN OBJECTIVE MEASURES AND SELF-REPORTS OF PHYSICAL FUNCTION

The correlations between the two objective measures (6-MWD test and the CRCI based on a steady-rate walking test) and the two self-reports (SIP and SF-36) appear in Table 4. The 6-MWD and the SIP were significant correlated ($r=-0.57$; $p<0.05$) The correlation is a negative value because a low score on the SIP represents a good state of health. The 6-MWD was also significantly correlated with the SF-36 ($r=0.67$; $p<0.05$) in which a high score represents a good state of health.

The CRCI was significantly correlated with the SIP ($r=-0.51$; $p<0.05$) and with the SF-36 ($r=0.70$; $p<0.01$).

CORRELATION BETWEEN THE 6-MWD AND THE CRCI

The correlation between the two objective measures (6-MWD and the CRCI) appear in Table 4. Individual data for the 6-MWD practice trials and test and the CRCI appear in Table 5 and 6. The correlation of $r=0.50$ ($p<0.05$) was observed between the 6-MWD and the CRCI. A paired t-test revealed no significant difference between the average HR's of the third test value of the 6-MWD and the CRCI ($t=0.56$, df 16, $p>0.05$).

TABLE 4

SUMMARY OF THE CORRELATIONS BETWEEN THE OBJECTIVE MEASURES AND THE SELF-REPORTS

	6-MWD	CRCI	SIP
CRCI	0.50*		
SIP	-0.57*	-0.51*	
SF-36	0.67*	0.70**	-0.80**

LEGEND:

6-MWD - 6 minute walk distance
CRCI - cardiorespiratory conditioning index
SIP - Sickness Impact Profile
SF-36 - Short Form-36

* - p<0.05
** - p<0.01

TABLE 5-1

INDIVIDUAL DATA FOR THE 6-MINUTE WALK DISTANCE

Subject	Trial 1 (m)	% HRmax	Trial 2 (m)	%HRmax	Test (m)	%HRmax
1	539.42	68	538.40	67	562.04	74
2	407.13	61	407.01	63	405.23	61
3	663.97	63	676.08	66	676.13	66
4	470.92	62	485.40	68	497.48	69
5	655.29	63	696.27	65	702.77	67
6	571.08	64	584.24	67	584.81	65
7	388.32	63	425.55	64	443.40	63
8	525.34	65	600.43	63	618.76	72
9	514.84	72	522.51	72	516.88	71
10	556.89	66	525.09	67	587.96	74
11	490.28	68	500.21	65	515.41	67
12	511.51	60	513.71	68	517.48	66
13	347.89	65	394.11	74	397.78	66
14	409.86	71	464.39	74	473.43	71
15	488.13	64	493.48	65	468.57	61
16	595.35	65	625.99	68	644.50	67
17	523.93	63	524.52	61	529.25	66
MEAN SD	509.42 87.83	64.9 3.28	528.08 86.42	66.9 3.67	537.76 89.33	67.4 3.97

TABLE 5-2

ANOVA SUMMARY FOR THE 6-MINUTE WALK DISTANCE

Effect	df	SS	MS	F	p-level
Trial / Test	2	3526.939	297.9635	11.8	0.0001

LEGEND:

ANOVA - analysis of variance (one way)
df - degrees of freedom
SS- sum of squares
MS - mean square
% HRmax - % of age-predicted maximum heart rate

TABLE 6

INDIVIDUAL DATA FOR THE CARDIORESPIRATORY CONDITIONING INDEX

Subject	CRCI	% HRmax
1	-22	81
2	-13	60
3	-10	78
4	-2	76
5	+25	75
6	-2	62
7	-15	66
8	+18	63
9	-1	64
10	-10	70
11	-6	62
12	+4	72
13	-11	60
14	-6	61
15	+2	75
16	+1	72
17	-9	77
MEAN SD	-3.35 11.56	69.1 7.17

LEGEND:

CRCI - cardiorespiratory conditioning index
% HRmax - % of age-predicted maximum heart rate

CORRELATION BETWEEN THE SIP AND THE SF-36

The correlation between the two self-report measures of physical function (SIP and the SF-36) was $r=-0.80$ ($p<0.01$). Individual data for the SIP physical categories and the SF-36 physical scales and the physical dimension scores for each questionnaire appear in Table 7 and 8. A summary of the distribution of the physical dimension scores on the SIP and the SF-36 appears in Figure 3 and Figure 4 respectively. In terms of the SIP, the range of scores was 0 to 16.58, with a mean and standard deviation of 4.95 ± 5.17. It was found that two subjects (representing 12% of the total sample) attained a score of 0 on the physical dimension score of the SIP, representing a perfect state of physical health and is referred to as a ceiling effect. In the individual categories, ceiling effects were seen in five, sixteen, and six subjects for the ambulation, mobility, and body care and movement categories respectively. No subject had a score of 100, representing the poorest state of health which is referred to as a floor effect.

In comparison, the scores in the SF-36 ranged from 16.00 to 68.93 with a mean and standard deviation of 41.53 ± 11.87. No subject attained a perfect score on the physical dimension as the SF-36 physical dimension score is derived from norms of the United States general population. There were however, ceiling effects noted in the SF-36 scales for one subject in the physical function scale, seven subjects in the role limitations due to physical health scale, and in two subjects in the bodily pain scale. Floor effects were found in three subjects for the role limitations due to physical health scale.

TABLE 7

INDIVIDUAL DATA FOR THE SICKNESS IMPACT PROFILE CATEGORY SCORES AND THE PHYSICAL DIMENSION SCORES

Subject	Ambulation	Mobility	BCM	PDS
1	24.47	9.18	7.29	11.73
2	37.41	0	13.78	16.58
3	0	0	0	0
4	12.35	0	1.50	3.76
5	0	0	0	0
6	16.39	0	0	3.87
7	9.86	0	5.09	5.19
8	0	0	1.50	0.84
9	22.80	0	0	5.39
10	0	0	2.90	1.63
11	0	0	1.50	0.42
12	20.07	0	1.50	5.58
13	40.74	0	10.98	15.80
14	5.40	0	0	1.52
15	4.16	0	0	0.98
16	24.35	0	3.59	5.89
17	12.35	0	3.59	4.94
Score Range	0-100	0-100	0-100	0-100
Mean SD	13.61 13.12	.54 2.23	16.69 15.37	4.95 1.25

LEGEND:

BCM - body care and movement
PDS - physical dimension score

TABLE 8

INDIVIDUAL DATA FOR THE SHORT FORM-36 SCALES AND THE PHYSICAL DIMENSION SCORES

Subject	PF	RP	BP	GH	PDS
1	45	0	74	20	28.78
2	20	0	31	25	16.00
3	95	100	84	77	52.51
4	45	50	62	72	37.21
5	100	100	100	82	68.93
6	55	0	74	40	31.57
7	55	50	41	57	31.33
8	80	100	84	67	49.61
9	85	75	64	72	44.20
10	80	100	62	50	46.03
11	70	75	84	57	43.02
12	50	100	61	77	40.87
13	35	50	72	27	30.85
14	70	100	100	82	50.93
15	85	75	74	77	48.09
16	65	100	62	82	44.55
17	55	75	84	62	41.55
Score Range	0-100	0-100	0-100	0-100	0-100
Mean SD	64.12 21.88	67.65 37.25	71.35 18.16	60.35 21.05	41.53 11.88

LEGEND:

PF - physical function
RP - role limitations due to physical health
BP - bodily pain
GH- general health
PDS - physical dimension score

FIGURE 3

DISTRIBUTION OF THE SICKNESS IMPACT PROFILE PHYSICAL DIMENSION SCORES

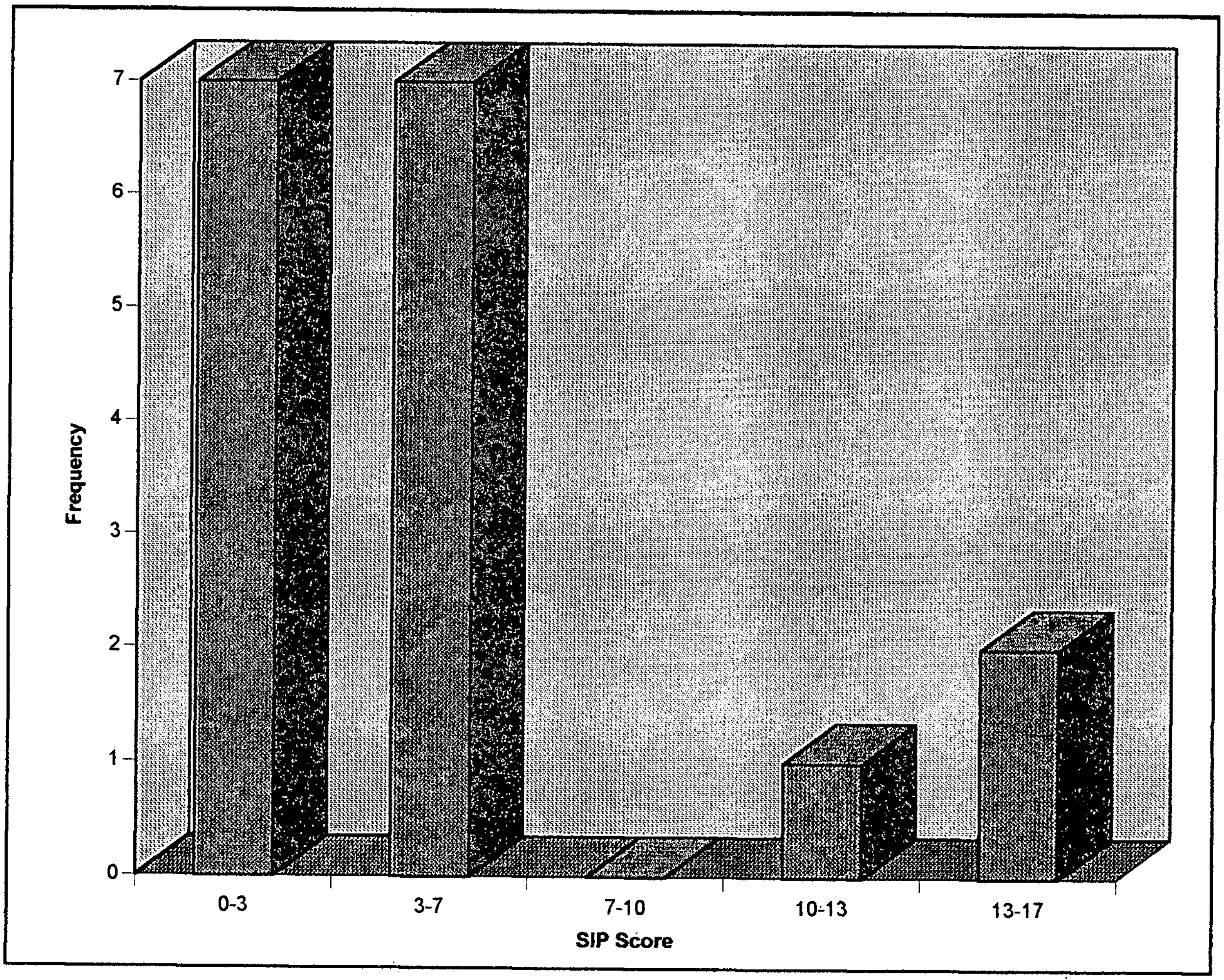
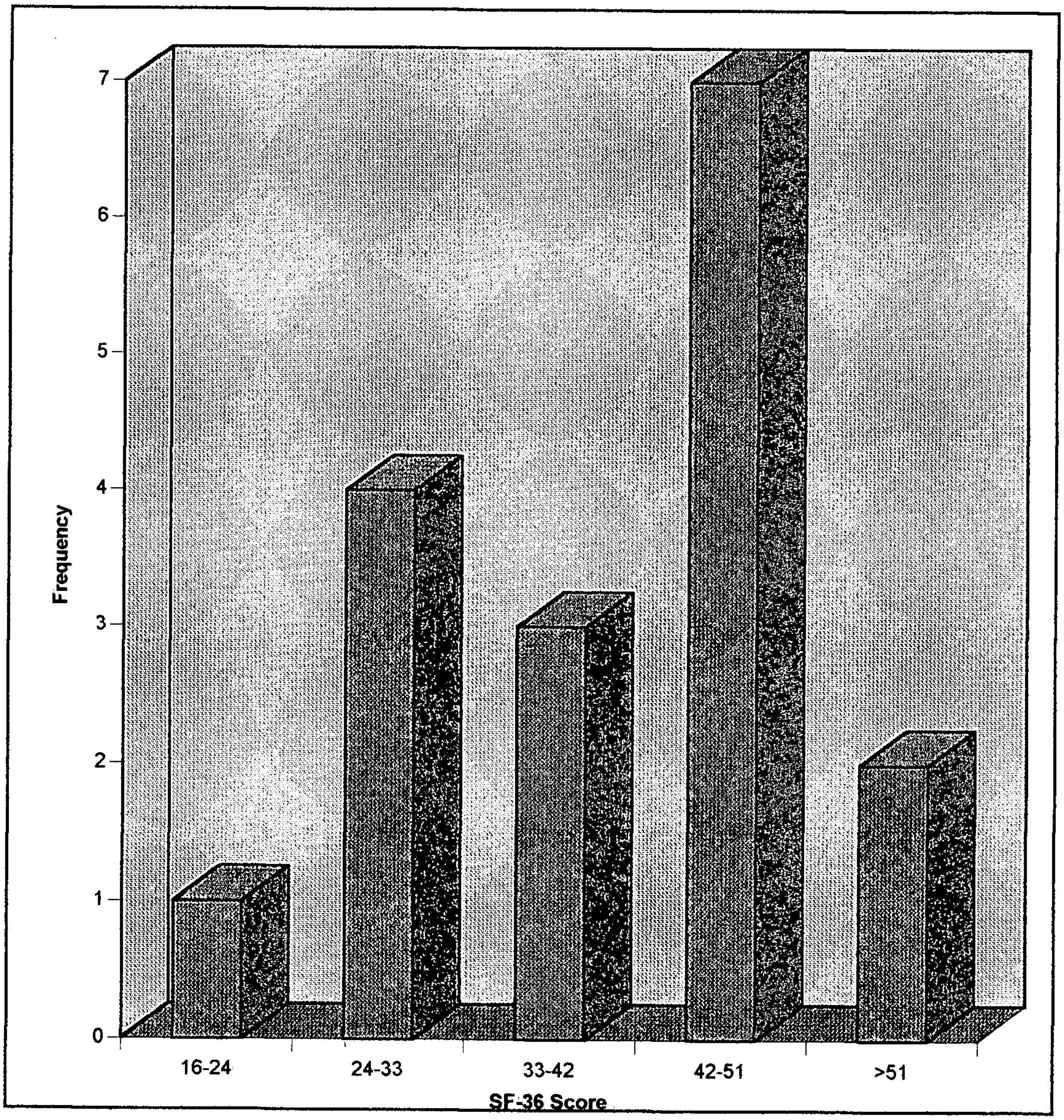


FIGURE 4

DISTRIBUTION OF THE SHORT FORM-36 PHYSICAL DIMENSION SCORES

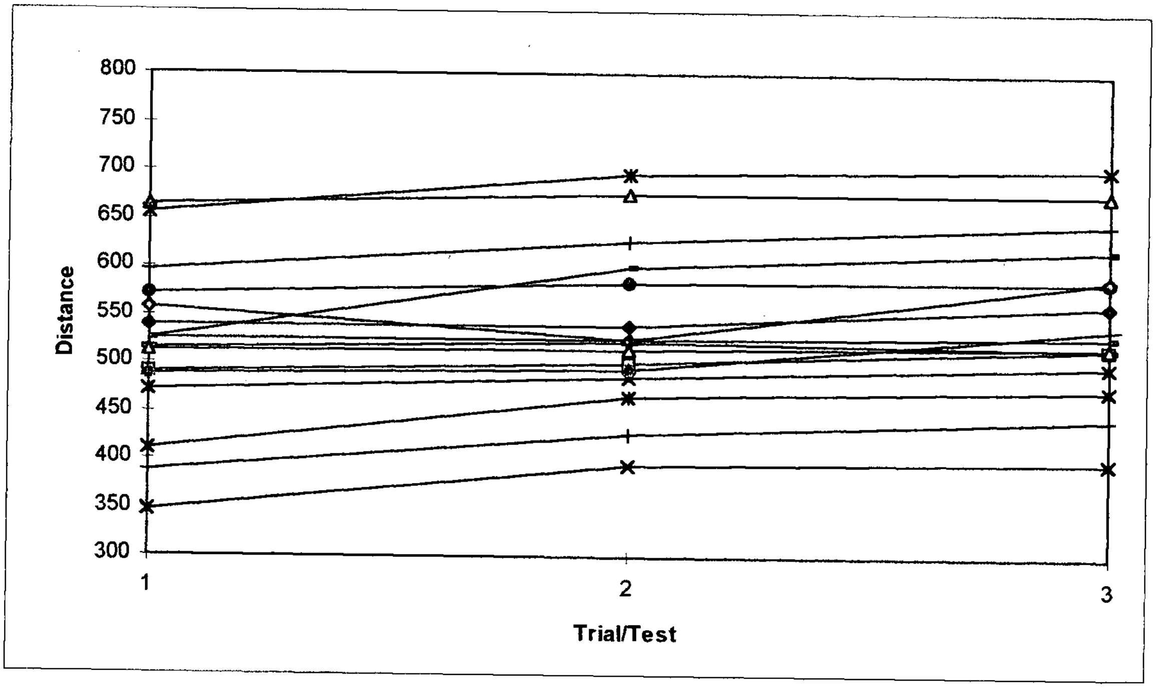


DISTANCE COVERED IN THE 6-MWD OVER THREE TRIALS

The distances walked in two practice trials and in the third test value appear in Table 5A. The majority of subjects increased his or her distance with practice (Figure 5). One of the subjects who had an very active day before the final 6-MWD test had a lower distance walked on the third test compared with the second trial. Based on an ANOVA (Table 5B) and a Tukey's post hoc test, a statistically significant difference was observed between practice trials one and two, and practice trial one and the final test value. No statistical difference was observed between practice trail two and the third test.

FIGURE 5

DISTRIBUTION OF THE 6-MINUTE WALK DISTANCES OVER THREE TRIALS



DISCUSSION

RELATIONSHIP BETWEEN THE 6-MWD AND THE PHYSICAL DIMENSION SCORE ON THE SIP AND THE SF-36

The results of this study support the first two hypotheses specifically, that there is a correlation between the 6-MWD with physical dimension score on both the SIP and the SF-36 health status measures. In terms of the relationship between the 6-MWD and the physical dimension score of the SIP a correlation of $r=-0.57$, $p<0.05$ was observed. The correlation is negative due to the scoring method of the SIP health status measure. A score of 0 indicates a good state of health and a score of 100 represents a poor state of health.

These findings are consistent with the literature. Jones et al. (1989) reported a correlation of $r=-0.72$ between the 6-MWD and the physical dimension score of the SIP in individuals with COPD, however the level of significance was not reported. Leidy and Traver (1995) investigated the relationship between the 12-MWD and the physical dimension score on the SIP and reported a correlation of $r=-0.49$ ($p<0.01$) also in the COPD patient population. The relationship between these two measures is consistent in both individuals with the late sequelae of poliomyelitis and in the COPD patient population even though they are distinct pathological conditions. The late sequelae of poliomyelitis is a neuromuscular condition and the limiting factors are peripheral muscle weakness in the lower extremity muscles, pain, as well as local and general fatigue with exercise (Dean, 1991; Halstead & Rossi, 1985, 1987). These individuals typically have musculoskeletal deformities which impair their biomechanics. Chronic obstructive pulmonary disease in contrast, is a cardiorespiratory condition resulting in symptoms of dyspnea, altered lung volumes and flow rates as well as respiratory muscle weakness and peripheral muscle weakness (Jones et al., 1989; Leidy & Traver, 1995; Weaver & Narsavage, 1992). The similar findings for the relationship between the objective measure and self-report of physical function in these two types of conditions suggest that the 6-MWD and the physical dimension score of the SIP is a generic relationship and is not disease specific. Further research is needed to examine this relationship in other patient populations.

The assessment of physical function using the 6-MWD test and score on the SIP appears to reflect daily function. Even though the instructions for the 6-MWD test is "cover as much ground as you can in six minutes", it has been reported that individuals select a pace below a maximum level of ventilation and oxygen consumption that they can sustain without undue discomfort or fatigue (Gosselink et al., 1996; Swinburn et al., 1985). The questions in the physical dimension assessed by the SIP also assess a reported level of physical function as opposed to a capacity measure. In the ambulation category of the SIP, an example of a question is "I walk by myself but with some difficulty, for example, limp, wobble, stumble, have stiff leg". Individuals would have responded "yes" to this question if it described her or his state of health today. There are also questions in the SIP physical dimension which incorporate aspects of physical function other than ambulation and appear to be less related to 6-MWD. An example of a question in the body care and movement category is "I am very clumsy in body movements". Even though the objective measure of physical function using the 6-MWD test just provides a total distance walked and the SIP assesses a variety of physical activities, both measures reflect aspects of daily physical function.

In terms of the relationship between the 6-MWD and the physical dimension score of the SF-36, a correlation of $r=0.67$ ($p<0.05$) was observed. To the best of our knowledge no previous studies have examined these relationships, thus, we were unable to compare our results. The SF-36 physical and mental summary scoring manual (Ware et al., 1994) has only recently been developed, therefore we may be among the first to examine this relationship. The majority of the studies investigating this particular relationship have been done with the COPD population using the SIP's physical dimension score. However, the SF-36 has been recently receiving considerable attention within health care (Freeman et al., 1996) because it requires only five to ten minutes to complete and has strong psychometric properties (Mc Horney et al., 1992; Ware & Sherbourne, 1992). Therefore, the results of the present study provide a basis for future research.

The relationship between the 6-MWD and the SF-36's physical dimension score also indicates that both measures are assessing similar aspects of physical function. The SF-36, like the SIP, also measures self-reported physical function as opposed to a capacity measure. Questions in the SF-36 assess the degree of limitation experienced in a range of daily physical activities from vigorous activities to bathing and dressing. An example of a question from the SF-36 physical dimension scale asks if an individual is limited a lot, a little, or not at all in "walking more than a kilometer".

In the present study the results indicate that the correlation between the 6-MWD and the SF-36 is stronger than that between the 6-MWD and the SIP. There are two possible explanations for this finding. One explanation is that qualities assessed by the SIP and the SF-36 physical dimensions are different. In the SIP the physical dimension score is comprised of ambulation, mobility, and body care and movements. The physical dimension of the SF-36, however, consists of the physical function scale, role limitations due to physical health, bodily pain, and general health perceptions. The qualitative differences between these two dimensions of physical function likely contribute to the different correlations. The stronger correlation between the SF-36 and the 6-MWD may reflect the fact that the SF-36 incorporates more beliefs and attitudes about a person's perception of health by including items on bodily pain and general health perceptions These two scales ask individuals to quantify how limited they have been by their bodily pain and how they perceive their overall general health compared with other individuals. Morgan et al. (1983) reported that the distance covered in the 12-MWD test by individuals with COPD was more strongly influenced by attitudes and beliefs than mood or ventilatory capacity. The questions in the physical dimension score of the SIP are objective statements about physical function which may be less affected by a person's attitudes and beliefs.

The distribution of the scores on the SIP and the SF-36's physical dimension may also contribute to the difference in magnitude between the correlation of the two health status measures with the 6-MWD. The scores on the SIP range from 0 to 16.58, with a mean and standard deviation of 4.94 ± 5.17. On the SF-36 there is a broader range, from 16.00 to 68.93, with a mean and standard deviation of 41.53 ± 11.88. The physical dimension score of the SF-36 is based upon the United States general population, so the average population has a mean and standard deviation of 50 ± 10.

As indicated in Figure 3, the SIP portrayed the subjects as having relatively good physical functioning. A total of five subjects had a ceiling effect on the ambulation category, sixteen subjects for the mobility category, six subjects in the body care and movement category, and two subjects had an overall physical dimension score of zero. In this study, individuals had to be able to walk on a treadmill at a speed of at least 1.0 mph, with only minimal hand support. These criteria eliminated individuals with severe limitations in their physical function and those who depend on assistive devices and mobility aids. In the literature, the SIP has been reported to exhibit a ceiling effect with relatively high functioning patient populations. Andresen et al. (1995) showed a skew of the SIP physical dimension score towards good health in older adults. The range of reported SIP physical dimension scores was 0 to 27, and 103 subjects out of a sample size of 200 had a score of zero, demonstrating a ceiling effect. The investigators concluded that the SIP should not be used as a measure of health status among healthy, community-dwelling adults. Another study by Weinberger et al. (1991) used the SIP to assess health status in elderly male veterans. The SIP portrayed a more optimistic picture of health than the SF-36. The SIP scores had a mean and standard deviation of 14.5 ± 2.96 and the investigators reported a tendency toward a ceiling effect. No floor effects were found in the present study, which is also consistent with the literature (Andresen et al., 1995; Weinberger et al., 1991).

In terms of the SF-36, there was a wider range of physical dimension scores than seen with the SIP. Only one subject reported a perfect state of physical health on the SF-36 physical function scale. Ceiling effects, however, were observed in seven subjects for the role limitations due to physical health, and for two subjects in bodily pain. No ceiling or floor effects were found in the general health scale. In the literature, a ceiling effect has been reported in healthy older adults in both the physical function scale and the role limitations due to physical health, and no ceiling effects have been reported in the general health perception scale which is consistent with the findings in this study (Andresen et al., 1995). In the present study, floor effects were found in three subjects for the role limitations due to physical health scale.

In summary, the SIP portrayed the subjects as having a better state of physical health which suggests this health status measure is less sensitive in discriminating levels of physical function. This may in turn affect the correlation with the 6-MWD. In contrast, the SF-36 may assess a broader range of physical health giving rise to a stronger correlation with the 6-MWD.

RELATIONSHIP BETWEEN THE CRCI AND THE PHYSICAL DIMENSION SCORE ON THE SIP AND THE SF-36

The CRCI based on a steady-rate walking test was observed to correlate both with the physical dimension score of the SIP ($r=-0.51$; $p<0.05$) and with the SF-36 ($r=0.70$; $p<0.01$), thereby supporting the hypotheses proposed in the study. Both objective measures, the 6-MWD and the CRCI, demonstrated higher correlations with the physical dimension of the SF-36 compared with the SIP. The steady-rate walking test used to derive the CRCI required the individual to obtain HR within 60% to 80% of his or her age-predicted maximum. To achieve this HR and maintain a comfortable walking cadence the grade of the treadmill is increased accordingly. A comfortable walking cadence was selected for the basis of this test in order to equate the test with an individual's functional performance in daily activities (Dean & Ross, 1988, 1991). However, the test often requires the use of a grade on the treadmill and is sustained for five minutes. It is therefore likely that the steady-rate walking test equates to a high level of physical function and correlates with the SF-36 that also assesses a higher level of physical activities than the SIP.

CLINICAL SUITABILITY OF THE 6-MWD TEST AND THE CRCI BASED UPON A STEADY RATE WALKING TEST

To date, use of the 6-MWD test has not been previously reported in the literature with individuals with the late sequelae of poliomyelitis. The test was appropriate for all of the subjects included in the study. None of the subjects had to stop during the test. Even though the subjects in this study did not use any mobility aids the test would have been suitable if they had needed them. The subjects that were unable to achieve a HR of 60% of their predicted maximum due to musculoskeletal limitations, and were thereby excluded from the study, preferred the 6-MWD test. These subjects reported that they were able to walk "normally" during the 6-MWD test whereas with the treadmill test it required them to concentrate more on their gait pattern to maintain their balance. The 6-MWD test likely represented the individual's functional gait pattern and walking on the treadmill altered their gait mechanics.

All of the subjects attained a HR of at least 60% of age-predicted maximum in the 6-MWD test and ranged between 60% to 74%. In the 6-MWD test, the individual self-selected the walking pace, thus making it more dependent on the ability of a person to pace himself of herself and motivation (Swinburn et al., 1985). Individuals with the late sequelae of poliomyelitis are often limited by fatigue, muscle weakness, and pain (Halstead & Rossi, 1985, 1987) and are frequently instructed to modify their physical activity to a low to moderate level (Agre et al., 1991). These individuals often do not experience these symptoms immediately after exercise but may feel fatigued for example, the next day. Although the instructions for the test were to "cover as much ground as possible" it appears that the test was submaximal and the subjects paced themselves accordingly. In the literature the 6-MWD test has been repeatedly cited in the literature as assessing something different from traditional treadmill and cycle ergometer maximal or symptom-limited tests and is viewed as a measure of a person's ability to undertake physically demanding tasks of daily living (Bittner et al., 1993; Mc Gavin et al., 1976, 1978; Nixon et al., 1996). The physical dimension of the SIP and the SF-36 questionnaire were designed to assess self-reported level of functioning and were both significantly correlated with the 6-MWD in the present study. This further supports the finding of the 6-MWD being a functional measure of the ability to do daily activities. Other advantages of the 6-MWD clinically were that it did not require the use of any specialized equipment other than the portable HR monitor and it was possible to analyze the subject's normal gait pattern.

The practice effect with timed walking tests, such as with the 6-MWD test and the 12-MWD test reported in the literature (Guyatt et al., 1984, 1985a; Mc Gavin et al., 1976, 1978) was also found in this study. The distances for the 6-MWD test ranged from 347.89 m to 702.77 m, and the mean distances and standard deviations were 509.42 $\pm$ 87.83 m, 528.08 $\pm$ 86.42 m, and 537.76 $\pm$ 89.33 m for trial one, trial two, and the third test value respectively. A significant difference was observed between trial one and trial two, and trial one and the third test value. No significant difference was noted between trial two and the third test value. This observation is consistent with the literature supporting the need for only one practice trial (Mc Gavin, 1976, 1978). Other studies however, have reported the need for two or more practice trials (Guyatt et al., 1984, 1985a; Mungall & Hainsworth, 1979; Knox et al., 1988) but the largest increase in distance has been observed between the first two practice trials (Knox et al., 1988). It has also been reported that respiratory patients showed a greater improvement in walking distance over time than the cardiac patients ($p<0.05$) (Guyatt et al., 1984).

Explanations for the improvement with subsequent trials of walking tests such as the 6-MWD test and the 12-MWD test as well as with cycle ergometer and treadmill tests are unclear. In the literature, these improvements are often referred to as "practice effects" or "learning effects". It has been demonstrated that there is a significant difference in physiological responses ($p<0.01$) between the first and second trials in a submaximal treadmill test in healthy subjects which was associated with lower systolic BP and a reduced step cadence (Dean et al., 1989). The investigators concluded that the practice effect had a direct effect on reducing the magnitude of cardiorespiratory responses due to a reduced arousal and improved mechanical efficiency. It is also assumed that in healthy populations the practice trials are insufficient to result in any cardiovascular training effects (Astrand & Rodahl, 1977).

In patient populations, the practice effect is not as clear (Dean et al., 1989). These individuals are likely not exercising regularly as a result of their physical health and may be apprehensive about performing an exercise test. There may be a practice effect as an individual learns about a test. In the present study two practice trials of the 6-MWD test were conducted before the final test to minimize any practice effect associated with the test. The literature supporting the need for two practice trials has been done primarily in individuals with respiratory disease (Guyatt et al., 1984, 1985a; Mungall & Hainsworth, 1979). The present study used the 6-MWD test for individuals with the late sequelae of poliomyelitis. As previously mentioned, the late sequelae of poliomyelitis presents very differently than a respiratory disease such as COPD. The late sequelae of poliomyelitis is a neuromuscular condition and limiting factors in exercise are pain and muscle weakness (Agre et al., 1991; Dean, 1991), whereas COPD is a cardiorespiratory condition and dyspnea is often the limiting factor (Mc Gavin et al., 1978). This difference between these two patient populations may contribute to the difference noted in the number of required practice trials.

In the present study, no significant difference was noted for the overall sample between the second practice trial and the third test value. It is possible that the significant increase in distance between the first two practice trials was a practice effect and thereafter the nonsignificant increase was an improvement in movement efficiency. Individuals with the late sequelae of poliomyelitis are often inefficient due to malalignment, drop foot, pelvic obliquities, and differences in limb length. Dean and Ross (1991) demonstrated that following a six week exercise walking program there was a significant improvement in mechanical efficiency without any change in cardiorespiratory conditioning. Further research should investigate the practice effect in subsequent trials of the 6-MWD test in individuals with the late sequelae of poliomyelitis and other patient populations. Clinicians should use a minimum of two practice trials with walking tests such as the 6-MWD and the 12-MWD test until the practice effect is better understood. More research is also needed to investigate the sensitivity of the 6-MWD in assessing change and determining what represents a clinical versus a statistical significant difference.

Another important issue with regard to the 6-MWD test is the lack of standardization reported in the literature with respect to the administration of this test. The increase in the distance walked over a practice trial has significant implications if the test was used clinically. If only one test was performed and a treatment intervention was administered between the first and second trial, the significant increase in distance walked would have been incorrectly attributed to the treatment administered.

In the literature there is a lack of consistency in the number of practice trials. Often no practice test was given (Alison & Anderson, 1981; Anderson, 1995; Bittner et al., 1993; Nixon et al., 1996) and there was considerable variation in the amount of rest between tests. The trial that was recorded as a test value was performed by some investigators on the same day (Cahalin et al., 1995, 1996; Fitts & Guthrie, 1995; Mak et al., 1993) and others performed in on a separate day (Gosselink et al., 1996; Guyatt et al., 1985a, 1985b). There was also very different versions of the instructions used for both the 6-MWD tests and the 12-MWD tests. Some investigators mentioned that the individual was allowed to stop if necessary in the instructions (Nixon et al., 1996) while others instructed the subject to pace themselves so that they would not have to stop (Bernstein et al., 1994). The scoring of the test is also not standardized. Most investigators reported using the final value (Guyatt et al., 1985a, 1985b; Mc Gavin 1976, 1978), however, some reported using the largest value (Gosselink et al., 1996). Another limitation is the lack of stringent monitoring of physiological variables while the individual is completing the test.

The 6-MWD test, as well as other walking tests have the potential to show a wide degree of variation and so a value reported in a research study should not be accepted as a significant finding without reviewing the procedures used in the test. Further research is needed to refine the standardization of testing.

The steady-rate walking test used to calculate the CRCI in this study has been previously validated (Dean & Ross, in preparation) and used in individuals with the late sequelae of poliomyelitis (Dean & Ross, 1988, 1991, 1993) unlike the 6-MWD test. Some subjects preferred walking on a treadmill because they reported it was enjoyable to walk with the treadmill propelling them forward. Also by walking on the treadmill in the laboratory, some subjects felt safer than when walking out in the corridor where students or staff members might walk by.

The treadmill test also had the advantage of being able monitor the subject's EKG, BP, and ratings of perceived exertion and pain/discomfort more readily. The protocol was very appropriate for those subjects who could attain a heart rate between 60 to 80% of age-predicted maximum and did not have significant musculoskeletal limitations. As previously mentioned, in four of the subjects their gait pattern prevented them from reaching a sufficiently high intensity safely, so their tests were not valid. The treadmill therefore, limited the type of subject to relatively high functioning individuals with the late sequelae of poliomyelitis.

The familiarization session on the treadmill prior to performing the actual test was necessary. We observed that the subjects had a lower resting HR and exercising HR at similar parameters on the treadmill on the test compared with the practice session. Several subjects had never been on a treadmill before and felt much more comfortable walking on it after the practice trial.

The mean CRCI (± standard deviation) reported in this study was -3.4±11.6. This suggested that the individuals had a slightly below average level of cardiorespiratory fitness as a normal value is zero or higher (Dean & Ross, 1991). In comparison to the baseline measures taken before a six week walking program in individuals with the late sequelae of poliomyelitis, the subjects had an average CRCI value of 0.5±9.4 in control group and -2.1±12.0 in the experimental group (Dean & Ross, 1991,1993). Thus, the findings in the present study are within the range reported in earlier studies

The correlations of the CRCI with the physical dimension score on the SIP and the SF-36 indicate that the CRCI based on a steady-rate walking test assesses physical function in individuals with the late sequelae of poliomyelitis. Although the CRCI based on a steady-rate walking test and the 6-MWD appear comparable in their ability to reflect physical function as perceived by the individual, the low absolute correlation between the CRCI and the 6-MWD, may reflect some physiologic distinctions. For example, the work rate in the submaximal test used to derive the CRCI was more stable with a five minute steady-rate plateau compared with the 6-MWD where the individual was required to self-pace. Further, treadmill walking is known to be biomechanically distinct from normal walking, and this distinction may be exaggerated in individuals with physical disabilities (Bassey et al., 1976; Dean, 1996).

The low correlation between these two objective tests may also result from the CRCI being a derived variable that represents an index of aerobic fitness, whereas, the 6-MWD is a pure objective measure. The steady-rate walking test used to derive the CRCI is based upon measures of HR. The limitation of using HR as the basis of an exercise test is that HR is influenced by factors other than an exercise work load. Although standardized procedures were used to minimize the effect of anxiety, medication, and caffeine on the HR response, other factors such as anticipation of effort, anxiety, total circulating hemoglobin, and overall body posture may have affected the HR response (Ebbeling et al., 1991; Shephard, 1987). In addition the CRCI uses age-predicted maximal heart rate (HRmax) to derive the index which has a reported error range of $\pm$ 10 to 15 beats per minute (Ward et al., 1995).

The most suitable test to use clinically, i.e. the 6-MWD test or the CRCI based on a steady-rate walking test, depends on the purpose of doing the test. Typically, clinicians and researchers have been interested in objective physiological measures and in exercise testing for VO_2max; the gold standard. However, as health care shifts to focus on function, outcomes, which have more relevance to activities in daily living, the 6-MWD test and other equivalent tests may be the test of choice. Future research needs to establish the sensitivity of these tests to detect clinical change in status in order for them to serve as objective measures in clinical decision making and in research trials.

CLINICAL SUITABILITY OF THE SIP AND THE SF-36 HEALTH STATUS MEASURES

The SIP and the SF-36 are widely used generic health status measures. Both of these instruments were chosen for this study because they have well established psychometric properties and have been used with a variety of patient populations. In this study the physical dimension of the SIP and the SF-36 were strongly correlated ($r=-0.80$; $p<0.01$) indicating they are assessing similar dimensions of physical function. At this time, no literature was found correlating the SIP physical dimension score with the recently published SF-36 physical dimension score. However, in a study by Andresen et al. (1995) the physical dimension score of the SIP was compared to the individual scales of the SF-36. The correlation between the SIP's physical dimension score was $r=-0.47$ ($p<0.01$) for the physical dimension scale, $r=-0.39$ ($p<0.01$) for the role limitations due to physical health, and $r=-0.33$ ($p<0.01$) for the general health perceptions scale on the SF-36. All three SF-36 scales were significantly correlated with the SIP's physical dimension and as would be expected, the physical function scale of the SF-36 had the greatest correlation.

Weinberger et al. (1991) investigated the relationship between the various scales on the SIP and the SF-36. They reported that the two health status measures provided similar rankings of health status, but as reported earlier in the present study, the SIP portrayed a more optimistic picture of a person's health. Another study by Stucki et al. (1995) also used both the SIP and the SF-36 to assess health status in individuals undergoing a total hip replacement. They reported that the scores on the two measures were highly correlated ($r=-0.76$; $p<0.01$). However, a wider range of scores was noted with the SF-36. The strong correlation between the physical dimension of the two health status measures therefore is consistent across patient populations, further validating the use of these questionnaires as generic tools.

To determine the usefulness of a health status measure, a primary consideration is the ability of the questionnaire to detect change. This present study did not assess this property however, Katz et al. (1992) investigated the sensitivity of the SIP to detect clinical change by assessing individuals undergoing hip arthroplasty preoperatively and at three months postoperatively. They calculated the standard response mean for the physical dimension of the SIP and the physical function scale, role limitations due to physical health, and bodily pain scale of the SF-36. It was reported that the SF-36 physical function scale was more sensitive than the physical dimension score on the SIP. The investigators concluded the sensitivity of the SF-36 was not sacrificed by its brevity. This is an important issue in determining the clinical use of health status measures and should be assessed in future studies involving patient populations including the late sequelae of poliomyelitis.

Although the SIP and the SF-36 both assess physical function, the questions within each questionnaire are quite different. The statements within the SIP's physical dimension score examine ambulation, mobility, and body care and movements. In the ambulation category, the most physical demanding statements ask the individual about the amount of assistance required to manage stairs. In the present study, the statements that was most frequently checked off were "I walk shorter distances or stop to rest often" (n=10) and "I walk more slowly" (n=8). It appeared that for our particular sample of subjects, the SIP did not have enough questions regarding limitations in more vigorous activities. The sample of subjects in this study tended to be high functioning because of the requirement to use the treadmill. The body care and movement category was applicable to some of the subjects and five subjects checked off the statement "I stand only for short periods of time" and "I change position frequently". Only one subject responded to a statement in the mobility category and this category was not useful for the present sample.

A proportion of our sample of individuals with the late sequelae of poliomyelitis had a high functioning capacity which may not have been adequately tapped by the SIP. Some lower functioning individuals require a lot of assistance in ambulation and mobility as a result of their musculoskeletal contractures and deformities. As well, this study only used the physical dimension score of the SIP for data analysis even though the entire questionnaire was administered to the subjects. In scoring the SIP questionnaire, we noted that the categories on sleep and rest, work, recreation and pastimes contained a number of questions with which the subjects identified problems. In the late sequelae of poliomyelitis, fatigue is a primary problem that affects the individual's ability to work as well as participate in recreational activities. These areas of health should be investigated in future research. In addition, the SIP needs to be administered to individuals with the late sequelae of poliomyelitis with varying levels of ability before drawing conclusions about the suitability of this health status measure in this patient population.

In terms of administering the SIP, there were no difficulties experienced by the subjects in completing the questions. On average, the subjects required 15 to 20 minutes which was the estimated time specified in the user's manual. The questionnaire was easy to score. In summary, the SIP was well received by the subjects, however, some subjects noted many questions were not applicable to them.

The SF-36's physical dimension score was primarily composed of the physical function scale, the role limitations due to physical health, bodily pain, and general health perceptions. The physical dimension score contained a wider range of physical activities than the SIP, including vigorous activities to bathing and dressing. This scale was more informative than the equivalent items contained in the SIP because it assessed the degree of limitation, i.e. (limited a lot, limited a little, not limited at all). The scale on role limitations due to physical health also appeared appropriate in assessing physical function in individuals with the late sequelae of poliomyelitis. Because response to this scale involved either a "yes" or "no" to the questions, a ceiling effect was noted in seven subjects and a floor effect in three subjects. The late effects of poliomyelitis are characterized by a decline in function. For many individuals, the onset of late effects ranges between the ages of 40 to 55 years; the decline in function has an enormous impact on their ability to work, manage a family, and pursue other interests. Thus, this scale is highly relevant to the post poliomyelitis population.

The third scale within the physical dimension of the SF-36, bodily pain, a well recognized problem in these individuals, is not assessed by the SIP. In a study by Westbrook and Mc Dowell (1991) a sample of 300 individuals with the late sequelae of poliomyelitis were surveyed and 84% identified symptoms of muscle pain and 80% noted symptoms of joint pain. Therefore, the bodily pain scale in the SF-36 has particular value for individuals with the late sequelae of poliomyelitis.

Finally, the general health perception scale assessed some of the individual's attitudes and beliefs by comparing how the subjects perceived their health in relation to others. It also assessed how the subjects thought their health was going to change in the future. This is a very interesting area to assess within this population because the majority of the individuals contracted poliomyelitis during the epidemic in the 1950's. The late effects of poliomyelitis were only recognized as a distinct health concern in the 1980's, so knowledge of the long term effects is limited.

Overall, the SF-36 seemed to be the more suitable health status measure for this sample. It assessed a broader range of physical function than the SIP and had more relevant items assessing physical function. Although only the physical dimension component of the SF-36 was used for data analysis, the other scales, in particular the vitality scale which assess energy and fatigue, seemed applicable. The SF-36 required only 5 to 10 minutes to complete and was easy to score. Manuals were provided to score both the questionnaire and to derive the physical dimension score of each. To add to its ease of administration there is a version of the SF-36 designed for a scanner. In addition, due to the widespread use of the SF-36, the Medical Outcomes Trust which has the copyright for the SF-36, has collected data for healthy individuals and various patient populations to develop norms. This work will enable results from individuals with the late sequelae of poliomyelitis to be compared with the patient populations that present with similar symptoms as well as with other types of conditions.

In 1991, the International Quality of Life Assessment Project started to translate the SF-36 into other languages as a cross-cultural effort (Ware et al., 1996). To date, the SF-36 has been translated into 14 languages and another 16 countries are presently involved with the project. This will allow the SF-36 to be used world wide and promote cross-cultural comparisons.

CLINICAL IMPLICATIONS

With increased attention on individuals and their needs in today's health care system, the need for practical and functional outcome measures has escalated. In this particular study, we showed that the objective physical function measures have a strong correlation with self-reports of health status. This raises the question that if both types of measures assess similar aspects of physical function, are both necessary or would one measure suffice; and if so which one. To answer these questions the strengths and limitations of both the objective and self-report measures of physical function need to be examined. Directions for future research are also discussed.

Physical therapists primarily diagnose and treat dysfunction in movement in various systems of the body. Historically, objective measures have been used in assessments. The objective measure of physical function obtained with the 6-MWD test or the CRCI based on a steady-rate walking test provide a numeric value which is objective in nature. In addition to providing an objective measure, these tests allow a physical therapist to observe the individual's gait, assess movement efficiency, and the response to a given treatment. This would not be possible with just the administration of a questionnaire. Limitations of objective measures include the risk of injury to the individual while performing the test, staff time and effort, the need for equipment, and the inability to discriminate between motivated and unmotivated individuals (Guralnik et al., 1989; Reuben & Siu, 1990).

Health status measures are a relatively new measure for assessing health. Even though the physical dimension of health was just isolated in this study, these measures can investigate mental health, social functioning, and various other aspects of health, providing an overall picture. New standardized tools that are based on an individual's self-report need to be developed further to monitor medical outcomes (Editorial, 1997; Ware & Sherbourne, 1992). Such tools provide a standardized measure of an individual's report of physical function rather than the clinician's extrapolation based on an objective walking test. It also allows for the assessment of the individual's functioning in his or her home environment in doing daily tasks. This may be a better measure than what is assessed by just the objective measure if the person's home environment has been adapted. For example, if a person had a poor walking endurance due to their low level of physical function they may have a motorized scooter at home in order to be more mobile. By having the scooter, the individual would not necessarily respond to some of the statements on the SIP's mobility category such as "I am not going into town" or "I stay home most of the time" because they have adapted to their deficit in physical function. Based on the objective measure alone, the physical therapist's interpretation of a person's physical function may not be accurate. A major limitation of health status measures is the need for a certain level of cognitive and language function. There has been a lower agreement between objective measures and self-reports in the older frail population. Sager et al. (1992) reported older individuals tended to over estimate their level of physical functioning in self-report in comparison to an occupational therapist's objective assessment. Other limitations of health status measures include not having well established psychometric properties and the inability of some health status measures to discriminate between motivated and unmotivated individuals.

Spiegel et al. (1988) addressed the use of objective measures and self-reports in assessment. They identified the need to recognize the relationship as well as the distinctions between these two types of measures. If the primary objective of a particular intervention is to alter the outcome at the level of impairment then the primary tool that measures that outcome should be selected. At the present time, the factors that influence a person's self-report are not clearly understood. If the objective measures were excluded and measures of health status became the primary focus of assessment, then certain interventions may not be properly assessed. Spiegel et al. (1988) give the example that if only a health status measure was used in assessing the effect of a medication on the symptoms of disease activity in rheumatoid arthritis, the placebo effect of the medication may not be detected. The subject may report that joint pain is improved in the absence of objective change in the symptoms and this is not enough to conclude that the drug was effective. So in this situation the objective measure should be the primary measure but the addition of a health status measure as a secondary measures provides useful information in terms of the person's perception and change in function with the medication.

Directions for Future Research

Although the objective measures of function used in this study were correlated, various limitations are associated with both. Some individuals felt that the 6-MWD test did not provide an accurate estimate of their level of functioning with other activities such as using stairs, getting out of a chair, or getting up from the floor. Physical therapists need to incorporate other objective measures of physical function that are commonly used in the geriatric population. The addition of these tests would contribute to a more complete objective assessment of physical function. The use of timed tests provide a useful measure to detect clinical change, e.g. the Timed Up and Go (Podsiadlo & Richardson, 1991) in which an individual rises from a standard arm chair, walks 3 meters, turns, returns to the chair, and sits back down again.

In addition, physical therapists need to develop clinical guidelines to determine which exercise test is appropriate for which individual. A clinician may intuitively select a test for an individual, however, specific criteria are needed of the application of such tests. In this study, the 6-MWD test appeared better suited for a wider range of subjects, however, the steady-rate walking test used to derive the CRCI also had various attributes that the 6-MWD test did not have, such as the ability to assess an individual at a percent grade on the treadmill at a constant speed. The primary consideration in selecting a test is its purpose. To investigate how a person paces himself and herself and to observe their gait the clinician could select the 6-MWD test. This test does not provide an index of aerobic fitness as no norm values are available. However, if the primary objective is to assess how an individual responds to a set intensity, i.e. speed and grade on a treadmill, and to obtain an index of aerobic fitness, the CRCI based on a steady-rate walking test or a comparable submaximal test should be considered. Other important factors to be considered in selecting an exercise test are the person's age, body weight, medical history, medications, use of mobility aids, muscle strength, activity level, balance, and coordination. If the exercise test is to provide the basis for an exercise prescription, be specific to the type of exercise anticipated in the training program. For example if an individual is going to start a daily walking program then the exercise test should use a walking test opposed to a cycle ergometer test.

As well, future research should investigate if health status measures, such as the SIP and the SF-36, enhance the selection of an appropriate exercise test based on the physical dimension score. This could provide standardized guidelines, and in addition provide the clinician with insight into a person's overall health status, i.e. mental health and vitality.

The criteria for selecting an appropriate health status measure have been well established in the literature (Fricke, 1993; Jeffrey, 1993; Ware et al., 1981). The criteria include consideration of the dimensions that it assesses, the population for whom it was developed, the populations that it has been used with, the reliability, the validity, and general administration (i.e. time to complete, scoring, and method of administration) (Fricke, 1993, Jeffrey, 1993; Ware et al., 1981). In conditions where disease-specific measures are available clinicians must clearly determine the purpose of administering the questionnaire so the appropriate generic or the disease-specific measure is selected.

The full potential of health status measures used in this study, the SIP and the SF-36, and other comparable measures in our current health care system has yet to be recognized. Measures such as the SF-36 only require 5 to 10 minutes to complete and can be self-administered to anyone over the age of 14 years. They can be readily incorporated into a clinician's standardized assessment. The data would enable the clinician to monitor an individual's health status over time and detect problems early. Health status measures that are self-administered by mail could serve as a screening tool to identify potential problems that require intervention. If these tools could screen the individuals without visits to the health care worker it may help reduce health care costs.

Further studies are needed to determine the role of health status measures in discharge planning. If older individuals have the cognitive capacity to complete a health status questionnaire it may guide the team in deciding the place of discharge. Finally, research must continue to investigate the sensitivity of various health status measures to detect clinical change and establish what degrees of change constitute a clinical versus a statistical difference.

SUMMARY AND CONCLUSIONS

1. In individuals with the late sequelae of poliomyelitis, the 6-MWD was correlated significantly with both the physical dimension score of the SIP ($r=-0.57$; $p<0.05$) and the SF-36 ($r=0.67$; $p<0.05$). The correlation observed in the present study of the 6-MWD with the physical dimension score of the SIP was similar to the finding observed in individuals with COPD. This indicates that this particular relationship is not specific to a given patient population. We were unable to compare the physical dimension score of the SF-36 because, to the best of our knowledge, no previous studies have explored this relationship. In the present study, the SF-36 appeared to assess a wide range of physical functioning in our sample. The relationship between the 6-MWD with the physical dimension score of the SF-36 warrants further study in individuals with the late sequelae of poliomyelitis and other patient populations.

2. There was a significant correlation between the CRCI and the physical dimension score of the SIP ($r=-51$; $p<0.05$) and the SF-36 ($r=0.70$; $p<0.01$) in individuals with the late sequelae of poliomyelitis. The stronger correlation of the CRCI with the SF-36 is possibly a result of the questions in the SF-36 pertaining to a higher level physical functioning than the SIP. The steady-rate walking test used to calculate the CRCI, is physically demanding as individuals often walk at a percent grade on the treadmill for an average of 5 to 7 minutes.

3. The results of the present study support the use of submaximal walking tests, i.e. the 6-MWD test and the CRCI based on a steady-rate walking test, in individuals with the late sequelae of poliomyelitis. Both walking tests correlated significantly with the physical dimension score of the SIP and the SF-36. In terms of the 6-MWD test, it elicited an average HR of 67% of age-predicted HRmax in the final test which is within the target range of 60%-80% of age-predicted HRmax. A statistically significant difference was observed between trial one and trial two of the 6-MWD test, as well as with trial one and the third test value. However, there was no statistical difference observed between trial two and the third test value. Although there was no difference in distance achieved between trial two and the final test, further investigation on the practice effect of exercise tests is warranted in individuals with the late sequelae of poliomyelitis and other patient populations. A review of the literature indicated that the 6-MWD test has been poorly standardized in terms of its administration, and warrants more rigorous procedures to ensure test validity and reliability.

The steady-rate walking test used to derive the CRCI was also found to be a useful test in this study for high level functioning individuals. Its use is limited to high functioning persons because many individuals with lower extremity musculoskeletal deficits can not be safely tested on a treadmill. The steady-rate walking test is also not as functional as the 6-MWD test in terms of assessing an everyday activity. However, the steady-rate walking test does allow the individual's physiological variables such as HR, EKG, BP, perceived exertion, and perceived pain and discomfort to be monitored closely. It is important to note that the CRCI is an index of cardiorespiratory conditioning and is a derived variable rather than a true objective measure and this may partially account for only a moderate correlation ($r=0.50$; $p<0.05$) of the 6-MWD with the CRCI.

4. The two generic health status measures, the SIP and the SF-36, used in this study were appropriate for assessing health in individuals with the late sequelae of poliomyelitis. Both physical dimension scores were strongly correlated ($r=-0.80$; $p<0.01$) indicating that both are assessing similar aspects of physical function. In the present study, the SF-36 was useful in assessing a wide range of physical function, however, our sample was not truly representative of the population of individuals with the late sequelae, i.e. from the "invisible polio" to the extremely disabled individual. Future research is needed to extend our work examining the usefulness of these two health status measures. In addition, more work is needed to investigate the sensitivity of these questionnaires in assessing change and determining what represents a clinically significant difference.

5. We conclude that there is a role for the use of both the objective measures and self-reports to accurately assess physical function comprehensively in the clinical setting. Clinicians need to be aware of the limitations of both objective measures and self-reports. For example, both are reliant on the individual's motivation. Further research in this area will elucidate this relationship. Clinically, it is important to establish if an

objective measure or a component of a health status measure should be the primary or secondary measure. The selection and administration of appropriate tools will result in a comprehensive assessment of a person's physical function and will guide treatment planning.

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APPENDIX A

FUNCTIONAL CAPACITY STUDY
DATA SHEET

Today's date:_______________

Name:_____________________ Date of birth:_______________

Age:_______________________ Gender: Female____ Male____

Height:_________ Weight:_________ BMI:_________

Contact person / phone number:____

Do you smoke? Yes____ No____ If yes, how much (# per day & # of yrs)_________
If you have quit smoking, when?____

Are you presently employed? Yes____ No____
If yes, full time____ or part time____; number of years____; type of job_______

<u>Present Medical History</u>
Do you have any late effects of poliomyelitis? Yes____ No____ Don't know____
If yes, confirmed by a health care worker________________________________
Date of onset of poliomyelitis and late effects_____________________________

Do you have osteoporosis? Yes____ No____ Don't know____
If yes, confirmed by a health care worker________________________________
Date of onset____

Do you have lung disease? Yes____ No____ Don't know____
If yes, confirmed by a health care worker________________________________
Date of onset____

If you answered "No" to the above 3 conditions are you participating as a healthy control? Yes____ No_____

Have you seen a doctor recently? Yes____ No____
If yes, when and what for:____
____

<u>Past Medical History</u>
Past medical history / surgical history (dates & type):__________________________
____
____
____
____

Medications

Are you taking any medications regularly? Yes____ No____
If yes, please list and give the reason for taking each one:______________________

____

____

Respiratory Status

Do you have any difficulties breathing? Yes____ No____
If yes, what type(s) and for how long:__________________________________

____

Is it associated with exercise? (if yes please describe) ________________________

____

Musculoskeletal Status

Have you had any recent fractures? Yes____ No____
If yes, what location, duration, and treatment:______________________________

____

Activity Status

How much activity do you do? (type, duration, # times per week):_______________

____

____

During exercise do you have any of the following?

heart palpitations	**Yes____**	**No____**
dizziness	**Yes____**	**No____**
shortness of breath	**Yes____**	**No____**
any other	**______________**	

How far can you walk? (# of blocks) 1-3____ 4-9____ unlimited____
Do you use any mobility aids? (i.e. cane, ankle brace)________________________
Have you walked on a treadmill before? Yes____ No____
If yes, when:____

Pain Status

Do you have any pain? Yes____ No____, If yes, describe (location & type):______

____

____

Fatigue Status

Do you have any problems with fatigue? Yes____ No____
If yes, a) Is it generalized or associated with muscle weakness:_________________
b) Is it related to exercise? Yes____ No____
c) Is it related to time of day? Yes____ No____
If yes, what time_________

Other Health Problems

Have you had any of the following?

a) other neurological disease?	Yes____	No____	Duration________
b) any heart disease?	Yes____	No____	Duration________
c) any chest pains?	Yes____	No____	Duration________
d) high blood pressure?	Yes____	No____	Duration________
e) shortness of breath?	Yes____	No____	Duration________
f) asthma?	Yes____	No____	Duration________
g) persistent cough?	Yes____	No____	Duration________
h) a tendency to faint?	Yes____	No____	Duration________
i) diabetes?	Yes____	No____	Duration________
j) arthritis?	Yes____	No____	Duration________
k) cancer?	Yes____	No____	Duration________
l) kidney trouble?	Yes____	No____	Duration________
m)difficulty swallowing?	Yes____	No____	Duration________

n) other? Please specify____

o) are you adversely affected by: Heat Yes____ No_____

Cold Yes____ No_____

Additional Information

When did you last eat? (time & type of meal) ________________________________

____

Have you had any coffee, tea or other caffeinated beverages today?______________

____

Do you have any other health concerns or conditions?__________________________

____

____

____

LATE EFFECTS OF POLIOMYELITIS
SCREENING ASSESSMENT FORM
UBC ERGOMETRIC PERFORMANCE CLINIC/LABORATORY

PLEASE ANSWER THE FOLLOWING QUESTIONS REGARDING YOUR HISTORY OF POLIOMYELITIS AS ACCURATELY AS POSSIBLE.

At what age did you contract poliomyelitis?____

What symptoms did you have at onset?____

Was the diagnosis confirmed by a doctor?______ Did you have a spinal tap?________

What was your level of function when you reached PEAK recovery? Were you walking independently? With or without aids? Able to do most things your peers did? Able to function at school or work?

____

____

What is your level of function NOW with respect to the following activities?
Walking (assisted or unassisted)__________________ Taking care of myself______________
Shopping____________ Cleaning_____________ Working (type of work)______________
Visiting and socializing_____________

Indicate what **NEW OR WORSENING** problems you have developed that may be related to your history of poliomyelitis: Increased fatigue in muscles_______ Increased general fatigue__________ Increased weakness_____________ Increased pain ____________ Increased shortness of breath____ Increased swallowing or choking problems __________ Increased sensitivity to cold in affected limbs__________ Psychological problems___________

Have you had a diagnosis of the late effects of poliomyelitis or post polio syndrome confirmed? ______

APPENDIX B

When did these **NEW OR WORSENED** problems start?________ Was there anything else, eg, a major life event, going on at that time?_____ If so, what? ______________________________________

Do you have any of the following problems? Anemia________ Arthritis_______ Heart problems ____
What type?________________________ Lung problems________ What type?______________
Sleep disturbances_______________ Poor nutritional habits_____________ Choking or swallowing problems__________________ Stomach/intestinal problems_________________ What type?____________________
Do you smoke?_______ If so, how much?____
How much coffee or regular tea do you drink per day?__________________________________
How many hours a night do you sleep? __________ Do you feel restored in the morning?________
Do you rest in the day?_______ If so, for how long?________ Do you feel restored after?_______

APPENDIX B

Sickness

Impact

Profile™

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SIP - 10030
SD I - 03564
SD II - 03657

THE FOLLOWING INSTRUCTIONS ARE FOR THE
INTERVIEWER-ADMINISTERED QUESTIONNAIRE

INSTRUCTIONS TO BE READ TO THE RESPONDENT

Before beginning the questionnaire, I am going to read you the instructions.

You have certain activities that you do in carrying on your life. Sometimes you do all of these activities. Other times, because of your state of health, you don't do these activities in the usual way: you may cut some out; you may do some for shorter lengths of time; you may do some in different ways. These changes in your activities might be recent or longstanding. We are interested in learning about <u>any</u> changes that describe you today and are related to your state of health.

I will be reading statements that people have told us describe them when they are not completely well. Whether or not you consider yourself sick, there may be some statements that will stand out because they describe <u>you</u> today and are related to your state of health. As I read the questionnaire, think of <u>yourself today</u>. I will pause briefly after each statement. When you hear one that does describe you and <u>is</u> related to health please tell me and I will check it.

Let me give you an example. I might read the statement "I am not driving my car." If this statement is related to your health and describes you today, you should tell me. Also, if you have not been driving for some time because of your health, and are still not driving today, you should respond to this statement.

If you are in the hospital today, you are here because of your state of health, and you are not doing a number of the things you usually do. For instance, if driving is usual for you, then you are <u>not</u> driving today because you are in the hospital, and you should respond to this statement.

On the other hand, if you never drive or are not driving today because your car is being repaired, the statement, "I am not driving my car" is not related to your health and you should not respond to it. If you simply are driving less, or are driving shorter distances, and feel that the statement only partially describes you, please do not respond to it.

I am now going to begin the questionnaire. Please tell me if you want me to slow down, repeat a statement, or stop so that you can think about one. Also let me know any time you would like to review the instructions. Remember we are interested in the recent or longstanding changes in your activities that are related to your health.

THE FOLLOWING INSTRUCTIONS ARE FOR THE SELF-ADMINISTERED QUESTIONNAIRE

PLEASE READ THE ENTIRE INTRODUCTION BEFORE YOU READ THE QUESTIONNAIRE. IT IS VERY IMPORTANT THAT EVERYONE TAKING THE QUESTIONNAIRE FOLLOWS THE SAME INSTRUCTIONS.

You have certain activities that you do in carrying on your life. Sometimes you do all of these activities. Other times, because of your state of health, you don't do these activities in the usual way: you may cut some out; you may do some for shorter lengths of time; you may do some in different ways. These changes in your activities might be recent or longstanding. We are interested in learning about any changes that describe you today and are related to your state of health.

The questionnaire booklet lists statements that people have told us describe them when they are not completely well. Whether or not you consider yourself sick, there may be some statements that will stand out because they describe you today and are related to your state of health. As you read the questionnaire, think of yourself today. When you read a statement that you are sure describes you and is related to your health, place a check on the line to the right of the statement. For example:

I am not driving my car ___√___ (031)

If you have not been driving for some time because of your health, and are still not driving today, you should respond to this statement.

On the other hand, if you never drive or are not driving today because your car is being repaired, the statement, "I am not driving my car" is not related to your health and you should not check it. If you simply are driving less, or are driving shorter distances, and feel that the statement only partially describes you, do not check it. In all of these cases you would leave the line to the right of the statement blank. For example:

I am not driving my car ______ (031)

Remember that we want you to check this statement only if you are sure it describes you today and is related to your state of health.

Read the introduction to each group of statements and then consider the statements in the order listed. While some of the statements may not apply to you, we ask that you please read <u>all</u> of them. Check those that describe you as you go along. Some of the statements will differ only in a few words, so please read each one carefully. While you may go back and change a response, your first answer is usually the best. Please do not read ahead in the booklet

<u>Once you have started the questionnaire, it is very important that you complete it within one day (24 hours).</u>

If you find it hard to keep your mind on the statements, take a short break and then continue. When you have read all of the statements on a page, put a check in the BOX in the lower right-hand corner. If you have any questions, please refer back to these instructions.

<u>Please do not discuss the statements with anyone, including family members, while doing the questionnaire.</u>

Now turn to the questionnaire booklet and read the statements. Remember we are interested in the recent or longstanding changes in your activities that are related to your health.

(SR-0499)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I spend much of the day lying down in order to rest	____	(083)
2.	I sit during much of the day	____	(049)
3.	I am sleeping or dozing most of the time - day and night	____	(104)
4.	I lie down more often during the day in order to rest	____	(058)
5.	I sit around half-asleep	____	(084)
6.	I sleep less at night, for example, wake up too early, don't fall asleep for a long time, awaken frequently	____	(061)
7.	I sleep or nap more during the day	____	(060)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

(EB-0705)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I say how bad or useless I am, for example, that I am a burden on others	_____	(087)
2.	I laugh or cry suddenly	_____	(068)
3.	I often moan and groan in pain or discomfort	_____	(069)
4.	I have attempted suicide	_____	(132)
5.	I act nervous or restless	_____	(046)
6.	I keep rubbing or holding areas of my body that hurt or are uncomfortable	_____	(062)
7.	I act irritable and impatient with myself, for example, talk badly about myself, swear at myself, blame myself for things that happen	_____	(078)
8.	I talk about the future in a hopeless way	_____	(089)
9.	I get sudden frights	_____	(074)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

PLEASE RESPOND TO (CHECK) <u>ONLY</u> THOSE STATEMENTS THAT YOU ARE <u>SURE</u> DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I make difficult moves with help, for example, getting into or out of cars, bathtubs	_____	(084)
2.	I do not move into or out of bed or chair by myself but am moved by a person or mechanical aid	_____	(121)
3.	I stand only for short periods of time	_____	(072)
4.	I do not maintain balance	_____	(098)
5.	I move my hands or fingers with some limitation or difficulty	_____	(064)
6.	I stand up only with someone's help	_____	(100)
7.	I kneel, stoop, or bend down only by holding on to something	_____	(064)
8.	I am in a restricted position all the time	_____	(125)
9.	I am very clumsy in body movements	_____	(058)
10.	I get in and out of bed or chairs by grasping something for support or using a cane or walker	_____	(082)
11.	I stay lying down most of the time	_____	(113)
12.	I change position frequently	_____	(030)
13.	I hold on to something to move myself around in bed	_____	(086)

(Continued on next page)

(Continued from previous page)

14.	I do not bathe myself completely, for example, require assistance with bathing	______	(089)
15.	I do not bathe myself at all, but am bathed by someone else	______	(115)
16.	I use bedpan with assistance	______	(114)
17.	I have trouble getting shoes, socks, or stockings on	______	(057)
18.	I do not have control of my bladder	______	(124)
19.	I do not fasten my clothing, for example, require assistance with buttons, zippers, shoelaces	______	(074)
20.	I spend most of the time partly undressed or in pajamas	______	(074)
21.	I do not have control of my bowels	______	(128)
22.	I dress myself, but do so very slowly	______	(043)
23.	I get dressed only with someone's help	______	(088)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

THIS GROUP OF STATEMENTS HAS TO DO WITH ANY WORK YOU USUALLY DO IN CARING FOR YOUR HOME OR YARD. CONSIDERING JUST THOSE THINGS THAT YOU DO, PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE <u>SURE</u> DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH

1.	I do work around the house only for short periods of time or rest often	____	(054)
2.	I am doing <u>less</u> of the regular daily work around the house than I would usually do	____	(044)
3.	I am not doing <u>any</u> of the regular daily work around the house that I would usually do	____	(086)
4.	I am not doing <u>any</u> of the maintenance or repair work that I would usually do in my home or yard	____	(062)
5.	I am not doing <u>any</u> of the shopping that I would usually do	____	(071)
6.	I am not doing <u>any</u> of the house cleaning that I would usually do	____	(077)
7.	I have difficulty doing handwork, for example, turning faucets, using kitchen gadgets, sewing, carpentry	____	(069)
8.	I am not doing <u>any</u> of the clothes washing that I would usually do	____	(077)
9.	I am not doing heavy work around the house	____	(044)
10.	I have given up taking care of personal or household business affairs, for example, paying bills, banking, working on budget	____	(084)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

(M-0719)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I am getting around only within one building	_____	(086)
2.	I stay within one room	_____	(106)
3.	I am staying in bed more	_____	(081)
4.	I am staying in bed most of the time	_____	(109)
5.	I am not now using public transportation	_____	(041)
6.	I stay home most of the time	_____	(066)
7.	I am only going to places with restrooms nearby	_____	(056)
8.	I am not going into town	_____	(048)
9.	I stay away from home only for brief periods of time	_____	(054)
10.	I do not get around in the dark or in unlit places without someone's help	_____	(072)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I am going out less to visit people	_____	(044)
2.	I am not going out to visit people at all	_____	(101)
3.	I show less interest in other people's problems, for example, don't listen when they tell me about their problems, don't offer to help	_____	(067)
4.	I often act irritable toward those around me, for example, snap at people, give sharp answers, criticize easily	_____	(084)
5.	I show less affection	_____	(052)
6.	I am doing fewer social activities with groups of people	_____	(036)
7.	I am cutting down the length of visits with friends	_____	(043)
8.	I am avoiding social visits from others	_____	(080)
9.	My sexual activity is decreased	_____	(051)
10.	I often express concern over what might be happening to my health	_____	(052)
11.	I talk less with those around me	_____	(056)
12.	I make many demands, for example, insist that people do things for me, tell them how to do things	_____	(088)
13.	I stay alone much of the time	_____	(086)

(Continued on next page)

(Continued from previous page)

14.	I act disagreeable to family members, for example, I act spiteful, I am stubborn	______	(088)
15.	I have frequent outbursts of anger at family members, for example, strike at them, scream, throw things at them	______	(119)
16.	I isolate myself as much as I can from the rest of the family	______	(102)
17.	I am paying less attention to the children	______	(064)
18.	I refuse contact with family members, for example, turn away from them	______	(115)
19.	I am not doing the things I usually do to take care of my children or family	______	(079)
20.	I am not joking with family members as I usually do	______	(043)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

(A-0842)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I walk shorter distances or stop to rest often	______	(048)
2.	I do not walk up or down hills	______	(056)
3.	I use stairs only with mechanical support, for example, handrail, cane, crutches	______	(067)
4.	I walk up or down stairs only with assistance from someone else	______	(076)
5.	I get around in a wheelchair	______	(096)
6.	I do not walk at all	______	(105)
7.	I walk by myself but with some difficulty, for example, limp, wobble, stumble, have stiff leg	______	(055)
8.	I walk only with help from someone	______	(088)
9.	I go up and down stairs more slowly, for example, one step at a time, stop often	______	(054)
10.	I do not use stairs at all	______	(083)
11.	I get around only by using a walker, crutches, cane, walls, or furniture	______	(079)
12.	I walk more slowly	______	(035)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I am confused and start several actions at a time	____	(090)
2.	I have more minor accidents, for example, drop things, trip and fall, bump into things	____	(075)
3.	I react slowly to things that are said or done	____	(059)
4.	I do not finish things I start	____	(067)
5.	I have difficulty reasoning and solving problems, for example, making plans, making decisions, learning new things	____	(084)
6.	I sometimes behave as if I were confused or disoriented in place or time, for example, where I am, who is around, directions, what day it is	____	(113)
7.	I forget a lot, for example, things that happened recently, where I put things, appointments	____	(078)
8.	I do not keep my attention on any activity for long	____	(067)
9.	I make more mistakes than usual	____	(064)
10.	I have difficulty doing activities involving concentration and thinking	____	(080)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

(C-0725)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I am having trouble writing or typing	____	(070)
2.	I communicate mostly by gestures, for example, moving head, pointing, sign language	____	(102)
3.	My speech is understood only by a few people who know me well	____	(093)
4.	I often lose control of my voice when I talk, for example, my voice gets louder or softer, trembles, changes unexpectedly	____	(083)
5.	I don't write except to sign my name	____	(083)
6.	I carry on a conversation only when very close to the other person or looking at him	____	(067)
7.	I have difficulty speaking, for example, get stuck, stutter, stammer, slur my words	____	(076)
8.	I am understood with difficulty	____	(087)
9.	I do not speak clearly when I am under stress	____	(064)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

THE NEXT GROUP OF STATEMENTS HAS TO DO WITH ANY WORK YOU USUALLY DO OTHER THAN MANAGING YOUR HOME. BY THIS WE MEAN ANYTHING THAT YOU REGARD AS WORK THAT YOU DO ON A REGULAR BASIS.

DO YOU USUALLY DO WORK OTHER THAN MANAGING YOUR HOME?

___ YES ___ NO

IF YOU ANSWERED YES, GO ON TO THE NEXT PAGE.

IF YOU ANSWERED NO:

ARE YOU RETIRED?

___ YES ___ NO

IF YOU ARE RETIRED, WAS YOUR RETIREMENT RELATED TO YOUR HEALTH?

___ YES ___ NO

IF YOU ARE NOT RETIRED, BUT ARE NOT WORKING, IS THIS RELATED TO YOUR HEALTH?

___ YES ___ NO

NOW SKIP THE NEXT PAGE.

(W-0515)

IF YOU ARE NOT WORKING AND IT IS NOT BECAUSE OF YOUR HEALTH, PLEASE SKIP THIS PAGE.

NOW CONSIDER THE WORK YOU DO AND RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH. (IF TODAY IS A SATURDAY OR SUNDAY OR SOME OTHER DAY THAT YOU WOULD USUALLY HAVE OFF, PLEASE RESPOND AS IF TODAY WERE A WORKING DAY.)

---

1. I am not working at all _____ (361)
   (IF YOU CHECKED THIS STATEMENT, SKIP TO THE NEXT PAGE.)

2. I am doing part of my job at home _____ (037)
3. I am not accomplishing as much as usual at work _____ (055)
4. I often act irritable toward my work associates, for example, snap at them, give sharp answers, criticize easily _____ (080)
5. I am working shorter hours _____ (043)
6. I am doing only light work _____ (050)
7. I work only for short periods of time or take frequent rests _____ (061)
8. I am working at my usual job but with some changes, for example, using different tools or special aids, trading some tasks with other workers _____ (034)
9. I do not do my job as carefully and accurately as usual _____ (062)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

THIS GROUP OF STATEMENTS HAS TO DO WITH ACTIVITIES YOU USUALLY DO IN YOUR FREE TIME. THESE ACTIVITIES ARE THINGS THAT YOU MIGHT DO FOR RELAXATION, TO PASS THE TIME, OR FOR ENTERTAINMENT. PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

---

1. I do my hobbies and recreation for shorter periods of time _____ (039)
2. I am going out for entertainment less often _____ (036)
3. I am cutting down on some of my usual inactive recreation and pastimes, for example, watching TV, playing cards, reading _____ (059)
4. I am not doing any of my usual inactive recreation and pastimes, for example, watching TV, playing cards, reading _____ (084)
5. I am doing more inactive pastimes in place of my other usual activities _____ (051)
6. I am doing fewer community activities _____ (033)
7. I am cutting down on some of my usual physical recreation or activities _____ (043)
8. I am not doing any of my usual physical recreation or activities _____ (077)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

(E-0705)

PLEASE RESPOND TO (CHECK) ONLY THOSE STATEMENTS THAT YOU ARE SURE DESCRIBE YOU TODAY AND ARE RELATED TO YOUR STATE OF HEALTH.

1.	I am eating much less than usual	____	(037)
2.	I feed myself but only by using specially prepared food or utensils	____	(077)
3.	I am eating special or different food, for example, soft food, bland diet, low-salt, low-fat, low-sugar	____	(043)
4.	I eat no food at all but am taking fluids	____	(104)
5.	I just pick or nibble at my food	____	(059)
6.	I am drinking less fluids	____	(036)
7.	I feed myself with help from someone else	____	(099)
8.	I do not feed myself at all, but must be fed	____	(117)
9.	I am eating no food at all, nutrition is taken through tubes or intravenous fluids	____	(133)

CHECK HERE WHEN YOU HAVE READ ALL STATEMENTS ON THIS PAGE ☐

NOW, PLEASE REVIEW THE QUESTIONNAIRE TO BE CERTAIN YOU HAVE FILLED OUT ALL THE INFORMATION. LOOK OVER THE BOXES ON EACH PAGE TO MAKE SURE EACH ONE IS CHECKED SHOWING THAT YOU HAVE READ ALL OF THE STATEMENTS. IF YOU FIND A BOX WITHOUT A CHECK, THEN READ THE STATEMENTS ON THAT PAGE.

APPENDIX C

ENGLISH-CANADIAN

SF-36

SF-36 Acute English-Canadian
Version 1.0

SF-36 HEALTH SURVEY

INSTRUCTIONS: This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

1. In general, would you say your health is:

(circle one)

Excellent 1

Very good 2

Good 3

Fair 4

Poor 5

2. <u>Compared to one week ago</u>, how would you rate your health in general <u>now</u>?

(circle one)

Much better now than one week ago 1

Somewhat better now than one week ago 2

About the same as one week ago 3

Somewhat worse now than one week ago 4

Much worse now than one week ago 5

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3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

(circle one number on each line)

ACTIVITIES	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
a. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing **several** flights of stairs	1	2	3
e. Climbing **one** flight of stairs	1	2	3
f. Bending, kneeling, or stooping	1	2	3
g. Walking **more than a kilometre**	1	2	3
h. Walking **several blocks**	1	2	3
i. Walking **one block**	1	2	3
j. Bathing or dressing yourself	1	2	3

4. During the past week, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

(circle one number on each line)

	YES	NO
a. Cut down on the **amount of time** you spent on work or other activities	1	2
b. **Accomplished less** than you would like	1	2
c. Were limited in the **kind** of work or other activities	1	2
d. Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

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5. During the past week, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

(circle one number on each line)

	YES	NO
a. Cut down the **amount of time** you spent on work or other activities	1	2
b. **Accomplished less** than you would like	1	2
c. Didn't do work or other activities as **carefully** as usual	1	2

6. During the past week, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(circle one)

Not at all 1

Slightly 2

Moderately 3

Quite a bit 4

Extremely 5

7. How much bodily pain have you had during the past week?

(circle one)

None 1

Very mild 2

Mild 3

Moderate 4

Severe 5

Very severe 6

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8. During the past week, how much did pain interfere with your normal work (including both work outside the home and housework)?

(circle one)

Not at all	1
A little bit	2
Moderately	3
Quite a bit	4
Extremely	5

9. These questions are about how you feel and how things have been with you during the past week. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past week -

(circle one number on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
a. Did you feel full of pep?	1	2	3	4	5	6
b. Have you been a very nervous person?	1	2	3	4	5	6
c. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
d. Have you felt calm and peaceful?	1	2	3	4	5	6
e. Did you have a lot of energy?	1	2	3	4	5	6
f. Have you felt downhearted and blue?	1	2	3	4	5	6
g. Did you feel worn out?	1	2	3	4	5	6
h. Have you been a happy person?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6

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10. During the past week, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

(circle one)

All of the time 1

Most of the time 2

Some of the time 3

A little of the time 4

None of the time 5

11. How TRUE or FALSE is each of the following statements for you?

(circle one number on each line)

	Definitely True	**Mostly True**	**Don't Know**	**Mostly False**	**Definitely False**
a. I seem to get sick a little easier than other people	1	2	3	4	5
b. I am as healthy as anybody I know	1	2	3	4	5
c. I expect my health to get worse	1	2	3	4	5
d. My health is excellent	1	2	3	4	5

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APPENDIX D

AN EXAMPLE OF A CALCULATION FOR THE CARDIORESPIRATORY CONDITIONING INDEX

An example for a 39 year old female.

	OBSERVED	**PREDICTED**

1. **Heart Rate** (HR)

   Steady-rate HR is 141 bpm — Age-predicted HRmax is 185 bpm

- therefore this subject is at 141/185 = 76% of her age-predicted HRmax

2. **Maximum Oxygen Consumption** (VO_2max)

   VO_2max based on parameters of test is 18.8 ml•kg^{-1}•min^{-1} — Based on norms the predicted value is 28 ml•kg^{-1}•min^{-1}

- therefore this subject is at 18.8/28 = 67% of VO_2max

3. Based on the Relationship Between HR and VO_2

   76% of age-predicted HRmax is equivalent to 63% of VO_2max

4. Calculation for the Cardiorespiratory Conditioning Index (CRCI)

   CRCI = Estimated (% pred max) - Predicted (% pred max) for an observed HR (% pred max)

   = 67 - 63
   = +4

   Since this value is greater than zero it indicated that this subject has an above average level of cardiovascular fitness based on this index of conditioning.

Note: age-predicted HRmax = 210 - (0.65) * age