

## RELIABILITY OF THE ADULT GROWTH EXAMINATION: A STANDARDIZED TEST OF INDIVIDUAL AGING

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*Summary.*—50 male residents of Nova Scotia from 20 to 70 chronological years old were paid volunteers in a test-retest study of the Adult Growth Examination (AGE) test of bodily aging. With test-retest intervals of from 1 to 8 wk., the product-moment correlations of reliability were .88 full test, .75 systolic blood pressure subtest, .92 hearing level subtest, .93 near vision subtest; the standard error of measurement of body age was 4.98 yr. AGE full-test Body-age scores correlated .81 with chronological age. Additional subtest correlations and inter-correlations are made and comparisons with results from other samples and related research are included. All correlations were high and significant ( $p = .01$ ).

People age at different rates. Benjamin in 1949 was among the first to suggest a reliable test of aging as an individual difference. Subsequent suggestions for items and procedures in such a test were offered by Murray in 1951. Although Murray suggested an age test would greatly benefit science, medicine, and insurance companies, there followed no further papers on the subject for nearly a decade. In the early 1960s several authors renewed the search for systematic indices of biological or physiological aging (Clarke, 1960; Bourliere, 1963; Jalavisto & Makkonen, 1963a, 1963b; Jalavisto, 1965). In 1968 Morgan revived the concept of a brief standardized age test by using data from a 1962 United States National Health Survey (Linder, 1964) to illustrate the utility of his 'Adult Growth Examination.' There was some suggestive evidence that race and sex were characterized by different patterns of aging. Adult Growth Examination (AGE) uses and items were discussed subsequently in the United States (*Science Digest*, 1969), Great Britain (Morgan, 1969), and Canada (Morgan, 1970). On the basis of professional feedback and further research the AGE test was standardized<sup>2</sup> and validated (Morgan, 1971). While the manual included age norms in years for optional supplementary measures (glucose tolerance, cholesterol level, finger dexterity, periodontal index, dental decay) the basic test consisted of three short painless subtests in the areas of hearing, vision, and blood pressure. All three subtest areas changed systematically with adult aging and, therefore, age norms in years were associated with subtest raw scores. The full-test Body-age was considered to be the median age score of the three subtests. At this stage it was considered useful to evaluate the reliability of the full test and its subtests.

<sup>1</sup>Also at Hunters Point-Bayview, Community Health Service.

<sup>2</sup>R. F. Morgan. The Adult Growth Examination (AGE), manual for a compact standardized test of individual aging. (Unpublished manual, California School of Professional Psychology, 1971)

## METHOD

*Measurement Instrument*

The Adult Growth Examination is presently based on norms derived from a carefully collected cross sample of several thousand United States adults tested in the 1962 National Health Survey (Linder, 1964) as well as subsequent norms from hundreds of adults examined in New York state in 1969 and then in Nova Scotia in 1970.<sup>2</sup>

The first subtest, systolic blood pressure, was the average of three readings made at rest separated by intervening activity (the other two subtests). Measurements were made with the middle of the cuff over the bulge in the upper left arm, with the cuff remaining loose on the arm between measurements. Only the systolic blood pressure was recorded. Procedures derive from Gordon (1964) and Florey and Acheson (1969).<sup>2</sup>

The second subtest, hearing loss at high frequency, was recorded at 6000 cycles per second for the better ear after a rehearsal at 1000 cycles per second for both ears. An audiometer with comfortable air-conduction earphones was used to communicate standard pure tones at varying decibel intensities (range 0 to 110 db). *S* faced the audiometer with his back to the tester and signaled by a raised hand on the side of the ear stimulated that the tone had been heard. Beginning with an intensity large enough for the tone to be heard, usually 50 db, intensity was decreased until a level was reached at which *S* missed the tone about half the time. Once this level was confirmed by retesting at 5-db intervals above and below it, it was recorded. Procedures derive from Glorig and Roberts (1965) and Roberts (1968a).<sup>2</sup>

The third subtest measure, lens accommodation tested by near vision threshold, was the closest measured distance for uncorrected binocular vision that a printed target (pica: 11 letters per inch) sentence would begin to blur at. *S* with his chin on a rest sighted down a ruled slide at the white printed target card at the far end of the slide. The tester moved the slide closer until blurring was reported. The tester continued to move the target somewhat closer and then gradually returned to the point of blurring, eventually recording the point at which blurring was seen to commence from either direction. Procedures derive from Chapanis, *et al.* (1949, 1956), Hofstetter (1954), Roberts (1968b) and Roberts and Cohrsen (1968).<sup>2</sup>

*Subjects*

Fifty adult male volunteers answered an advertisement for short-term employment in the only major Nova Scotia newspaper. Since past research had indicated sex differences probable on the AGE (Morgan, 1968) it was decided to test one sex at a time rather than maintain the same number of *Ss* subdivided into two separate sex groups (a limited budget precluded increasing the number of *Ss*). It was agreed to replicate the present study with both sexes at a later

date presuming greater financial affluence. The male volunteers in the present study agreed to be examined at two sessions separated by at least a week in time with payment following the second session. They ranged in age from 20 to 70 yr., with a mean age of 38. The age distribution generally followed the Province-wide pattern (by decade: 20s- 18 Ss, 30s- 8 Ss, 40s- 6 Ss, 50s- 7 Ss, 60s- 7 Ss, 70s- 4 Ss). Income level, marital status, family size, and education (except at the 20s where college students were a majority) reflected Province-wide patterns.

#### Procedure

The male volunteers were tested on the AGE on a test-retest basis, with a range of 1 to 8 wk. and a median of 1.6 wk. between sessions. None were told at the end of the first session that the second session was to involve the same procedure. All those tested at the first session returned for the second session and their remuneration.

#### RESULTS

All test-retest product-moment correlations were significant ( $p = .01$ ). Raw-score reliabilities for the three subtest measures ranged from .79 for systolic blood pressure to .93 for near vision and .95 for hearing level. When subtest raw scores were converted to Body-age scores, test-retest reliability correlations ranged from .75 for systolic blood pressure to .92 for hearing level and .93 for near vision. The total Body-age score of the AGE, median of the three subtest age scores, showed a test-retest reliability correlation of .88. The standard error of measurement was 4.98 yr.

Occasionally one of the AGE subtests may be inappropriate for some S (e.g., deaf or blind Ss). It was therefore decided to determine the effect on the reliability of the total Body-age score of dropping each of the subtests, one at a time. The three resulting combinations yielded acceptably high correlations which ranged from .81 (near vision missing) and .83 (hearing level subtest missing) to .95 (systolic blood pressure subtest missing). These data are found in Table 1.

TABLE 1  
ADULT GROWTH EXAMINATION (AGE) TEST-RETEST CORRELATIONS FOR 50 MALES  
WITH CHRONOLOGICAL AGES OF 20 TO 70 YEARS

AGE Variables	Raw score $r$	Age score $r$
Subtest 1: Hearing loss	.95*	.92*
Subtest 2: Near vision	.93*	.93*
Subtest 3: Systolic blood pressure	.79*	.75*
<i>Mdn</i> of Subtests 1 + 2		.95*
<i>Mdn</i> of Subtests 1 + 3		.81*
<i>Mdn</i> of Subtests 2 + 3		.83*
AGE total scores: <i>Mdn</i> of all subtests		.88*

\* $p < .01$ .

TABLE 2  
SELECTED ADULT GROWTH EXAMINATION (AGE) CORRELATIONS AND  
COMPARISONS

AGE Variables	Raw score $r^*$	Age score $r^*$
A. With chronological age		
Subtest 1: Hearing loss	.68	.76
Subtest 2: Near vision	.73	.84
Subtest 3: Blood pressure	.55	.51
AGE total score		.81
B. Subtest intercorrelations		
Subtests 1 + 2	.66	.73
Subtests 1 + 3	.38	.43
Subtests 2 + 3	.59	.60
C. Subtests with AGE total score		
Subtest 1: Hearing loss	.67	.73
Subtest 2: Near vision	.84	.89
Subtest 3: Blood pressure	.81	.82

*Note*—All correlations in parentheses are based on a validation sample of 107 male and female Nova Scotians in the chronological age range of 20 to 70 yr. They are included for comparison with the correlations derived from data collected from the 50 male Nova Scotians aged 20 to 70 yr. and tested in the present study. Validation sample correlations derive from Morgan (1971<sup>a</sup>).  
 $*p < .01$  for every product-moment correlation in the table.

Other correlational analyses are depicted in Table 2. The reliability sample of this study was compared with a validation sample of Nova Scotians presented in another study (Morgan, 1971). Correlations with chronological age across subtests and total Body-age score are high, significant, and similar for both groups. Clarke in 1960, also testing Nova Scotians, found similar correlations with age for his 102 Ss (hearing loss .57, systolic blood pressure .65, near vision .67). Florey and Acheson in 1969, examining more than 3000 Ss from 18 to 79 yr., also reported significant correlations with age for AGE subtest measures (.62 white females, .59 black females, .47 black males, .43 white males) of systolic blood pressure.

The total Body-age score of the AGE correlated .81 with chronological age for the reliability sample in the present study and .82 with chronological age for the validation sample (Morgan, 1971).

Across both samples, subtest intercorrelations ranged from .38 to .73. The hearing-loss subtest was less effective at predicting the total Body-age score than the other two subtests.

In summary, the total Body-age score of the Adult Growth Examination was highly correlated with chronological age (.81) and highly reliable on a retest basis (.88).

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