OPERATIONALIZING ALTERNATIVE DISABILITY DEFINITIONS IN A HOUSEHOLD SURVEY

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This paper reports on some early findings from the Income Survey Development Program (ISDP). As part of the developmental work for the forthcoming Survey of Income and Program Participation (SIPP), several large-scale surveys were conducted [1]. The 1978 Research Panel, for which the data have now become available, had a national sample of approximately 2000 households. Most of these were drawn from a simple area probability sample, but some 400 were drawn from recipents of Supplemental Security Income (SSI). Approximately 50% of these would be expected to be receiving benefits because of blindness or disability; the others would be old-age recipients. Households in the sample were administered five interviews at quarterly intervals. The content of these interviews can be divided roughly into two categories: questions on the receipt and amount of various forms of income, and questions on characteristics associated with eligibility for government transfer programs.

As part of this exploratory work, the third interviews, conducted in October, 1978, included a series of questions related to disability status. Programs and payments for the disabled population are of substantial concern to the government. Costs are substantial, and the growth of such programs has been difficult to project. Much of the difficulty is dùe to the elusive nature of the disability concept, or rather concepts. Different programs, each with its own focus, (e.g., vocational rehabilitation, workers' compensation, discrimination), have developed dissimilar concepts and criteria. A common problem, however, is that the various forms of disability are all relational, behavioral conditions, products of the interaction of disabled individuals with others and their surroundings. These relational concepts are complex, and in practice program administration tends to rely on relatively objective, quantifiable criteria such as health problems and observable activity impairments. This tends to resolve the problem of reliability, but at the cost of operationalizing complex disability concepts in simple measures of uncertain reliability [2].

In response to this problem, the Social Security Administration has carried out large-scale surveys of disabled and non-disabled adults in 1966, 1972, and 1978. A lengthy interview makes it possible to collect information on both simple attributes and more complex relational conditions, and thus to examine the interrelations between disability, however conceived, and the criteria by which it may be measured in practice.

The Survey of Income and Program Participation has a flexible design and can be used to carry out similar investigations [3]. However, its panel design is particularly effective for measuring short-term changes in behavior, and essentially cross-sectional surveys are an inefficient use of the SIPP mechanism. It should almost automatically provide specific information on other types of highly relevant information, such as before-and-after characteristics of persons who become ill, injured, or disabled during the life of the panel and how this affects their labor force participation. At the same time, persons who report themselves to be disabled or are receiving disability-related income can be studied as they re-enter the labor force.

The survey's increased capacity to make such measurements does not do away with the conceptual problem of defining disability addressed by the SSA surveys, of course. However, effective use of the SIPP requires that the lengthy question batteries used in disability surveys be reduced. The problem facing the survey staff is to minimize interview burden while retaining as much information as possible from the reduced question set. This paper presents the results of an initial effort in this direction.

At this stage in the history of the ISDP, operational problems of verifying data coding and construction of analysis files still loom large. Indeed, they place greater constraints on analysis files than any inherent limits on the sample size or the skills of the analyst. The results reported here cannot, therefore, be taken as definitive, but they do provide an indication of the direction in which development of the new survey can proceed on the basis of results from the field.

In the following sections, the variables are described, responses are tabulated, and results of an investigation of possible question set reduction using discriminant analysis are described.

The Disability Section of the October, 1978 Questionnaire

Design of the disability section was substantially based on the 1978 Disability Survey designed by the Office of Research and Statistics in the Social Security Administration, and fielded by the Bureau of the Census in the same month (October, 1978). This instrument was taken as a starting point because limits on staff resources precluded a substantial development of the state of the art in this area, and because the 1978 Disability Survey addressed the major current policy concerns that appeared amenable to personal inteviewing. The ISDP disability questions represented only a subset of the ORS/SSA items; income, personal background, and household composition were already covered more exhaustively at other points in the 1978 Research Panel cycle, while sections dealing with attitudes and feelings could not be handled easily within the context of proxy interviews and the training given interviewers by the Census Bureau. The ISDP has at various times experimented with alternative interviewing rules, and these restrictions will not necessarily apply to the SIPP. In 1978, however, the disability sections were only a portion of an instrument testing a number of questions and procedures, and a significant change in interviewer instructions was not considered to be justifiable.

Despite these deletions the October ISDP questionnaire (ISDP-503) contained a lengthy series of questions for those persons who had present or past disabling conditions to report. The primary intent of these was to test the feasibility

of administering a relatively lengthy and potentially burdensome series of questions in the context of an ongoing longitudinal panel. At issue was not only whether respondents could give generally meaningful responses to these items, but also whether they would be perceived as excessively tedious or drawn-out and therefore endanger reporting for the subsequent interviews.

Field observations include several interviews in which the disability section took more than 20 minutes - a significant amount of time, considering that there were some 20 minutes of other questions, that respondents had previously been subjected to two interviews, and that they knew that they would be asked to spend more time answering questions in the future. Fortunately, these questions seemed generally well-received by the more impaired population, who tended to talk readily about their health and health problems, and not infrequently appeared eager to draw out the interview and extend the opportunity for social contact.

Indeed, the interviews appeared most burdensome for respondents who had to answer the least. The underlying rationale of the instrument was to avoid the frequent pitfall of concentrating only on the portion of the population that identifies itself as disabled. In attempting to understand the incidence, (and particularly increases in incidence) of disability, it is not sufficient to measure the prevalence of health problems, activity limitations, and the like in the disabled population. For a full understanding, it is essential to know how frequently these characteristics are encountered in the non-disabled population. Conditions found frequently among the disabled have little explanatory power if they are also encountered frequently among the non-disabled. Therefore, a large portion of the disability battery was administered to all respondents, regardless of their selfidentified disability. The only exception to this was that all respondents over the age of 65 were skipped over the sections relating to work limitations. These questions were considered only minimally appropriate for a population which had for the most part left the labor force; moreover, government transfer program regulations assume that 65+ persons are not working, and therefore do not distinguish between the disabled and non-disabled in calculating eligibility and amounts of old-age benefits.

With this exception, the adult popoulation were asked about a number of characteristics thought to be related to disability. The analysis reported here is based four sub-sections for the disability battery. The work-related questions dealt most directly (though not necessarily reliably) with disability as it is usually defined for program purposes. In this paper, sample adults have been placed into one of four groups according to their self-assessed ability to work. Those who indicated that they were not limited in any way ("No" to question 5) were coded as non-disabled. Those who indicated that they could not work at all ("Yes" in question 5, "Not all" in question 8 or 9) were classified as completely disabled. After persons 65+, who were skipped over this section, were assigned a separate code, the remainder were classified as partially disabled. These might be able to do only certain kinds of work, only part-time work, or only occasional work, or some combination of these limitations. The groups were therefore as follows:

Group 1 - no work disability
Group 2 - partial work disability
Group 3 - complete work disability
Group 4 - aged 65+

All adults were asked about whether they had any of 37 health conditions and illnesses. This was asked in three ways: first, whether they had conditions which had been diagnosed by a doctor, second, whether they had "any other" diagnosed conditions (this was to encourage response: replies were coded back whenever possible into one of the 37 categories), and third, whether they had any conditions which had not been diagnosed "but that you know you have". In this paper only the first category of responses is used as a measure of health conditions; the latter two were reported by relatively few persons and appear subject to more error in classification.

Two other types of variables were also covered in the disability section and seem likely to be linked with work limitations. A short battery of symptoms and a more lengthy battery of activity limitations were asked of everyone. To minimize the tedium of these question sequences for the considerable portion of the sample in good health, and to reduce the tendency of falling into a negative response pattern of muttering "No, no, no..." without listening closely to the questions (a problem encountered in previous ISDP interviews when asking about income), a series of skip patterns were built into the limitation questions to reduce the number of questions where answers could be reasonably inferred. Thus, persons who were bedridden ("Yes" to 46a) were assured to be incapable of walking long distances, lifting heavy weights, etc., and those who could lift 50 pounds were assumed to be capable of lifting 10 pounds.

Results from the October 1978 interviews were processed into hierarchical files, in which household, adult, child, income type, etc. information is encoded on different levels of the hierarchy. This study uses data from the adult records, manipulated using the SPSSH8.0 package. A total of 4127 records were examined. Some 235 of these were person noninterviews (Type Z in Census/ISDP jargon) and consisted of largely blank adult records carried under household records provided by a more available or cooperative member of the household. In addition, due to errors in coding, unresponsiveness to the disability questions (which came at the end of a relatively lengthy interview), and other miscellaneous causes information is missing for specific items. Generally speaking, data was provided on some 92% of the adult records. No records are available for the approximately 10% of households where no interviews could be obtained.

A substantial portion of the national sample indicated work-related disability: complete inability to work for 10% of the under-65 group who were asked these questions, and partial disability for another 7.3%. Larger numbers, however, reported various health conditions, symptoms, and limitations. A total of 4901 doctor-diagnosed health problems were reported by 1932 persons, 46.8% of the sample (including the over-65 respondents). Symptoms of one or another kind were reported by 1303 persons. Activity limitations are more dif-

ficult to summarize, in part because of the skip patterns discussed above.

The Data Collected

Of the very large number of possible comparisons, this examination focussed on the relations between reported work-disability status and reports of health problems, symptoms, and activity.

By and large the relaton of self-declared work disability to doctor-diagnosed health conditions is self-explanatory. With few exceptions, the non-disabled are least likely to report a problem, the totally disabled are the most likely, and the partially disabled are intermediate. Aside from a few variables with very small n's, the exceptions to this pattern are "hernia or rupture", "other trouble with back or spine", and "chronic severe allergy". As with the other variables, the non-disabled are least likely to report these, but they are more common among the partially than the totally disabled. It should also be noted that while health problems are more frequent among the disabled, they are not precisely characteristic of them. That is, the majority of persons reporting a particular problem are nearly always persons who report that they are not limited in the kind or amount of work that they can do.

The distribution of symptoms also appears consistently related to ability to work. Fewer than 18% of the nondisabled group report any symptom, compared with 68% of the partially disabled and 85.7% of the completely disabled. In every instance, the proportions reporting a specific symptom show a similar pattern, with the nondisabled reporting least and the completely disabled reporting most. It seems not unlikely that each of these symptoms can reflect either causes or effects of work limitations. Conditions such as shakey hands, weakness, tiredness, etc., can have a significant psychological component and reflect stress induced by failure to participate successfully in the labor force or the marginal status of non-participants of working age in a society where holding down a regular job is considered to be the norm. On the other hand, it is not difficult to visualize how fatigue and unsteadiness with a purely physiological basis could impair the ability to hold down a regular job. It is probably this combined objective and subjective significance of the symptoms listed which makes them relatively useful indicators of work disability. While the underlying causality is not easy to determine, such indicators are promising measures for screening samples, since they are reasonably simple and brief to ask.

Activity limitations are, in a sense, intermediate in their usefulness as disability indicators, even though one would expect them to be most directly related to actual limitations on ability to work (Table 3). Unsurprisingly, very few people who report themselves to have no limits on the kind or amount of work they can do then report that they are bedridden, unable to dress themselves, or required to stay sitting. However, only a small portion of the completely disabled report these problems. Indeed, a sizeable majority of the completely disabled report that they can get out of doors unassisted, use public transportation, and drive cars. Some other activities are better indicators - trouble walking long distances, using stairs, standing for long periods, and stooping are reported by substantial majorities of the completely disabled and only small minorities of the nondisabled. Even here, however, quite sizeable minorities of the disabled do not report such limitations.

The Discriminant Analysis

The three scales reviewing health conditions, symptoms, and activity limitations contained 60 separate categories - in effect, 60 different questions. As mentioned earlier, the disability section took up a sizeable part of the interview time even for persons who were not limited or disabled. Given the priorities of the SIPP, it cannot routinely collect this amount of detail, unless disability-related characteristics are considered substantially more important for the data collection program than now appears likely. On the other hand, disability (conceived either as work limitation or activity limitation requiring assistance) is of substantial importance to the income and program participation focus of the survey. It would be desirable, therefore, to arrive at some basis for reducing the number of items to a more manageable set which could be administered to the SIPP panels relatively frequently. A reasonable approach to the reduction process is to determine which variables best distinguish beween the disabled and non-disabled populations. The particular importance of the marginal population of the partially disabled, who may either be fully self-supporting or fully dependent on government assistance, suggest that it would also be of particular interest to find a set of variables which distinguish this group.

Discriminant analysis performs precisely this function. Given two or more groups and a set of possible discriminant variables, it selects and weights one or more linear combinations which maximize the difference in discriminant scores between groups. The discriminant equation(s) can be used to sort cases whose groups are unknown. They can also be used, as in this study, to determine which of the possible discriminating variables contribute substantially to distinguishing the groups and which make little or no contribution. Relative importance can be examined by employing a stepwise procedure and taking note of the order of inclusion of variables, or by including all variables in the analysis and comparing their standardized weights in the resulting discriminant function.

The analysis reported below was performed using the SPSSH.80 package; the algorithms used in computation are fully documented [4] and need not be set out here. The initial step was to perform the discriminant analysis procedure using each of the three sets of related variables (health conditions, symptoms, and activity limitations) to distinguish between self-described work limitation status. Results are shown in Table 1.

The pattern is quite similar for each of the three sets of discriminators. For each set, about 86% of the cases are correctly identified by the discriminant functions. The nondisabled are nearly always correctly identified, the disabled passably (as totally disabled 55-75% of the time, and as partially disabled 7-14%) and the partially disabled cases are poorly classified.

In each analysis two discriminant functions are discriminated (Table 5). The first accounts for 94-97% of the variance explained, and is clearly a discriminator of disability status in general. Regardless of the variables used to create the

function, the nondisabled group mean differs only slightly from zero, the totally disabled group mean is relatively large and of opposite sign, and the partially disabled group is intermediate. For each set, the second (orthogonal) function explains a relatively small part of the variance (3-6%) and has a relatively low canonical correlation with the group variable. Nonetheless, the second function is not only statistically significant but interpretable. In each instance, the partially disabled group mean has one sign, the totally disabled group mean has another, and the nondisabled group lies in between. Clearly the small amount of variance which this second function explains is the variation between the partially and totally disabled.

Of particular interest for the purposes of variable reduction, the standardized weights of the discriminator variables are quite unequal Several are of some importance in distinguishing between disability categories, and others virtually useless. As an example of the first, the ability to drive a car has one of the highest weights observed for both the first and second functions (based on activity limitations). On the other hand, in the analysis based on symptoms, muscle spasms appear to explain almost none of the variance in either function. This strongly suggests that a reduced set may be as effective in discriminating disability groups as the full 60 variables

The second stage of the analysis was therefore to generate discriminant functions based on all 60 functions and on a subset. The subset was selected by using a stepwise procedure (entering variables in order of increase in generalized distance between groups as measured by Rao's V) and arbitrarily selecting as a cutoff MAXSTEPS=10. In addition, both analyses were performed on the three groups previously discussed, and on a simplified two-group problem created by collapsing the partially and totally disabled into a single work-disabled group to be distinguished from the nondisabled. This was done to insure that the discriminant procedure was not introducing distortion through treating as independent three groups which are known a priori to be arranged ordinally. However, the single discriminant function this produced differed little from the first function derived from the three-group analysis (Table 2).

Using all 60 variables rather than 10 does improve classification somewhat, but not a great deal. There is little difference in the two-group problem, when the nondisabled are to be distinguished from the others. The major improvement is in the discrimination of the partially disabled in the three-group problem (Table 3). This is the most successful classification of this difficult-to-distinguish group, but even here the majority are not correctly identified.

However, the functions generated by combining the three types of discriminators (health conditions, symptoms, and limitations) are clearly better discriminators than the functions based on each set alone. It is interesting that no one type of variable predominates in the resulting discriminant functions. The "best 10" set, whose weights are similar to those in the full-60 functions, includes four health conditions, two symptoms, and four limitations (for the three-group problem) and three, two, and five (for the two-group problem).

These results suggest further work in several directions. The definition of the groups to be discriminated can be refined, for example. Self-defined work limitations do not always correspond with those used in determining program eligibility, and for the purposes of the SIPP it would be even more desirable to discriminate the latter. All persons in the sample who are receiving SSI and are under 65 have, necessarily, been examined and found disabled. Since the sample was supplemented with SSI cases, this group is fairly numerous, and will probably repay the computational difficulties of separating it out from the somewhat complex working files now available. Another possibility is to exclude the nondisabled who had no problems, etc. to report. It is obviously not difficult to discriminate these; the more interesting task is to examine the impaired who report that they can work and how they differ from the impaired who report that they cannot. Despite the limitations of the 1978 Research Panel data base, it promises to be a rich source of data for research in this area.

References

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TABLE 1

Using Health Conditions

ACTUAL GROUP	No. of CASES	PREDICTED GROUP MEMBERSHIP 1	2	3
Group 1	2525	2360	116	49
		93.5%	4,6%	1.9%
Group 2	204	120	55	29
		58.8%	27.0%	14.2%
Group 3	296	92	41	163
		31.1%	13.9%	55.1%
Ungrouped Cases	777	438	84	255
(Group 4)		56.4%	10.8%	32.8%

PERCENT OF "GROUPED CASES CORRECTLY CLASSIFIED: 85.22%

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CANONICAL: CORRELATION:	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFI-CANCE
1	0.81938	93.85	0.6710905 :	0.5216506	1955.5	70	0.0000
2	0.05365	6.15	0.2256520 :	0.9490812	157.04	34	0.0000

Using Symptoms

ACTUAL GROUP	No. of CASES	PREDICTED GROUP MEMBERSHIP 1	2	3
Group 1	2525	2393	41	91
		94.8%	1.6%	3.6%
Group 2	204	122	21	61
		59.8%	10.3%	29.9%
Group 3	296	89	21	186
		30.1%	7.1%	62.8%
Ungrouped Cases	777	465	32	280
(Group 4)		59.8%	4.1%	36.0%

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 85.95%

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CANONICAL: CORRELATION:	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFI-CANCE
1	0.70416	97.46	0.6428073 :	0.5762176	1664.3	14	0.0
2	0.01836	2.54	0.1342830 :	0.9819681	54.935	6	0.0000

Using Activity limitations

ACTUAL GROUP	No. of CASES	PREDICTED GROUP MEMBERSHIP 1	2	3
Group 1	2525	2353	88	84
		93.2%	3.5%	3.3%
Group 2	204	101	55	48
		49.5%	27.0%	23.5%
Group 3	296	39	34	223
		13.2%	11.5%	75.3%
Ungrouped Cases	777	325	68	384
(Group 4)		41.8%	8.8%	49.4%

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 86.98%

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CANONICAL: CORRELATION:	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFI-CANCE
1	1.28241	95.56	0.7495782 :	0.4134870	2662.2	32	0.0000
2	0.05980	4.44	0.2371738 :	0.9437486	174.53	15	0.0

Table 2

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFCIEIENTS:

Health Conditions	Function 1	Function 2
Tuberculosis	-.05030	-.11304
Bronchitis	-.13626	-.05515
Emphysema	-.13360	.04523
Arteriosclerosis	-.04007	.04469
Hypertension	-.12088	.14245
Coronary	-.22930	-.12102
Stroke	-.17909	.33678
Other heart prob.	-.22522	-.02706
Tumor	.00886	.15747
Cancer	-.14982	-.09384
Other lung prob.	.02582	.17826
Gall bladder/liver	-.09877	.06729
Other stomach prob.	-.06985	.02134
Kidney stones	-.08675	-.00709
Arthritis	-.20960	.09179
Mental Illness	-.34959	.19163
Nervous/emotional	-.21415	.05770
Retarded	-.31687	-.08969
Diabetes	-.14299	-.05287
Thyroid	.04014	.06206
Epilepsy	-.14056	.24007
Multiple sclerosis	-.03966	-.23000
Alcohol/drugs	-.08725	.07314
Hernia	-.06317	-.28928
Deafness	-.08099	.00064
Blindness	-.06057	.18602
Poor vision	-.12531	-.01816
Missing legs/feet	-.19818	.20025
Missing arm/hand	.01989	-.12493
Broken bones	-.09949	.10996
Limb stiffness	-.17104	.08622
Back stiffness	-.19529	-.22181
Other spine prob.	-.19696	-.57147
Paralysis	-.08554	.00603
Chronic allergy	.01752	.24016
Symptoms		
Weakness	-.46399	.20137
Tiredness	-.20771	.28117
Shakey hands	-.13575	.67012
Spasms	-.03406	.01277
Pain	-.29886	-.41401
Stiffness	-.23873	.60140
Swelling	-.13582	-.06505
Limitations		
Bedridden	.12220	-.09168
Getting dressed	-.14570	.22876
Going Outdoors	-.06737	-.31443
Using buses	.22104	-.36083
Driving car	-.44100	.43199
Staying sitting	.20546	-.13042
Walking far	-.18129	.05198
Climbing stairs	-.16211	.16056
Standing	-.18689	-.47232
Sitting	-.04109	-.23512
Stooping	-.16160	-.28056
Lifting 10 lb.	-.27176	.33461
Lifting 25 lb	-.09949	-.10838
Lifting 50 lb	-.06279	-.21370
Reaching	-.16002	-.06099
Using Fingers	-.05893	.05100

TABLE 3

Three-group problem

Classification Results - using "best 10" variables

Actual Group	No. of Cases	Predicted Group Membership 1	2	3
Group 1	2525	2435	51	39
		96.4%	2.0%	1.5%
Group 2	204	103	51	50
		50.5%	25.0%	24.5%
Group 3	296	43	47	206
		14.5%	15.9%	69.6%
Ungrouped Cases	777	382	66	329
		49.2%	8.5%	42.3%

("grouped" cases correctly classified): 88.99%

Classification Results - using all 60 variables

Actual Group	No. of Cases	Predicted Group Membership. 1	2	3
Group 1	2525	2440	65	20
		96.6%	2.6%	0.8%
Group 2	204	91	77	36
		44.6%	37.7%	17.6%
Group 3	296	37	43	216
		12.5%	14.5%	73.0%
Ungrouped Cases	777	387	72	318
		49.8%	9.3%	40.9%

("grouped" cases correctly classified): 90.,35%