Rate of Speech/Reading in Dravidian Languages

[1]Savithri S.R. & [2]Jayaram M.

Abstract

Rate of speech is an important variable in the evaluation and treatment of fluency disorders. The present study investigated rate of speech/ reading in 4 Dravidian languages and **established normative data on rate of speech in Kannada, Tamil, Telugu, and Malayalam in subjects ranging in 10 decades of age.** *Four hundred and one (Kannada = 136, Telugu = 69, Tamil = 103, Malayalam = 93) normal subjects participated in the study. All subjects were literates and were from urban population. Informed consent was obtained from subjects prior to collection of speech samples. Subjects in the age range of 4-10 years described cartoons and narrated stories and subjects in the age range of 11-100 years read passages which were developed by the investigators. All these were audio-recorded and analyzed to obtain syllables per second, syllables per minute and words per minute. Cool Edit software was used to eliminate pause and calculate duration. Results indicated significant difference between age groups, and languages. Rate of speech increased with increase in age till about 40 years and declined after 40 years (except Tamil). Malayalam had the highest SS and SPM compared to other languages. No significant difference between genders was observed. The results provide normative data for clinical purposes and to set rate of speech in persons with stuttering and cluttering.*

Key words: Rate of speech, Words per minute, Syllables per minute, Dravidian languages.

Fluency is the effortless production of long, continuous utterances at a rapid rate (Starkweather, 1981). The rate at which speech is produced is an important aspect of fluency. Writers attempting a description of stuttering have most often not included material on normal fluency, even though a substantial scientific literature on the rate, rhythm and timing of normal adult speech has long existed. Descriptions of children's fluency development have referred only to the frequency and type of discontinuities. But it is not just the continuity of speech that signals fluency. The rate of speech, the length of utterances, consistency in the duration of elements, and the overall quantity of speech are also signs of the facility with which speech is produced. With increased age, these signs show developmental change, signaling development of fluency.

Rate of speech is an important variable in the evaluation and treatment of fluency disorders. It is well known that the rate of speech correlates negatively with the severity of stuttering (Bloodstein, 1944; Sander, 1961) because frequent and/or long duration stutters result in reduced speech output. However, a deliberate reduction in the rate of speech has a beneficial effect on the frequency of stutters (Adams, Lewis & Besozzi, 1973; Johnson & Rosen, 1937) and, therefore, nearly all stuttering treatment approaches include rate reduction as one of their goals. Rate control is also a treatment target in cluttering (Daly, 1986). In addition, rate of speech is an important factor in the perceptual evaluation of normalcy of speech following treatment of stuttering (Ingham & Packman, 1978). Extremely slow rate of speech even if completely devoid of dysfluencies, is perceived as unnatural by listeners. There is some preliminary evidence that the rate of speech of parents may be an important factor in incipient stuttering (Meyers & Freeman, 1985; Stephenson-Opsai & Bernstein Ratner, 1988).

The rate of speech primarily depends on the speed of articulatory movement and the degree of coarticulatory overlap. It also depends on the linguistic structure and culture. Rate of speech can be measured in two ways. One is a measure of the

[1]*Professor, Dept. of Speech-Language Sciences, All India Institute of Speech & Hearing, Manasagangothri, Mysore 570 006, email:Savithri_2k@yahoo.com,* [2]*Professor, Dept. of Speech Pathology and Audiology, NIMHANS, Bangalore 560 029,*

number of syllables per unit time. The second is words per minute. The word is more of an information unit than a speech production unit. Consequently, words per minute are a measure of the amount of information a speaker is producing. It is related to but not the same as the rate at which syllables are produced. The more syllables a word contains, the more rapidly each syllable in the word is produced (Klatt, 1973). Word duration and utterance duration seem to depend on the amount of information contained in the utterance, but syllables per second seems independent of content, as long as the sample is to contain a large variety of syllables.

It is important for the practicing clinician to know about these changes, for the assessment of stuttering and cluttering should be made by comparing the client's fluency with the level of fluency that would be expected for a normal person of the same age. Surprisingly, however, there are few empirically derived guidelines available for clinical measurement of rate and for setting goals for rate (Ingham & Cordes, 1997). Adult speakers of English speak at an average rate of 5 to 6 syllables per second (Walker & Black, 1950). When rate is measured in words per minute, most of the variation is attributable to the duration and frequency of pauses. When these pauses are excluded, the variability of speech rate is much reduced (Goldman-Eisler, 1968). The normal rate of speech is 80-180 words per minute. However, one can consider a rate of up to 280 words per minute as normal provided the intelligibility is not affected. This is supported by reports that speech could be compressed up to 275 wpm mechanically with little loss of comprehension, but comprehension declines rapidly at higher speeds.

Rathna, Subba Rao & Bharadwaj (1979) reported 361 syllables per minute and 104 words per minute in spontaneous speech and 427 syllables per minute and 94 words per minute in reading in Kannada. Venkatesh, Purushothama & Poornima (1983) investigated rate of speech in 64 Kannada speakers in the age range of 17-66 years. They reported 282 syllables per minute in adult Kannada speakers. Rathna et. al. took 1-minute sample and Venkatesh et. al. took males, females, urban, rural, literate and illiterate population and recorded conversation. Samples in both these studies are not adequate and do not represent any specific population. Also, pauses were not eliminated in these studies.

Some studies have investigated differences between genders. Johnson (1961) reported higher range and docile values for adult females than for adult males in two spontaneous speech tasks and one reading task. In contrast, Lutz & Mallard (1986) found that adult male subjects talked and read at a faster rate than adult female subjects in their study. However, statistical tests were not performed in either study to determine whether the differences in rate between males and females were significant. In a study of rate of speech in cidren, Haselager, Slis & Rietveld (1991) reported that the boys did not significantly differ from girls in the rate of production of spontaneous speech. It is not known whether the findings of Haselager et. al. would also apply to young adults. It is important, for clinical purposes, to determine whether statistically significant differences exist between adult males and females in the rate of reading and discourse.

Values of approximately 200 SPM or 150 SPM are frequently used in setting goals for rate of speech (Perkins, 1973; Boberg & Kully, 1985) because mean rates of adult discourse tend to converge around these values (Luchsinger, 1965). Answers to basic questions such as the size of the sample necessary to obtain a reliable measure of rate and the variability or stability of rate in different tasks typically used to measure rate in clinical settings are not known. Johnson, Darley & Spriesterbach (1963) recommend that a 3-minute sample of spontaneous speech and a 300-word reading passage be used to determine rate. Castello & Ingham (1984) suggest that a 2-minute sample of uninterrupted speech be used to determine the rate during the evaluation of stuttering. However, there is little objective data in support of these recommendations.

There is also an uncertainty concerning the unit of speech appropriate for the computation of rate. Expression of rate in syllables per minute (SPM) appears to be generally favored over the computation involving words per minute (WPM) because the length of syllables, whether measured in phonemes or in units of time tends to be less variable than length of words (Umeda & Quinn, 1980; Ingham, 1984; Costello & Ingham, 1984). However, there is little empirical evidence to support the view that SPM is a more valid measure of speech rate than WPM, particularly in clinical situations where a certain amount of variability in speech rate is expected and accepted.

Though the rate of speech is an important parameter it has not been studied extensively in the Indian context. As the linguistic structure of Dravidian and Indo-European languages differ, it is probable that the rate of speech also differs. Also, most rate control therapies donot consider age as criteria to set goals for rate of speech. It is hypothesized that age and language have significant effect on the rate of speech. In this context, the present study **established normative data on rate of speech in Kannada, Tamil, Telugu, and Malayalam in subjects ranging in 10 decades of age**. The end results brought out from this project can be utilized as normative data.

This can be used as a reference or standard to measure rate of speech in clients with fluency disorders.

Method

Subjects: Four hundred and one normal subjects in four languages - Kannada, Tamil, Telugu, and Malayalam - participated in the study. All subjects were literates and were from urban population. Informed consent was obtained from the subjects prior to collection of speech samples. Table 1 shows subject details.

Age range/ Language	Kannada		Telugu		Tamil		Malayalam	
Age	M	F	M	F	M	F	M	F
3-3.11	5	5						
4-4.11	5	5						
5-5.11	5	5			2	2		
6-6.11	5	5			3	5		
7-10	5	5			5	5		
11-15	5	5	5	5	5	5	5	5
16-20	5	5	5	5	5	5	5	5
21-30	5	5	5	5	5	5	5	5
31-40	5	5	5	5	5	5	5	5
41-50	5	5	5	5	5	5	5	5
51-60	5	5	5	5	5	5	5	5
61-70	5	5	3	3	5	5	5	5
71-80	5	5	1	0	5	5	5	5
81-90	5	1	2	0	0	1	5	5
91-100	0	0	0	0	0	0	1	2
Sub-total	70	66	36	33	50	53	46	47
Total	401							

Table 1: Details of subjects.

Material: Cartoons (4-6 years), pictures depicting Panchatantra stories (7-10 years), and standardized reading passages were used to elicit spontaneous speech/reading samples. Pictures of cartoons and Panchatantra stories were taken from Indu (1992) Yamini (1992) and Rajendra Swamy (1995). Passages in four languages were developed by the experimenters. There were 304, 306, 414, and 307 words in Kannada, Telugu, Tamil, and Malayalam passages, respectively.

Procedure: Children in the age range of 4-10 years were instructed to describe the cartoons and story, and adults read the passage at a comfortable pitch and loudness. All samples were audio-recorded and were digitized at 16,000 Hz sampling frequency. Pauses, if any, were removed from the waveform using Cool Edit software. Each syllable

and word was highlighted using the waveform and the duration was measured using the software. The number of syllables per second (SS), syllables per minute (SPM) and words per minute (WPM) were calculated by using the following formule:

SS = Total number of syllables / Total time taken (seconds).

SPM = Total number of syllables /Total time taken (minute).

WPM = Total number of words / Total time taken (minute).

Statistical analysis: ONE-WAY ANOVA was done to compare the rate of speech across age, gender, and language, and MANOVA was used to examine the interaction effects.

Results

Kannada

The results indicated an increase in SS, SPM and WPM from 3 years to 40 years and decrease in SS, SPM and WPM in the age group of 41-90 years. Table 2 shows the mean and range of syllables per second (SS), syllables per minute (SPM) and words per minute (WPM) from 3 to 90 years in Kannada speaking subjects.

Age	M/SD	SS	SPM	WPM	
3-3.11	Mean	4.9	291	129	
	SD	1.3	78	34	
4-4.11	Mean	4.2	252	91	
	SD	.79	48	17	
5-5.11	Mean	4.2	254	120	
	SD	1.3	79	37	
6-6.11	Mean	4.3	261	92	
	SD	0.84	50	18	
7-10	Mean	4.1	250	85	
	SD	0.65	41	14	
11-15	Mean	5.7	343	104	
	SD	.83	48	14	
16-20	Mean	7.0	425	127	
	SD	.96	58	17	
21-30	Mean	6.5	386	116	
	SD	.96	70	21	
31-40	Mean	7.2	434	131	
	SD	.31	19	6	
41-50	Mean	6.8	410	124	
	SD	.87	53	16	
51-60	Mean	6.9	415	124	
	SD	.62	37	11	
61-70	Mean	6.9	404	125	
	SD	.73	52	12	
71-80	Mean	6.4	390	118	
	SD	.85	51	15	
81-90	Mean	5.6	337	102	
	SD	.97	58	17	
	Mean	5.3	318	104	
	SD	2.20	133	40	

Table 2: Mean and SD of rate of speech in Kannada speakers.

ONE-WAY ANOVA indicated significant difference between age groups {SS = [F (14, 121) = 16.70, p < 0.01], SPM = [F (14, 121) = 15.665, p < 0.01], WPM = [F (14, 121) = 5.718, p < 0.01]}. Tables 3 to 5 show results of the Duncan's post-hoc test. Values in the same column are not significantly different.

Age Group	1	2	3	4
3-3.11	4.2358			
4-4.11	4.2031			
5-5.11	4.2358			
6-6.11				
7-10				
11-15		5.7000	5.7000	
16-20				7.0300
21-30			6.4900	
31-40				7.1800
41-50				6.7900
51-60				6.8640
61-70				6.9540
71-80			6.4400	6.4400
81-90		5.6200		

Table 3: Results of Duncan's post-hoc test for SS (Kannada).

Age Group	1	2	3	4	5
3-3.11	290.9821				
4-4.11	252.1879				
5-5.11	254.1461				
6-6.11					
7-10					
11-15			343.10	343.10	
16-20					425.10
21-30			385.50	385.50	385.50
31-40					434.20
41-50					410.41
51-60					415.10
61-70					403.60
71-80				389.80	389.80
81-90		337.3400	337.34		

Table 4: Results of Duncan's post-hoc test for SPM (Kannada).

Age Group	1	2	3
3-3.11			128.6358
4-4.11	91.3535		
5-5.11		119.7360	119.7360
6-6.11	92.3000		
7-10	84.5000		
11-15	103.6844	103.6844	
16-20			127.3501
21-30		116.2539	116.2539
31-40			131.0137
41-50			123.6824
51-60			124.1360
61-70			124.8651
71-80		117.7516	117.7516
81-90	101.7867	101.7867	

Table 5: Results of Duncan's post-hoc test for WPM (Kannada).

Telugu

SS, SPM, and WPM increased till 30 years and declined thereafter. Table 6 shows mean and SD of SS, SPM, and WPM.

Age	M/SD	SS	SPM	WPM
11-15	Mean	7	431	123
	SD	1.25	132	37
16-20	Mean	7	439	125
	SD	0.61	36	10
21-30	Mean	8	466	133
	SD	0.58	36	10
31-40	Mean	6	384	116
	SD	0.95	54	23
41-50	Mean	7	389	117
	SD	1.04	75	20
51-60	Mean	6	392	110
	SD	1.04	69	18
61-70	Mean	6	336	96
	SD	0.99	60	17
71-80	Mean	5	309	89
	SD	0.19	11	4
81-90	Mean	5.14	309	88.82
	SD	0.19	11.31	3.85
	Mean	6.4	384	111
	SD	0.76	53.81	15.87

Table 6: Mean and SD of rate of speech in Telugu speakers.

ONE-WAY ANOVA indicated significant difference between age groups {SS = [F (8, 73) = 4.832, p < 0.01], SPM = [F (8, 731) = 2.495, p < 0.05], WPM = [F (10, 91) = 2.285, p < 0.05]}. Tables 7 to 9 show results of the Duncan's post-hoc test. Values in the same column are not significantly different.

Age Group	1	2	3	4
11-15		6.2460	6.2460	
16-20			6.9700	6.9700
21-30			7.4060	7.4060
31-40				7.7100
41-50		6.3750	6.3750	
51-60			6.8970	6.8970
61-70		6.4230	6.4230	
71-80	5.5990	5.5990		
81-90	5.1400			

Table 7: Results of Duncan's post-hoc test for SS (Telugu).

Age Group	1	2	3
11-15			441.1000
16-20		421.0000	421.0000
21-30			438.7000
31-40			466.1000
41-50	384.3000	384.3000	384.3000
51-60	389.4000	389.4000	389.4000
61-70	391.9000	391.9000	391.9000
71-80	337.3000	337.3000	
81-90	309.0000		

Table 8: Results of Duncan's post-hoc test for SPM (Telugu).

Age Group	1	2	3
11-15			126.0180
16-20		120.3800	120.3800
21-30		125.2300	125.2300
31-40			133.1500
41-50	116.0610	116.0610	116.0610
51-60	116.6800	116.6800	116.6800
61-70	110.1630	110.1630	110.1630
71-80	96.4930	96.4930	
81-90	88.8200		

Table 9: Results of Duncan's post-hoc test for WPM (Telugu).

Tamil

SS, SPM, and WPM increased from 5 years to 80 years. However, there was no consistent linear increase in the rate of speech. Table 10 shows mean and SD of SS, SPM, and WPM.

Age	M/SD	SS	SPM	WPM	
5-5.11	Mean	4.9950	299.4675	113.9975	
	SD	1.0360	62.3379	23.7109	
6-6.11	Mean	4.6484	278.9059	86.0060	
	SD	1.0709	64.2550	19.8293	
7-10	Mean	6.6920	401.5178	123.8661	
	SD	1.6674	100.0455	30.8635	
11-15	Mean	4.5113	271.7749	94.6891	
	SD	.3627	21.8501	7.7201	
16-20	Mean	6.5238	383.5347	133.0958	
	SD	.7114	53.0329	18.4800	
21-30	Mean	6.5044	390.8467	135.6623	
	SD	1.2267	73.5010	25.4697	
31-40	Mean	5.4654	326.3887	113.5195	
	SD	1.1116	67.7142	23.5099	
41-50	Mean	5.9058	352.6335	122.4497	
	SD	.8357	49.1482	17.2613	
51-60	Mean	5.4330	326.3735	114.8765	
	SD	.8551	51.5573	20.3268	
61-70	Mean	5.6564	339.9639	118.0024	
	SD	1.0284	61.8869	21.4296	
71-80	Mean	5.9033	353.8821	123.3533	
	SD	.9218	54.2288	18.5347	
Average	Mean	5.7169	342.1399	117.0508	
	SD	1.2058	72.3806	24.6119	

Table 10: Mean and SD of rate of speech in Tamil speakers.

ONE-WAY ANOVA indicated significant difference between age groups {SS = [F (10, 91) = 4.719, p < 0.01], SPM = [F (10, 91) = 4.398, p < 0.01], WPM = [F (10, 91) = 4.459, p < 0.01]}. Tables 11 to 13 show results of the Duncan's post-hoc test. Values in the same column are not significantly different.

Age Group	1	2	3	4	5
5-5.11	4.9950	4.9950	4.9950		
6-6.11	4.6484	4.6484			
7-10					6.6920
11-15	4.5113				
16-20				6.5238	6.5238
21-30				6.5044	6.5044
31-40	5.4654	5.4654	5.4654	5.4654	
41-50			5.9058	5.9058	5.9058
51-60	5.4330	5.4330	5.4330	5.4330	
61-70		5.6564	5.6564	5.6564	5.6564
71-80			5.9033	5.9033	5.9033

Table 11: Results of Duncan's post-hoc test for SS (Tamil).

Age Group	1	2	3	4	5
5-5.11	299.4675	299.4675	299.4675		
6-6.11	278.9059	278.9059			
7-10					401.5178
11-15	271.7749				
16-20				383.5347	383.5347
21-30				390.8467	390.8467
31-40	326.3887	326.3887	326.3887	326.3887	
41-50			352.6335	352.6335	352.6335
51-60	326.3735	326.3735	326.3735	326.3735	
61-70		339.9639	339.9639	339.9639	339.9639
71-80			353.8821	353.8821	353.8821

Table 12: Results of Duncan's post-hoc test for SPM (Tamil).

Age Group	1	2	3
5-5.11		113.9975	113.9975
6-6.11	86.0060		
7-10			123.8661
11-15	94.6891	94.6891	
16-20			133.0958
21-30			135.6623
31-40		113.5195	113.5195
41-50			122.4497
51-60		114.8765	114.8765
61-70			118.0024
71-80			123.3533

Table 13: Results of Duncan's post-hoc test for WPM (Tamil).

Malayalam

SS, SPM, and WPM increased from 11 years to 30 years and decreased steadily from 31 years to 100 years. Table 14 shows mean and SD of SS, SPM, and WPM.

Age	M/SD	SS	SPM	WPM	
11-15	Mean	7.9082	474.4926	115.2427	
	SD	.8486	50.9189	12.3654	
16-20	Mean	8.8040	528.9257	128.2894	
	SD	1.2238	73.3538	17.7127	
21-30	Mean	9.2600	557.9370	135.4231	
	SD	.9902	61.7733	14.9202	
31-40	Mean	8.2000	492.1712	119.4511	
	SD	.6055	35.5242	8.5534	
41-50	Mean	7.9000	476.6454	115.6346	
	SD	1.2275	80.9450	19.7229	
51-60	Mean	7.9390	482.6940	117.1112	
	SD	1.0498	66.8788	16.1906	
61-70	Mean	7.8170	447.6767	109.9117	
	SD	.5858	66.2682	12.4797	
71-80	Mean	7.0350	423.1902	102.3253	
	SD	1.6478	99.4643	23.9974	
81-90	Mean	6.6160	397.8133	96.4343	
	SD	.8643	51.8349	12.7868	
91-100	Mean	4.2800	257.4613	62.6108	
	SD	.7302	43.9912	10.7018	
	Mean	7.8240	468.6865	113.8287	
	SD	1.4037	87.6557	21.0098	

Table 14: Mean and SD of rate of speech in Malayalam speakers.

ONE-WAY ANOVA indicated significant difference between age groups conditions {SS = [F (9, 83) = 9.173, p < 0.01], SPM = [F (10, 91) = 8.241, p < 0.01], WPM = [F (10, 91) = 8.606, p < 0.01]}. Tables 15 to 17 show results of Duncan's post-hoc test. Values in the same column are not significantly different.

Age Group	1	2	3	4	5
11-15			7.9082	7.9082	
16-20				8.8040	8.8040
21-30					9.2600
31-40			8.2000	8.2000	8.2000
41-50				7.9000	7.9000
51-60				7.9390	7.9390
61-70				7.8170	7.8170
71-80				7.0350	7.0350
81-90		6.6160			
91-100	4.2800				

Table 15: Results of Duncan's post-hoc test for SS (Malayalam).

Age Group	1	2	3	4	5
11-15			474.4926	474.4926	
16-20				528.9257	528.9257
21-30					557.9370
31-40			492.1712	492.1712	492.1712
41-50			476.6454	476.6454	
51-60			482.6940	482.6940	
61-70		447.6767	447.6767		
71-80		423.1902	423.1902		
81-90		397.8133			
91-100	257.4613				

Table 16: Results of Duncan's post-hoc test for SPM (Malayalam).

Age Group	1	2	3	4	5
11-15			115.2427	115.2427	
16-20				128.2894	128.2894
21-30					135.4231
31-40			119.4511	119.4511	119.4511
41-50			115.6346	115.6346	
51-60			117.1112	117.1112	
61-70		109.9117	109.9117		
71-80		102.3253	102.3253		
81-90		96.4343			
91-100	62.6108				

Table 17: Results of Duncan's post-hoc test for WPM (Malayalam).

Comparison of languages

MANOVA showed significant difference between languages {S − [F (3,325) = 85.323, p < 0.001], SPM - [F (3,325) =64.822, p < 0.001]} on syllables per second and syllables per minute. No significant differences between languages on WPM were evident. Also, no significant gender difference was observed. Table 18 shows results of post-hoc Duncan's test for significant difference between languages. Results indicate no significant difference between Tamil and Kannada and significant difference between Telugu and other languages, and Malayalam and other languages (SS and SPM). Values in the same column are not significantly different.

	N	Subset			
		SS			
Language		1	2	3	
Tamil	103	5.6720			
Kannada	136	5.7771			
Telugu	82		6.6651		
Malayalam	93			7.8240	
		SPM			
Tamil	103	339.4596			
Kannada	136	346.7957			
Telugu	82		406.2927		
Malayalam	93			468.6865	

Table 18: Results of Duncan's test on significant difference between languages.

Discussion

The results indicated significant differences in rate of speech/ reading across Dravidian languages. On an average the rate was 6, 6, 6, and 8 syllables per second in Kannada, Telugu, Tamil, and Malayalam, respectively; the syllables per minute was 346, 384, 342, and 469; words per minute was 113, 111, 117, and 114 in the four languages, respectively. The average rate of reading in Kannada, Telugu, and Tamil are in consonance with the earlier studies by Walker & Black (1950), Rathna et. al. (1979), and Venkatesh et. al (1983). However, Malayalam seems to be an exception with higher rates of SS and SPM. The differences between languages can be attributed to differences in syllable structure. Table 19 shows the syllable types and percent occurrence of such syllables in four Dravidian languages. The data is extracted from the reading passages used in this study. Unlike in Kannada, consonants occur in word-final position in Telugu, Tamil and Malayalam. Higher occurrence of V type of syllables and lower occurrence of CCV type of syllables in Malayalam compared to Kannada and Tamil seems to contribute to higher syllables per second in Malayalam.

Syllable type	Kannada	Telugu	Tamil	Malayalam
V	6.3	8.2	4.8	7.3
CV	73	67	54	74
CCV	21	22	0.4	3.6
CVC		1.6	38	13.4
CCVC		0.5		0.2
CCCV		0.2		
VCC			0.1	0.2
VC			2.7	1.1
CVCC			0.3	0.2
Total	100	100	100	100

Table 19: Percent syllable type in four Dravidian languages.

One of the criteria for successful treatment outcome in fluency disorders is a speech rate within normal limits. This is to ensure that a reduction in stuttering is not achieved by abnormally slowing down speech rate that might adversely affect speech naturalness. A major basis of this study was that speech rate data available in the literature is not appropriate for formulating target rates in rate control therapies because rate of speech/ reading depends on age and language. A rate at the lower boundary of 95% confidence interval for mean may be appropriate for setting goals in rate control therapies. That is the rate as

prescribed in Appendix I may be set as a goal in rate control therapy depending upon the age and language of the subjects.

Summary and Conclusions

Rate of speech is an important variable in the evaluation and treatment of fluency disorders. It is well known that the rate of speech correlates negatively with the severity of stuttering because frequent and/or long duration stutters result in reduced speech output. However, a deliberate reduction in the rate of speech has a beneficial effect on the frequency of stutters and, therefore, nearly all stuttering treatment approaches include rate reduction as one of their goals. Rate control is also a treatment target in cluttering. In addition, rate of speech is an important factor in the perceptual evaluation of normalcy of speech following treatment of stuttering. Extremely slow rate of speech, even if completely devoid of dysfluencies, is perceived as unnatural by listeners. It is important for the practicing clinician to know about these changes, for the assessment of stuttering and cluttering should be made by comparing the client's fluency with the level of fluency that would be expected for a normal person of the same age.

Surprisingly, however, there are few empirically derived guidelines available for clinical measurement of rate and for setting goals for rate. Values of approximately 200 SPM or 150 SPM are frequently used in setting goals for rate of speech (Perkins, 1973; Boberg & Kully, 1985) because mean rates of adult discourse tend to converge around these values (Luchsinger, 1965). However, rate of speech depends on age, gender and language and therefore a common rate can't be set as a goal in rate control therapy for various age groups and languages. But, there is little objective data in support of these recommendations. In this context, the present study investigated rate of speech/ reading in 4 Dravidian languages and ***established normative data on rate of speech in Kannada, Tamil, Telugu, and Malayalam in subjects ranging in 10 decades.***

Four hundred and one (Kannada = 136, Telugu = 69, Tamil = 103, Malayalam = 93) normal subjects participated in the study. All subjects were literates and were from urban population. Informed consent was obtained from subjects prior to collection of speech samples. Subjects in the age range of 4-10 years described cartoons and narrated stories and subjects in the age range of 11-100 years read passages which were developed by the investigators. All these were audio-recorded and analyzed to obtain syllables per second, syllables per minute and words per minute. Cool Edit software was used to eliminate pause and calculate duration.

Results indicated significant difference between age groups, and languages. Rate of speech increased with increase in age till about 40 years and declined after 40 years (except Tamil). Malayalam had the highest SS and SPM compared to other languages. No significant difference between genders was observed. The results provide normative data for clinical purposes and to set rate of speech in persons with stuttering and cluttering.

References

Adams, M., Lewis, J., & Besozzi, T. (1973). The effect of reduced reading rate on stuttering fluency. *Journal of Speech and Hearing Research, 16,* 671-675.

Bloodstein, O. (1944). Studies in the psychology of stuttering: XIX. The relationship between oral reading rate and severity of stuttering. *Journal of Speech Disorders, 9,* 161.

Boberg, E., & Kully, D. (1985). *Comprehensive stuttering program: Clinical Manual.* San Diego, CA: College-Hill.

Costello, J. M., & Ingham, R. J (1984). Assessment strategies in stuttering: In R. F. Curlee & W. H. Perkins (Eds.). *Nature and treatment of stuttering: New directions.* San Diego, Ca: College-Hill Press.

Daly, D. A. (1986). The clutterer. In K. O. St.Louis (Ed.). *The atypical stutterer.* Orlando, Fl: Academic Press.

Goldman-Eisler, F. (1968). Psycholinguistics: Experiments in spontaneous speech. New York: Academic Press.

Haselagar, G. I. T., Slis, I. H., & Rietveld, A. C. M. (1991). An alternative method of studying the development of rate. *Clinical Linguistics and Phonetics, 5,* 53-63.

Ingham, R. (1984). Stuttering and behavior therapy: current status and experimental foundations. San Dieogo, Ca: College-Hill Press.

Ingham, R. J., & Cordes, A. K. (1997). Self-measurement and evaluating stuttering treatment efficacy. In R. F. Curlee & G. M. Siegel (Eds.). *Nature and treatment of stuttering*. Boston: Allyn and Bacon.

Ingham, W., & Packman, A. C. (1978). Perceptual assessment and speaking rate and dysfluency of adult male and female stutteres and nonstutterers. *Journal of Speech and Hearing Research, 21,* 63-73.

Johnson, W (1961). Measurements of oral reading and speaking rate and dysfluency of adult male and female stutterers and non stutterers. *Journal of speech and Hearing Disorders (*Monograph Supplement), *7,* 1-20.

Johnson, W., & Rosen, L. (1937). Studies in psychology of stuttering: VII. Effect of certain changes in speech pattern upon frequency of stuttering. *Journal of Speech Disorders, 2,* 105-109.

Johnson, W., Darley, F. L., & Spriesterbach, D. C. (1963). *Diagnostic methods in speech pathology.* New York: Harper & Row.

Klatt, D. (1973). Interaction between two factors that influence o\vowel duration. *Journal of the Acoustical Society of America, 54,* 1102-1104.

Luchsinger, R. (1965). *Voice – Speech - Language.* Belmont, CA: Wadsworth Publishing Company.

Lutz, K. C., & Mallard, A. R. (1986). Disfluencies and rate of speech in young adult nonstutterers. *Journal of Fluency Disorders, 11,* 307-316.

Meyers, S. C., & Freeman, F. J. (1985). Mother and child speech rates as a variable in stuttering and dysfluency. *Journal of Speech and Hearing Research, 28,* 436-444.

Perkins, R. W. (1973). Replacement of stuttering with normal speech: II Clinical procedures. *Journal of Speech and Hearing Disorders, 38,* 283-294.

Rathna, N., Subba Rao, T. A., & Bharadwaj, A. K. (1979). Rate of speech in Kannada. Cit. in C. S Venkatesh, G. Purushothama, & M. S. Poornima (1983). Normal rate of speech in Kananda. *Journal of the All India Institute of Speech and Hearing*, 15, 7-12.

Sander, E. (1961). Reliability of the Iowa speech dysfluency test. *Journal of Speech and Hearing Disorders (*Monograph Supplement), *7,* 21-30.

Stephenson-Opsal, D., & Bernstein Ratner, N. (1988). Maternal speech rate modification and childhood stuttering. *Journal of Fluency Disorders, 13,* 49-56.

Umeda, N., & Quinn, M. S. (1980). Some notes on reading: Talkers, material and reading rate. *Journal of Speech and Hearing Research, 23,* 56-72.

Venkatesh, C. S., Purushothama, G., & Poornima, M. S. (1983). Normal rate of speech in Kannada. *Journal of the All India Institute of Speech and Hearing*. 15, 7-12.

Walker, C., & Black, J. (1950). *The intrinsic intensity of oral phrases* (Joint Project Report No. 2). Pensacola, Fla,: Naval Air Station, U. S. Naval School of Aviation Medicine.

Appendix I– Normative data on rate of speech/reading in 4 Dravidian languages

M = Mean, A= Average

Age		Kannada			Telugu			Tamil			Malayalam		
		SS	SPM	WPM	SS	SPM	WPM	SS	SPM	WPM	SS	SPM	WPM
3-3.11	M	4.9	291	129									
	SD	1.3	78	34									
4-4.11	M	4.2	252	91									
	SD	.79	48	17									
5-5.11	M	4.2	254	120				5	299	114			
	SD	1.3	79	37				1	62	24			
6-6.11	M	4.3	261	92				4.65	278	86			
	SD	0.84	50	18				1	64	20			
7-10	M	4.1	250	85				6.7	402	130			
	SD	0.65	41	14				1.67	100	31			
11-15	M	5.7	343	104	7	431	123	4.5	272	95	7.9	474	115
	SD	.83	48	14	1.25	132	37	.4	22	8	.8	51	12
16-20	M	7.0	425	127	7	439	125	6.5	384	133	8.8	529	128
	SD	.96	58	17	0.61	36	10	.7	53	18	1.2	73	18
21-30	M	6.5	386	116	8	466	133	6.5	391	136	9.3	558	135
	SD	.96	70	21	0.58	36	10	1.2	74	25	.9	62	15
31-40	M	7.2	434	131	6	384	116	5.5	326	114	8.2	492	119
	SD	.31	19	6.	0.95	54	23	1.1	68	24	.6	36	9
41-50	M	6.8	410	124	7	389	117	5.9	353	122	7.9	477	116
	SD	.87	53	16	1.04	75	20	.8	49	17	1.2	81	20
51-60	M	6.9	415	124	6	392	110	5.4	326	115	7.9	483	117
	SD	.62	37	11	1.04	69	18	.9	52	20	1	67	16
61-70	M	6.9	404	125	6	336	96	5.7	340	118	7.8	448	110
	SD	.73	52	12	0.99	60	17	1	62	21	.6	66	12
71-80	M	6.4	390	118	5	309	89	5.9	354	123	7	423	102
	SD	.85	51	15	0.19	11	4	.9	54	19	1.6	99	24
81-90	M	5.6	337	102	5.14	309	88.8				6.6	398	96
	SD	.97	58	17	0.19	11.3	3.85				.86	52	13
91-100	M										4.3	257	63
	SD										.7	44	11
A	**M**	**5.3**	**318**	**104**	**6.4**	**384**	**111**	5.7	34	117	**7.8**	**469**	**114**
	SD	**2.20**	**133**	**40**	**0.76**	**53.8**	**15.9**	1.2	72	25	**1.4**	**88**	**21**

95% confidence intervals for mean
LB: Lower boundary, UB: Upper boundary

Kannada						
Age	**SS**		**SPM**		**WPM**	
	LB	UB	LB	UB	LB	UB
3-3.11	3.9	5.8	235	347	104	153
4-4.11	3.6	4.8	218	286	79	104
5-5.11	3.3	5.2	198	310	93	146
6-6.11	3.7	4.9	225	296	80	105
7-10	3.7	4.6	220	279	75	94
11-15	5.1	6.3	309	377	94	114
16-20	6.3	7.7	383	466	115	139
21-30	5.8	7.2	336	435	101	131
31-40	7.0	7.4	421	448	127	135
41-50	6.2	7.4	372	448	112	135
51-60	6.4	7.3	388	442	116	132
61-70	6.4	7.5	366	441	117	133
71-80	5.8	7.1	353	426	107	129
81-90	4.6	6.6	276	399	83	120

Tamil						
Age	**SS**		**SPM**		**WPM**	
	LB	UB	LB	UB	LB	UB
5-5.11	3.3	6.6	200	399	76	152
6-6.11	3.7	5.5	225	333	69	103
7-10	5.5	7.9	330	473	101	146
11-15	4.3	4.8	256	287	89	100
16-20	6.0	7.0	346	421	120	146
21-30	5.6	7.4	338	443	117	154
31-40	4.7	6.2	278	374	97	130
41-50	5.3	6.5	317	388	110	135
51-60	4.8	6.0	289	364	100	129
61-70	4.9	6.4	296	384	103	133
71-80	5.2	6.6	315	393	110	137

Telugu						
Age	**SS**		**SPM**		**WPM**	
	LB	UB	LB	UB	LB	UB
11-15	5.4	7.1	315	567	90	162
16-20	6.1	7.9	367	475	105	136
21-30	7.0	7.8	413	464	118	132
31-40	7.3	8.1	441	492	126	141
41-50	5.7	7.1	346	422	100	132
51-60	6.2	7.6	336	443	102	131
61-70	5.7	7.2	342	441	97	123
71-80	4.9	6.2	297	377	85	108
81-90	3.4	6.9	207	411	54	123

Malayalam						
Age	**SS**		**SPM**		**WPM**	
	LB	UB	LB	UB	LB	UB
11-15	7.3	8.5	438	511	106	124
16-20	7.9	9.7	476	581	116	141
21-30	8.6	10	514	602	125	146
31-40	7.7	8.6	467	518	113	126
41-50	7.0	8.8	419	535	101	130
51-60	7.2	8.7	435	531	106	129
61-70	7.4	8.2	400	495	101	119
71-80	5.9	8.2	352	494	85	119
81-90	6.0	7.2	360	435	87	106
91-100	2.5	6.0	148	367	36	89