APHASIOLOGY, 1997, VOL. 11, NO. 4/5, 533–542

Aphasia in African-Americans and Caucasians: severity, improvement, and rate of improvement

R. T. WERTZ, L. L. AUTHER and K. B. ROSS

Veterans Administration Medical Center, TN, USA, and
Vanderbilt University School of Medicine, Nashville, TN, USA

Abstract

We compared initial severity, amount of improvement, and rate of improvement of aphasia in African-Americans and Caucasians. Study patients were aphasic subsequent to a first, left hemisphere, thromboembolic infarct, and all were entered in a 44-week treatment trial designed to provide 6–8 h of treatment each week between 4 and 48 weeks post-onset. There was no significant difference between African-Americans and Caucasians in severity of aphasia on the Porch Index of Communicative Ability, a word fluency measure, or the Token Test prior to the initiation of treatment at 4 weeks post-onset. At 48 weeks post-onset, African-Americans performed significantly lower on the Porch Index of Communicative Ability Gestural and Graphic modality scores. Both African-American and Caucasian aphasic patients displayed significant improvement in aphasia during the 44-week treatment trial, and there were no significant differences between groups in the amount or rate of improvement. Thus, our samples of African-American and Caucasian aphasic patients displayed essentially the same initial severity, amount of improvement, and rate of improvement of aphasia during the first year post-onset.

Introduction

Risk (Kittner *et al.* 1993); incidence (Kittner *et al.* 1990); and mortality and morbidity (Carter *et al.* 1992) of stroke are higher in African-Americans than in Caucasians and most other minority groups even after adjusting for age, hypertension, and diabetes. In addition, outcome following stroke may be poorer in African-Americans than in Caucasians (Gillum 1988). African-Americans appear to have more intracranial occlusive cerebral disease, and Caucasians have more extracranial occlusive disease (Inzitari *et al.* 1990). This difference in stroke localization may have significant behavioural consequences. For example, initial physical and functional impairment subsequent to stroke is significantly more severe in African-Americans than in Caucasians (Horner *et al.* 1991). Improvement in functional impairment is slower, and improvement in physical impairment is less.

Observations of functional deficits and their recovery in African-American stroke patients and comparisons with Caucasian stroke patients have focused on activities of daily living (Haerer and Woolsey 1975, Horner *et al.* 1991, Howard *et al.* 1985, 1986, Keller 1972). There have been no systematic investigations

Address correspondence to: Robert T. Wertz, PhD, Audiology and Speech Pathology, VA Medical Center, 1310 24th Avenue, South, Nashville, TN 37212, USA.

0268–7038/97 $12·00

of aphasia subsequent to stroke in African-Americans (Peters-Johnson and Taylor 1986, Taylor 1992, Wallace 1996). Thus, severity and prognosis for improvement in aphasia for African-American stroke patients are unknown, and differences in severity and improvement in aphasia between African-American and Caucasian stroke patients, to our knowledge, have not been reported.

Several problems complicate comparison of severity and prognosis for improvement in aphasia between African-American and Caucasian stroke patients. First, even though a higher risk and incidence of stroke in African-Americans than in Caucasians would not dictate greater severity and a poorer prognosis, increased general morbidity subsequent to stroke in African-Americans may imply more severe aphasia and less improvement. A comparison of severity and improvement in aphasia between African-Americans and Caucasians would require employing rigid selection criteria in selecting study patients. If we are interested in the influence of race on severity and improvement, we need to ensure all other influences on severity and improvement are, essentially, equal.

Second, there may be premorbid racial differences that influence the severity of and improvement in aphasia subsequent to stroke. For example Jackson (1985) suggests development and ageing differ between African-Americans and Caucasians. Wallace's (1993) survey of neurological impairment among elderly African-American and Caucasian nursing-home residents may demonstrate the influence of these variables on the type of neurological impairment that occurs. She reports the diagnosis of neurological impairment in African-American and Caucasian males was similar; however, there was a higher prevalence of neurological impairment in African-American females than in Caucasian females. Significantly more African-American males were observed to be impaired subsequent to stroke, whereas more Caucasian males were observed to be impaired subsequent to a non-specific dementia.

Third, the measures used to assess severity and improvement in aphasia may be culturally biased (Anderson and Ulatowska 1978, Taylor 1992, Wallace 1996). Aphasia tests, for the most part, were developed using educated, middle-class, Caucasians as the normative sample. Thus, the linguistic diversity in African-Americans may be ignored or penalized by these measures. Alternatively, the restricted range of responses measured, for example, primarily at the lexical and sentence level, may have limited value in relating severity of aphasia to functional outcome in communicative competence (Chapman and Ulatowska 1994, Holland 1983, Holland and Forbes 1986).

Fourth, if treatment for aphasia influences improvement, availability and utilization of treatment, as well as the nature and content of the treatment provided, may result in differences in improvement between African-Americans and Caucasians. Kenton (1991) implies access to neurological care differs among races, and Harris (1992) speculates that African-Americans, especially older African-Americans, are less likely to utilize the treatment resources that are available. Moreover, Wallace (1996) observes that clinicians who treat aphasia may not be knowledgeable about multicultural issues and, therefore, employ only their own cultural experience in the treatment they administer.

The paucity of data on potential differences in severity and improvement of aphasia between African-Americans and Caucasians and the rationale, reviewed above, for expecting differences may exist, prompted us to compare initial severity, amount of improvement, and rate of improvement in aphasia between samples of

African-American and Caucasian patients who were aphasic subsequent to a first, left hemisphere stroke. All study patients met elaborate selection criteria, and all were entered in a 44-week treatment trial between 4 and 48 weeks post-onset. We asked three questions: does severity of aphasia differ at 4 weeks post-onset, does the amount of improvement obtained between 4 and 48 weeks post-onset differ, and does the rate of improvement during a 44-week treatment trial differ between African-American and Caucasian aphasic patients?

Method

Study patients were selected from the 67 participants in the first Veterans Administration Cooperative Study on Aphasia (Wertz *et al.* 1981). All were male veterans and met the following selection criteria: age, 40–80 years; literacy, premorbidly able to read and write English; aetiology, first thromboembolic CVA; localization, damage confined to the left hemisphere; medical status, no coexisting major medical complications; sensory and motor status, auditory acuity no worse than a 40 dB speech reception threshold in the poorer ear, visual acuity no worse than 20/100 corrected in the poorer eye, and adequate sensory and motor ability in one hand to write and gesture; time post-onset, 4 weeks at entry; and language severity, 10th–75th overall percentile performance on the Porch Index of Communicative Ability (PICA) (Porch 1967). All African-American and Caucasian patients entered in the VA Cooperative Study who had received at least 11 weeks of treatment, from entry at 4 weeks post-onset to 15 weeks post-onset, during the 44-week treatment trial were selected. Samples of 35 Caucasians and 15 African-Americans were obtained using this criterion.

At entry, 4 weeks post-onset, in the treatment trial, mean age in African-American subjects was 58·8 years, and mean age in Caucasian subjects was 59·1 years. The groups did not differ significantly ($t(48) = 0{\cdot}10, p > 0{\cdot}05$) in age. Mean years of education in African-American subjects was 9·3 years, and mean years of education in Caucasian subjects was 11·4 years. The groups did not differ significantly ($t(18, 56) = 1{\cdot}67, p > 0{\cdot}05$) in years of education. Mean PICA Overall performance in African-American subjects was 9·48 (35th percentile), and mean PICA Overall performance in Caucasian subjects was 9·89 (39th percentile). There was no significant difference ($t(48) = 0{\cdot}76, p > 0{\cdot}05$) between groups in severity of aphasia at 4 weeks post-onset as measured by the PICA Overall score.

The PICA; a Word Fluency Measure (WFM) (Borkowski 1967) requiring subjects to say all of the words they could think of, in 1 minute, that begin with a specified letter—'s', 't', 'p', 'c'; and the Token Test (TT) (DeRenzi and Vignolo 1962) were administered at entry (4 weeks post-onset) and after every 11 weeks of treatment (15, 26, 37, and 48 weeks post-onset) during the 44-week treatment trial. Subjects were assigned randomly to either individual or group treatment for 6–8 h each week for 44 weeks. Individual treatment included traditional, stimulus–response manipulation of language deficits in all modalities—auditory comprehension, reading, oral-expressive language, and writing. Group treatment involved conversation and discussion in groups of four to seven patients with no direct manipulation of speech and language deficits.

Four of the 15 African-American patients received individual treatment, and 11 received group treatment. Nineteen of the 35 Caucasian patients received individual

treatment, and 16 received group treatment. Attrition during the 44-week treatment trial was 47% for African-American patients and 37% for Caucasian patients. The most common reasons for dropping out were having to remain hospitalized or having to drive long distances to receive treatment. Reasons for dropping out did not differ between African-American and Caucasian subjects.

Significant differences in improvement in the VA Cooperative Study between individual and group treatment were few. Those that occurred were confined to the PICA, where individually treated patients made significantly more ($p < 0{\cdot}05$) improvement than group-treated patients at specific points during the 44-week treatment trial (Wertz *et al.* 1981). In the present investigation, individual- and group-treated patients were combined in the analyses.

Results

Our first purpose was to compare the severity of aphasia at 4 weeks post-onset, prior to the initiation of treatment, between African-Americans and Caucasians. As shown in Table 1, African-American and Caucasian subjects performed similarly on all measures. *T*-tests indicated no significant differences between groups on the PICA Overall score ($t(48) = 0{\cdot}76, p > 0{\cdot}05$); the Gestural modality score ($t(48) = 1{\cdot}05, p > 0{\cdot}05$); the Verbal modality score ($t(48) = -0{\cdot}94, p > 0{\cdot}05$); or the graphic modality score ($t(48) = 1{\cdot}82, p > 0{\cdot}05$) at 4 weeks post-onset. Similarly, there were no significant differences between groups on the Word Fluency Measure ($t(48) = 0{\cdot}06, p > 0{\cdot}05$) or the Token Test ($t(48) = 1{\cdot}44, p > 0{\cdot}05$).

At the end of the 44-week treatment trial, 48 weeks post-onset, we employed intent-to-treat analyses (Wertz 1995) to compare severity between groups. Intent-to-treat analysis requires all subjects who are randomized to be analysed regardless of whether they received the amount and duration of treatment prescribed. This is the preferred analysis for clinical treatment trials (Lee *et al.* 1991, Collins and Dorus 1991). As shown in Table 2, there was no significant difference between groups on the PICA Overall score ($t(48) = 1{\cdot}53, p > 0{\cdot}05$); PICA Verbal modality score ($t(48) = -0{\cdot}01, p > 0{\cdot}05$); Word Fluency Measure ($t(48) = 0{\cdot}73, p > 0{\cdot}05$); or Token Test ($t(48) = 1{\cdot}73, p > 0{\cdot}05$). However, African-American subjects performed significantly lower than Caucasian subjects on the PICA Gestural modality score ($t(48) = 2{\cdot}20, p < 0{\cdot}05$) and the PICA Graphic modality score ($t(48) = 2{\cdot}27, p < 0{\cdot}05$).

Our second purpose was to compare the amount of improvement in aphasia obtained by African-American and Caucasian patients during the 44-week treatment trial. As indicated in Table 3, both groups made significant improvement over time. Intent-to-treat analyses, using a separate analysis of variance for each measure, indicated both groups improved significantly on all PICA scores—Overall ($F(1,48) = 120{\cdot}22, p < 0{\cdot}001$); Gestural ($F(1,48) + 40{\cdot}92, p < 0{\cdot}001$); Verbal ($F(1,48) = 45{\cdot}56, p < 0{\cdot}001$); and Graphic ($F(1,48) = 79{\cdot}31, p < 0{\cdot}001$). Between entry at 4 weeks post-onset and 48 weeks post-onset, African-American subjects improved 20 points and Caucasian subjects improved 25 points on the PICA Overall percentile. On the Gestural percentile, African-American subjects improved 20 points and Caucasian subjects improved 17 points; on the Verbal percentile, African-American subjects improved 12 points and Caucasian subjects improved 18 points; and on the Graphic percentile, African-American subjects improved 25 points and Caucasian subjects improved 25 points. *T*-tests on change

Table 1. Mean severity on outcome measures at 4 weeks post-onset for African-American and Caucasian aphasic patients

	Group						
	African-American			Caucasian			
Measure	$\bar{x}$	Range	SD	$\bar{x}$	Range	SD	Mean difference
PICA							
Overall	9·48	6·54–12·33	1·66	9·89	6·56–12·49	1·77	−0·41
Gestural	11·51	7·51–14·04	1·89	12·07	7·36–14·03	1·68	−0·56
Verbal	9·57	2·98–13·80	3·46	8·55	2·83–13·85	3·58	+1·02
Graphic	6·71	4·20–10·17	1·59	7·68	4·08–11·18	1·77	−0·97
Word Fluency	6·80	0–39	10·71	6·97	0–33	9·53	−0·17
Token Test	16·87	1–58	16·39	24·77	1–58	18·30	−7·90

Table 2. Mean severity on outcome measures at 48 weeks post-onset for African-American and Caucasian aphasic patients

	Group						
	African-American			Caucasian			
Measure	$\bar{x}$	Range	SD	$\bar{x}$	Range	SD	Mean difference
PICA							
Overall	11·24	8·58–13·73	1·57	11·98	9·49–14·53	1·55	−0·74
Gestural	12·81	11·31–14·14	1·02	13·44	12·44–14·80	0·88	−0·63*
Verbal	11·75	7·03–14·55	3·41	11·74	6·85–14·73	2·81	+0·01
Graphic	8·82	6·58–12·65	1·98	10·30	7·20–14·38	2·16	−1·48*
Word Fluency	12·07	0–41	13·04	15·31	0–57	14·88	−3·24
Token Test	25·60	0–59	22·14	36·11	4–59	18·59	−10·51

* Significant at $p < 0·05$.

Table 3. Mean improvement on outcome measures between four and 48 weeks post-onset for African-American and Caucasian aphasic patients

	Group		
Measure	African-American	Caucasian	Mean difference
PICA			
Overall	1·76	2·09	−0·23
Gestural	1·30	1·37	−0·07
Verbal	2·18	3·19	−1·01
Graphic	2·11	2·62	−0·51
Word Fluency	5·27	8·34	−3·07
Token Test	8·73	11·34	−2·61

scores between 4 and 48 weeks post-onset indicated no significant difference in the amount of improvement between groups on any PICA measure—PICA Overall score ($t(48) = 0·92$, $p > 0·05$); Gestural modality score ($t(48) = 0·15$, $p > 0·05$);

Table 4. Percentage of total, mean improvement on outcome measures for African-American (AA) and Caucasian (C) aphasic patients at each evaluation date between 4 and 48 weeks post-onset

	Groups by time							
	15 weeks		26 weeks		37 weeks		48 weeks	
Measure	AA	C	AA	C	AA	C	AA	C
PICA								
Overall	58	65	66	86	83	94	100	100
Gestural	67	63	77	79	91	98	100	100
Verbal	71	68	77	97	86	97	100	100
Graphic	42	68	50	89	77	89	100	100
Word Fluency	76	66	100	85	100	100	100	100
Token Test	83	86	83	86	96	100	100	100

Verbal modality score ($t(48) = 1{\cdot}28, p > 0{\cdot}05$); and Graphic modality score ($t(48) = 0{\cdot}96, p > 0{\cdot}05$).

Similarly, both groups displayed significant improvement between 4 and 48 weeks post-onset on the Word Fluency Measure ($F(1,48) = 25{\cdot}17, p < 0{\cdot}001$) and the Token Test ($F(1,48) = 26{\cdot}27, p < 0{\cdot}001$). There was no significant difference between groups in the amount of improvement on either of these measures—Word Fluency Measure ($t(48) = 1{\cdot}13, p > 0{\cdot}05$) and the Token Test ($t(48) = 0{\cdot}67, p > 0{\cdot}05$).

Our third purpose was to compare the rate of improvement in aphasia between African-American and Caucasian patients. Table 4 shows the percentage of total, mean improvement on each outcome measure for African-American and Caucasian aphasic patients at each evaluation date between 4 and 48 week post-onset. Intent-to-treat analyses indicated no significant time × group interaction for any measure—PICA Overall score ($F(1,48) = 0{\cdot}85, p > 0{\cdot}05$); PICA Gestural modality score ($F(1,48) = 0{\cdot}02, p > 0{\cdot}05$); PICA Verbal modality score ($F(1,48) = 1{\cdot}65, p > 0{\cdot}05$); PICA Graphic modality score ($F(1,48) = 0{\cdot}91, p > 0{\cdot}05$); Word Fluency Measure ($F(1,48) = 1{\cdot}29, p > 0{\cdot}05$); and the Token Test ($F(1,48) = 0{\cdot}44, p > 0{\cdot}05$). Thus, African-American and Caucasian subjects improved at essentially the same rate during the 44-week treatment trial.

Discussion

Our results indicate severity of aphasia at 4 weeks post-onset, before treatment was initiated, did not differ significantly between African-Americans and Caucasians on our language measures–PICA, Word Fluency Measure, and Token Test. However, at 48 weeks post-onset, after both groups had received treatment, African-American aphasic patients performed significantly lower than Caucasian aphasic patients on the PICA Gestural and Graphic modality scores. Because groups did not differ on these measures at 4 weeks post-onset, and because there was no significant difference between groups in improvement or rate of improvement on these measures, the differences at 48 weeks post-onset are enigmatic.

A potential explanation for the difference in the Graphic modality score is the type of treatment received. Four African-American patients received individual

treatment, and 11 received group treatment. Nineteen Caucasian aphasic patients received individual treatment, and 16 received group treatment. One of the few differences between individual and group treatment in the VA Cooperative Study (Wertz *et al.* 1981) was in the PICA Graphic modality, in which individually treated patients made significantly more improvement than group-treated patients. It is possible that the unequal assignment of African-American patients to treatments (more in group than in individual) and the equal assignment of Caucasian patients to treatments (essentially the same number in each treatment) may have prompted sufficiently more improvement in Caucasian subjects' PICA Graphic performance to show a difference between groups at 48 weeks post-onset. This does not explain the difference in severity between groups in the PICA Gestural score. No significant difference in improvement between individual and group treatment was observed for the PICA Gestural modality score in the VA Cooperative Study.

Another explanation for group differences in PICA Gestural and Graphic performance at 48 weeks post-onset may be the influence of intent-to-treat analysis. Utilizing the principle 'once randomized, always analysed' (Wertz 1995), intent-to-treat analysis requires all subjects be included in the end-point analyses even if they did not receive the prescribed amount and duration of treatment. While there was no significant difference in the number and rate of drop-outs between groups, a larger percentage (47 %) of African-American patients dropped out than Caucasian patients (37 %). Early termination of patients may be sufficient to affect the end-point (48 weeks) severity between groups on the PICA and Graphic modality scores without affecting the amount of improvement between groups from 4 to 48 weeks post-onset.

We found no significant difference between groups in the amount of improvement in aphasia. Both improved significantly between 4 and 48 weeks post-onset, and there was no significant difference between groups in the amount of improvement on any outcome measure. Moreover, the absence of significant group × time interactions implies that African-American aphasic patients improve at a similar rate to Caucasian aphasic patients.

We conclude that initial severity of aphasia, amount of improvement, and rate of improvement was essentially the same in our samples of African-American and Caucasian aphasic patients. Application of these conclusions requires caution. They apply only to African-American and Caucasian aphasic people who meet our selection criteria. The selection criteria tended to equate the two groups on variables that may influence severity and improvement in aphasia. However, observations about stroke in African-Americans imply everything is not equal. Previous reports on samples of African-American and Caucasian stroke patients imply strokes in African-Americans may be more severe (Carter *et al.* 1992); in areas that may be more disruptive to language (Inzitari *et al.* 1990); and result in a poorer functional outcome (Gillum 1988, Horner *et al.* 1991). Our application of rigid selection criteria in selecting study patients may have obscured differences that exist in the population.

Failure to find significant differences in severity, improvement, and rate of improvement between our samples of African-American and Caucasian aphasic patients may imply the measures we employed—PICA, Word Fluency Measure, and Token Test—are not culturally biased. Reports on the development of these measures do not indicate whether attention was given to the appropriateness of stimuli and tasks for different cultures, and the ethnic distribution in the normative

samples is not reported. Heuristically, the PICA, Word Fluency Measure, and Token Test appear to be 'culture-free'. However, PICA reading and writing tasks may be influenced by education, and scoring of PICA verbal tasks may penalize non-standard grammatical usage and pronunciation. Education between our groups did not differ significantly, and there was no difference in initial severity, improvement, and rate of improvement in PICA verbal performance. Nevertheless, the influence of cultural bias, even in equated groups who do not differ in performance, cannot be completely dismissed. For example, if our measures are culturally biased, our African-American aphasic patients' performance may have been lower than it would have been on more culturally appropriate measures. Davis-McFarland *et al.* (1995) suggest studies of communication in African-Americans should be based on an 'ethnolinguistic' model that accounts not only for subjects' use of language, but also for the cultural context in which language is used. Investigations of aphasia in African-Americans may require a 'neuroethnolinguistic' model.

Employing rigid selection criteria in studies of aphasia can be useful. It permits generalization of results to those who meet the selection criteria. However, when there is a need to identify variables that may influence results, a natural history design open to differences in aetiology, gender, age, education, ethnicity, culture, etc. may be preferable. Regardless of the design, sample size must be sufficient to provide acceptable statistical power. If we are interested in differences that may make a difference, a high probability of a Type 2 error is unacceptable. Our sample size is small. Statistical power for improvement over time exceeded 0·95 for all outcome measures. However, power for all other analyses was 0·60 or lower; thus the probability of a Type 2 error is high. Our effort requires replication with larger samples.

Acknowledgements

This research was supported by the Department of Veterans Affairs Cooperative Studies Program and the Department of Veterans Affairs Medical–Surgical Research Historically Black Colleges and Universities (HBCU) Program. We are indebted to the Veterans Administration Cooperative Study Group—Michael J. Collins, David Weiss, John F. Kurtzke, Thomas Friden, Robert H. Brookshire, James Pierce, Pat Holtzapple, D. J. Hubbard, Bruce E. Porch, Joyce A. West, Larry Davis, Violet Matovitch, Gerald K. Morley, and Ernesto Resurreccion.

References

Anderson, E.and Ulatowska, H. (1978) A problem of diagnosis: Black English or aphasia? In R. H. Brookshire (Ed.) *Clinical Aphasiology: Collected proceedings 1972–1976* (BRK, Minneapolis, MN), pp. 125–138.

Borkowski, J. G., Benton, A. L. and Spreen, O. (1967) Word fluency and brain damage. *Neuropsychologia*, **5**, 135–140.

Carter, L., Walton, S., Knowles, M., Wing, S. and Tyroler, H. (1992) Social inequality of stroke mortality among U.S. black populations, 1968 to 1987. *Ethnicity and Disease*, **2**, 343–351.

Chapman, S. B. and Ulatowska, H. K. (1994) Differential diagnosis in aphasia. In R. Chapey (Ed.) *Language Intervention Strategies in Adult Aphasia, 3rd edn* (Williams & Wilkins, Baltimore, MD), pp. 122–134.

Collins, J. F. and Dorus, W. (1991) Patient selection bias in analyses using only compliant patients.

In J. A. Cramer and B. Spiker (Eds) *Patient Compliance in Medical Practice and Clinical Trials* (Raven Press, New York), pp. 335–348.

DAVIS-MCFARLAND, E., FAIN, M. and Moss, S. (1995) Future directions for communications research in African Americans with Alzheimer's disease. Paper presented to the American Speech–Language–Hearing Association, December, Orlando, FL.

DERENZI, E. and VIGNOLO, L. A. (1962) The Token Test: a sensitive test to detect receptive disturbances in aphasics. *Brain*, **85**, 665–678.

GILLUM, R. F. (1988) Stroke in blacks. *Stroke*, **19**, 1–9.

HAERER, A. F. and WOOLSEY, P. C. (1975) Prognosis and quality of survival in a hospitalized stroke population from the South. *Stroke*, **6**, 543–548.

HARRIS, J. L. (1992) Stimulus-effects on monologic language samples elicited from African American women. Unpublished doctoral dissertation, University of Texas, Austin.

HOLLAND, A. L. (1983) Nonbiased assessment and treatment of adults who have neurologic speech and language problems. In S. Terrell (Ed.) *Topics in Language Disorders: Non-Biased Assessment* (Aspen, Gaithersburg, MD), pp. 67–75.

HOLLAND, A. L. and FORBES, M. (1986) Non-standardized approaches to speech and language assessment. In O. Taylor (Ed.) *Treatment of Communication Disorders in Culturally and Linguistically Diverse Populations* (College Hill Press, San Diego, CA), pp. 49–66.

HORNER, R. D., MATCHAR, D. B., DIVINE, G. W. and FEUSSNER, J. R. (1991) Racial variations in ischemic stroke—related physical and functional improvements. *Stroke*, **22**, 1497–1501.

HOWARD, G., TILL, S., TOOLE, J. F., MATTHEWS, C. and TRUSCOTT, L. (1985) Factors influencing return to work following cerebral infarction. *Journal of the American Medical Association*, **253**, 226–232.

HOWARD, G. S., WALKER, M. D., BECKER, C., COULL, B., FEIBEL, J., MCLEROY, K., TOOLE, J. F. and YATSU, F. (1986) Community hospital-based stroke programs: North Carolina, Oregon, and New York. III. Factors influencing survival after stroke: Proportional hazards analysis of 4219 patients. *Stroke*, **17**, 294–299.

INZITARI, D., HACHINSKI, V. C., TAYLOR, D. W. and BARNETT, H. J. M. (1990) Racial differences in the anterior circulation in cerebrovascular disease: how much can be explained by risk factors? *Archives of Neurology*, **47**, 1080–1084.

JACKSON, J. S. (1985) National origin, ethnicity, and aging. In R. H. Binstock and K. Shanas (Eds) *Handbook of Aging and the Social Sciences, 2nd edn* (Van Nostrand Reinhold, New York), pp. 264–303.

KELLER, A. Z. (1972) Residence, age and blood pressures in the survival with cerebral hemorrhage. *American Journal of Epidemiology*, **95**, 327–336.

KENTON, E. J. (1991) Access to neurological care for minorities. *Archives of Neurology*, **48**, 480–483.

KITTNER, S. J., MCCARTER, R. J., SHERWIN, R. W., SLOAN, M. A., STERN, B. J., JOHNSON, C. J., BUCHHOLZ, D., SEIPP, M. J. and PRICE, T. R. (1993) Black–white differences in stroke risk among young adults. *Stroke* (Suppl. I), **24**, I-13–I-15.

KITTNER, S. J., WHITE, L. R., LOSONCZY, K. G., WOLF, P. A. and HEBEL, J. R. (1990) Black–white differences in stroke incidence in a national sample: the contribution of hypertension and diagetes mellitus. *Journal of the American Medical Association*, **264**, 1267–1270.

LEE, Y. J., ELLENBERG, J. H., HIRTZ, D. G. and NELSON, K. B. (1991) Analysis of clinical trials by treatment actually received: Is it really an option? *Statistics in Medicine*, **10**, 1595–1605.

PETERS-JOHNSON, C. A. and TAYLOR, O. L. (1986) Speech, language, and hearing disorders in black populations. In O. L. Taylor (Ed.) *Nature of Communication Disorders in Culturally and Linguistically Diverse Populations* (College Hill Press, San Diego, CA), pp. 157–179.

PORCH, B. E. (1967) *Porch Index of Communicative Ability* (Consulting Psychologists Press, Palo Alto, CA).

TAYLOR, O. L. (1992) Opening statement. In O. Taylor, H. Kayser, S. Fujikawa, F. Herzon, and G. Wallace (Eds), *Research and Research Training Needs of Minority Persons and Minority Health Issues* (National Institute on Deafness and Other Communication Disorders, Published Working Group Report, Bethesda, MD), pp. 1–11.

WALLACE, G. L. (1993) Neurological impairment among elderly African-American nursing home residents. *Journal of Health Care for the Poor and Underserved*, **4**, 40–50.

WALLACE, G. L. (1996) Management of aphasic individuals from culturally and linguistically diverse populations. In G. L. Wallace (Ed.) *Adult Aphasia Rehabilitation* (Butterworth–Heinemann, Boston, MA), pp. 103–119.

WERTZ, R. T. (1995) Intent to treat: once randomized, always analyzed. In M. L. Lemme (Ed.) *Clinical Aphasiology*, vol. 23 (Pro-Ed., Austin, TX), pp. 57–64.

WERTZ, R. T., COLLINS, M. J., WEISS, D., KURTZKE, J. F., FRIDEN, T., BROOKSHIRE, R. H., PIERCE, J., HOLTZAPPLE, P., HUBBARD, D. J., PORCH, B. E., WEST, J. A., DAVIS, L., MATOVITCH, V., MORLEY, G. K. and RESURRECCION, E. (1981) Veterans Administration cooperative study on aphasia: a comparison of individual and group treatment. *Journal of Speech and Hearing Research*, **24**, 580–594.