Prognosis in Aphasia: Investigation of the High-Overall Prediction (HOAP) Method and the Short-Direct or HOAP Slope Method to Predict Change in PICA Performance

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"We've never been so self-conscious about ourselves as we seem to be these days," began Lewis Thomas (1979) in The Medusa and The Snail. That should not remind us of anything, really, but it did. Clinicians who treat aphasic patients have never been so self-conscious about their inability to predict the future for their clients as they seem to be these days. Perhaps the recent reports (Basso et al., 1979; Wertz et al., 1978) that indicate aphasia therapy really does work have diverted us from a concern about the efficacy of our efforts to wondering how we might predict how efficacious those efforts are going to be. This, of course, questions our ability to state an accurate prognosis, and this is what we will discuss, self-consciously, in this paper.

Current methods for predicting an aphasic patient's future include the use of prognostic variables (Darley, 1972); behavioral profiles (Schuell, 1965); and statistical prediction (Porch et al., 1980). Each method has its strengths and its weaknesses, and each is more accurate for predicting group performance than for predicting individual performance.

Two additional approaches, the High-Overall Prediction Method (HOAP) and the Short-Direct or HOAP Slope Method, developed by Porch (1972), have been employed clinically, but neither has been submitted to an empirical test. Both utilize performance on the Porch Index of Communicative Ability (PICA) (Porch, 1967) early postonset to predict performance at a later date. Both are based on the assumption that improved PICA scores represent improvement in aphasia. This assumption gains some validity from Holland's report (1978) that PICA performance correlates significantly with other measures of aphasia and the Wertz, et al. (1978) results showing that change in PICA performance correlates significantly with change on other measures of aphasia. The purpose of this paper is to report an empirical test of the HOAP and HOAP Slope methods for predicting change in aphasia during the first six months postonset.

METHOD

The HOAP (High-Overall Prediction) Method involves administering a PICA at approximately one month postonset, computing the patient's Overall score, and utilizing the Overall and High Percentile (mean of the nine best subtests) Table in the PICA Manual to predict performance at six months postonset. The clinician finds the patient's Overall PICA score at one month postonset in the percentile table, moves laterally in the table to the "Highs" column, selects the High raw score, re-enters the Overall column, moves upward until the selected High score is found, and selects the corresponding percentile to represent the patient's predicted performance at six months postonset. For example, as shown in Figure 1, if a patient

obtains a PICA Overall score of 12.25 (71st percentile) at one month post-onset, the clinician enters the percentile Table Overall column and locates the adjacent "high" score, which is 14.33. Re-entering the Overall column, the clinician moves upward to find a raw score of 14.33. Once located, the raw score is converted to the corresponding percentile (96th percentile), and this becomes the patient's predicted performance at six months postonset.

APPENDIX E

RECOVERY CURVE PERCENTILES, LEFT HEMISPHERE DAMAGE (N =280)

%	Highs	OA	Lows
//	//	//	//
97	14.96	14.46	13.95
96	14.95	14.33	13.72
95	14.93	14.21	13.49
94	14.91	14.12	13.83
93	14.89	14.03	13.17
92	14.88	13.95	13.01
91	14.86	13.86	12.85
90	14.84	13.77	12.69
89	14.83	13.68	12.53
88	14.80	13.59	12.38
87	14.77	13.50	12.22
86	14.75	13.41	12.07
85	14.73	13.32	11.91
84	14.70	13.25	11.80
83	14.67	13.18	11.69
82	14.65	13.11	11.58
81	14.62	13.04	11.47
80	14.59	12.97	11.36
79	14.57	12.89	11.22
78	14.54	12.81	11.07
77	14.52	12.72	10.93
76	14.49	12.64	10.78
75	14.47	12.56	10.64
74	14.43	12.48	10.52
73	14.40	12.40	10.40
72	14.36	12.33	10.28
71	14.33	12.25	10.16
70	14.29	12.17	10.04

Predicted OA %ile at 6 MPO

Predicted OA at 6 MPO

Predicted OA at 6 MPO

OA at One MPO

Figure 1. Use of the HOAP method to predict Overall percentile at six months postonset for a patient with a 12.25 Overall score at one month postonset.

The Short-Direct, or HOAP Slope Method, involves use of the HOAP Slope graph provided by Porch (Figure 2). A PICA is administered within the first six months postonset. The Overall score is computed and converted to a percentile. Utilizing the HOAP Slope sheet, the clinician finds the patient's appropriate months postonset (MPO) column, locates the patient's Overall percentile in the MPO column, and moves parallel up the nearest HOAP Slope to find the patient's predicted performance at points in time up to six months postonset. For example, as shown in Figure 3, a PICA Overall score of 12.25 obtained at one MPO converts to the 71st percentile. Entering the one MPO column and moving downward to the HOAP Slope at the 70th

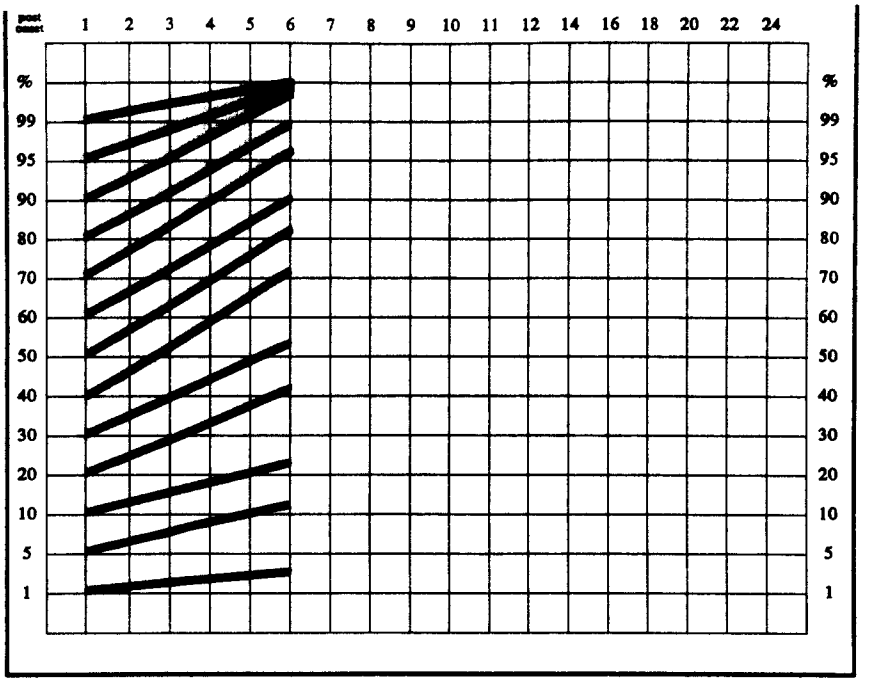

Figure 2. HOAP Slope recovery curves. Adapted from Porch (1972).

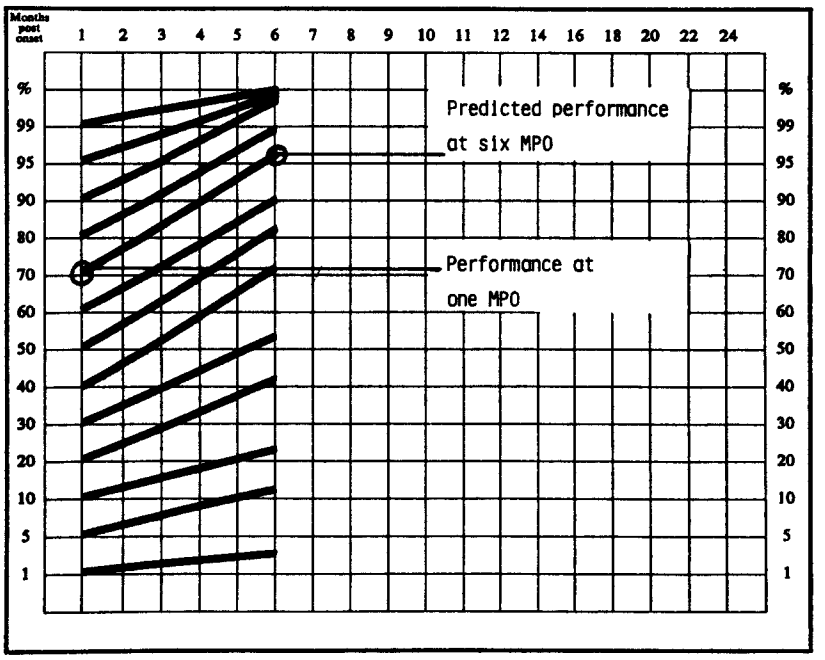

Figure 3. Use of the HOAP slope to predict performance at six months postons for a patient at the 70th percentile at one month postonset.

percentile, the clinician then moves parallel along this slope to predict 85th percentile performance at three MPO and 96th percentile performance at six MPO. (Porch cautions that both methods are most accurate when predicting for patients who suffer aphasia subsequent to a thromboembolic CVA.)

Subjects. Eighty-five patients who had sustained a single, left hemisphere thromboembolic CVA served as subjects. All received at least two PICAs within the first six months postonset. All received language therapy; however this varied widely in its duration and intensity.

The sample was subdivided into appropriate subgroups for (a) the method being evaluated, HOAP or HOAP Slope, and (b) the time postonset PICAs were administered. One prediction group, one MPO predicting six MPO, was used to test the HOAP method. Three prediction groups--one MPO predicting three MPO, one MPO predicting six MPO, and three MPO predicting six MPO--were used to test the HOAP Slope method. Some patients were included in more than one prediction group.

RESULTS

HOAP (High-Overall Prediction) Method. The 63 patients used to test the HOAP method had a mean age of 58 years and ranged from 36 to 79 years. Mean Overall PICA percentile performance at one month postonset was at the 42nd percentile, with a range from the 4th to the 74th percentile. The mean Overall percentile predicted by the HOAP method at six months postonset was the 72nd. Mean Overall percentile actually obtained by this group was the 67th. The correlation between predicted and obtained performance was 0.75, which was significant at $p < 0.01$. The range of error between predicted and obtained scores for individual patients was between -40 and +27 percentile units.

Traditionally, a ten percentile change in PICA Overall percentile score is considered to be clinically significant (Wertz, et al., 1978). Using this as a limiting criterion to determine the accuracy of the HOAP method, we computed the percent of our sample obtaining scores within plus or minus ten percentile units of those predicted (accurate prediction); the percent obtaining scores greater than plus ten percentile units (underprediction); and the percent obtaining scores greater than minus ten percentile units (overprediction). The HOAP method predicted accurately for 49 percent of the sample, underpredicted for 40 percent, and overpredicted for 11 percent. Figure 4 shows that of the 49 percent of the sample for whom HOAP was accurate, 22 percent obtained scores slightly more than and 27 percent obtained scores slightly less than those predicted. Of the 37 percent of the sample obtaining scores 11 to 20 percentile units different from those predicted, HOAP underpredicted for 30 percent and overpredicted for seven percent. Of the 11 percent of the patients obtaining scores 21 to 30 percentile units different from those predicted, HOAP underpredicted for ten percent and overpredicted for one percent. Three percent of the sample obtained scores that differed from those predicted by 31 to 40 percentile units. For all of these patients, HOAP overpredicted.

Short-Direct HOAP Slope Method. The descriptive data for the three HOAP Slope prediction groups are shown in Table 1. Mean age was 58 years in two groups and 62 years in one group. The mean PICA Overall percentile was at the 42nd in two groups and at the 60th in one group. Initial severity varied widely among patients, from the 4th to the 90th percentile across groups.

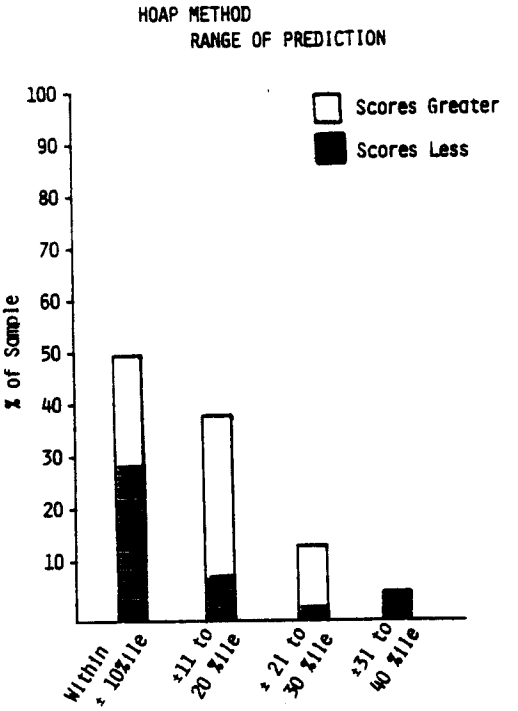

Figure 4. Percent of sample obtaining scores within plus or minus ten percentile units and percent over plus or minus 11 percentile units of the score predicted by the HOAP method.

Table 1. Descriptive data for the three prediction groups used to test the short-direct HOAP Slope Method.

Prediction Groups	N	Age In Years		Initial PICA Overall Percentile	
		$\bar{x}$	Range	$\bar{x}$	Range
1 MPO - 3 MPO	69	62	42-79	42nd	4th - 74th
1 MPO - 6 MPO	63	58	36-79	42nd	4th - 74th
3 MPO - 6 MPO	65	58	42-79	60th	12th - 90th

Table 2 shows that the HOAP Slope method predicted a mean overall percentile of 56 for the one MPO predicting three MPO group. A mean percentile of 59 was obtained. For the one MPO predicting six MPO group, 71st percentile mean performance was predicted, and 67th percentile performance was obtained. For the three MPO predicting six MPO group, 76th percentile mean performance was predicted, and 66th percentile performance was obtained. Correlations between predicted performance and performance obtained were significant ($p < 0.01$) for all groups. The range of error in percentile units

for individual patients was wide, -27 to +40 for the one MPO predicting three MPO group, -38 to +35 for the one MPO predicting six MPO group, and -27 to +27 for the three MPO predicting six MPO group.

Table 2. Comparison of predicted and obtained scores using the HOAP Slope Method.

Prediction Group	N	$\bar{x}$ OA %ile Predicted	$\bar{x}$ OA %ile Obtained	r	Range of Error In %ile Units For Individuals
1 MPO - 3 MPO	69	56th	59th	0.84*	-27 %ile to +40 %ile
1 MPO - 6 MPO	63	71st	67th	0.76*	-38 %ile to +35 %ile
3 MPO - 6 MPO	65	76th	66th	0.88*	-27 %ile to +27 %ile

*Significant at $p < 0.01$

Table 3 shows the results of applying the plus or minus ten percentile units criterion to test the accuracy of the HOAP Slope method. Prediction was accurate for 67 percent of the patients in the one to three MPO group, 52 percent in the one to six MPO group, and 42 percent in the three to six MPO group. Of the patients for whom this method was not accurate, the tendency was to overpredict for the one to three MPO group and underpredict for the one to six MPO and three to six MPO groups.

Table 3. Percent of patients obtaining scores within plus or minus ten percentile units, over plus ten percentile units, and over minus ten percentile units of scores predicted by the HOAP Slope Method.

Prediction Group	N	% Within ± 10 %ile	% Over + 10 %ile	% Over - 10 %ile
1 MPO - 3 MPO	69	67	7	26
1 MPO - 6 MPO	63	52	35	13
3 MPO - 6 MPO	65	42	56	2

Figure 5 shows that the majority of patients in the one MPO predicting three MPO group received adequate prediction. Of those who obtained scores more than plus or minus 11 percentile units of the score predicted, most performed worse than predicted. Figure 6 shows that in the one MPO predicting six MPO group, over half of the patients received adequate prediction. Of those who obtained scores more than plus or minus 11 percentile units of the score predicted, most performed better than predicted. Figure 7 shows that

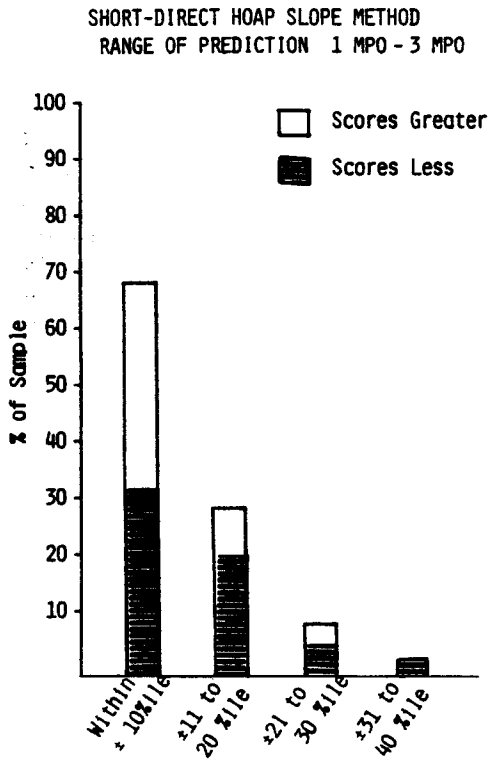

Figure 5. Percent of sample in the one MPO predicting three MPO group who obtained scores within plus or minus 10 percentile units and percent over plus or minus 11 percentile units of the score predicted by the HOAP Slope method.

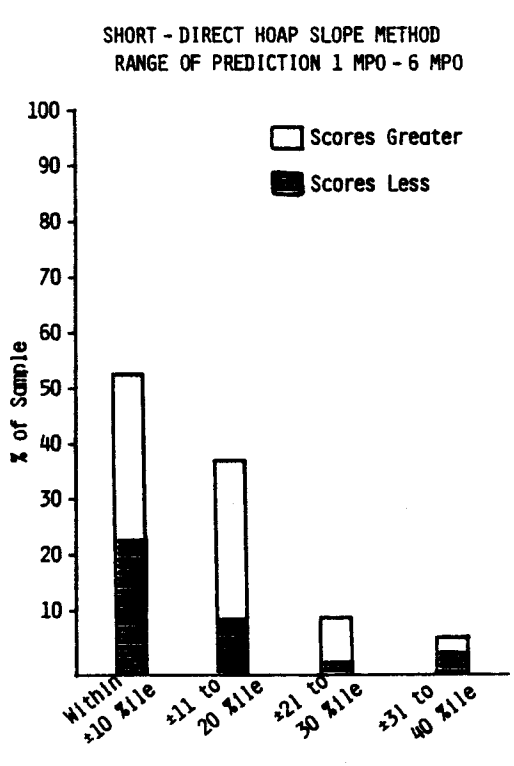

Figure 6. Percent of sample in the one MPO predicting six MPO group who obtained scores within plus or minus 10 percentile units and percent over plus or minus 11 percentile units of the score predicted by the HOAP Slope Method.

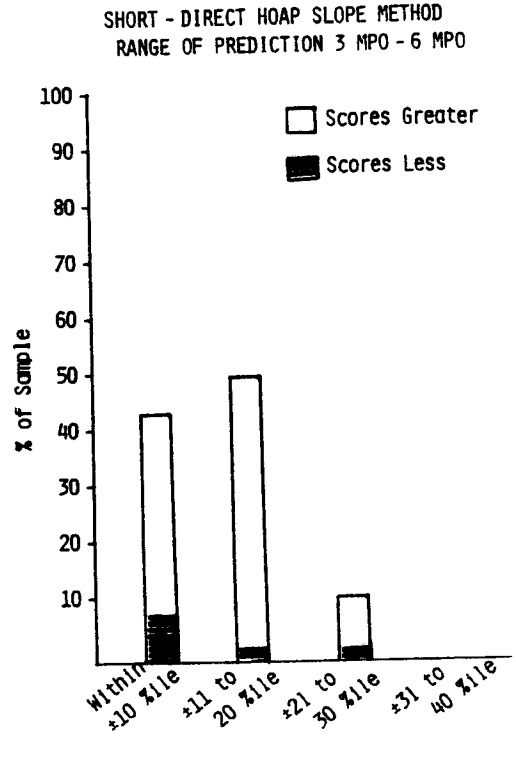

Figure 7. Percent of sample in th three MPO predicting six MPO group who obtained scores within plus or minus 10 percentile units and percent over plus or minus 11 percentile units of the score predicted by the HOAP Slope method.

in the three MPO predicting six MPO group, less than half of the sample received adequate prediction. Of those who obtained scores more than plus or minus 11 percentile units of the score predicted, the overwhelming majority obtained scores better than predicted.

DISCUSSION

Our results suggest that the HOAP and the HOAP Slope methods for predicting improved PICA performance are more promising than practical. Neither method placed more than 67 percent of the patients in any of our prediction groups within plus or minus ten percentile units of the PICA score obtained. Group predictions were more accurate than individual predictions. While correlations between predicted scores and scores obtained were significant ($p < 0.01$), the range of misprediction for individual patients was frightening.

Prediction using the HOAP Slope method was more accurate during the period early postonset, one predicting three months, than for the later period, three predicting six months, or the entire period, one predicting six months. Results using the HOAP method, one MPO predicting six MPO, were essentially similar to results using the HOAP Slope method for predicting over the same period.

Mispredictions with the HOAP Slope method varied according to the time postonset predictions were made. During the early postonset period (one MPO predicting three MPO) predictions tended to overestimate patients' improvement potential. Twenty-six percent of our sample obtained PICA scores less than those predicted. During the later period postonset (three MPO predicting six MPO) predictions underestimated potential improvement. Fifty-six percent of our sample obtained scores greater than those predicted. Predicting over a longer period (one MPO predicting six MPO) also tended to underestimate potential improvement. Thirty-five percent of the patients in the longer prediction group obtained scores greater than those predicted.

Reasons for our lack of accuracy are probably multiple. Two appear salient. First, a possible reason why several prognostic methods exist is that no single method provides sufficient precision. Perhaps concentrating solely on test performance fails to capture the variability induced by medical, biographical, and behavioral variables. For example, our data indicate that the accuracy of both the HOAP and HOAP Slope methods is influenced by initial severity. Both are less accurate for predicting change in patients below the 25th percentile, tending to overpredict for these severe patients. A combined approach that includes specific test performance, other prognostic variables, and the patient's behavioral profile may yield more accurate prediction than any single method. Second, an uncontrolled variable in our analysis is the influence of treatment. While all of our patients were treated, no control was exercised over the amount, intensity, or quality of that treatment. Recent reports (Basso, et al., 1979; Helm, 1978; Wertz, et al., 1978) agree that not only does treatment influence improvement in aphasia, but also duration, intensity, and type of treatment have specific influences. Therefore, any prognostic method that ignores the general and the specific influences of treatment appears futile.

Thus, we have tested the accuracy of the HOAP and HOAP Slope methods for predicting change in PICA performance. Neither appears sufficiently accurate to permit precise clinical application. However, a more complete test of both methods awaits an investigation that controls additional variables that may influence improvement.

ACKNOWLEDGMENT

We thank Dr. Bruce Porch for his creativity (probably right hemisphere in origin) in developing the HOAP and HOAP Slope methods and his generosity in sharing his thoughts and his time as we put this paper together.

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DISCUSSION

Q: How many patients in Dr. Porch's sample were treated?

A: We do not know, and Dr. Porch was unable to tell us. However, it does not matter. Both the HOAP and the HOAP Slope methods are based on Dr. Porch's belief that a patient's best performance early postonset will predict his overall performance at six months postonset. Therefore, the methods were derived by taking the mean of the patients' nine highs at one month postonset--performance on their nine best PICA subtests, converting this mean to an Overall percentile, and using the percentile as the predicted Overall performance at six months postonset. Dr. Porch's patients were not followed to determine whether they achieved the performance predicted by the HOAP or HOAP Slope methods. The predicted performance came from data collected at one month postonset. Thus, it does not matter whether Dr. Porch's patients were treated or not.

Q: Will you construct new HOAP Slopes from your data? Or, are you telling us to forget about this method?

A: A HOAP Slope connects PICA Overall percentiles at two points in time, one month postonset and six months postonset. For example, a patient who performs at the 70th percentile at one month postonset is plugged into the HOAP Slope that begins at the 70th percentile at one month postonset. His predicted performance at six months postonset, if you follow the HOAP Slope upward across months postonset from the first to the sixth, is around the 96th percentile, because the mean of his nine highs at one month postonset, when converted to an Overall percentile, is at the 96th percentile. Our data indicate that not all patients who perform at the 70th percentile at one month postonset end up at the 96th percentile at six months postonset. Therefore, we cannot generate new HOAP Slopes, a line that connects two points in time. We can generate a "fan," a range of predicted performance. However, our data indicate this range would be rather wide, perhaps 20 to 60 percentile units depending on severity at one month postonset. We do not believe this would be very useful. We do not advocate the method be dropped. It is accurate for many patients. However, we caution that, for many patients, the method will predict performance that is 20 to 40 percentile units different from that obtained. Like most of Dr. Porch's ideas, the HOAP and HOAP Slope concepts are good ones. Because our empirical test of their precision was somewhat disappointing does not suggest they should be abandoned. They worked for some patients and did not work for others. The next steps are to determine why and why not.

Q: This is a related question. In looking over your data, retrospectively, and not just the PICA data, what did you see that may assist in obtaining a more accurate prediction of change?

A: That is a good question and an even better suggestion. We need to do what we have not done, fractionate our data. For example, we could look for common characteristics in our patients for whom the methods were accurate. Conversely, we could look for common characteristics in the patients for whom the methods mispredicted. An alternative approach, of course, is to do what you suggest, list variables that we suspect might influence change and manipulate each, independently as a single degree of freedom, and determine its contribution to change or the lack of it and to predictive precision. We have examined only etiology, all patients sustained a single, thromboembolic CVA; hemispheric localization, all sustained a unilateral left hemisphere lesion; time postonset, all were evaluated twice within the first six months postonset; and Dr. Porch's suggestion that a patient's best performance early postonset will predict his overall performance at six month's postonset. We need to refine and qualify for whom the methods are appropriate and accurate. Within the limits of our data, we will. And, if some clarity surfaces, we will report it.