

The Index of Independence in Activities of Daily Living (ADL), now in frequent use in rehabilitation settings, has application for prevention of disability and maintenance of rehabilitation gains in the aging person in all settings. Since the Index is sensitive to changes in meaningful self-care functions, uses well-defined criteria, and can be broadly taught to non-professionals, it has considerable practical value as a longitudinal measure of change and predictor of adaptive capacity in terms of community residences and congregate living facilities.

Progress in Development of the Index of ADL¹

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The Index of Independence in Activities of Daily Living (Index of ADL) was developed as a measure of function which could be used in objective evaluations of chronically ill and aging populations (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). The Index has been used as a tool to help accumulate much-needed information about prognosis and about the dynamics of disability in the aging process (Katz, Ford, Chinn, & Newill, 1966; Katz, Heiple, Downs, Ford, & Scott, 1967; Steinberg & Frost, 1963). It has also been used to assess need for care, to determine effectiveness of treatment, and as a teaching aid in rehabilitation (Katz, Vignos, Moskowitz, Thompson, & Svec, 1968; Katz et al., 1963).

It is the purpose of this report to describe the progress in the continuing development of the Index. The form of this presentation will be, first, to describe the measure and, second, to describe a series of applications. The results of a recent theoretic study will then be described;

and, finally, implications of the practical and theoretic experiences will be discussed.

The Index of ADL

The Index of ADL summarizes over-all performance in six functions, namely, bathing, dressing, going to toilet, transferring, continence, and feeding (Katz, et al., 1963). According to the Index, performance is summarized as grades **A, B, C, D, E, F, or G**, where **A** is the most independent grade relative to the scale and **G** the most dependent grade.

By means of a series of questions and observations, the observer forms a mental picture of the patient's ADL status as it existed during a 2-week period preceding the evaluation. The observer determines whether another person assisted the patient or whether the patient functioned alone, defining assistance as **active personal assistance, directive assistance, or supervision**. The actual existence of such assistance is considered in the evaluation, **not** the potential or ability of the patient. Thus, for example, overprotective assistance is defined as assistance although the observer considers the patient as more able; and refusal to perform a function is considered nonfunctioning although the patient is deemed able. The observer uses the following definitions in completing the form reproduced in Table I and records, for each

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Table 1. Evaluation Form

Name Day of evaluation

For each area of functioning listed below, check description that applies. (The word "assistance" means supervision, direction, or personal assistance.)

Bathing—either sponge bath; tub bath, or shower.

- | | | |
|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Receives no assistance (gets in and out of tub by self if tub is usual means of bathing) | Receives assistance in bathing only one part of the body (such as back or a leg) | Receives assistance in bathing more than one part of the body (or not bathed) |

Dressing—gets clothes from closets and drawers—including underclothes, outer garments and using fasteners (including braces if worn)

- | | | |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Gets clothes and gets completely dressed without assistance | Gets clothes and gets dressed without assistance except for assistance in tying shoes | Receives assistance in getting clothes or in getting dressed, or stays partly or completely undressed |

Toileting—going to the "toilet room" for bowel and urine elimination; cleaning self after elimination, and arranging clothes

- | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Goes to "toilet room," cleans self, and arranges clothes without assistance (may use object for support such as cane, walker, or wheelchair and may manage night bedpan or commode, emptying same in morning) | Receives assistance in going to "toilet room" or in cleansing self or in arranging clothes after elimination or in use of night bedpan or commode | Doesn't go to room termed "toilet" for the elimination process |

Transfer—

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Moves in and out of bed as well as in and out of chair without assistance (may be using object for support such as cane or walker) | Moves in and out of bed or chair with assistance | Doesn't get out of bed |

Continence—

- | | | |
|----------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Controls urination and bowel movement completely by self | Has occasional "accidents" | Supervision helps keep urine or bowel control; catheter is used, or is incontinent |

Feeding—

- | | | |
|-------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeds self without assistance | Feeds self except for getting assistance in cutting meat or buttering bread | Receives assistance in feeding or is fed partly or completely by using tubes or intravenous fluids |

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function, the most dependent degree of performance during the 2-week period.

Bathing is the over-all complex behavior of getting water and cleansing the whole body. A patient receives "no assistance" (first of the three classes of bathing in Table 1) if no other person is involved in any part of the process of taking a sponge, shower, or tub bath to wash the whole body. Such a patient goes to the sink by himself if he sponge-bathes at the sink, gets in and out of a tub by himself if he tub-bathes, and is not supervised in the shower if showering is the means of bathing. A patient receives "assistance in bathing only one part of the body" if he functions by himself as defined above, except that he is assisted in washing only one part of the body, as his back alone or one leg alone. The class "assistance in bathing more than one part of the body" includes the individual who is assisted in washing more than one part of the body or who does not bathe. This last, most dependent category, includes also the following: the patient to whom water is brought even though he washes himself; the person who is helped in or out of a tub as regularly as once a week; the patient who is regularly supervised for reasons of safety although he washes himself; and the patient who cannot reach his feet to wash them.

Dressing is the over-all complex behavior of getting clothes from closets and drawers and then getting dressed. A patient gets "completely dressed without assistance" (first of the three classes of dressing in Table 1) if no other person is involved in getting clothes from closets and drawers nor in putting on the clothes, including brace, if worn, and including outer garments and footwear. Fasteners must also be managed without assistance. Footwear includes such items as socks and slippers or shoes. The intermediate category of dressing includes those who get their own clothes and dress independently as defined above "except for assistance in tying shoes." A patient is placed in the third and most dependent category if he receives "assistance in getting clothes or in getting dressed" or remains "partly or completely undressed."

Going to toilet is the act of going to the room termed the "toilet room" for bowel and bladder function, transferring on and off the toilet, cleaning after elimination, and arranging clothes. The patient who functions wholly by himself, including getting to the room, is classed as functioning "without assistance" (first of the three classes in Table 1). It should be

noted that an individual in this class may or may not be using an object for support such as a cane, walker, or wheelchair; and he may be using a bedpan or commode at night, in which case he must empty it himself in order to be considered in the "without assistance" category. If another person assists in any part of the function, the toileting status is recorded as "receives assistance" (intermediate toileting category in Table 1). Toileting status is also recorded as "receives assistance" for an individual who uses the toilet room at certain times and at other times uses a daytime bedpan or commode. The third category, namely, "doesn't go to room termed toilet," is self-explanatory. Note that toileting is not concerned with continence. If a patient is occasionally incontinent, but manages himself completely independently insofar as toileting is concerned, toileting function is recorded as "without assistance."

Transfer is the process of moving in and out of bed and in and out of a chair. If no other person is involved in the transfer, the patient is considered to function "without assistance" (first of three classes of transfer in Table 1). Such a patient may be using an object for support, e.g., cane, walker, or bedpost. The intermediate category, namely, "with assistance," applies if another person is involved in the process. Patients in the third category are bedridden and do not leave the bed at all. In evaluating transfer status, the observer may be told that the patient is not allowed to transfer unless supervised for reasons of safety. The observer then determines whether such supervision is a reality. The observer may occasionally find, for example, that a daughter claims she supervises her mother whenever her mother moves from one place to another, while observation reveals that the mother moves about entirely on her own and the daughter means that she is always within hearing distance.

Continence refers to the physiological process of elimination from bladder and bowel, where incontinence is the involuntary loss of urine and/or feces. The function is thought of as the primitive function of control and does not include any consideration of hygiene, toileting, or constipation. The patient is classed as "controls urination and bowel movement completely by self" (first of three continence categories in Table 1) if no other person assists. Such a patient can exert some degree of control on the process himself by medication or by self-administered enema (or, in the case of a

patient with a colostomy, may manage this by himself). The case in which a slight amount of wetness or slight soiling of underclothes is occasionally noted by others and not perceived as incontinence by the patient is recorded as "controls urination and bowel movement." The patient who does not get to the bathroom or commode on time or who is incontinent at least once during the 2-week period of the evaluation is considered as "has occasional accidents," the intermediate category. Patients in the third category are incontinent or controlled by the supervision, direction, or intervention of another person. Presence of a catheter or planned,

supervised scheduling for bowel control are included in the incontinent category.

Feeding concerns the process of getting food from a plate or its equivalent into the mouth. It is considered in a primitive sense and without concern for social niceties. A patient feeds himself "without assistance" (first of three classes of feeding in Table 1) when this primitive process of ingestion is accomplished without the aid of another person. The intermediate category applies to the individual who feeds himself but receives assistance in cutting meat or buttering bread. The third category, "receives assistance," applies to the individual

Table 2. Index of Independence in Activities of Daily Living.

The Index of Independence in Activities of Daily Living is based on an evaluation of the functional independence or dependence of patients in bathing, dressing, going to toilet, transferring, continence, and feeding. Specific definitions of functional independence and dependence appear below the index.

- A—Independent in feeding, continence, transferring, going to toilet, dressing, and bathing.
- B—Independent in all but one of these functions.
- C—Independent in all but bathing and one additional function.
- D—Independent in all but bathing, dressing, and one additional function.
- E—Independent in all but bathing, dressing, going to toilet, and one additional function.
- F—Independent in all but bathing, dressing, going to toilet, transferring, and one additional function.
- G—Dependent in all six functions.

Other—Dependent in at least two functions, but not classifiable as C, D, E, or F.

Independence means without supervision, direction, or active personal assistance, except as specifically noted below. This is based on actual status and not on ability. A patient who refuses to perform a function is considered as not performing the function, even though he is deemed able.

Bathing (Sponge, Shower, or Tub)

- Independent: assistance only in bathing a single part (as back or disabled extremity) or bathes self completely
- Dependent: assistance in bathing more than one part of body; assistance in getting in or out of tub or does not bathe self

Dressing

- Independent: gets clothes from closets and drawers; puts on clothes, outer garments, braces; manages fasteners; act of tying shoes is excluded
- Dependent: does not dress self or remains partly undressed

Going to Toilet

- Independent: gets to toilet; gets on and off toilet; arranges clothes; cleans organs of excretion; (may manage own bedpan used at night only and may or may not be using mechanical supports)
- Dependent: uses bedpan or commode or receives assistance in getting to and using toilet

Transfer

- Independent: moves in and out of bed independently and moves in and out of chair independently (may or may not be using mechanical supports)
- Dependent: assistance in moving in or out of bed and/or chair; does not perform one or more transfers

Continence

- Independent: urination and defecation entirely self-controlled
- Dependent: partial or total incontinence in urination or defecation; partial or total control by enemas, catheters, or regulated use of urinals and/or bedpans

Feeding

- Independent: gets food from plate or its equivalent into mouth; (precutting of meat and preparation of food, as buttering bread, are excluded from evaluation)
- Dependent: assistance in act of feeding (see above); does not eat at all or parenteral feeding

who is assisted in this feeding process or who is fed partly or completely parenterally.

The form in Table 1 includes all the terms needed in the evaluation. Extensive guides are not needed, although the definitions presented above may be required initially to instruct the observer or in unusual patient circumstances. In the interest of maximum accuracy and reliability, the observer may create test situations. She may, for example, ask the patient to show her the bathroom and medications in another room (or a meaningful substitute object). This serves as an opportunity for direct observation of transfer and locomotion and checks on the reliability of information given about bathing, dressing, going to the toilet, and transferring.

Data recorded on the form are converted into an Index of ADL grade with the aid of the definitions presented in Table 2. Note from Table 2 that two descriptions would permit one to distinguish between "Independent" and "Dependent" levels for grading purposes; yet three descriptions are presented for the observer to consider on the recording form. Introduction of an intermediate description increases observer awareness of subtle distinctions and, thereby, increases reliability. The intermediate description is classified as dependent for certain functions and independent for others. For grading purposes, the intermediate description of bathing and dressing, for example, is classed as dependent. The occasional individual classified as *Other* (usually less than 5% of the patients) according to the Index does not have to be eliminated from all studies. By definition, a patient so classed is more dependent than one classed as **A** or **B**, and more independent than one classed as **G**. Individuals classed as *Other* can, therefore, always be compared relative to those classed as **A**, **B**, or **G**. Experience has also shown that the unique profile of a person classed as *Other* tends to persist and thus permits a precise determination of improvement or deterioration when changes occur. For example, a patient who is classified as *Other* because he is incontinent and dependent in dressing clearly deteriorates when he develops bathing dependence in addition to incontinence and dressing dependence (grade of **D**).

Environmental artifacts that tend to influence ADL levels are occasionally encountered. For safety reasons, some hospitals require nurses to supervise patients who shower or get into tubs. During the first few days in the hospital,

patients are sometimes kept in bed until the staff can assess their behavior and the degree of dependence permissible. In some nursing homes, patients are kept in bed and not permitted to dress. For safety and convenience, water for bathing and clothes for dressing are sometimes brought to patients. All these special conditions can result in ADL ratings that are lower than they might be in the absence of such restrictions. A test of actual functional level is possible and is indicated for certain studies.

Uses of the Index

At Abington House (formerly the Benjamin Rose Hospital), follow-up information has been accumulated for more than 10 years about groups of consecutively admitted patients with fracture of the hip and with stroke. The long-term observations of levels of function, using the Index of ADL as well as other measures, has led to objective information about the progression and regression of these chronic illnesses and has contributed new information about such practical questions as: Who shows changes in function? What is the likelihood of change? To whom should specific preventive and therapeutic measures be applied? What type and how much assistance is required to maintain the patient in the community?

For patients with fracture of the hip, for example, most full and partial recoveries occurred within 1 year after fracture, and there was little chance of recovery after 2 years (Katz et al., 1967). Recovery in ADL tended to precede recovery in walking. When recovery occurred, it was generally sustained for 2 years or longer. The estimated average life-span after fracture was 6½ years in contrast to a figure of 9 years for a comparable unselected population in the same section of the country. Predictors of a poor outcome were advanced age, prefracture disability as determined by the Index of ADL, and coexisting major chronic disease.

Follow-up of the group with stroke indicated that the majority of recoveries occurred within 6 mo. after stroke, and there was little likelihood of recovery after 2 years (Katz et al., 1966). When recovery occurred, it was generally sustained for a year or longer. At the end of 2 years, six of ten survivors walked without personal assistance and received minimal or no assistance with activities of daily living. Four of the six were at prestroke functional levels. The risk of death after stroke

was greater than would be expected for the general population, but the accelerated rate of death subsided by 24 to 30 mo. after stroke. Advanced age, the absence of early neuromuscular improvement, the presence of coexisting major chronic disease, and the presence of more than one stroke were factors associated with a poor outcome. The predictive information gained from these follow-up studies was used by hospital personnel in the process of decision-making during rehabilitation.

In other studies, the type and amount of personal assistance required was correlated with Index levels. For example, in a group of hemiplegic patients, 53 graded as **A** according to the Index of ADL had no nonfamily attendants and, by definition, received no assistance. With one exception, patients in this class lived in nonprotective residences. With increasing dependence according to the Index grades, increasing proportions were found in nursing homes, hospitals, or custodial institutions. Of 22 patients in the most dependent ADL classes (**E**, **F**, or **G**), 21 were receiving nonfamily attendant care, and more of this dependent group were correspondingly in nursing homes or other protective institutions. Patients in intermediate ADL classes were in intermediate positions with regard to the frequency of nonfamily attendant care and with regard to the frequency of institutional care.

The above correlation between the Index grade and the type and amount of assistance was concerned with the relationship between the Index grade and assistance status as concurrent characteristics. The Index grade was, also, demonstrated to be predictive of future assistance needs (Katz et al., 1963). Thus, among hemiplegic patients discharged from a rehabilitation hospital, 79% of those graded **D**, **E**, **F**, or **G** at discharge were receiving nonfamily attendant care one year after stroke. The corresponding figure at one year was 45% for patients who had been graded **B** or **C** at discharge. Noteworthy was the fact that dependence in a single function, namely, going to toilet, divided subjects into groups that required significantly different amounts of assistance on a predictive basis and also differentiated between those who did and did not enter long-term institutions.

Use of the Index of ADL to describe outcome in a service program was demonstrated in a comparison study of patients referred to the Home Care Demonstration Program of the Visiting Nurse Association of Cleveland.

Changes in function one year after referral were compared between two groups: 1) all consecutively referred patients who were accepted into the home care program during a 1-year period; and 2) all consecutively referred patients who were not accepted for home care during the same year. Of the 87 patients who were accepted, 57% were receiving major assistance at the time of the referral (grades of **D** or lower by the Index). Of the 30 patients who were not accepted, 73% were receiving major assistance at the time of the referral. During the year after referral, 22% of those accepted and 40% of those not accepted had deteriorated. Each group had ten fatalities. The observations contributed to the agency's decision to devote resources to research which was designed to test the value of its services for selected groups of chronically ill patients. In particular, those responsible for the agency wished to learn more about the dynamics of its services as an aid to planning for care of the aging and chronically ill within the community.

In addition to the interest of the staff of the Visiting Nurse Association, personnel in the rehabilitation hospital had reason to think of home care. A follow-up clinic had been established in the hospital, and the clinic experience demonstrated that very old and disabled patients were unable to come to the clinic. As a result of the mutual concern for more effective ways of continuing the long-term rehabilitation process, a controlled experiment was designed and carried out to test the effectiveness of 2 years of public health nursing in the homes of aged patients (Ford, Katz, & Adams, 1965). In a second and related experiment, the effectiveness of a long-term multidisciplinary program of coordinated care between clinic and home for outpatients with rheumatoid arthritis was evaluated (Katz et al., 1968). As one example of use of the Index of ADL in these experiments, we demonstrated a beneficial effect by the multidisciplinary program, in terms of fewer deteriorations in activities of daily living, for outpatients with rheumatoid arthritis.

The Index of ADL was used as one of several measures in a multidisciplinary screening schedule designed to detect chronic disease and disability in "new" outpatients who came to the medical clinics of University Hospitals of Cleveland. In the study, it was possible to evaluate the meaning and applicability of the Index to conditions of ambulatory young

patients. Findings by the screening procedures were compared with findings by routine and independently performed complete physical examinations and medical histories. In a one-in-five random sample of new patients, major chronic illness was detected in approximately 70%; and about one-half of the latter had disability, primarily in the form of restricted activity. Patients without chronic disease did not have disability. The presence or absence of disability was significantly related to the presence or absence, respectively, of major chronic diseases. Disability measures included the Index of ADL, the New York Heart Association Classification of Cardiac Function, and measures of house-confinement, walking, and muscle evaluations. Of methodological interest was the fact that most of the disabled patients were identified as disabled by more than one of the disability measures.

Limitations of space do not permit continuing detailed descriptions of all of the uses of the Index of ADL. Thousands of evaluations have been made both in and out of institutions. Patients have been evaluated in all types of residences, in general hospitals, in rehabilitation hospitals, in extended care units, in nursing homes, in custodial mental institutions, in private practices (e.g., private practices of orthopedic surgeons), in housing projects for the aged, and, in other countries, to list some of the many circumstances known to us. Although originally developed in relation to stroke and fracture of the hip, the Index has since been applied to an extensive spectrum of chronic diseases of adults and has contributed much useful information.

Theoretic Development

In earlier studies of uses of the Index of ADL, the interesting observation was made that certain recovering patients passed through three stages: 1) return of independence in feeding and continence; 2) recovery in transferring and going to toilet; and 3) recovery of independence in dressing and bathing (Katz et al., 1963). This pattern not only parallels the order of functions on the ADL scale but is also similar to the progression of functional development in the young child. This observation and information about behavior of primitive peoples from anthropological studies gave rise to the theory that the Index appears to be based on functions of biological primacy and that the Index, itself, reflects the adequacy of organized neurological and locomotor response.

In the current report, we describe new information about this theoretic statement. If, in fact, the statement is true, we hypothesized that the Index should better predict patient adaptation in terms of the longitudinal course of over-all function than should measures of either physical or mental function alone. Reported here are the results of a study which was designed to test this thesis, in the form of correlation studies between selected predictive measures and measures of the longitudinal course of function. The predictive measures included the Index of ADL, a test of range of motion and strength, the Raven test of intellectual function, and a test of orientation and mental control modified after Wechsler. The longitudinal course of function was evaluated in terms of mobility and of house-confinement 2 years later. Examined, also, were correlations between the predictive factors and survival.

The sample for the study included patients discharged from Abington House, a hospital for the chronically ill, and admitted into a 2-year study whose primary goal was to test experimentally the effectiveness of a sustained program of home nursing services after rehabilitation (Ford et al., 1965). Among the originally recorded secondary goals, the study was also designed to collect data for methodological purposes, namely, to learn more about methods of measuring patient function and about methods of longitudinal data analysis. The information reported here was collected and examined to learn more about the Index of ADL. During a period of 22 mo., starting in 1963, 300 consecutively discharged patients, who met the following criteria, were admitted into the primary study of effectiveness; 1) discharged to a home (noninstitutional residence), 2) residing within a predefined geographic area, 3) at least 50 years old, 4) hospital stay of at least 1 week, and 5) did not leave the hospital against medical advice. All tested patients of the 300 could be ranked relative to each other by the Index of ADL, the Raven test, the test of orientation and mental control, the mobility scale, and the house-confinement scale. Using the range of motion test, however, not all patients could be ranked relative to each other. One subgroup of 270 patients could be so ranked and was numerically large enough for the proposed correlation studies. A second subgroup of 30 patients required a separate system of ranking and was numerically too

small for analysis. The larger (270 patients) and more typical subgroup was, therefore, selected for the present studies.

Patients in the study ranged in age from 50 to 94 years, and 75% were 65 years old or older. More than half were women. Socioeconomically, the group was more independent, on the average, than a group of people of similar ages from the general population. Only 4% received financial assistance from public or voluntary charitable agencies. About one-fifth were in the upper two classes according to the Hollingshead Two-Factor Index of Social Position (Hollingshead, 1957). Stroke, fracture of the femur, or chronic brain syndrome were the principal diagnoses in one-half the sample. Rheumatoid arthritis, arteriosclerotic heart disease, cancer, and osteoarthritis accounted for another 18%, while the remaining 32% had one of 78 other chronic diseases.

In addition to the Index of ADL which has been described, other measures in the study, as mentioned above, included the test of range of motion and strength, the Raven Test, the test of orientation and mental control modified after Wechsler, a mobility scale, and a scale of house-confinement. The standardized test of range of motion and strength has been described previously (Katz et al., 1966). In this test, the patient is asked to perform a series of six maneuvers with each lower limb and ten maneuvers with each upper limb. Each maneuver is tested under standard circumstances, and with and without resistance. Grades of function for each extremity are converted to "good," "fair," and "poor" categories. For this study, a summary grade of range of motion was established for each patient according to the following five-grade scale: 1) all limbs test "good"; 2) limbs on one side of the body test "good," and one or both on the other side test "fair"; 3) limbs on one side of the body test "good," and one limb on the other side tests "poor"; 4) limbs on one side of the body test "good," and both limbs on the other side test "poor"; 5) three or four limbs test "poor." The Raven's Coloured Progressive Matrices is a standardized measure of observation and clear thinking which requires no manual dexterity or spoken language (Raven, 1962). As used among the elderly, it has been found to correlate reasonably well with the Wechsler Adult Intelligence Scale. The test of orientation and mental control,

adapted from Wechsler, serves as a measure of orientation for time, place, and person, as well as a measure of simple mental control (Wechsler, 1945). Mobility was evaluated by a graded measure of independence or dependence in walking (Katz et al., 1967). Classification for the present study was based on the following ordered four-grade scale: 1) walks with or without mechanical aid, 2) walks with personal assistance, 3) walks with personal and mechanical assistance, and 4) doesn't walk. The degree of house-confinement was measured in terms of the number of days on which the patient had been outside of his residence during the 2 weeks preceding the evaluation. Classes were defined as: 1) three or more times during the 2 weeks, 2) one or two times, and 3) no time. Survival was expressed as the number of months lived during the 2 years of the study.

The **index of order association**, denoted as **h**, was selected as the appropriate index to use in measuring the association between predictive and outcome factors (Stevens, 1968; Wallis & Roberts, 1956).

Associations which were found between predictive factors and over-all function 2 years later are presented in Table 3. A negative or positive sign before the index value on the table reflects the direction of association and is, of course, influenced by which ends of the measurement scales are defined as favorable. Although the table includes both negative and positive values, all eight index values were in the direction

Table 3. Order Association Indices Between Predictive Factors and Long-Term Function in a Theoretic Study of the Index of Activities of Daily Living.

	Predictive Factors ^a			
	Index of ADL	Range of Motion	Raven Test	Orientation Test
Correlation with mobility^b				
Index of order association	0.5033	0.5550	-0.2779	-0.3853
Standard deviation	0.1182	0.1283	0.1210	0.1262
Number of patients	193	193	176	186
Statistical probability	<0.01	<0.01	<0.01	<0.01
Correlation with house-confinement^b				
Index of order association	0.3882	0.3829	-0.3234	-0.2078
Standard deviation	0.1453	0.1581	0.1394	0.1554
Number of patients	192	192	175	185
Statistical probability	<0.01	<0.05	<0.05	N.S.

^a Predictive factors are defined in detail in the text and include the Index of ADL, a test of range of motion and strength, the Raven test of observation and clear thinking, and a test of orientation and mental control modified after Wechsler.

^bCorrelations with mobility measured by a test of independent walking and with house-confinement are based on evaluations made 2 years after prediction. The index of order association is described in detail in the text. N.S. means not significant by statistical test.

expected, and no value represented an inverse association along a favorable-unfavorable axis. As defined for this study, higher scores were more favorable on the scales of intellectual function, and lower scores were more favorable for the Index of ADL and for the test of range of motion and strength. The association between the orientation test scores and house-confinement 2 years later was the only association in Table 3 which was not significantly different from zero at the 5% significance level. The Index of ADL was the only predictive factor for which associations with both subsequent mobility and house-confinement were significant at the 10% level.

Associations between predictive factors and survival during the 2 years of the study are presented in Table 4. All four index values were in the direction expected, although the value for range of motion was quite small, i.e., 0.0949. The index value for the Raven test was the only one significantly different from zero at the 5% level, although association values for the Index of ADL and the orientation test approached this level closely.

Remarks

The aims of preventive medicine are to prevent or interrupt the effects of unfavorable internal and external forces on people and, at the same time, to assist favorable forces. In order to apply the best of our rationality to goals of prevention and health-maintenance, we need, first, accurate information about the origins and dynamics of health and illness, as well as accurate predictive information about expected outcomes. When, in the past, we have been most certain about the cause and effect relationships between the determinants and results of health and illness,

we have been most successful in prevention. Note, for example, the rapid progress in prevention which followed identification of the causes of various infectious diseases. In the case of chronic diseases and aging, the same degree of progress toward so-called primary prevention is not generally expected in view of the complexity of causes or origins and dynamics. MacMahon, Pugh, and Ipsen (1960) have called such complex circumstances of origin the "web of causation." Although the processes of chronic illness and aging are also intricate, they are currently more amenable to description, and we look hopefully to goals of secondary prevention, that is, to interrupt or slow the processes of deterioration which have already begun. Predictive information is especially important in decision-making about how and when, in the course of illness or of the aging process, to apply our preventive and restorative resources most effectively. Practitioners and institutions, for example, develop service strategies and programs in order to achieve favorable results which can be predicted or in order to prevent unfavorable results which can be predicted. Once having developed specific ideas and actions for prevention or health-maintenance, their effectiveness must be evaluated.

A great deal of information for the purposes of health-maintenance and prevention is lacking; therefore, judgments tend to be limited. In order to increase the amount of useful and accurate information about prediction and effectiveness, we need more studies which use well-defined criteria and quantitative methods, and it is toward this end that the Index of ADL has been developed (Dyar, 1953). Emphasis on function has practical importance, since function can be measured relatively objectively, is a measurable milestone in the course of illness, and is sensitive to changes of illness and aging. Functional status also reflects the existence, stage, and impact of unfavorable forces at a time when knowledge about cause and pathogenesis is not advanced enough to permit measurement in the latter terms. Measures of function, thus, become useful indicators of severity and of the changing course of illness and aging. Measures of function also offer a conceptual basis for homogeneous groupings of populations. As illustrated in an earlier part of this paper, experience with uses of the Index of ADL supports the contention that it is a widely applicable

Table 4. Order Association Indices Between Predictive Factors and Survival in a Theoretic Study of the Index of Activities of Daily Living.

	Predictive Factors ^a			
	Index of ADL	Range of Motion	Raven Test	Orientation Test
Correlation with survival ^b				
Index of order association	-0.2211	-0.0949	0.2843	0.2207
Standard deviation	0.1406	0.1596	0.1322	0.1383
Number of patients	270	270	240	259
Statistical probability	N.S.	N.S.	<0.05	N.S.

^aPredictive factors are defined in detail in the text and include the Index of ADL, a test of range of motion and strength, the Raven test of observation and clear thinking, and a test of orientation and mental control modified after Wechsler.

^bSurvival is defined as the number of months lived during the 2-year study period. The index of order association is described in detail in the text. N.S. means not significant by statistical test.



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sensitive and objective measure of function. Use of the Index has provided new predictive information and information about the progression and regression of disabling chronic diseases. The Index has, also, helped to evaluate the effectiveness of health services.

We described earlier how the order of functions on the Index scale were shown to parallel the order of functional recovery in certain patients, and this order is similar to the progression of functional development in the young child. These observations and anthropological information about the behavior of primitive peoples gave rise to the theory that the Index appears to be based on functions of biological primacy and reflects the adequacy of organized neurological locomotor response. New data of theoretic interest in this report demonstrate that, for the rehabilitated patients in one large study, the Index predicted long-term outcome in terms of mobility and house-confinement as well or better than did either selected measures of mental or physical function. Mobility and house-confinement were selected as criteria of long-term outcome which reflect important concepts of adjustment and adaptation of the organism as these are discussed in the writings of such men as Freud, Havighurst, and Kuhlen.

Freud conceived of the personality of man as a dynamic system of energies which he named the id, ego, and superego. These three systems of psychological forces dynamically interacting with one another produce the individual's behavior (Krech & Crutchfield, 1958). The ego emerges from the individual's efforts to satisfy the id impulses in the reality of an external world. The ego is a system of forces having the psychological function of conscious control and redirection of the id impulses in such a way that gratifications can be achieved in the organism's specific environment (the "reality principle"). The ego includes the system of cognitive processes—perceiving, thinking, planning, deciding. More than this, the ego is responsible for mobility of the organism, its movement through time and space. This movement may be thought of as a biological and psychological unfolding of the genetically determined psycho-physiological organism and, at the same time, a physical translocation of the organism in some environment. Such mobility will be modified by the assets and limitations of the organism, be they physical,

directed by cognitive processes, purposive adjustment or adaptive actions depend, thus, on such factors as the intactness of a coordinated neurological and locomotor system, as well as the adequacy of organized psychological and social behavior patterns. In the presence of strong adjustment or adaptive forces (e.g., neurological, locomotor, and behavioral functions), the injured organism will better recover its mobility, even to the point of making use of substitute devices or new-learned behavior.

Havighurst (1968) has, also, stressed ideas of personality organization, coping style, and adaptation. He has identified adaptation as the key concept which helps to understand the processes of growing old, meaning "an adaptation to: a) changes in the structure and functions of the human body, b) changes in the social environment." Kuhlen (1959) has also considered concepts of adjustment to be important in understanding aging. He has stated that the "achievement and maintenance of good adjustment require the potential of mobility, a certain freedom on the part of the individual to move out of a threatening or frustrating situation into one more satisfying or at least less threatening."

In these contexts, we selected mobility (independence in walking) and house-confinement as the long-term outcome criteria for the present correlation study. The measures used in the study represent only a few of the predictive factors and long-term adjustment factors which might be used to understand fully the theoretic basis of the Index of ADL. It was not the design of the present study, however, to go beyond this point, and the factors which were selected are considered to represent important ideas and permit extension of the existing theory in explicit terms. We can say, at this time that the Index of ADL appears to be based on functions of biological primacy and that it reflects the adequacy of organized neurological and locomotor response. From the present studies, we feel that the case for this theory has been strengthened by the observation that the Index predicted long-term adaptation (in terms of 2-year mobility and house-confinement) as well or better than did either selected measures of mental or physical function. In combination with the reported experiences about its uses, the Index of ADL appears to be a reasonably appropriate tool with a sound base in concept. We consider