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COMBINED NATIONAL SAMPLE-1985 NORMS: AGES 5-60 YEARS

Jack Katz and many others

The purpose of this article is to bring together the SSW normative data into a coherent standard. Data from the two National Samples for children have been combined with the recent results for adults to form a strong and logical standard. The results follow predictable patterns and are supported by the previous SSW studies.

The Combined National Sample-1985 (C-NS-1985) standard is not meant to replace the C-SSW/A-SSW Category Table (Katz, 1968). Rather, C-NS-1985 should be used to evaluate the presence of a Central Auditory Processing (CAP) disorder as opposed to identifying AR/NAR involvement.

Ideally, one would like a CAP standard to 1) identify those with such problems, 2) avoid mislabeling normals, 3) reflect normal auditory maturation with succeeding age-group means, 4) demonstrate better non-competing than competing scores, 5) better RC than LC performance and 6) to agree closely with the aggregate of previous research studies using the SSW test.

BACKGROUND INFORMATION

Myrick's (1965) data served as a useful standard for many years in identifying CAP problems in children. However, the norms had two major limitations, 1) learning disabled (LD) children were not specifically excluded from the sample and, 2) the 20-item C-EC list which was used, did not provide a standard for response bias.

Stubblefield & Young (1975) and White (1977) questioned whether the SSW norms might be stricter to permit greater CAP identification without increasing false positive rate for normals. A National Sample was undertaken to develop norms that would be applicable to children 5 years and older, throughout the US. Details of the first National Sample (NS-I) were printed in the SSW Reports in 1981. The sample included children 5-12 years of age on the EC list. The correction factor (for C-SSW scores) was based on the results of the recorded W-22 word discrimination test. Testing was carried out by clinicians who had attended one or more SSW Workshops. Children were excluded from the study if they had a history of neurological disorder, significant otological involvement, LD, hearing loss or an air-bone gap.

One hundred-thirty one useable cases were submitted for NS-1, however there was some crossing of mean data points for successive age groups and a major problem with the 5-yr-old sample. The means for the 5-yr-olds were equivalent to the 7-yr-olds and better than the 6-yr-olds. Because of the uncertainty about the 5- and 6-yr-olds and the small 12-yr-old sample, the report was limited to the 7 through 11 year range. To strengthen the NS-1 study and eliminate the incoherent portions, the data were tempered by Myrick's, White's and Johnson and Sherman's (1979) results. From this information Katz, Johnson and White (1981)

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The Combined National Sample data were gathered by many, many audiologists and speech pathologists. To all of you who took the time to aid in this effort, we all thank you!

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proposed tentative normal limits for C-SSW scores.

Vogel and Johnson (1982) tested the value of the tentative norms compared to Myrick's findings. They found NS-1 to be superior by increasing the identifications among LD children without materially increasing the number of false positives. This lent support to the findings of Stubblefield & Young and White.

NATIONAL SAMPLE II (NS-II)

The purpose of NS-II was to increase the sample of normal subjects so that limits could be assigned with greater confidence and to establish a completely new 5-yr norm. The original data for 5-yr-olds was considered a spoiled sample for two reasons: 1) children were, no doubt, chosen by the clinicians as being capable of taking a 40-item EC test. Perhaps there was a tendency to test youngsters who would be least likely to be frustrated by the procedure, and thus, a better than average group of 5-yr old children comprised the sample; 2) for consistency, the W-22s were used for all age groups, although they are not recommended for young children. This might account for the poorer WDS for the 5-yr-olds, compared to each of the other groups. When the depressed WDSs were subtracted from the R-SSW errors, it made the C-SSW appear too favorable.

New data were solicited for NS-II. The NS-I criteria were used for all groups except the 5-yr-olds. For the 5-yr-olds, clinicians 1) were encouraged to test normal but not exceptional children, 2) were to administer only the first 20 items of the EC test and, 3) used PB-Ks to obtain the WDS scores. Data for seventy subjects between 5 and 12 years were submitted for NS-II. A significant proportion were 5-yr-olds.

NS-I PLUS NS-II: THE C-NS-1985 STANDARD

Table 1 shows the make-up of the combined sample for subjects 5-60 years of age. It includes 183 children 5 through 11 and 104 subjects 12 through 59. Approximately equal numbers of males and females were represented.

TABLE 1.
NORMATIVE POPULATION C-NS-1985:
AGES 5 TO 60

Age Group	Mean Age	Males	Females	Total
5	5-7	11	7	18
6	6-7	15	11	26
7	7-5	4	13	17
8	8-6	24	12	36
9	9-7	17	15	32
10	10-6	17	17	34
11	11-7	9	11	20
Child	Subtotal	(97)	(86)	(183)
12-60	26-5	42	62	104
Total		139	148	287

Table 2 shows the means (M), standard deviations (SD) and normal limits (NL) for C-SSW scores by age group. NL is set at +1 SD for ages 5-12 and +2 SD 12 years and over. Scores larger than the NL values are considered abnormal.

TABLE 2.
COMBINED NATIONAL SAMPLE 1985: C-SSW DATA

Age Group	RNC M	RNC SD	RNC NL	RC M	RC SD	RC NL	LC M	LC SD	LC NL	LNC M	LNC SD	LNC NL
5	5	8	13	36	15	51	40	19	59	7	13	20
6	3	7	10	17	13	30	30	17	47	2	8	10
7	1	5	6	8	7	15	18	11	29	1	5	6
8	1	4	5	6	7	13	10	8	18	0	4	4
9	1	3	4	4	5	9	8	8	16	0*	3	3
10	-1	4	3	3	5#	8	7	7	14	0	3	3
11	-1	3	2	1	3	4	5	6	11	-1	4	3
12-60	-1	2	3	0	2	4	1	4	9	-1	2	3

* was rounded up instead of down # was rounded down instead of up

COMPARISON OF C-NS-1985 STANDARD WITH PREVIOUS STUDIES

The new standard is very similar to the tentative standard of 1981. Excluding the estimates made for the 6-yr olds, all of the NL fell between -1 and +3 of the 1985 norm. Even the estimate proved quite reasonable, varying by as much as +3 and -4. The mean difference was the same as for the all of the groups, about -1%. These differences are extremely small and overall would account for a miniscule diagnostic difference when considering all of the SSW indicators.

Table 3 compares the NL for 5 SSW EC studies. The NS-I was not completely independent as it took other studies into account. Only C-NS-1985 had samples for all ages.

The new C-NS-1985 norms appear to represent a valid and coherent standard by which to judge C-SSW results. Clinicians and researchers are asked to adopt this standard as it is similar to other suggested standards, has a larger sample size than any of the previous studies, follows predictable relationships between competing and noncompeting right and left and importantly from one age group to the next. Finally the norm includes a wide range of ages of normal listeners from across the US and parts of Canada. By adopting a single standard we will reduce confusion, increase communication for purposes journal publications and aid clients and audiologists in transfering information from one another. Comparisons of hit-miss ratios for normal and non normal populations are welcome.

Table 3 Shows various studies in reversed chronological order. Certain data were unavailable at this time for inclusion and are designated by dashes. The studies represented are Berrick, Shubow, Schultz Freed, Fournier and Hughes (1984) [Berr'k]; Katz, Johnson and White (1981) [NS-I]; White (1977) and Myrick (1965).

TABLE 3
:-SSW NORMAL LIMITS IN 5 EC STUDIES

ıge ır.	Study	RNC	RC	LC	LNC
5	C-NS	13	51	59	20
	NS-I	13	50	59	20
6	C-NS	10	30	47	10
	NS-I*	(10)	(33)	(44)	(14)
7	C-NS	6	15	29	6
	NS-I	8	17	29	8
	WHITE	-	13	30	-
	MYRICK	6	35	33	4
8	C-NS	5	13	18	4
	BERR'K	2	15	17	3
	NS-I	4	13	20	4
	WHITE	-	-	24	-
	MYRICK	1	10	33	6
9	C-NS	4	9	17	3
	BERR'K	2	11	16	5
	NS-I	4	10	19	4
	WHITE	-	-	19	-
	MYRICK	5	10	33	4
10	C-NS	3	8	14	3
	BERR'K	0	8	14	3
	NS-I	4	7	17	4
	WHITE	-	-	18	-
	MYRICK	1	6	19	1
11	C-NS	2	4	11	3
	BERR'K	2	7	7	0
	NS-I	4	4	10	4
	MYRICK	3	9	9	0
12-60	C-NS	3	4	9	3

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RESPONSE BIAS NORMS: C-NS-1985
Jack Katz

Most normative studies emphas-
.zed SSW scores and not response
)ias. Some people do not realize
:hat response biases are an integral
)art of the SSW test, others are unconvinced of their importance and still others are unsure just how to establish a normal standard. I'm sort of in the latter group.

Many of us find response biases an indispensible aspect of the SSW test, whether it is used for neurological localization or for auditory processing evaluations-recommendations. Therefore, an appropriate normal standard is needed. Data from NS-I and II were analyzed to obtain the information presented here. The findings for 188 children, 5 through 11 years, were used. All children except the 5-yr-olds were administered 40 items (EC list). The 5-yr-olds were given just the first 20 items of this list.

REVERSALS

Reversals are a form of response bias that can be analyzed numerically. There are a possible 40 reversals, if the entire test is administered. How many can a person have without arousing concern? With adults, one reversal is not usually considered important, but two or more are thought to be significant. Normal children have fewer reversals as they get older (White, 1977). These findings are based on hit-miss ratios rather than on means (M) and standard deviations (SD). Since most people have no reversals and some have 10-15 or even 20, the M and SD do not describe the data very well. For this reason the hit-miss ratio cutoffs were used here.

Table 1 presents all of the response bias cutoffs. Those indicated for reversals for the various age groups produced 7% false positives. This is felt to be a bit high, but perhaps the percentage will be significantly reduced if Engineer's Reversals and Reversal-Ear Effects are eliminated.

The results appear coherent in that there is a steady reduction in the permissible reversals (remember that 5-yr-olds had only 20 items). Please note that these are permissible limits. Additional reversals suggest significance of the finding.

ORDER AND EAR EFFECTS

It is more difficult to determine on what basis the Order/ Ear standars should be set. Thus far, we have treated Order and Ear Effects on a hit-miss basis, as we had reversals. Another approach would be to look at all differences and calculate means and standard deviations. Katz, Johnson and White (1981) presented a set of simple guidelines using the hit-miss principle. The results were easy to follow because distinctions between high/low and low/high were not made. The desire for maximum accuracy encourages us to distinguish between the two Order Effects and the two Ear Effects in stting up norms, if indeed they differ. Order/Ear Effects in the presence of a Type A are ignored.

Should we treat Order H/L and L/H separately? Yes, for both Order and Ear Effects there were more normal children who had 5 or more error differences between halves for the anterior signs. That is to say, Order H/L and Ear L/H were the two that had more discrepancies between halves than the posterior indicators Order L/H and Ear H/L. There were 33 anterior indicators and 21 posterior. The extreme score were not noted in the posterior indications, but were found in the anterior (eg, differences of 14 and 15 points). Furthermore, there were more Order Effects over a 5 point difference than Ear Effects. Thus, it is appropriate to look at each of the four indicators separately.

The normal limits for Order Effect are shown in Table 1. There is a steady decrease in the permitted differences between halves with increasing age. For Order Effect the H/L and L/H are the same except for the 9-yr-olds. For the 188 children in the sample, there were 3.5% false positives for H/L and 1.5 % for L/H.

Normal limits for Ear Effects differ somewhat from the Order Effects. For one thing, the half list for 5-yr-olds did not reduce the numbers with differences of ≥ 5 for Order but did for Ear Effect. A difference of 5 is considered significant for a 5-yr-old taking a 20 item test, the same criterion for an adult taking a 40 item test. A posterior Ear Effect (H/L) was quite unusual in this sample, but the two anterior signs were quite similar to one another with regard to cutoff points.

These findings show what we have known for a long time, that there is a greater tendency toward anterior signs over posterior ones, especially Order Effects (Lucker, 1981). These data indicate that the pattern exists for normal children as well as for those with learning disabilities. Using the criteria in Table 1, 3.5% false positives were noted for Ear L/H and 1.5% for Ear H/L. Overall, there was about a 5% false positive rate for Order as well as for Ear Effects.

TYPE A OR B

Type B's were rare in the NS data. Only 2 cases or 1% reached the adult criterion of a difference of 3 points (as well as $\geq$ 2x each of the other columns). Because they resembled the Type A's, the data for these two indicators were combined.

Table 1 shows the normal limits for differences between column F (or B) vs. each of the other 7 CN. There was a 3% false positive rate using these criteria for significance. One of the six false positive cases had a Type B.

TABLE 1. RESPONSE BIAS CRITERIA -- LIMITS OF NORMAL

AGE GROUP	REVERSALS #	ORDER* H/L	ORDER* L/H	EAR* L/H	EAR* H/L	TYPE A DIFFERENCES**
5	3	7	7	4	4	4
6	6	7	7	7	5	5
7	5	7	7	7	5	5
8	4	6	6	7	5	5
9	3	6	4	7	5	4
10	3	4	4	5	5	4
11	3	4	4	5	5	2
12-59	1	4	4	4	4	2

* Differences for Order and Ear Effects
** Only for columns B or F and also 2X ea. other CN.

TABLE 2. COMPARISON OF RESPONSE BIAS NORMS WITH PREVIOUS DATA

AGE GROUP	REVERSALS #		ORDER* H/L	ORDER* L/H	EAR* L/H	EAR* H/L	TYPE A DIFFERENCES**	
5	(5) 3	(7)	7	7	4	4	(5)	4
6	(5) 6	(7)	7	7	7	5	(5)	5
7	(5) 5	(7)	7	7	7	5	(5)	5
8	(4) 4	(7)	6	6	7	5	(5)	5
9	(4) 3	(7)	6	4	7	5	(5)	4
10	(4) 3	(7)	4	4	5	5	(5)	4
11	(4) 3	(7)	4	4	5	5	(2)	2

COMPARISON WITH PREVIOUS STANDARDS

The May 1983 issue of the SSW reports summarizes previous response bias data, based on the White (1977) Johnson and Sherman (1981) and NS-I. This information is shown in Table 2 (in parentheses) to the left of the C-NS-1985 norm. It can be seen that the C-NS-1985 results are generally quite similar to the previous (temporary) norms. The temporary norms were established to represent a good but conservative standard until final levels could be determined.

SUMMARY

The present standard (C-NS-1985) appears to be an appropriate companion to the C-SSW standard which was described previously. It is based on a large sample of normal children and is internally consistent. It also agrees quite well with the temporary standards that were employed since 1981, with good success. Further analyses and comparisons are always desireable. Please send normative results or data for children with CAP dysfunction to test these cutoff points.