

An Epidemiology of Disability among Adults in the United States

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This paper presents the findings of an epidemiological analysis of disability among adults in the noninstitutionalized continental United States population. Data were collected through interviews with a probability sample of persons 18 and over, yielding 6,493 completed schedules comprising 80.3 percent of the sample. Distinctions were made among concepts and indicators of pathology, impairment, individual performance, and social performance. Central to the analysis were two dimensions of individual performance (physical and emotional) and two dimensions of disability in social performance (work and independent living). A number of socio-demographic characteristics were included in the analysis.

The results show the relative contributions of pathology and impairment to performance on the individual level, and the relative contributions of all of these factors on social performance, that is, the two dimensions of disability. Through pathology, impairment, performance at the individual level, and the socio-demographic characteristics, it was possible to account for 38 percent of the variance in work disability and 74 percent of dependence-independence in community living. Further explanations are given for variance in work disability. Estimates of the size of populations reporting varying types and severities of disability are also presented.

The Problem

Despite its significance as a health and social problem, it is only recently that disability has attracted attention as an object of epidemiological analysis (Berkowitz and Johnson, 1970; U.S. Department of Health, Education, and Welfare, 1970). This might be attributable, at least in part, to the preoccupation of epidemiologists with the various forms of pathology and impairment, the conceptual confusion that surrounded disability and related terms, and problems in the reliability and validity of available measures. Increasing attention to the problem over the last decade has contributed greatly to the clarification of concepts and measures. Conceptual distinctions were outlined among pathology, impairment, limitations in the performance of the human organism, and disability in performing social roles and activities (Nagi, 1965;

Haber, 1967; Burk, 1967). In addition to the inclusion of disability measures in the National Health Surveys (NHS) administered periodically by the National Center for Health Statistics (1973), questions seeking information about work disability were incorporated in the 1970 Census of the United States (U.S. Bureau of the Census, 1972). National surveys of disability were also conducted by the Social Security Administration (SSA) employing detailed measures (Haber, 1967).

Important as these developments are, many important gaps remain evident in epidemiological knowledge about disability. For example, the thrust of the SSA survey and the items included in the 1970 census were on work disability. Therefore, the populations covered were limited to persons between 18 and 64 who constitute the great majority of the labor force. The census included no questions concerning pathology impairment, or limitations in organismic performance. In the SSA survey, which employed far more developed instruments for identifying these entities, the full range of information was sought only for persons for whom indicators of work disability were reported in a screening phase. The data yielded do not allow for comparisons between vocationally disabled and nondisabled sectors of the population.

The National Health Surveys collect information about pathology and impairment and are not restricted to specific age categories. However, they do not ask questions about performance of the organism nor do they ask about work disability among housewives who are out of the labor force. Finally, available literature shows no significant attempts toward constructing multivariate schemes for explaining variance in rates of disability.

This analysis is addressed to some of these gaps in current knowledge about the epidemiological patterns of disability. The specific objectives are: (1) to further the development of measures of disability and related factors; (2) to identify prevalence rates and distributions of two dimensions of disability—in work and in community living; (3) to compare these rates with others obtained in national surveys; and (4) to construct and test an explanatory scheme for variance in the occurrence of disability. Generally, the presentation of material will follow the order of these objectives.

Concepts and Measures

As has already been mentioned, distinctions among pathology, im-

pairment, limitations in the functioning or performance of the human organism, and disability have become more widely accepted. Central in this report are the latter two concepts—performance at the individual level, and disability in social performance. Although overlapping in some respects, three dimensions of performance are conceptually and analytically separable: physical, emotional, and mental. Physical performance refers to sensory-motor functioning of the organism as indicated by limitations in such activities as walking, climbing, bending, reaching, hearing, etc. Emotional performance refers to a person's effectiveness in psychological coping with life stress and can be manifested through levels of anxiety, restlessness, and a variety of psychophysiological symptoms. Mental performance denotes the intellectual and reasoning capabilities of individuals which have been most commonly measured through problem-solving tests such as the I.Q. An important point to be made in connection with these three dimensions of performance is that their indicators can be found in the characteristics of the human organism itself. Disability, on the other hand, is used here to mean inability or limitations in performing social roles and activities such as in relation to work, family, or to independent living. In contrast to organismic performance, indicators of disability can be found in both the characteristics of individuals and in the requirements of the social roles in question. In this sense, the same types and degrees of limitations in the performance of the organism can lead to varying dimensions and degrees of disability. While paralysis affecting the upper limbs, and therefore the function of reaching and use of hands and fingers, may become disabling to a surgeon, the same physical limitations may not influence a teacher in performing his role. Furthermore, it should be noted that disability in a given role does not necessarily mean disability in another. Not all people with work disability require assisted living, nor is it the case that all persons who need such assistance are also vocationally disabled. The material in this paper is organized around two dimension of organismic performance (physical and emotional) and two dimensions of disability (work and independent living). Indications of pathology and impairment were also sought in the study and will be included in the analysis.

Two Dimensions of Individual Performance

The scope of the survey did not allow for administering meaningful

TABLE 1
Responses to Items Comprising Physical Performance and Emotional Performance Scales
and Their Loading Values in Factor Analysis

ITEM	DEGREE OF DIFFICULTY						TOTAL SAMPLE ^a	SCALE FACTOR LOADINGS	
	None		Some		Great			Physical Performance	Emotional Performance
	N	%	N	%	N	%			
Difficulty standing for long periods	4,199	64.7	1,735	26.7	558	8.6	6,492	0.70	0.39
Difficulty lifting or carrying weights of approximately ten pounds	5,199	80.1	891	13.7	402	6.2	6,492	0.64	0.36
Difficulty going up and down stairs	5,105	78.6	1,001	15.4	385	5.9	6,491	0.79	0.37
Difficulty walking	5,495	84.6	748	11.5	249	3.8	6,492	0.77	0.32
Difficulty stooping, bending, or kneeling	4,771	73.5	1,282	19.7	439	6.8	6,492	0.72	0.35
Difficulty using hands and fingers	5,816	89.6	527	8.1	148	2.3	6,491	0.48	0.27
Difficulty reaching with either/or both arms	5,854	90.2	460	7.1	177	2.7	6,491	0.55	0.29
Nervousness, tension, anxiety, and depression	2,975	45.8	2,857	40.0	658	10.1	6,490	0.36	0.76
Trouble getting to sleep and staying asleep	3,929	60.5	1,968	30.3	592	9.1	6,489	0.34	0.52
Troubled with hands sweating and feeling damp and clammy	4,777	73.8	780	12.1	915	14.1	6,472	0.20	0.40
Heart beating hard even when not exercising or working hard	4,489	69.3	726	11.2	1,267	19.5	6,482	0.45	0.53
Pains, aches, or swelling in parts of the body	4,227	65.1	1,627	25.1	635	9.8	6,489	0.52	0.42
Weakness, tiring easily, no energy	3,411	52.6	2,339	36.0	740	11.4	6,490	0.59	0.61
Fainting spells, dizziness, sick feelings	5,397	83.2	947	14.6	146	2.2	6,490	0.46	0.47
Shortness of breath, trouble breathing even when not exercising or working hard	5,220	80.4	945	14.6	325	5.0	6,490	0.50	0.46

^aTotals do not add up to the 6,493 interviews completed because of non-response to certain items.

tests to measure intellectual functioning. Although questionable in some respects, education will be considered as the best available indicator for this dimension of performance. Measures for physical and emotional performance employed in this survey were in the form of 15 questions for which answers constituted a four-point scale (see items in Table 1). The first seven items addressed physical performance (adapted from Nagi, 1969), the following three (used in Srole et al., 1962; Gurin et al., 1960) addressed psychophysiological reactions as indicators of emotional performance, and the last four items (from Haber, 1967) related to generalized symptoms which were believed to be manifestations of either/or both physical and emotional limitations.

A factor analysis was computed to identify the underlying dimensions and the loading values of the various items.¹ The computation yielded two factors which are labeled "Physical Performance Scale" (PPS) and "Emotional Performance Scale" (EPS). The loading values of the 15 items in relation to the two factors (Table 1) followed the expected pattern: the first seven loaded highly on Physical Performance, the following three loaded highly on Emotional Performance, and each of the last five loaded almost equally on both factors.²

Two Dimensions of Disability

This study focused on disabilities in two of the most significant spheres of social roles and activities—work and independent living. To consider work disability first, an index measuring this dimension was based on the actual work history of respondents and reported difficulties in meeting the requirements of their roles in current and previous jobs. The Work Disability Index (WDI) was constructed

¹The technique used in factor analysis was an "Oblimin Oblique Rotation" as specified in Nie et al. (1970). This type of rotation was used because of an assumed association between physical and emotional performance. The value of delta used in this analysis was equal to zero.

²All items were used in computing each of the two factors. Scores on each item were standardized and then weighted through multiplication by the corresponding factor coefficients. The standardized weighted scores were further adjusted by adding a constant in order to eliminate negative values. Using a delta value equaling zero, the correlation obtained between the two factors for the total sample was $r = .60$. Scores for respondents on the resulting two scales ranged from zero to 7.49.

only for persons between ages 18 and 64. It comprised three levels:

No Work Disability: Persons who are working regularly in jobs (36 hours or more), housekeeping, or school work, and reported no limitations in current or previous work.

Limited in Work Roles and Activities: Persons who are working regularly in jobs, housekeeping, or in school, but reported difficulties in performing their current work or a change in jobs because of disability.

Vocationally Disabled: Persons who are out of the labor market because of being disabled; are below 65 and have retired or left their last employment because of disability; or who cannot perform housekeeping or school work. This category includes a small number of persons who, because of health problems, were working on a limited part-time basis.

The second index measures limitations in independent living and was based on a series of questions addressing "the need for help in looking after personal needs such as dressing, bathing, eating, and other daily activities"; "the need for help in going outside the residence"; and "the need for help in shopping and household chores." This Independent Living Index (ILI) was constructed for all persons in the sample (18 and over) who were grouped into four categories:³

No Limitations: Persons who reported no significant difficulty in walking, going up or down stairs, stooping, bending or kneeling, handling and fingering, reaching, and who were neither blind nor deaf.

Limited but Independent: Persons who reported significant difficulty in walking, using stairs, stooping, bending or kneeling, handling or fingering, reaching, or who were blind or deaf, but who require no assistance in community living.

Needing Assistance in Mobility: Persons requiring assistance in

³Distinctions between the first two categories of this index (No Limitations and Limited, but Independent) are based on responses to items used in constructing the physical and emotional performance scales. We believe it is useful to distinguish people falling within these categories. However, the two categories are combined in the analysis of relations between the Independent Living Index and the two scales of organismic performance. This assures the independence of the concepts and their indicators, and avoids spuriousness in their relations.

mobility outside the home or residence; they were also persons who needed assistance in housekeeping, work, and shopping.

Needing Assistance in Personal Care: Persons requiring assistance in activities of daily living such as clothing, feeding, and personal hygiene.

Pathology and Impairment

Briefly defined, pathology is viewed as a condition of mobilization of the organism's defenses in the event of disease and injuries (Selye, 1956), impairment as an anatomical, physiological, intellectual, or emotional abnormality or loss (Nagi, 1965). An impairment may not be associated with active pathology such as in the case of healed amputations and residual paralyses, or may be associated with pathology as in hypertension and diabetes. The interview schedules used in this survey included items seeking two types of data from which inferences can be made regarding the existence and seriousness of pathology and impairment. The first type of data is in the form of responses to the question: "In general, how would you judge your health to be now? Would you say it is excellent, good, fair, poor or very poor?" The second set of data identifies the health conditions which underlie each of the specific limitations constituting the physical performance and the emotional performance scales.⁴ In the absence of better analytical ways for evaluating the severity of individual and combinations of conditions, the sheer number of conditions mentioned will be used as a rough measure of severity. No clinical examinations were performed in connection with this survey; information concerning pathology and impairment is limited by the knowledge and recall of respondents.

Sampling Design and Data Collection

Data to be reported here were derived from a larger survey of disability and the interaction between organizations engaged in the delivery of human services and related sectors of the population.

⁴The "health status" question was used in a variety of surveys including that of the SSA referred to frequently here. The question about "the underlying health conditions" was used by the National Health Survey.

The survey was conducted in 1972 and included 8,090 households constituting a probability sample of the continental United States, excluding Alaska (see Kish and Hess, 1969). One person (18 or over) in each household was selected at random for personal interviews. The survey yielded 6,493 (80.3 percent) completed interviews; 92 percent of the respondents were either household heads or their spouses. Compared to persons 18 and over reported in the 1970 U.S. Census, this sample includes 5.5 percent more females, 6 percent fewer white males, 5.7 percent fewer single persons, and 2 percent more persons 65 and older. Reasons for the 19.7 percent non-completed interviews were: refusals by designated respondents or on their behalf (11.2 percent), no contacts made with any members of the household (2.8 percent), selected respondents unavailable (2.8 percent), and other miscellaneous reasons (2.9 percent). Data were collected through personal interviews conducted by well-trained interviewers on the field staff of the University of Michigan's Survey Research Center. Table 2 presents the demographic composition of respondents.

Physical and Emotional Performance

Three approaches suggest themselves in creating categories out of continua such as those represented by the sample scores on the Physical Performance and the Emotional Performance Scales. The problem is one of selecting appropriate points for defining the categories. One way to establish these points is to divide the scale into equal intervals. Thus, for example, to create four categories of Physical Performance or Emotional Performance, the full *range of scores* on each scale would be divided in four equal intervals. Another way of categorization is through dividing the *sample* into four equal groups regardless of the points on the scale that define these groupings. While the first approach creates equal scale intervals, the second results in equal categories of people; both represent arbitrarily created classes. A third approach was used in this analysis. Histograms representing the distributions of sample scores were examined in order to identify forms of clustering and therefore the natural points of differentiation among categories. The objective was to arrive at more conceptually meaningful classifications by "carving at the joints" to use Kaplan's (1964) metaphor. Because of

the association between the two scales ($r = .60$), points of differentiation on them were similar. Minor adjustments were made by bringing these points to scores representing the closest round figures. Four categories resulted from this approach to classification; they were labeled and defined as follows:

None or Minimal Limitations.....	Scores 0 to 1.99
Some Limitations	Scores 2 to 2.99
Substantial Limitations	Scores 3 to 3.99
Severe Limitations	Scores 4 to 7.49

Table 2 presents the distributions of limitations in *physical* performance in relation to a number of socio-demographic characteristics. Substantial and severe limitations were reported by 9.7 percent of the respondents. The distributions show differentials for age and education; and to a lesser extent for marital status, racial background, and sex. To be noted are the particularly high rates of "substantial" and "severe" physical limitations among persons 75 and over, and the relatively high concentration of these severer limitations among persons with low formal education and widowed respondents. The higher rates of severer limitations among the latter two categories are in part a function of age—proportionately, more of the widowed respondents and persons with lower education are in the older age brackets. It is also important to note the association between income levels and limitations in physical performance. Underlying this relationship is "work disability" which, as will become evident later, is significantly associated with limitations in physical performance while it contributes greatly to reduction in income (Haber, 1967; Gurin et al., 1960; Nagi, 1969). Finally, the data presented in Table 2 show the strong influence of pathology and impairment, as indicated by the number of health conditions and the evaluations of health status, upon the respondents' levels of physical performance.

In order to assess the combined effects of the various independent variables discussed above, and the amount of variance in physical performance attributable to their collective influence, a regression coefficient was computed. Scores on the Physical Performance Scale constituted the dependent variable in the computations presented in Table 3. Fully 62.02 percent of the variance in this dimension of performance can be explained through the six independent variables introduced to the analysis. As would be expected, in-

TABLE 2
 Limitations in Physical Performance and Selected Characteristics
 for Persons 18 and Over

CHARACTERISTICS	LIMITATIONS IN PHYSICAL PERFORMANCE											
	Totala		None or Minimal		Some		Substantial		Severe			
	N	%	N	%	N	%	N	%	N	%	N	%
Total Respondents	6,487	100.0	4,981	76.8	873	13.5	340	5.2	293	4.5		
Age												
18-44	3,312	100.0	2,996	90.5	250	7.5	40	1.2	26	0.8		
45-54	1,083	100.0	835	77.1	155	14.3	54	5.0	39	3.6		
55-64	935	99.9	611	65.3	176	18.8	79	8.4	69	7.4		
65-74	730	99.9	412	56.4	173	23.7	71	9.7	74	10.1		
75 and over	427	100.0	127	29.7	119	27.9	96	22.5	85	19.9		
Sex												
Male	2,728	99.9	2,250	82.5	263	9.6	110	4.0	105	3.8		
Female	3,759	100.0	2,731	72.7	610	16.2	230	6.1	188	5.0		
Education												
Below 9th grade	1,343	100.0	714	53.2	314	23.4	156	11.6	159	11.8		
9-11	1,259	100.0	919	73.0	181	14.4	93	7.4	66	5.2		
12 and above	3,872	100.0	3,341	86.3	376	9.7	90	2.3	65	1.7		
Family Income												
Below \$2,500	628	100.0	289	46.0	144	22.9	94	15.0	101	16.1		
2,500-4,999	953	99.9	576	60.4	212	22.2	85	8.9	80	8.4		
5,000-9,999	1,767	100.0	1,386	78.4	240	13.6	80	4.5	61	3.5		
10,000 and over	2,816	100.0	2,475	87.9	238	8.5	68	2.4	35	1.2		

Race	5,541	100.0	4,293	77.5	720	13.0	279	5.0	249	4.5
White	666	100.1	456	68.5	124	18.6	51	7.7	35	5.3
Black	255	99.9	213	83.5	26	10.2	8	3.1	8	3.1
Other										
Marital Status	4,409	100.0	3,570	81.0	518	11.7	176	4.0	145	3.3
Married	548	100.0	385	70.3	95	17.3	32	5.8	36	6.6
Sep./Div.	806	100.0	388	48.1	207	25.7	117	14.5	94	11.7
Widowed	721	100.0	637	88.3	52	7.2	15	2.1	17	2.4
Single										
# Health Conditions	4,221	100.0	3,930	93.1	270	6.4	20	0.5	1	0.0
None	1,594	100.0	924	58.0	412	25.8	167	10.5	91	5.7
1 or 2	672	100.0	127	18.9	191	28.4	153	22.8	201	29.9
3 or more										
Health Status	4,996	100.0	4,429	89.2	441	8.9	72	1.4	24	0.5
Good	1,073	100.0	494	46.0	334	31.1	168	15.7	77	7.2
Fair	437	100.0	52	11.9	97	22.2	99	22.7	189	43.2
Poor										

^aTotals vary from the 6,493 interviews completed because of non-responses to certain items.

TABLE 3
Regression Computation for Physical Performance

Variables ^a	Multiple R	R ²	R ² Change	Simple R	B
Number of Conditions	0.6944	0.4822	0.4822	0.6944	0.3285
Health Status	0.7725	0.5967	0.1145	0.6506	0.3283
Age	0.7858	0.6175	0.0208	0.4195	0.0082
Sex	0.7874	0.6201	0.0026	0.1162	0.0976
Education	0.7876	0.6202	0.0002	-0.3289	-0.0043
(Constant)					0.3600
N = 6438					

^aThe influence of "race" does not appear in the computation because of being lower than the cutting point in the program used.

indicators of pathology and impairment accounted for a large proportion of explainable variance (59.7 percent) with socio-demographic variables adding very little explanation. In part, this reflects the association of indicators of pathology and impairment with the socio-demographic characteristics, which limits the additional contributions of the latter variables to explaining limitations in physical performance. A regression coefficient for the influence of the four socio-demographic characteristics by themselves shows that they explain 22 percent of the variance in Physical Performance.

The distributions of limitations in *emotional performance* in relation to other characteristics of respondents are shown in Table 4. They exhibit a pattern similar to that of limitations in physical performance, especially in regard to persons falling in the "severe" categories. With the exception of sex differentials, the strength of relations of emotional performance to other characteristics of respondents are not as pronounced as those of physical performance.

Again, through regression analysis it was possible to account for 45 percent of the variance in emotional performance in terms of relations to the two indicators of pathology and impairment and the four socio-demographic variables shown in Table 5. As in the case of physical performance, most of the variance explained in emotional performance is accounted for by the number of "Health Conditions" and the evaluation of "Health Status." Very little additional variance is explained by introducing the socio-demographic

characteristics. When used independently of the "Health Conditions" and "Health Status," the socio-demographic characteristics by themselves explain 8.5 percent of the variance in emotional performance.

The expected overlap between the two dimensions of human performance (physical and emotional) resulted in 2.4 percent of the respondents reporting "severe" limitations on the two scales, and 7.3 percent reporting "severe" and "substantial" limitations on both. At the other end of the continua, 31.5 percent of the sample indicated "minimal" limitations along the two dimensions of performance. No direct comparison can be made between the distributions of scores discussed above and the findings of other surveys since other studies used the two performance scales constructed in this analysis. However, many of the items have been used earlier.

The relations shown between the scores and the socio-demographic characteristics are generally in directions similar to the results of other surveys (Gurin et al., 1960; Haber, 1967). However, the rates of prevalence of limitations and the strength of associations with socio-demographic variables may vary.

Work Disability

Because of the retirement of large sectors of the employed population at the age of 65, indices related to work disability could be meaningfully constructed only for persons below this age. Therefore, this part of the analysis is confined to the 5,332 respondents in the survey who were 18 to 65. As pointed out earlier, three levels of work disability were identified to include persons who reported "no work disability" (89.4 percent), "were limited in work roles and activities" (4.4 percent), or were "disabled" (6.3 percent). Table 6 presents the socio-demographic organismic performance and health characteristics of persons in the three categories of work disability. To be noted is the higher proportion of the disabled among blacks (more than twice that of whites), especially in view of the much smaller differences between the two racial groups on limitations in physical and emotional performance. This suggests that limitations of equal severity along these two dimensions are likely to affect the employment picture of blacks more adversely than in the case of whites. Also to be noted are the high rates of

TABLE 4
 Limitations in Emotional Performance and Selected Characteristics
 for Persons 18 and Over

CHARACTERISTICS	LIMITATIONS IN EMOTIONAL PERFORMANCE									
	Total ^a		None or Minimal		Some		Substantial		Severe	
	N	%	N	%	N	%	N	%	N	%
Total Respondents	6,487	99.9	2,195	33.8	2,617	40.3	1,239	19.1	436	6.7
18 and over										
Age										
18-44	3,312	99.9	1,200	36.2	1,404	42.4	571	17.2	137	4.1
45-54	1,083	99.9	376	34.7	401	37.0	217	20.0	89	8.2
55-64	935	100.0	276	29.5	387	41.4	191	20.4	81	8.7
65-74	730	100.0	234	32.1	257	35.2	165	22.6	74	10.1
75 and over	427	99.9	109	25.5	168	39.3	95	22.2	55	12.9
Sex										
Male	2,728	100.0	1,229	45.1	1,004	36.8	364	13.3	131	4.8
Female	3,759	100.0	966	25.7	1,613	42.9	875	23.3	305	8.1
Education										
Below 9th grade	1,343	100.0	379	28.2	448	33.4	327	24.3	189	14.1
9-11	1,259	100.0	386	30.7	472	37.5	276	21.9	125	9.9
12 and above	3,872	100.0	1,427	36.9	1,692	43.7	632	16.3	121	3.1
Family Income										
Below \$2,500	628	100.1	132	21.0	234	37.3	153	24.4	109	17.4
2,500-4,999	953	100.0	264	27.7	340	35.7	232	24.3	117	12.3
5,000-9,999	1,767	100.0	580	32.8	733	41.5	340	19.2	114	6.5
10,000 and over	2,816	100.0	1,091	38.7	1,190	42.3	453	16.1	82	2.9

TABLE 5
Regression Computations for Emotional Performance

<i>Variables</i>	<i>Multiple R</i>	<i>R²</i>	<i>R² Change</i>	<i>Simple R</i>	<i>B</i>
Number of Symptoms	0.6047	0.3657	0.3657	0.6047	0.3016
Health Evaluation	0.6474	0.4191	0.0535	0.5124	0.3065
Sex	0.6629	0.4395	0.0203	0.1993	0.2642
Age	0.6723	0.4520	0.0125	0.1285	-0.0066
Race	0.6732	0.4532	0.0012	-0.0025	0.0960
Education	0.6733	0.4533	0.0001	-0.2060	-0.0030
(Constant)					1.4117
<i>N</i> = 6438					

work disability among the widowed, and the separated or divorced. While the former rates can be partially attributed to the older ages of widowed respondents, the latter cannot be similarly explained. The association of work disability with age, education, income, performance scores, and health indices were to be expected, and confirm the findings of earlier surveys (National Center for Health Statistics . . ., 1973; U.S. Bureau of the Census, 1972; Haber, 1967).

In an attempt to explain variance in work disability, a regression coefficient was computed utilizing eight independent variables.⁵ These included the two performance scales, the two health indices, and four socio-demographic characteristics. As shown in Table 7, 38 percent of the variance in work disability is explainable through the eight independent variables included in the equation. Intercorrelations among the eight variables account for the small additional increments of variance being explained beyond the influence of Physical Performance. A regression analysis using the four demographic variables by themselves showed them independently to account only for 5.8 percent of variance in work disability.

Indications that work disability varies to a large extent independently of physical and emotional performance, and that the

⁵Since the Work Disability Index does not represent an interval scale, the variable was dichotomized in the analysis by grouping together persons in the two categories of "Limited" and "Disabled." Even with this grouping, the number of cases in this category constituted only 566 (10.7 percent) of the sample. This imbalance in proportions was equalized for this analysis by selecting 566 cases at random from the 4,766 persons between 18 and 64 who had "No Work Disability."

addition of socio-demographic characteristics to the regression equation still leaves about two-thirds of the variance in work disability unexplained, raise the important question of what other factors contribute to this form of disability. Answers to this question were sought through comparisons of persons in different categories of work disability while simultaneously controlling for the severity of limitations in physical and emotional performance. The question addressed to the data then was: Given the same degrees of limitations on the two dimensions of performance, why do some people become vocationally disabled and others do not? The analysis revealed three sources of influence. To begin with, there were problems characteristic of respondents, the influence of which was neither fully expressed through measures of performance nor through the socio-demographic attributes. Alcoholism constitutes an example of such problems. While 28 percent of the frequent "problem-drinkers" were among the disabled in work roles, only 6 percent of the respondents reporting infrequent or no problems with drinking were so disabled. The direction of the causality is not entirely clear in this case; while alcoholism can lead to work disability, the reverse relationship is also probable.

Another factor that differentiated vocationally disabled and nondisabled respondents with similar degrees of limitations in physical and emotional performance was the introduction of job adjustments by employers or by the respondents themselves. Information was sought in this survey about modifications in current jobs for employed persons and in last jobs for unemployed respondents. The question was connected to indications of needs for such modifications because of physical, emotional, and mental conditions. Table 8 presents a comparison between persons who were "limited" in work roles and activities but continued to work and the "vocationally disabled" who were out of the labor market in regard to whether or not work modifications were introduced into their employment situations. The distinctions clearly show the association of work modification with continuity in employment. Although reports of work modification, change, and other adjustments were more prevalent among the vocationally nondisabled than the disabled in every level of physical and emotional performance, differences in frequency were greatest when limitations in performance were severe. This is to say that adjustments in work requirements

TABLE 6
Work Disability and Other Characteristics of Respondents
18-64

CHARACTERISTICS	SEVERITY OF WORK DISABILITY							
	Total ^d		No Work Disability		Limited in Work Roles and Activities		Disabled	
	N	%	N	%	N	%	N	%
Total Respondents	5,332	100.1	4,766	89.4	232	4.4	334	6.3
18-64 years								
Age								
18-44	3,314	100.0	3,096	93.4	87	2.6	131	4.0
45-54	1,083	100.0	942	87.0	56	5.2	85	7.8
55-64	935	100.0	728	77.9	89	9.5	118	12.6
Sex								
Male	2,285	100.0	2,068	90.5	97	4.2	120	5.3
Female	3,047	100.0	2,698	88.6	135	4.4	214	7.0
Education								
Below 9th grade	758	100.0	581	76.7	60	7.9	117	15.4
9-11	1,034	100.0	890	86.1	60	5.8	84	8.1
12	1,932	100.0	1,775	91.9	80	4.1	77	4.0
13 and above	1,603	100.0	1,515	94.5	32	2.0	56	3.5
Family Income								
Below \$2,500	302	100.1	195	64.6	28	9.3	79	26.2
2,500-4,999	594	100.0	484	81.5	38	6.4	72	12.1
5,000-9,999	1,526	100.0	1,382	90.6	63	4.1	81	5.3
10,000 and above	2,669	100.0	2,489	93.3	94	3.5	86	3.2

seem to have been most effective for persons whose physical and emotional limitations were seriously restrictive.

The third set of factors contributing to work disability comprised limitations in specific physical functions, namely, walking, bending, and climbing. Although these functions were incorporated into the scales of physical and emotional performance, the weights these items were accorded in the scales were derived from their loading values on the performance factors rather than their relations to work disability. In this sense, the influence of limitations in these three functions on work disability was not fully expressed through the two performance scales.

The prevalence rates of work disability obtained in this survey can be meaningfully compared to those reported by the National Center for Health Statistics, the U.S. Census, and the Social Security Administration. In these three surveys, the severest category of work disability is variously defined to include people who were identified by the NCHS as "unable to perform major activity," by the Census as being kept "from holding any job at all" because of health or physical condition, and in the SSA and the present survey as "unable to work altogether or regularly." Of lesser severity is a category that generally includes people who are in the labor force but are limited in the type or amount of work they can perform. Percentages of the U.S. population falling in these categories are presented in Table 9. The marked differences in rates reported by the NCHS when compared to those of other surveys are largely due to the exclusion of housewives who are not in the labor force from the question of ability to work.⁶ Findings of the Census, the SSA, and the present survey are fairly similar. The small differences among them can be attributed to variations in age composition, sampling designs, the instruments used in data collection, codification of responses, and in the times at which the surveys were conducted.

The standard error for the proportions of "limited" and "disabled" in the present survey is large because of the small size of these groups in relation to the total population.⁷ However, con-

⁶A comparison of the 1970 Census and the 1973 NCHS surveys for males aged 45-64 shows similar proportions falling in the most severe category of work disability (7.2 percent and 7.6 percent, respectively). See National Center for Health Statistics (1974).

TABLE 7
Regression Computation for Work Disability

<i>Variables</i>	<i>Multiple R</i>	<i>R²</i>	<i>R² Change</i>	<i>Simple R</i>	<i>B</i>
Physical Performance	0.5795	0.3358	0.3358	0.5795	0.1271
Health Status	0.6057	0.3668	0.0310	0.5370	0.0830
Number of Conditions	0.6125	0.3752	0.0083	0.4946	0.0321
Education	0.6148	0.3780	0.0029	-0.3072	-0.0094
Emotional Performance	0.6156	0.3789	0.0009	0.4678	0.0165
Sex	0.6159	0.3794	0.0004	0.0565	0.0192
Age	0.6162	0.3797	0.0003	0.2466	-0.0007
Race	0.6162	0.3798	0.0001	0.0673	0.0136
(Constant)					0.0723
<i>N</i> = 1116					

TABLE 8
Comparison of Respondents Limited in Work Roles and Activities but Who Continued to Work and the Vocationally Disabled Who Were Out of the Labor Market or Whether or Not Work Modifications Were Introduced to Their Employment Situations

<i>Work Modifications</i>	<i>Limited in Work Roles and Activities</i>		<i>Vocationally Disabled</i>		<i>Total</i>	
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>
Modifications Reported	86	52.8	77	47.2	163	100.0
None Reported	146	36.2	257	63.8	403	100.0
Total	232	100.0	334	100.0	566	100.0

TABLE 9
Comparisons Among the Four Sets of National Data on Work Disability

<i>Survey</i>	<i>Limited (%)</i>	<i>Severely Disabled (%)</i>	<i>Total (%)</i>
NCHS (1969-70) 17-64 years of age	6.7	2.2	8.9
The Census (1970) 16-64 years of age	5.3	5.9	11.2
SSA Survey (1966) 18-64 years of age	4.9	5.9	10.8
Present Survey (1971) 18-64 years of age	4.4	6.3	10.7

TABLE 10
 Limitations in Independent Living and Other Characteristics
 of Respondents 18 and Over

CHARACTERISTICS	LIMITATIONS IN INDEPENDENT LIVING									
	Total ^a		None		Limited but Independent		Mobility Assistance Needed		Personal Care Assistance Needed	
	N	%	N	%	N	%	N	%	N	%
Total Respondents	6,493	100.0	5,740	88.4	406	6.3	230	3.5	117	1.8
Ages 18 and over										
Age										
18-44	3,314	100.0	3,196	96.4	83	2.5	19	0.6	16	0.5
45-54	1,083	100.0	973	89.8	67	6.2	28	2.6	15	1.4
55-64	935	100.0	749	80.1	112	12.0	49	5.2	25	2.7
65-74	731	100.0	566	77.4	81	11.1	62	8.5	22	3.0
75 and over	430	100.0	256	59.5	63	14.7	72	16.7	39	9.1
Sex										
Male	2,731	100.1	2,466	90.3	168	6.2	60	2.2	37	1.4
Female	3,762	99.9	3,274	87.0	238	6.3	170	4.5	80	2.1
Education										
Below 9th grade	1,344	100.0	1,012	75.3	161	12.0	120	8.9	51	3.8
9-11	1,261	100.0	1,097	87.0	81	6.4	57	4.5	26	2.1
12 and above	3,875	100.0	3,623	93.5	162	4.2	51	1.3	39	1.0
Family Income										
Below \$2,500	629	100.0	422	67.1	88	14.0	84	13.4	35	5.6
2,500-4,999	955	100.0	764	80.0	105	11.0	61	6.4	25	2.6
5,000-9,999	1,767	99.9	1,605	90.8	85	4.8	48	2.7	29	1.6
10,000 and over	2,817	100.0	2,665	94.6	109	3.9	23	0.8	20	0.7
Race										
White	5,546	100.0	4,920	88.7	338	6.1	186	3.4	102	1.8
Black	667	100.0	562	84.3	56	8.4	35	5.2	14	2.1
Other	255	100.0	236	92.6	10	3.9	8	3.1	1	0.4

sistency in these proportions among major surveys (refer to Table 10) provides confidence in their approximation of the true values. The prevalence rates of work disability obtained through the present study lead to the following unweighted estimates:

U.S. Population Between Ages 18 and 64 (1970)	100.0%	112,580,427
Persons Not Limited in Work Roles and Activities	89.4%	100,629,842
Persons Limited in Work Roles and Activities	4.4%	4,898,473
Persons Disabled	6.3%	7,052,112

Independent Living

Disability in living activities was assessed in terms of dependence-independence in performing these activities. It has already been mentioned that an Independent Living Index (ILI) was used to group respondents into four categories in regard to this dimension of disability: (1) not limited in performing these activities; (2) limited, but independent; (3) needing assistance in outdoor mobility and activities such as shopping and housework; and (4) needing assistance in self-care activities such as bathing, dressing, feeding, and the like. As shown in Table 10, these categories included 88.4 percent, 6.3 percent, 3.5 percent, and 1.8 percent of the total sample, respectively. The proportions of all persons with limitations, and particularly those with needs for assistance, are associated positively with age and negatively with educational and income levels. Particularly significant is the dramatic increase in the prevalence of needs for assistance in mobility and self-care for persons 75 and over. Compared with men, close to twice as many women need assistance in both types of activities. In part, this is due to the age structure where the ratio of women to men was higher in the older age brackets. The influence of limitations in physical and emotional

⁷Accepting 95 percent level of confidence, the sampling error for the proportions of the sample with "No Work Disability," the "Limited" and the "Disabled" are 1.0 percent, 5.1 percent, and .8 percent, respectively.

TABLE 11
Regression Computation for Independent Living

<i>Variables^a</i>	<i>Multiple R</i>	<i>R²</i>	<i>R² Change</i>	<i>Simple R</i>	<i>B</i>
Physical Performance	0.8462	0.7161	0.7161	0.8462	0.2093
Age	0.8537	0.7290	0.0129	0.5384	0.0030
Number of Conditions	0.8565	0.7336	0.0046	0.6479	0.0248
Sex	0.8584	0.7368	0.0032	0.1790	0.0664
Race	0.8697	0.7390	0.0022	0.0384	0.0631
Emotional Performance	0.8609	0.7411	0.0021	0.5549	-0.0372
Health Status	0.8621	0.7432	0.0021	0.6679	0.0287
(Constant)					-0.3493
<i>N</i> = 683					

^aThe influence of "education" does not appear in the computation because of being lower than the cutting point in the program used.

performance, and of health indicators, upon independent living is clearly reflected in Table 10.

Fully 74.3 percent of the variance in independent living can be explained through the two performance factors, the two health indicators, and the four socio-demographic variables included in Table 11.⁸ The intercorrelations among the independent variables limit the additional increments of variance explained through the addition of each of the variables beyond physical performance. However, an independent regression computation shows that age, sex, race, and education, by themselves, account for about 31 percent of the variance in capability for independent living.

The relations between indices of Independent Living and Work Disability can only be described for respondents below 65 because the latter index is limited to these age groups. Of the 5,332 persons between the ages of 18 and 64, 4,637 (87 percent) reported no disabilities in either set of roles and activities, and 105 (2.0 percent) in-

⁸Since the Index of Independent Living does not represent an interval scale, the variable was dichotomized by grouping together persons who reported needs for assistance into one category. This category remained relatively small, comprising 347 persons (5.3 percent). In order to equalize the two groups, a sample of 347 was selected at random from the 5,740 persons who reported no needs for assistance and who constituted the other group in the analysis. It should be noted also that grouping the first two categories of this index together eliminates the overlap with indices of individual performance, which distinguished between them, and thus eliminates spuriousness in this step of the analysis.

licated severe disabilities along both dimensions. These persons were disabled as far as work is concerned and also needed assistance in living. Of 152 persons requiring assisted living: nine (5.9 percent) had no work limitations, 38 (25.0 percent) were regularly engaged in full time work but with limitations in roles and activities, and 105 (69.1 percent) were not working because of disability. On the other hand, of the 334 vocationally disabled persons, 105 (33.4 percent) were in need of assisted living. In summary, to a large degree, the two dimensions of disability vary independently, and assisted living is more predictive of work disability than vice versa.

Based on the distributions of levels of dependence-independence in living activities obtained through this survey, and the size of the U.S. population in 1970, the numbers of persons falling in each of the categories of this index can be estimated as follows:

U.S. Population in 1970 (18 and over)	100.0%	131,679,216
Persons Not Limited in Living Activities	88.4%	116,408,232
Persons Limited, but Independent	6.3%	8,233,757
Persons Needing Assistance In Outdoor Mobility, Shopping, and Housework	3.5%	4,664,446
Persons Needing Assistance in Personal Care	1.8%	2,372,781

Summary and Conclusions

This report presented the findings of an epidemiological analysis of disability among adults in the noninstitutionalized continental United States population. Data were derived from a survey of a probability sample of persons 18 and over. Interviews were completed for 6,493 respondents representing 80.3 percent of persons comprising the sample. The conceptual framework was organized around distinctions among the concepts of pathology, impairment, levels of performance of the organism, and disability. Central to the study were indices for two dimensions of performance (Physical and

Emotional), and of disability (Work and Independent Living). A number of socio-demographic characteristics were included in the analysis.

The results showed the relative contributions of pathology and impairment, as indicated by the number of health conditions reported and the respondents' evaluations of their health status, to the levels of physical and emotional performance. Furthermore, it was possible to account for 38 percent of the variance in work disability and 74 percent of dependence-independence in community living through the influence of levels of performance, health conditions, and four socio-demographic characteristics. "Physical Performance" figured prominently in explaining variance in both Work Disability and Independent Living activities. The comparatively weaker role displayed by "Emotional Performance" could be, at least in part, a result of society's tendency to more readily institutionalize persons with severe emotional limitations than those with severe physical limitations. In this sense, the sample of non-institutionalized populations in this analysis represents a truncated distribution of levels of emotional performance with the most severe categories being excluded because of institutionalization. The independent contributions of the four socio-demographic variables (age, sex, race, and education) upon disability were also assessed. They accounted for 6 percent of the variance in Work Disability and 31 percent of that in Independent Living. Age, education, and income levels were most consistent in their relations to health conditions, physical and emotional performance, and the two dimensions of disability.

The degree of independence in variance exhibited by the indices of disability, limitations in physical and emotional performance, and the health conditions of respondents confirm the utility of distinctions made among these concepts. Differences in the amounts of variance in Work Disability (38 percent) and Independent Living (74 percent) explainable through individual attributes demonstrate the sensitivity of indices used in measuring these forms of disability. To a greater extent, work disability depends upon a variety of environmental factors such as the requirements of work roles, the labor-market demands, and the attitudes of employers. The significance of factors in the work environment was illustrated by the influence of job modification and change upon continuing employment on the part of respondents. Finally, it can be concluded that

the consistency in rates of work disability reported in the U.S. 1970 Census, the Social Security Survey of Disabled Adults, and this study attest to the reliability of available measures. Using prevalence rates yielded through this study and the 1970 U.S. Census data for the noninstitutionalized population, estimates were computed for the numbers of people 18 and over who fall within the various categories of work disability and independent living.

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