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# REPORTS

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## NATIONAL SAMPLE FOR THE ELDERLY - 1989

Jack Katz (with the help of many)

"Fools rush in where wisemen fear to tread." But what does a wiseman do when he tests a 75 year old person and has no norms with which to decide if the results are normal or not?

In about the 5th grade, I learned a poem that has encouraged me to believe that even difficult problems can be solved. It goes:

Somebody said that it couldn't be done,  
But, he with a chuckle replied,  
Maybe it couldn't, but he would be one,  
Who wouldn't say so till he tried.

So he buckled right in  
With a trace of a grin, on his face.  
If he worried he hid it,  
As he started to tattle the thing  
That couldn't be done, and he did it!

### THE PROBLEM

Aging is a whole-body effect. Some people notice the first signs of aging in their joints, others in their memories, while still others realize that they have impaired sensory functions as they grow older. Eventually, of course, everything starts to go.

We would have no trouble in establishing an SSW norm for elderly people if we could prove that our sample subjects 1) had normal auditory processing and normal hearing as young adults, 2) when evaluated with a (not yet developed) test, could assure us

that they had no significant auditory changes since adulthood, other than "normal aging", and of course 3) that hearing has remained normal. Alas, the lack of that test that tells us if the person has had a normal amount of aging or not might be a long way off. So what do we do until then?

### AN APPROACH

Over the past 10 years, I have asked my students who take the SSW course at UB to test normal individuals of various ages. In addition, some very kind folks have responded to my call for help in solving this normative problem by sending some elderly cases. The criteria used in choosing subjects is that they 1) have no significant history of neurological or otological problems, 2) be considered to have normal listening ability for their age, and 3) have essentially normal hearing for their age.

These criteria provide a good start for developing a norm for the elderly, but they don't eliminate those with rapid aging effects or undiagnosed disorders such as small strokes, early dementia, or cerebral atrophy. These conditions are more likely to be missed or ignored as individuals increase in age. How will these cases be identified?

To guard against the inclusion of abnormal data, we may take a statistical approach to weed out the obviously atypical cases. We assume that those with highly atypical scores are the individuals whose auditory systems are aging at an abnormally rapid rate, or

that there is more to the problem than "normal aging".

### THE NATIONAL SAMPLE, SAMPLE

Ninty-seven cases, 50-96 years of age, have been collected over the past 10 years (many thanks to those who contributed to this work!). This rather large sample permitted an assessment of the data in 5-year units, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79 and because of the limited sample, the oldest group was 80-99 years.

Six subjects (2 males and 4 females) were excluded from the initial sample because they had one or more C-SSW Condition scores that were more than 3 SDs above the mean for their subgroup. Clearly, such deviant scores must be considered "atypical" at least, even if we can't prove that these people had any organic dysfunction.

The initial and final sample sizes are shown in Table 1.

AGE GROUP	INITIAL SIZE	FINAL SIZE
50-54	8	8
55-59	24	22
60-64	24	24
65-69	12	11
70-74	12	11
75-79	11	9
80-99	6	6

New sets of means and standard deviations (SD) were calculated for the remaining 91 subjects. The mean age, sex distribution, word discrimination scores (WDS) and puretone speech averages (500, 1000, 2000 Hz) for the 5-year intervals are shown in Table 2.

### ANALYSIS OF 5-YEAR GROUPINGS

ANOVA's were calculated to compare the performance of the 5-year groupings and the 80-99 year sample. Overall, there were no significant differences among the 5-year groups (50 to 79 years of age), however, in essentially all comparisons, of the

younger groups with the 80-99 year group there was a significant difference. The following variables were considered: R-SSW Conditions, C-SSW Condition, Ear and Total scores. In addition, age comparisons were made for reversals on the SSW test and WDS-R&L, SP AVG-R&L. It was unfortunate that the 80-99 year group was so small (n=6) and that it was the one that was so different from the others. Thus, further study of this group is needed.

Indeed, Arnst (1980) found that by the time a person reached 80 years of age, it was likely (74%) that they would have a moderately (MO) or severely (S) abnormal TEC (by young adult standards). From our small data set we see a similar pattern. Four of the six subjects in the 80-99 year group had MO/S scores. Table 3 shows the C-SSW means and SDs for each of the subgroups.

### AGE CHANGES BY DECADES

Because the ANOVA's did not differentiate the subgroups below 80-99 years from one another, we are justified in combining some or all of these groups because the aging effects on the SSW appear to be rather minor. In fact, a glance at Table 3 shows similarities for both 50 year groups (although, the 55-59 sample appears to be a transition from the very normal early 50's group to the not quite so normal over 50s groups). The similarities within the 60-79 groups is impressive, with the major differences reflecting the differences in WDS more than the SSW itself. For this reason, the data for the six younger groups were combined into three. Table 4 shows the sample size, mean age, sex distribution, WDS and SP AVG scores for for each of the four age-subgroups. Table 5 displays the C-SSW results for the four Conditions.

### EXTENDING THE NATIONAL SAMPLE TO 80 YEARS OF AGE

The Combined National Sample (C-NS-1985) norms for control subjects

TABLE 2. MEAN AGE, SEX DISTRIBUTION, WDS AND PURETONE SPEECH AVERAGES (SP AVG) ARE SHOWN FOR THE AGE GROUPS.

AGE GROUP	MEAN AGE	FE-MALES	MALES	RE WDS	LE WDS	RE SP AVG	LE SP AVG
50-54	52.2	4	4	99.0 (1.85)	97.5 (3.67)	12.0 (8.85)	10.1 (8.92)
55-59	57.0	8	14	95.5 (3.33)	95.9 (3.73)	9.6 (8.20)	11.2 (8.00)
60-64	62.0	13	11	94.2 (4.72)	93.8 (5.14)	11.8 (8.86)	10.2 (7.29)
65-69	66.5	7	4	95.6 (4.18)	93.5 (5.73)	12.4 (9.99)	11.9 (8.15)
70-74	71.7	2	9	93.1 (8.02)	93.3 (6.08)	18.4 (12.21)	18.6 (13.90)
75-79	77.6	1	8	96.2 (4.30)	95.6 (5.08)	16.1 (6.25)	17.0 (8.60)
80-99	87.0	2	4	77.3 (20.66)	79.3 (20.15)	31.2 (12.80)	27.3 (13.16)

TABLE 3. MEANS AND SDs FOR 5-YEAR SUBGROUPS AND THE 80-99 YEAR SAMPLE FOR THE FOUR C-SSW CONDITIONS.

AGE GROUP	C = S S W C O N D I T I O N S			
	RNC	RC	LC	LNC
50-54	.1 (1.88)	0.0 (2.78)	-.4 (4.27)	-2.2 (3.92)
55-59	-3.5 (3.32)	-2.2 (3.62)	1.5 (5.70)	-3.4 (4.25)
60-64	-3.4 (5.11)	.3 (6.60)	3.3 (6.22)	-3.5 (5.00)
65-69	-1.8 (4.96)	3.4 (8.74)	6.8 (14.02)	-3.5 (7.46)
70-74	-3.4 (4.25)	3.6 (6.45)	8.7 (12.17)	-1.8 (5.71)
75-79	-1.1 (5.30)	6.7 (10.06)	6.8 (6.67)	-1.3 (4.56)
80-99	1.0 (19.08)	23.0 (27.56)	30.5 (25.95)	5.0 (12.12)

TABLE 4. MEAN AGE, SEX DISTRIBUTION, WDS AND SPEECH AVERAGE INFORMATION FOR DECADE AGE GROUPS AND SUBJECTS 80-99 YEARS.

AGE GROUP	MEAN AGE	FE-MALES	MALES	RE WDS	LE WDS	RE SP AVG	LE SP AVG
50-59	55.7	12	18	96.4 (3.38)	96.3 (3.72)	10.3 (8.29)	10.9 (8.11)
60-69	63.5	20	15	94.6 (4.54)	93.7 (5.25)	12.0 (9.09)	10.7 (7.50)
70-79	74.4	3	17	94.5 (6.64)	94.3 (5.63)	17.4 (9.81)	17.9 (11.56)
80-99	87.0	2	4	77.3 (20.66)	79.3 (20.15)	31.2 (12.80)	27.3 (13.16)

TABLE 5. MEANS AND SDs FOR DECADE GROUPS AND THE 80-99 YEAR SAMPLE FOR THE FOUR C-SSW CONDITIONS.

AGE GROUP	C = S S W C O N D I T I O N S			
	RNC	RC	LC	LNC
50-59	-2.6 (3.40)	-1.6 (3.51)	1.0 (5.36)	-3.1 (4.13)
60-69	-2.9 (5.04)	1.3 (7.35)	4.4 (9.32)	-3.5 (5.77)
70-79	-2.4 (4.76)	5.0 (8.18)	7.8 (9.88)	-1.6 (5.09)
80-99	1.0 (19.08)	23.0 (27.56)	30.5 (25.95)	5.0 (12.12)

TABLE 6. MEANS, SDs, +1, +2, -1, AND -2 SD POINTS FOR LIMITS OF NORMALITY FOR INDIVIDUALS 60 - 79 YEARS OF AGE. THE FOUR C-SSW CONDITIONS ARE SHOWN.

C-SSW CONDS	MEAN	SD	+1SD	+2SD	-1SD	-2SD
RNC	-2.7	4.90	2.19	7.09	-7.61	-12.51
RC	2.6	7.80	10.44	17.24	-5.16	-12.96
LC	5.7	9.58	15.24	24.82	-3.92	-13.50
LNC	-2.8	5.56	2.76	8.32	-8.36	-13.92

TABLE 7. THE PROPOSED C-SSW NORMS FOR INDIVIDUALS 60-79 YEARS OF AGE. THE +2SD POINTS WERE USED AS THE NORMAL LIMIT. THESE DATA ARE COMPARED WITH THE C-NS-85 NORMS FOR Ss 12-60 YEARS.

AGE GROUP	RNC			RC			LC			LNC		
	M	SD	NL	M	SD	NL	M	SD	NL	M	SD	NL
12-59	-1	2	3*	1	2	4	1	4	9	-1	2	3
60-79	-3	3	4*	3	8	13	6	10	26	-3	6	9

\* when the scores were rounded.

covers ages 5 to 60 years. The norm has proved effective and has gained wide acceptance. From Table 5 we see that the present data seem to follow rationally with increasing age when we look at the data grouped in one or two decades. Performance tends to decrease with age, with those 80 and above demonstrating the poorest performance and the widest SDs.

An ANOVA was calculated to determine if there was a significant difference among the 3 younger groups. As expected there was not. Because the 50 year olds were already part of the C-NS-85 sample, a normative group was made up of the 60 and 70 year old subjects (N=55). The mean age for the group is 67.4 (5.97). Their WDSs are 94.6% (5.34) in the RE and 93.9% (5.35) in the LE. Their puretone speech averages are 13.9 dB (9.63) in the RE and 13.3 (9.72) in the LE.

Table 6 shows that combining the data for Ss 60-79 does not inflate the SDs. And the data can be readily used with the more liberal (easier to fail)  $\pm 1$ SD limits of the more conservative

$\pm 2$ SD. A  $+1$ SD level is used with children 5-12 years of age and the  $+2$ SD is generally used with "adults" 12-60 years. This statistical analysis shows which elderly people are atypical for their group and not necessarily which ones have organic lesions above and beyond the normal aging process. We can say that they performed abnormally, and no doubt that they have auditory processing difficulties.

Table 7 shows the proposed standard for individuals 60-79 using the  $+2$ SD criteria. This is contrasted with the C-NS-85 standard for the four C-SSW Conditions.

I believe that the results look entirely reasonable. No doubt the slightly negative scores for the older sample reflects their poorer hearing and WDS but not major cerebral effects. The larger SDs in the older group increases the acceptable normal levels for individuals 60-79 years. While this does not represent as good scores as the norms for young normals, we have no evidence to show that these

levels are particularly debilitating (such research would be helpful). Generally speaking we can assume that at least the +1SD limit is probably reasonably normal, as these folks did not complain of difficulty and considered themselves essentially normal in communication for their ages.

### DISCUSSION

There have been a number of previous studies dealing with the SSW in elderly populations. In general, they present a consistent picture. For example, McCoy et al. (1977) found (as did Arnst, 1980) that elderly subjects with greater hearing losses were more likely to have poorer C-SSW scores despite the correction factor. We shall look at this factor in the present sample in a later issue.

Amerman and Parnell (1980) tested subjects 60-79 years of age and found their SSW scores to be poorer than expected for young adults. In addition, their Ss showed a great deal of variability. Finally, they showed that age was poorly correlated with the SSW. Each of these findings was replicated in the present study.

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### WHO'S USING WHAT WITH WHOM?

Jack Katz

A priest shocked us with a statement about George Washington. He said that Washington has been revered by all Americans. "After all, George was first in peace, first in war and first in the hearts of his countrymen. And yet," the priest continued, "Washington married a widow."

The point of the above statement is profound (if you dig deep enough). You can't do it all, you can't be all things to all people. Take the SSW test for example. You probably think it a pretty good test (after all, you spend \$10 every two years to see the latest data, or is it to laugh at a

few jokes and to be privy to the irreverent remarks?). The test, as good as it is, still has a way to go before it's done. It's nice to have a long suite, but we have to remember our shortcomings too.

In 1987 Susan Kay Oliver (of the Children's Hospital Medical Center in Oakland, CA) reported on a survey that she conducted from the end of '85 to the middle of '86. The paper, "Current Trends in Central Auditory Processing Testing" was presented at the California Speech-Language-Hearing Association meeting.

From the ASHA Guide to Clinical Services, she sent out 726 questionnaires to both accredited and non-accredited clinics that provided audiological services to learn what central test procedures they were using.

She pointed out that in 1978, I reported on a small survey. At that time, the SSW turned out to be the most typically used tool for testing adults as well as children. The Rush Hughes Difference test came in second for use with adults, while filtered speech (ala Bocca) was second in popularity for evaluating children.

Oliver received 394 of the surveys for an incredible 54% return rate (far more than the usual 25-33% return that we usually expect with questionnaires). Thus, we can assume that the data are fairly representative. Of course, one might argue that of those who did not respond, the major portion are those who do not use central tests. This is the problem that we face with all questionnaire research. But because of the fine turn out it is no doubt as representative as any such study and probably better than most.

Over half of the centers (52%) used central tests. Actually, 33 different tests were listed. Table 1 lists the most common tests performed with children and Table 2, the tests used with adults. The top 9 tests are shown numerically.

You will see that the SSW was the most popular test for evaluating children and, as a matter of fact, it was also the most used procedure for testing adults as well. So, it looks like central tests, over the years, that the SSW is still right up there. You will notice that the Rush Hughes Difference test is still being used but quite infrequently, by this group as is the filtered speech procedure.

Now you can see why the SSW does and next thing you know, you are down at 6%. That is not to say that popularity makes a test a good one. It's how well it works and how well it's

used. Nevertheless, I am gratified that the old SSW is still so widely used after so many years.

It is interesting to compare the results of Oliver's survey with the restricted one that I had carried out in 1976-7. At that time the major referral source for learning disabled children to the audiologists was the physician. At that time, 65% of all such referrals were made by medical doctors. At that time only 10% of the referrals were by the schools. I am sure that at the present time, the largest source of referrals for CAP evaluations are the schools-parents.

Table 1

The Most Common Central Tests Used with Children (after Oliver, 1987)\*.

TEST	<u>MEAN</u> <u>%</u>
1 Staggered Spondaic Word Test	63%
2 Willeford Competing Sent. Test	55%
3 Willeford Filtered Speech Test	46%
4 Willeford Binaural Fusion Test	45%
5 Willeford RASP	44%
6 Speech-in-Noise - Ipsilateral	42%
7 BSERA	36%
8 Speech-in-Noise - Contralateral	24%
9 Pitch Pattern Sequence Test	18%
SSI-ICM	16%
SSI-CCM	13%
Time Compressed Speech	11%
Dichotic Digit Test	7%
Filtered Speech	5%
Binaural Fusion (not Willeford)	5%
Phonemic Synthesis	4%
Language Based Tests	4%
Sentence Integration	3%
Masking Level Difference	3%
Goldman-Fristoe-Woodcock Test	3%
Pediatric Speech Intelligibility	2%
GFW Selective Auditory Attention	2%
Rush Hughes Difference Test	2%
Self devised Listening Tests	2%
Lindamood Auditory Concept. Test	1%
CES, ENG, Short Term Memory Tests	1%
Low Pass Filtered Speech, NU-20	<1%

Table 2

The Most Common Central Tests Used with Adults (after Oliver, 1987)\*.

TEST	<u>MEAN</u> <u>%</u>
1 Staggered Spondaic Word Test	59%
2 BSERA	48%
3 Speech-in-Noise - Ipsilateral	41%
4 Willeford Competing Sent. Test	32%
5 SSI-ICM	29%
6 Willeford Filtered Speech Test	26%
7 SSI-CCM	24%
8 Willeford Binaural Fusion Test	24%
9 Speech-in-Noise - Contralateral	23%
Willeford RASP	22%
Pitch Pattern Sequence Test	11%
Time Compressed Speech	10%
Dichotic CVs	7%
Filtered Speech	6%
Rush Hughes Difference Test	6%
Masking Level Difference	5%
Dichotic Digits	4%
Flowers-Costello Test	3%
Binaural Fusion (not Willeford)	2%
PI-PB Rollover	2%
Sentence Integration	2%
Phonemic Synthesis	2%
Language Based Tests	2%
Wichita Auditory Processing Test	1%
GFW Selective Auditory Attention	1%
<1%: Modified BSERA, NU-20, ENG, NU-BTL, RASP (not Willeford), Detroit	