Findings from a study of applicants to a long-term care facility suggested the possibility of developing a screening instrument concerning need for admission that might be administered prior to calling on the services of highly trained specialists. Such an instrument can be used as an aid to the professional and permit a more efficient allocation of his time. Using team judgments of need for admission as the criterion, data concerning 48 pre-coded items from 123 home interviews were subjected to discriminant function analysis—a statistical device by which responses to interview items might be translated into scores predictive of clinical judgments. Eighty-three cases were used for deriving the scores used for predicting need and 40 cases for testing the instrument. Because of the encouraging results, plans are underway to refine the instrument.

The Use of Easily Obtained Pre-coded Data in Screening Applicants to a Long-Term Care Facility[1]

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The increasing demand for medical and social services for the varied groups in our population has placed growing pressures on the institutions providing such services. In light of limited resources in plant and professional staff, it is becoming increasingly important to develop effective instruments that can be used to screen those individuals in greatest need of assistance. At the same time, of course, many institutions are concerned with finding ways to serve those individuals who may not exhibit the total cluster of symptoms required for "admission" but can be helped instead by some sort of out-of-institution assistance.

These issues were central in the demonstration project recently completed at the Hebrew Rehabilitation Center for Aged in Boston (HRCA). The Center (formerly the Hebrew Home for the Aged) had moved in 1963 to an expanded modern facility with increased functions combining those of residence, nursing home, and chronic disease hospital. It was filled to capacity within a few months after its opening; furthermore, applications to the new facility continued to increase. In less than a year, the waiting list grew to some 500 cases. As a matter of fact, because of the length of the waiting period, some individuals began to submit applications on a contingency basis. This practice undoubtedly aggravated the problem—with the attendant danger that some applicants with more urgent need for admission would suffer unnecessary delay. It became obvious that there was a serious lack of facilities for the aged in the Boston Metropolitan area.

The HRCA Demonstration Project

As one effort to deal with this problem, a 3-year demonstration project was inaugurated in

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1965 by the HRCA. The action program consisted of individualized clinical team evaluations and recommended services designed to help maintain applicants in the community and postpone the need for admission. The research component of the demonstration project consisted of a variety of controlled procedures aimed at testing the effectiveness of the action-program as well as learning about the characteristics and unmet needs of persons applying to a facility such as the HRCA. In line with these purposes, measurements were systematically obtained and recorded concerning the characteristics and diagnosed needs of the elderly persons participating in the demonstration project.

In order to learn about the impact of the demonstration services, the program operated within the framework of an experimental research design. Three groups were studied—two experimental groups and a control group. Different types of applicants[3] were assigned to each of these groups. Random sampling—a method that provides an equal chance of being selected for each of the groups—was used as the basis for assignment.[4] One of the experimental groups received full program services—clinical team diagnostic evaluation plus project follow-through efforts to coordinate and provide services based on team recommendations. The second experimental group received team diagnostic evaluation services only. The control group was observed over comparable time periods but received no project services[5] Evaluation of the impact of the demonstration program, however, is an area of investigation outside the province of this paper and will be reported elsewhere. Instead, this paper focuses on the analysis of factors that appear to characterize elderly persons in greatest need of institutionalization in a long-term care facility such as the HRCA. Since team judgments are being used as the criteria for need for admission, data concerning only the population (the two experimental groups) seen by the clinical team are relevant for this analysis.

The clinical team responsible for diagnostic evaluations was inter-disciplinary in nature. The team included three physicians—a physiatrist, a psychiatrist, and an internist—as well as a social worker and a public health nurse. It should be noted here that this team seemed to be unusually well integrated in its approach. For example, in a study of professional perspectives on the aged, Coe (1967), using transcripts of tape recorded discussions, found that physicians, dentists, physical therapists, nurses, and social workers tended to view older patients in terms of their own specific professional emphases to the exclusion of other professional perspectives. He concluded that informal communication between professional groups was rare because of their narrow perspectives that tend to be reinforced by communication only with colleagues. These findings, however, are not supported by the experience of the inter-disciplinary team in the HRCA study. Two of the physicians had previously participated in similar clinical teams. The social workers had a good deal of familiarity with medical factors and the nurse held a bachelor's degree in sociology from a well-known liberal arts college. For whatever reasons, each of the professionals on this team appeared to be sensitive to the broad range of needs characterizing the aged.

The operational procedures developed in this project required that an applicant come to the Center for clinical team examinations a short time after being interviewed at home by a project social worker or nurse. In addition to his own direct observations, the team member was able to draw upon available medical and social service records as well as the home interview summary consultation report. The home interview schedule itself contained many precoded and semi-structured items. However, since the schedule was quite long, team members tended not to refer to it directly at the time of the clinic or team evaluation sessions.

The Screening of Applicants

Among the judgments made by the team was one in response to the question "Would residency in the HRCA or in a similar long-term extended-care facility (old age home) best meet the needs of the applicant?" In a preliminary analysis of the data, statistical associations were found between this team judgment and information gained independently from the home interviews conducted prior to the clinical examinations. Responses bearing on the applicant's ability to do his own marketing and cooking, his financial status, having friends to turn to as well as other

3. For example, males and females were sampled separately. Females constituted about three-fourths of the waiting list pool. For purposes of analysis, it was considered important to have a larger distribution of males in the experimental and control groups than would be the case if simple random samples (without reference to "type of applicant") were drawn.

4. Family dynamics, however, were kept in mind and siblings applying to the Center were placed in the same group. For example, if the first brother on the waiting list were randomly assigned to the "no treatment" group, his brother, when sampled, would automatically be assigned to the same group. Couples, of course, where also treated as a unit.

5. Because of their relatively small number in the applicant population, couples were assigned randomly to only two of the groups—the experimental group receiving both diagnostic and follow-through services and the "no treatment" group.

interview items revealed situational factors related to clinical judgments of need for admission. Responses to such statements as "I have a lot to be sad about" were also associated with team judgments. These findings suggested the possibility of developing a screening instrument based on relatively straightforward data that could be collected by trained lay interviewers.

Judgmental data from the home interview were also found to be related to clinical team judgments regarding need for admission. For example, appraisals by the home interviewer (a social worker or nurse) concerning the manner in which the applicant deals with problems, the applicant's general comprehension, the appearance of the applicant (his looking "young for his age"), and the likelihood of the applicant's accepting admission to the Center if it were offered to him were found to be statistically associated with team judgments concerning admission. Attempts to develop a useful screening device might successfully concentrate on such judgmental data. However, the collection of this more subjective material requires the services of highly-trained diagnosticians. An instrument based on straightforward questions that can be asked by an intake secretary, on the other hand, can be used as an aid to the professional and permit a more efficient allocation of his time.

The usefulness of screening instruments that can be administered without the services of highly trained specialists has already been demonstrated. A classic example is the experiment conducted toward the end of World War II in which a self-administered paper and pencil test was developed to help differentiate between psychoneurotics and non-psychoneurotics among men about to be inducted into the Armed Services (Star, 1950). This instrument was used as an aid to the psychiatric examination. In the case of a man with a highly favorable score, the examination might be quite satisfactory, whereas a doubtful case was likely to receive a much more thorough examination.

A more recent example of such an effort is the screening instrument developed from the Health Opinion Survey by Macmillan (1959) as part of the Stirling County Study. This screening device was used in assessing the rough proportions of the ill and the well in the course of this community-wide study of the relationship between psychiatric disorder and environment. Responses to 75 health-oriented items on the Health Opinion Survey were subjected to discriminant function analysis in order to arrive at a scoring system that would distinguish "health" groups from hospital neurotics. Discriminant function analysis is a statistical device by which responses to items are translated into those scores that maximally enable a summary score of the items to classify members of a population correctly according to a given criterion—in this case classification according to whether or not the respondents were hospital neurotics. The test was continually refined and modified in the course of the on-going research and did indeed prove useful in discriminating between neurotics and non-neurotics. The investigators concluded that one of the potential uses of such a test might be "to provide a time-saving general overview of a patient's symptomatology for the busy physician."

Similarly an instrument that would translate relatively straightforward data into scores predictive of team judgments concerning need for admission might very well serve the same purpose in screening applicants for admission to the HRCA. As in the examples discussed above, examination of persons with extreme "high need" or "low need" scores could be considerably shortened, permitting the professional to concentrate his efforts on the borderline cases. Thus, the decision was made to concentrate on developing a screening instrument based on items from the home interview that do not require professional clinical judgments.

Developing a Screening Instrument

As in the Stirling County Study, discriminant function analysis was selected as the technique by which responses to straightforward home interview items might be translated into scores predictive of clinical judgments of need for admission. Complete data for 123 cases from the HRCA demonstration project were available for this study. Eighty-three of these cases—chronologically earlier applicants—were used in deriving the discriminant function necessary for predicting team judgments and the remaining 40 cases were used in testing the instrument. The team's clinical evaluation of an applicant was used as the basis for determining his need for admission to the HRCA.

Assumptions.—It was recognized, of course, that the latter procedure involved assumptions that eventually would have to be tested. Reliability of team judgments regarding need for admission, for example, was one such assumption. For purposes of analysis, however, it was being assumed that a comparable qualified clinical team at a different point in time would arrive

at the same judgments if presented with the same cases and situations. Another assumption—related primarily to the general question of determining needs—involves the validity of team judgments concerning need for admission. Using carefully defined measures of "outcome," at some point in time it should be determined whether individuals judged to have need for admission do fare better if institutionalized and whether those judged *not* to have need for admission fare better if they remain in the community under the conditions specified by the team. Again, for analytical purposes, it was being assumed that team judgments validly reflect actual need and that the services recommended would in fact be beneficial to the applicant.

Reliability and validity are but two of the questions that can be raised. As pointed out by Tripodi and Miller (1966), there is need for the systematic study of the many aspects of the clinical judgment process. But once again, in this preliminary attempt to develop a screening instrument it was being assumed that extraneous factors influencing the judgment process would remain constant or, in any case, would not differentially affect team judgments concerning need for admission to the Center.

Table 1. Characteristics of Selected Samples of Applicants to the HRCA

	Sample Used to Derive Discriminant Function (N=83)		Sample Used to Test Discriminant Function (N=49)		TOTAL (N=123)	
	N	%	N	%	N	%
Sex						
Male	40	48.2	19	47.5	59	48.0
Female	43	51.8	21	52.5	64	52.0
Marital status*						
Married	27	32.5	4	10.0	31	25.2
Single	6	7.2	3	7.5	9	7.3
Widowed	50	60.2	33	82.5	83	67.5
Age						
Under 75	19	22.9	11	27.5	30	24.4
75+	64	77.1	29	72.5	93	75.6
Place of birth						
Foreign-born	69	83.1	31	77.5	109	88.6
Native-born	14	16.9	9	22.5	14	11.4
Education						
0–4 years	32	38.6	19	47.5	51	41.5
5–8	35	42.1	11	27.5	46	37.4
9+	16	19.3	10	25.0	26	21.1
Length of residence in USA						
Under 50 years	12	14.5	2	05.0	14	11.4
50+	71	85.5	38	95.0	109	88.6
Living with						
Spouse or alone	47	56.6	17	42.5	64	52.0
Children	6	7.2	6	15.0	12	9.8
Other	30	36.1	17	42.5	47	38.2
Number of children						
None	10	12.0	9	22.5	19	15.4
One or more	73	88.0	31	77.5	104	84.6
Children nearby						
Yes	73	88.0	31	77.5	104	84.6
No	10	12.0	9	22.5	19	15.4
Occupation (for women, occupation of spouse)*						
White collar	28	33.7	21	52.5	49	39.8
Other	55	66.3	19	47.5	74	60.2
Financial status						
Independent	29	34.9	19	47.5	48	39.0
Outside aid	54	65.1	21	52.5	75	60.9

*Difference between samples significant at <0.05 level.

Characteristics of the sample.—From Table 1 it can be seen that the HRCA applicants participating in the demonstration project represent a predominantly immigrant population. While a majority of these applicants were born in Eastern Europe, most have lived in the United States for 50 years or more. Although educational backgrounds range from no formal education to those with some college, 80% of the total sample have only a grade school education. Proportionately few of the applicants have living spouses. The majority of the presently unmarried group are widowed. Only 7.3% of the applicants have been single all their lives. A generally consistent pattern of traits exists in the groups used to develop and test the instrument. However, compared with the group of 83 chronologically earlier applicants used to construct the instrument, the cross-validation sample has a significantly smaller proportion of persons with living spouses and a larger proportion of persons with white collar occupational backgrounds. These variables are included among those used in the discriminant function analysis. However, if the instrument proves to be a valid predictor of team judgments, differences between the two groups will in no way affect the usefulness of the instrument. Rather, the differences in these characteristics will be reflected in the distribution of scores for these groups.

The discriminant function analysis.—The responses of the first 83 applicants to 48 pre-coded items (see Chart I)—background and situational variables from the home interview were subjected to discriminant function analysis. As was indicated earlier, this is a method for scoring the responses to a set of items in such a way as to yield, for each member of a population, a summary score that corresponds as closely as possible to an external criterion. Thus, using the previously established judgment of need for admission as the criterion in this study: optimum point values (weights) for each response to the 48 items were derived; summary scores for each of the 83 applicants were computed; and the cutting point was established that best predicted the team judgments.

Table 2 shows the degree of correspondence

Chart 1. Variables Used in Discriminant Function Analysis[a].

A. Variables Found to Be Significantly Related to Team Judgments Concerning Need for Admission by Postulated Area of Influence[b].

Area of Influence	Variable	Response Categories Used in Scoring System		Response Related to "HRCA Best" Team Judgment
I. Need for life maintenance services offered by the facility	Lives in Nursing Home**	Yes	No	Yes
	Applicant receives services from community resources*	Yes	No	Yes
	Katz—ADL Health Scale***	6-item scale		Poorer functional health
	Rosow Functional Health Scale**	4-item scale		Poorer functional health
	Does own marketing*	Yes	No	No
	Does own cooking*	Yes	No	No
	"My health is:"*	Good	Not so good	Not so good
	Modified Kastenbaum Orientation Scale***	8-item scale		More disoriented
II. Lack of opportunities for peer group relationships	Has friends to turn to*	Yes	No	No
	Attends religious services at least occasionally*	Yes	No	No
	Presently belong to clubs*	Yes	No	No
	Persons thought of as real friends**	Number of persons		Fewer persons
	Friends live in neighborhood*	Yes	No	No
III. Morale	Powell Lawton Morale Scale**	21-item scale		Lower morale
	"I have a lot to be sad about"****	Yes	No	Yes
IV. Independence	Receives financial assistance**	Yes	No	Yes
	Lives alone (includes "with spouse")*	Yes	No	No
V. Style of life	Reads English newspapers**	Yes	No	No
	American education only*	Yes	No	No
	Education*	None	Some	None
	Educational level***	Number of years		Less education
	Family occupation*	White-collar	Skilled; Semi-skilled; Service	Skilled; Semi-skilled; Service
	Shares bath with non-family members***	Yes	No	Yes
	Prefers living situation other than the Center	Yes	No	No

B. Variables Found to be Significantly Related to Team Judgments Concerning Need for Admission Unaccounted for by Scheme.

Variable	Response Categories Used in Scoring System		Response Related to "HRCA Best" Team Judgment
Necessity for walking up stairs*	Yes	No (street level or elevator apt.)	No
Will probably make a change in living arrangements before entering Center*	Yes	No	Yes

C. Variables Not Found to be Significantly Related to Team Judgments Concerning Need for Admission

Variable	Response Categories Used in Scoring System	
Sex	Male	Female
Age at home interview	Age in months	
Marital status	Married	Widowed, divorced, separated, single
Place of birth	East Europe	Other
Primary language	English only	Other
Has some formal American education	Yes	No
Number of living children	Number of children	
Children living in community	Yes	No
Sees child once a week or more or has no child	Yes	No
Financial assistance from public funds—medical aid to aged and/or OAA	Yes	No
Old Age Assistance	Yes	No
Number of rooms for own exclusive use	Number of rooms	
Shares bath—includes shares bath with family and/or non-family members	Yes	No
Shares bedroom—includes family and/or non-family members	Yes	No
If in nursing home, shares room	Yes	No
Has someone with or nearby most of the time—daytime	Number of people listed	
Has someone with or nearby most of the time—nighttime	Number of people listed	
Obtains medical care from private physician	Yes	No
"In general, how is your health now?"	4-item scale	
Number of clubs applicant formerly belonged to	Number of clubs	
Sees enough of friends and relatives	Yes	No
Knows residents at the Center	Yes	No

[a]Home interview questions with pre-coded scaled responses or with dichotomous responses were used directly as variables. As required by the methodology for the discriminant function computer program used, a non-scaled question with more than two possible responses appears in the list as several variables, each with dichotomous responses.

[b]Significance at the 0.05 or less level.

That is, the differences found between the groups are considered statistically significant since the probability of obtaining such differences by chance are 5 or less in 100.

*The probability of obtaining such differences by chance are 5 or less but greater than 1 in 100.

**The probability of obtaining such differences by chance are 1 or less in 100 but greater than 1 in 1000.

***The probability of obtaining such differences is equal to or less than 1 in 1000.

between the team's recommendations and the predictions based on the discriminant function scores. Of the 41 applicants categorized "HRCA Best," 40 corresponded to actual team judgments. Of the 42 applicants categorized "HRCA Not Best," 41 corresponded to actual team judgments.

The accuracy of the discriminant function for future prediction was then tested on the 40 additional cases (more recent applicants to the HRCA). As can be seen in Table 3, of the 20 applicants categorized "HRCA Best," 15 corresponded to actual team judgments. Of the 20 categorized "HRCA Not Best," 12 corresponded to actual team judgments. Although the proportion of "hits" is considerably less in this cross-validation sample than in the first sample (67.5% "hits" compared with 97.6% "hits"), the results are encouraging. They point to the value of further refining the instrument. Hopefully, it will be possible to compute a new discriminant function that will increase the likelihood of correct assignment (as measured by team judgments) of cases in cross-validation samples while, at the same time, reducing the number of variables necessary for reasonably accurate predictions of team judgments.

Approaches to Revising Instrument

Refinement procedures can take various forms. One approach might involve the selection of an abbreviated set of variables on the basis of what can be termed "statistical decisions." For example, the 48 variables can be subjected to factor analysis techniques. For each "factor" thus derived, the variables having the highest correlation with the discriminant function summary score in the original computations can be selected to represent that factor in the new discriminant function analysis. Or, a set of variables can be selected on the basis of highest "standardized weights"—that is, the variables contributing most heavily to the discriminant function summary score. Similarly, variables can be selected on the basis of their correlations with the summary score.

Table 2. Discriminant Function Analysis "Hits—Misses" Table for the Sample Used to Derive the Function.

	Predicted Team Judgments[a]	
Actual Team Judgments	HRCA Best	HRCA Not Best
HRCA best	40	1
Not best	1	41

[a]97.6% "Hits" (81 of 83)

Chi-Square=75.21. (For an explanation of Chi-Square see: Blalock (1960, pp. 212-221); Mainland (1963, pp. 224-240); Roscoe (1969, pp. 196-201).

Sig. at <0.001 level (That is, the probability of finding such differences by chance is less than 1 in 1000.)

Table 3. Discriminant Function Analysis "Hits—Misses" Table for the Cross-Validation Sample.[a]

	Predicted Team Judgments[b]	
Actual Team Judgments	HRCA Best	HRCA Not Best
HRCA best	15	8
Not best	5	12

[a]Sample used to "test" instrument.

[b]67.5% "Hits" (27 of 40)

Yates Chi-Square=3.68. (For an explanation of Yates Chi-Square see: Blalock (1960, pp. 212-221); Mainland (1963, pp. 224-240); Roscoe (1969, pp. 196-201.)

Sig. at <0.10>0.05 (That is, the probability of finding such differences by chance is less than 10 but more than 5 in 100.)

A second approach might involve a new discriminant function analysis using a revised set of variables that is based on conceptualizations concerning influences on the team's deliberative process. If this approach is used, variables significantly related to team judgments and their correlations with the summary score can once again contribute, although in a different way, to the selection of a revised set of variables for a new discriminant function analysis. Seen in their totality, this group of variables can provide important clues concerning personal and situational characteristics that are taken as grounds for an "HRCA Best" recommendation.

Preparations are being made to use each of these procedures in attempts to refine the screening instrument. However, the second approach requires further hypothesis formulation. As a preliminary step in this direction, the concluding section of this paper will examine those variables found to be significantly related to team judgments concerning need for admission. The resulting hypotheses concerning areas of influence might then be used as the basis for selecting the new set of variables for discriminant function analysis.

Areas of Influence and the Decision-Making Process

As can be seen in Chart I, 26 of the 48 variables subjected to discriminant function analysis were found to be significantly associated to team judgments in the sample used to derive the function. An examination of these variables suggests five major areas of influence on team decisions:

I. *Need for life maintenance services offered by the facility*—Such services include providing a protective environment, nursing services, and aid in activities of daily living functions (loosely defined to include cooking, shopping, dressing, bathing and general maintenance of oneself).

II. *Lack of opportunities for peer group relationships*—In other words, lack of opportunities for mutual gratification with other than family

members (It is interesting to note that, in this sample of applicants, no relationship was found between team judgments and family relationships).

The above two areas of influence seem to act as "pushes" for a team decision that the facility is best for the applicant. The following three areas of influence seem to act as "pulls away" from a decision that the facility is best for the applicant.

III. *Morale*—If the applicant had high morale, it would appear that the team was reluctant to introduce any change into the situation. The members of the team seemed to take the position "let well enough alone."

IV. *Independence*—That is, the ability of the applicant to maintain himself financially and to live alone, either by himself or with his spouse. If he had to depend on either his family or on welfare, the team judgment was more likely to be that the facility is best for the individual.

V. *Style of life*—The more middle-class the person's style of life, the less likely would it be for the team to say that the facility is best for the individual—as, for example, whether or not the applicant can read English newspapers, has a white collar occupational background, a higher educational level, etc.

Chart I-A lists the variables found to be significantly associated with team judgments by postulated area of influence.

Only two of the variables found to be significantly related to team judgments are not accounted for by this scheme—namely, "no necessity for walking up stairs" and "will probably not make a change in living arrangements before entering Center." Further statistical analysis of the data is called for in order to determine whether these are spurious relationships or point to other important areas of influence that have not been taken into account in this discussion.

In any event, assuming that the five areas of influence described above may yield adequate indices of team judgment, an abbreviated set of variables for a new discriminant function analysis might be selected by using those variables correlating *most* highly with the discriminant function and tapping different aspects of each of these areas of influence.

Summary and Conclusions

The results of an initial effort to develop a screening instrument using discriminant function analysis of easily obtained pre-coded data have been most encouraging. A success rate of 97.6% "hits" was achieved on the original sample of 83 cases and a "hits" rate of 67.5% was achieved on a cross-validation sample of 40 cases. Plans are underway to refine and test the instrument.

The issues of validity and reliability were discussed as problems requiring further attention. Also, questions should be raised concerning the applicability of this instrument in other geographical areas, with different populations of applicants, with different professionals on the clinical team, and with a different set of resources available in the community. Obviously, a great deal of work needs to be done in order to achieve a more universally suitable instrument.

However, for those institutions interested in adapting such a tool for their own admission purposes as well as for more efficient deployment of scarce specialist time, the screening instrument described here may suggest a useful resource for such an effort. Finally, whatever its eventual utility as an admissions aid, this device can provide an impetus for a thorough discussion of the implicit criteria and value systems that often influence the various professionals involved in the admission process. It might be particularly valuable for sessions in which the clinicians themselves examine their own bases for decision making. It would encourage the overt specification of assumptions and norms being used in their determinations. A fuller understanding of the decision making process can be of real value not only for learning and training purposes but also in helping the experienced professional fulfill his role in a more productive manner. The range of issues raised in the development of this instrument suggest that it offers a potentially fruitful direction for further research.

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