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Demographic Characteristics and IQ Among Adults: Analysis of the WAIS-R Standardization Sample as a Function of the Stratification Variables

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The goal of the present investigation was to analyze data from the standardization sample of the 1981 Wechsler Adult Intelligence Scale-Revised (WAIS-R) to determine the relationships of WAIS-R IQs to the demographic variables upon which the sample was stratified. The sample included 1,880 adults stratified according to sex and age (equal numbers of males and females within nine age groups), race, occupation, urban-rural residence, geographic region, and education. There were 1,664 whites, 192 blacks, and 24 from other nonwhite groups. Analyses of variance were conducted separately for Verbal (VIQ), Performance (PIQ), and Full Scale IQ (FSIQ). The differences in mean IQs due to sex, urban-rural residence, and geographic regions were nonsignificant. However, there were significant differences that were due to race and education level, and there were also sizeable differences noted for occupational groups. There was a 14½-point difference in favor of whites over blacks on FSIQ. Differences due to education and occupation were striking: College graduates earned FSIQs that were 32½ points higher than the FSIQs of individuals with 7 years or less of schooling, and professional and technical workers outscored unskilled workers on the WAIS-R Full Scale by 22 points.

The IQ differences among groups according to sex, socioeconomic status (SES), place of residence, and other variables have been explored for a variety of intelligence tests (Anastasi, 1958; Tyler, 1965). The results of these various analyses have shed much light on the relationship of various demographic characteristics to performance on a host of mental tasks. Not only does this information aid in the development of better understanding of the nature of intelligence in general but it also has proved valuable to clinicians and others who use intelligence tests in their clinical interpretation of the performance of individuals on such tests. These data can also be quite helpful in the estimation of premorbid levels of intellectual functioning (Barona, Reynolds, & Chastain, in press). A major use of these data will be by school psychologists and other

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clinicians to make sense of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) norms.

Standardization samples of individual intelligence tests are typically large and representative of the U.S. population, and they have provided psychologists with extensive data on the relationship of IQ to various background variables. McNemar's (1942) careful analyses of the 1937 Stanford-Binet standardization sample was perhaps the first major endeavor of this sort; subsequent investigations have added to our understanding of the IQ construct and how its relationship to different background variables has changed over the past half century. These studies have included intelligence tests for preschoolers (Kaufman, 1973; Kaufman & Kaufman, 1973, 1975), school-age children (Kaufman & Doppelt, 1976; Kaufman & Kaufman, 1983; Seashore, Wesman, & Doppelt, 1950), and adults (Birren & Morrison, 1961; Matarazzo, 1972).

These studies have typically not provided very insightful information regarding sex differences in intelligence because the developmental stages of most tests usually serve to deliberately weed out items, tasks, or subtests that produce clear-cut sex differences, in an attempt to make the final battery as unbiased as possible against either males or females (Matarazzo, 1972). However, data on the relationship of IQ to education level, occupational group, race, geographic region, and urban-rural residence have been of immense value to theorists and practitioners. Some variables (e.g., occupational group) produce predictable, large differences between different categories, whereas a variable like urban-rural residence has shown a dramatic decline in group differences from generation to generation (Kaufman & Doppelt, 1976).

The availability of the 1981 WAIS-R sample with careful stratification along the same lines as the WISC-R and other well-standardized instruments enabled an analysis and extension of our knowledge of the relationship of demographic characteristics to mental test performance for 16- to 74-year-olds. For whatever reason, data from the 1955 WAIS were never analyzed as thoroughly and systematically as data from tests geared for children, including the WISC, WISC-R, and WPPSI. Hence, the present study not only serves to cross-validate previous investigations with preschool children, school-age children, and adolescents, but it provides comprehensive data relating WAIS-R Verbal (VIQ), Performance (PIQ), and Full Scale IQ (FSIQ) to variables, such as region and residence, that have not been previously published on carefully standardized intelligence tests for adults.

Matarazzo and Herman (1984) presented an analysis of WAIS-R standardization data by education level, showing substantial correlations between number of years of school completed and IQ, and reporting differences of 22–29 points in the mean IQs earned by college graduates versus those with 0–8 years of schooling. However, we chose to include education level in our study out of concern for three limitations of the Matarazzo and Herman (1984) study: (a) They did not subject the group differences to formal statistical analysis; (b)

they studied education in isolation from other stratification variables (except age), perhaps masking important interactions (e.g., Race x Education Level); and (c) they used broad age groupings (16–24, 25–44, 45–74), possibly obscuring essential age-education relationships.

METHODS

Subjects

The sample included the 1,880 adults in the WAIS-R standardization sample, which was stratified by sex according to nine age groups: age groups 16–17, 18–19, and 20–24 years, with 100 males and 100 females each; age group 25–34 years, with 150 males and 150 females; age groups 35–44 and 45–54 years, with 125 males and 125 females each; and age groups 55–64, 65–69, and 70–74 years, with 80 males and 80 females each. In addition to the variables of sex and age, the sample was stratified on race (1,664 whites, 192 blacks, 24 from "other" nonwhite races), education, occupational group, urban–rural residence, and geographic region. The sampling plan for stratification was based on 1970 U.S. Bureau of Census population statistics and the several statistical updates issued prior to the 1980 census. The sample closely matched the actual population demographics. Detailed information on the sample can be found in Wechsler (1981).

Procedures

Analyses of variance (ANOVAs) were conducted with data from 1,856 adolescents and adults in the WAIS-R standardization sample, of which the independent variables were sex, race (white, black), geographic region (Northeast, North Central, South, West), residence (urban–rural), and education level (0–7 years of schooling, 8 years, 9–11 years, high school graduation, 13–15 years, college graduation); the dependent variable was Verbal IQ. Then an identical ANOVA was conducted with Performance IQ as the dependent variable, and finally an ANOVA was done with Full Scale IQ serving as the dependent variable. Tukey's Honestly Significant Difference (HSD) post hoc test was conducted, as necessary, to follow up pertinent significant F values with pairwise comparisons. Harmonic means of sample sizes were used to correct for the moderate variations in sample size (Kirk, 1982).

The 24 individuals from "other" nonwhite races were eliminated from the ANOVAs because their small sample size would have produced many empty cells in the design matrix. Occupational group was not included as an independent variable because (a) it is substantially correlated with education level, another measure of socioeconomic status; (b) a total of 580 individuals in the sample were not in the labor force, which would have produced much missing data (it was unreasonable to include this group in the analysis because they

represented a "mixed bag" of adults who were either unemployed or retired from a variety of unknown previous occupations); and (c) the occupational group variable was an amalgam of adults actually employed in a given category (ages 20–74) and of the occupational group of the heads of the household of adolescents (ages 16–19).

When computing and presenting means for the standardization sample on all background variables except race, data from the 24 "other" adults were added in to the calculations so that the entire WAIS-R sample of 1,880 is represented in the tables reporting sex differences, educational differences, and the like. Technically, however, only the data from the 1,664 whites and 192 blacks were entered into the ANOVAs. In addition, to prevent overinterpretation of small differences, we have chosen not to present any means or *SD*s for groups smaller than 20 individuals. Usually this decision meant combining data from adjacent age groups, or merging categories (e.g., individuals having 0–7 years of schooling with those having 8 years of schooling) when some tables were constructed.

RESULTS AND DISCUSSION

Table 1 presents an overview of the relationship of VIQ, PIQ, and FSIQ to each stratification variable for the entire WAIS-R standardization sample. Means and *SD*s on the three IQs are presented for ages 16–74 combined by sex, race, region, residence, education, and occupation.

ANOVAs

The findings of the ANOVAs with VIQ, PIQ, and FSIQ were the same for all three IQs: (a) Race and education produced significant main effects at the .001 level (VIQ, Education main effect $F(5, 1802) = 27.3$, $p < .001$; VIQ, Race main effect $F(1, 1802) = 41.9$, $p < .001$; PIQ, Education main effect $F(5, 1802) = 16.0$, $p < .001$; PIQ, Race main effect $F(1, 1802) = 37.9$, $p < .001$; FSIQ, Education main effect $F(5, 1802) = 25.0$ $p < .001$; VIQ, Race main effect $F(1, 1802) = 47.0$, $p < .001$). (b) Sex, region, and residence produced nonsignificant main effects ($p > .05$). (c) None of the two-way interactions between pairs of background variables reached significance at the .05 level. Hence, the difference of about one standard deviation in favor of whites over blacks, and the difference of about two standard deviations between individuals with a college education and those with little formal schooling (Table 1), are large and demand attention when interpreting IQs of an adolescent or adult tested on the WAIS-R. In contrast, the mean differences of about 2 points in favor of males over females and urban over rural residents are trivial, and not worthy of consideration; neither are the mean IQ differences in favor of the highest-scoring regions (Northeast, West) over the lowest-scoring region, the South (see Table 1).

Table 1
Means and Standard Deviations of WAIS-R IQs on Background Variables for the Total Sample

		VIQ		PIQ		FSIQ	
Variable	*N*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Sex							
Male	940	100.90	15.07	100.51	15.19	100.92	15.31
Female	940	98.67	14.68	99.06	15.07	98.70	14.92
Race							
White	1,664	101.24	14.50	101.27	14.66	101.38	14.67
Black	192	87.88	13.09	87.32	13.66	86.86	13.03
Others	24	94.17	13.06	96.46	13.75	94.04	12.93
Region							
Northeast	464	101.65	14.81	101.36	14.93	101.62	14.98
North Central	497	98.60	14.27	99.99	14.38	89.04	14.16
South	576	98.57	15.69	97.05	16.13	98.00	16.33
West	343	101.02	14.33	101.93	14.15	101.50	14.31
Residence							
Urban	1,421	100.36	15.03	99.96	15.15	100.27	15.23
Rural	459	97.99	14.42	99.23	15.13	98.36	14.82
Education							
1 (0–7 years)	133	82.16	13.62	84.49	14.98	82.48	14.31
2 (8 years)	158	90.22	11.03	93.04	14.35	90.82	12.00
3 (9–11 years)	472	96.06	13.80	97.74	14.85	96.41	14.21
4 (HS grad.)	652	100.12	12.05	100.16	13.49	100.04	12.49
5 (13–15 years)	251	107.68	10.85	105.43	12.02	107.32	11.05
6 (College grad. +)	214	115.71	11.56	110.98	12.88	115.17	12.20
Occupation							
1 Profess. & Tech.	206	111.26	12.77	108.16	13.79	111.00	13.43
2 Manager, Cler., Sales	409	104.31	12.25	103.34	13.10	104.13	12.58
3 Skilled workers	213	98.43	11.94	101.15	13.58	99.49	12.56
4 Semiskilled workers	404	92.72	13.55	94.54	15.32	93.06	14.16
5 Unskilled workers	68	88.88	15.34	90.84	15.42	89.07	15.16
6 Not in labor force	580	99.21	15.50	98.49	15.26	98.85	15.56

Sex Differences

Overall, males earned higher mean scores than females by about 2 points on VIQ, 1 1/2 points on PIQ, and 2 points on FSIQ. These differences, nonsignificant in the ANOVA, are extremely similar to the sex differences reported by Kaufman and Doppelt (1976) for the WISC-R and by Seashore et al. (1950) for the WISC, on which boys outscored girls by 2 1/2 points on VIQ, 1/2 point on PIQ, and 1 3/4 points on FSIQ. Matarazzo (1972) reported mean sums of scaled scores (rather than IQs) for males and females on the three WAIS scales and found that males in 9 of the 11 age groupings between ages 16 and 64 in the normative sample, scored slightly higher than females on the Verbal scale and Full Scale and in 7 of the 11 age groupings scored slightly higher on the

Performance scale. If one enters the mean sums of scaled scores in the appropriate IQ conversion table in the WAIS manual (Wechsler, 1955), the following mean IQ differences emerge for the total WAIS standardization sample: No difference on the Performance scale, and about a 1 point advantage for males on the Verbal scale and Full Scale. These results resemble the findings for the WAIS-R.

Table 2 presents an age-by-age breakdown of sex differences and also reports sex differences separately for blacks and whites. In general, sex differences are smaller for adolescents and young adults (ages 16–24) than for other adults. The largest differences (3–4 points) were observed at ages 25–44, but even at these ages the differences are not substantial enough (in comparison with the *SD* of 15) to warrant separate sex norms or to affect test interpretation in any meaningful or practical way. This conclusion is the same as that reached by Kaufman and Doppelt (1976) for the WISC-R.

Table 2 reveals that black as well as white males scored slightly higher than females across the WAIS-R age range, but that the sex differences for blacks were only about 1 point on each IQ scale. However, as noted previously, the Sex × Race interactions in the three ANOVAs were not statistically significant.

It is important to reiterate that these data on sex differences do not serve to enhance our understanding of theoretical differences or similarities in male versus female intellectual functioning and mental processing: "From the very beginning developers of the best known individual intelligence scales (Binet, Terman, and Wechsler) took great care to *counterbalance* or *eliminate* from their final scale any items or subtests which *empirically* were found to result in a higher score for one sex over the other" (Matarazzo, 1972, p. 352). Thus, the lack of significant sex differences in the WAIS-R merely indicates that Wechsler met one of his goals in developing his test.

Race Differences

Table 3 shows black-white IQ differences for four broad age groups, 16–19, 20–34, 35–54, and 55–74 years. Data for adjacent age groups were combined to ensure that generalizations about race discrepancies at different ages are based on adequate samples of blacks (40 or more per group). The overall differences in favor of whites of about 13½ points on the Verbal scale, 14 points on the Performance scale, and 14½ points on the Full Scale (Table 1) also characterize each of the four age groups presented in Table 3. Mean IQs for blacks were remarkably constant from age group to age group for VIQ (87.8–88.4), PIQ (87.2–87.5), and FSIQ (86.6–87.0). These differences of about one standard deviation on conventional IQ tests are consistent with a considerable body of research on individual differences and represent a finding, for the most part, impervious to time (see Jensen, 1980, and Reynolds & Brown, 1984, for reviews).

The significantly different means for white and black adolescents and adults

TABLE 2
Sex Differences on the WAIS-R IQs by Age and Race

	VIQ			PIQ			FSIQ		
Age/ statistic	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
16-17									
N	100	100		100	100		100	100	
Mean	100.90	99.37	1.53	101.17	99.45	1.72	101.10	99.11	1.99
SD	15.96	13.59		15.86	13.93		16.20	13.24	
18-19									
N	100	100		100	100		100	100	
Mean	98.33	97.60	.73	97.07	98.67	-1.6	97.67	98.00	-.33
SD	13.77	15.06		13.69	16.54		13.81	15.68	
20-24									
N	100	100		100	100		100	100	
Mean	100.49	99.65	.84	100.62	99.66	.96	100.80	99.81	.99
SD	15.20	13.97		14.37	15.67		15.30	14.82	
25-34									
N	150	150		150	150		150	150	
Mean	101.89	98.01	3.88	101.83	98.79	3.04	101.92	97.97	3.95
SD	15.43	14.92		15.94	15.84		15.73	15.63	
35-44									
N	125	125		125	125		125	125	
Mean	100.80	97.13	3.67	101.02	98.28	2.74	101.21	97.40	3.81
SD	15.37	15.20		14.99	15.59		15.51	15.35	
45-54									
N	125	125		125	125		125	125	
Mean	101.68	99.90	1.78	101.56	98.86	2.70	101.76	99.12	2.64
SD	14.74	15.10		16.24	13.80		15.65	14.31	
55-64									
N	80	80		80	80		80	80	
Mean	101.33	98.54	2.79	100.34	98.96	1.38	101.14	98.56	2.58
SD	14.83	14.36		15.41	14.14		15.20	14.63	
65-69									
N	80	80		80	80		80	80	
Mean	100.59	99.32	1.27	99.72	99.55	.17	100.72	99.64	1.08
SD	15.61	15.53		15.07	15.78		15.54	16.23	
70-74									
N	80	80		80	80		80	80	
Mean	101.59	99.09	2.50	99.86	99.94	-.08	101.20	99.56	1.64
SD	14.75	16.21		14.21	14.12		14.40	14.30	
Total blacks									
N	93	99		93	99		93	99	
Mean	88.23	87.55	.68	87.90	86.78	1.12	87.30	86.44	.86
SD	13.05	13.18		14.74	12.61		13.61	12.52	
Total whites									
N	836	828		836	828		836	828	
Mean	102.30	100.17	2.13	101.90	100.63	1.27	102.42	100.33	2.09
SD	14.67	14.28		14.63	14.66		14.78	14.49	

TABLE 3
Race Differences on the WAIS-R IQs by Age

	VIQ			PIQ			FSIQ		
Age	White	Black	Diff.	White	Black	Diff.	White	Black	Diff.
16–19									
N	344	50		344	50		344	50	
Mean	100.73	88.02	12.71	100.74	87.24	13.50	100.78	86.86	13.92
SD	14.01	14.53		14.37	14.57		14.06	14.51	
20–34									
N	440	50		440	50		440	50	
Mean	101.54	88.44	13.10	101.89	87.50	14.39	101.82	87.00	14.82
SD	14.67	11.86		15.19	12.51		15.09	11.62	
35–54									
N	443	51		443	51		443	51	
Mean	101.29	87.24	14.05	101.36	87.24	14.12	101.37	86.61	14.76
SD	14.71	13.49		14.80	13.43		14.81	13.21	
55–74									
N	437	41		437	41		437	41	
Mean	101.28	87.80	13.48	100.96	87.32	13.64	101.43	87.00	14.43
SD	14.55	12.59		14.21	14.61		14.61	13.00	
Total									
N	1,664	192		1,664	192		1,664	192	
Mean	101.24	87.88	13.36	101.28	87.32	13.96	101.38	86.86	14.52
SD	14.50	13.09		14.66	13.66		14.67	13.03	

on the WAIS-R are substantial and are important to take into account when interpreting an individual's test scores. For example, when a black male or female earns IQs in the mid to high 80s, it is important to note in a case report that whereas these IQs correspond to a percentile rank of about 20 in the population at large, they are about average for black adolescents and adults who reside in the United States.

Regional Differences

The small differences in mean IQs earned by individuals living in the four regions of the United States (Table 1) are consistent with the results of regional differences on both the WISC-R (Kaufman & Doppelt, 1976) and WPPSI (Kaufman, 1973). On the WAIS-R, regional differences ranged from 2½ points on the Full Scale to 5 points on the Performance scale. WISC-R regional differences were about 6 points on each IQ scale, and for the WPPSI the differences between the highest and lowest region were 6–7 points. For the WAIS-R, WISC-R, and WPPSI, highest scores were earned by individuals from the West and Northeast, and the lowest scores were obtained by children and adults living in the South.

Sex and race differences within each region were examined, but the data are

not presented here. The 2-point advantage for males over females in the total sample on the Full Scale was reflected precisely in each of the four separate regions of the United States. Black-white differences, by region, are difficult to interpret because of small sample sizes in the West ($N = 12$) and North Central region ($N = 26$). Full Scale IQ discrepancies in favor of whites were 13 1/2 points in the South and West, 14 points in the Northeast, and 18 points in the North Central region. However, the slightly larger North Central Full Scale IQ difference is conceivably a quirk of the limited sample.

Overall, regional differences on the WAIS-R are trivial and insignificant, and of no consequence for test interpretation.

Urban–Rural Residence Differences

Overall, urban individuals outscored those from rural residences by a nonsignificant 2 1/2 points on VIQ, less than 1 point on PIQ, and 2 points on FSIQ (Table 1). Residence data by sex and race are summarized here, but are not presented. For males, urban residents scored higher by 2 points on VIQ and 1 1/2 points on FSIQ, but there was no mean difference on PIQ. Urban females earned higher means than rural females by 3 points, 2 points, and 2 1/2 points on the VIQ, PIQ, and FSIQ scales, respectively. For both sexes, residence differences were insignificant and, as noted previously, the Sex × Residence interaction was nonsignificant.

There were only 25 rural blacks in the entire standardization sample, so no generalizations about residence differences by race are possible. The mean IQs for these 25 rural blacks were only slightly lower than the means for urban blacks (1/2 point on VIQ, 2 points on PIQ, 1 point on FSIQ). On the WISC-R, the 65 rural black children scored 2 1/2–4 1/2 points lower than their urban counterparts (Kaufman & Doppelt, 1976).

The trivial urban-rural differences for the WAIS-R are consistent with research in the last 15 years that has shown a considerable narrowing of the 6- to 12-point IQ advantage enjoyed by urban children, ages 2–18 years, a half century ago (McNemar, 1942). The 1949 WISC produced IQ differences favoring urban children of 4–6 points (Seashore et al., 1950), the 1967 WPPSI showed 3 1/2-point differences (Kaufman, 1973), and the 1974 WISC-R produced differences of 1 1/2–2 IQ points (Kaufman & Doppelt, 1976)—virtually identical to the WAIS-R differences reported here. Quite conceivably, even the 2 points favoring urban residents on the WISC-R and WAIS-R would disappear if other variables (e.g., socioeconomic status) were controlled. For the WPPSI, the urban and rural difference of 3 1/2 points reduced to zero on VIQ, PIQ, and FSIQ after the urban and rural samples were carefully matched on age, sex, race, geographic region, and father's occupation (Kaufman, 1973).

Presumably, the impact of mass media and improved educational facilities and opportunities has led to a steady elimination of any advantage that urban

children, adolescents, or adults may have experienced a half century ago or even a generation ago.

Occupational Group

Although occupational group was not included as an independent variable in the ANOVAs for reasons mentioned earlier, the data presented in Table 1 show large differences in mean IQs earned by various occupational categories: Professional and technical workers scored higher than unskilled workers by about 22½ points on VIQ, 18½ points on PIQ, and 22 points on FSIQ.

Table 4 helps illuminate these aggregated data by showing the differences separately by age group. The nine standardization age groups were merged into three broad groups (16–19, 20–54, 55–74 years) to ensure that means were based on sample sizes of at least 20.

The 16–19 group includes adolescents who are categorized by their *parents'* occupational category, whereas the other two categories include adults who are actually in the given occupational groups. Data for adults aged 55–74 were not merged with the younger adults because the age 55 + group was composed primarily (67%) of adults not in the labor force (category 6 in Table 4).

Table 4
Means and Standard Deviations of WAIS-R IQs for Occupational Groups by Age

		VIQ		PIQ		FSIQ	
Occupational group	*N*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Ages 16–19							
1 Profess. & Tech.	62	107.58	11.91	104.71	12.98	107.06	12.22
2 Manager, Cler., Sales	108	103.28	12.89	102.60	14.48	103.07	13.68
3 Skilled workers	86	97.19	12.99	98.99	13.65	97.72	13.02
4 Semiskilled workers	120	93.45	14.85	94.59	15.51	93.44	14.84
5 Unskilled workers	24	92.67	12.25	91.62	16.68	91.71	16.90
6 Not in labor force	0	—	—	—	—	—	—
Ages 20–54							
1 Profess. & Tech.	124	112.56	12.85	109.69	14.16	112.44	13.73
2 Manager, Cler., Sales	248	103.65	11.80	103.03	12.49	103.55	11.92
3 Skilled workers	103	99.43	11.19	102.68	13.08	100.74	12.11
4 Semiskilled workers	225	91.92	13.32	94.15	15.70	92.33	14.15
5 Unskilled workers	35	86.69	14.86	89.54	15.08	87.14	14.85
6 Not in labor force	265	99.30	16.05	98.26	15.75	98.71	16.09
Ages 55–74							
1 Profess. & Tech.	20	114.60	12.96	109.40	12.49	114.25	13.02
2 Manager, Cler., Sales	53	109.51	11.96	106.30	12.80	109.00	12.38
3 Skilled workers	24	98.58	11.13	102.38	14.92	100.46	12.49
4 Semiskilled workers	59	94.31	11.44	95.95	13.54	95.10	12.70
5 Unskilled workers	9	—	—	—	—	—	—
6 Not in labor force	315	99.12	15.05	98.69	14.85	98.97	15.12

The range between occupational Groups 1 and 5 is 13–16 points for the 16-to-19-year-olds who were categorized by parental occupation. Ranges for adults actually employed in the groups are larger: For ages 20–54, professionals and technical workers outscored unskilled workers by 26 points on VIQ, 20 points on PIQ, and 25 points on FSIQ. There were an insufficient number of adults in occupational Group 5 at ages 55–74 to permit analysis of data for unskilled workers, but the range between occupational Groups 1 and 4 (semi-skilled workers) for these older adults was a substantial 13½–20 IQ points. (For 16- to 19-year-olds, the range between occupational Groups 1 and 4 was 10–14 points.) For all three age groups, differences in PIQ across the occupational categories were smaller than corresponding differences in VIQ or FSIQ.

This difference resulted primarily from the fact that the superiority of VIQ scores of professional and technical workers (or their adolescent children) in each age group was 3–5 points greater than the advantage in PIQ scores. A similar finding emerged for the WISC-R for children of professional and technical workers (Kaufman & Doppelt, 1976).

Occupational data by sex and race are presented in Table 5. Data for occupational Groups 1, 2, and 3 were merged, as were data for occupational Groups 4 and 5, because of small sample sizes for females in Group 5 ($N = 16$), and for blacks in occupational Groups 1 ($N = 10$), 3 ($N = 9$), and 5 ($N = 16$).

Sex differences were constant across occupational groups; males scored 2–3 points higher on VIQ, 1–1½ points higher on PIQ, and 2–2½ points higher on FSIQ for Group 1-2-3 and Group 4-5. When occupational Groups 1, 2, and 3 are examined separately by sex (data not presented), males are seen to have consistently scored higher than females, by about the same margin, for each separate occupational category.

The occupational group by race analysis shown in Table 5 reveals that whites in Group 1-2-3 earned mean IQs that were 8½–11½ points higher than whites in Group 4-5. For blacks, the difference was a similar 8–10 points. Hence, occupational group seems to be related to VIQ, PIQ, and FSIQ to about the same degree for each racial group. Nonetheless, it is evident from Table 5 that the mean IQs of blacks in occupational Group 1-2-3 are comparable in magnitude to the mean IQs of whites in Group 4-5.

In general, the analyses of occupational group by sex and race parallel fairly closely the findings with the WISC-R (Kaufman & Doppelt, 1976). For the WISC-R sample, the range in mean IQs between occupational Groups 1 and 5 was 21 points for VIQ, 17 points for PIQ, and 21 points for FSIQ. These results are strikingly similar to the corresponding WAIS-R values for the total sample (see Table 1) of 22½, 18½, and 22. Mean ranges for preschool children tend to be smaller than the values for school-age children and adults: The ranges on the WPPSI were 17, 15, and 18 points (Kaufman, 1973); and the range on the McCarthy General Cognitive Index was 16½ points.

Occupational group differences for the WAIS-R, most notably for the 20- to 54-year-olds actively employed in various occupations, are quite substantial

Table 5
Means and Standard Deviations of WAIS-R IQs for Occupation by Sex and Race

	VIQ			PIQ			FSIQ		
Occupation[a]:	1-2-3	4-5	6	1-2-3	4-5	6	1-2-3	4-5	6
Male									
N	485	287	168	485	287	168	485	287	168
Mean	105.42	93.33	100.77	104.63	94.31	99.20	105.55	93.52	100.18
SD	13.27	14.40	15.95	13.90	15.16	15.07	13.69	14.86	15.51
Female									
N	343	185	412	343	185	412	343	185	412
Mean	103.26	90.37	98.57	103.06	93.55	98.20	103.37	90.89	98.31
SD	12.80	12.83	15.28	13.19	15.74	15.34	12.95	13.44	15.56
White									
N	769	380	515	769	380	515	769	380	515
Mean	105.19	93.88	100.76	104.70	96.00	100.02	105.41	94.44	100.49
SD	12.96	13.61	15.15	13.36	14.96	14.95	13.17	14.03	15.22
Black									
N	48	84	60	48	84	60	48	84	60
Mean	94.94	84.81	86.52	93.12	85.26	85.57	93.46	84.18	85.33
SD	11.98	12.74	12.49	14.03	14.02	11.57	12.85	13.01	11.49

[a]See Table 7 for descriptions of specific occupation codes 1–6.

and should be understood well by practitioners, especially for vocational counseling. An individual who aspires to a professional or technical position, for example, can be aided by the data on occupational groups in Tables 1, 4, and 5. If such an individual earns a WAIS-R Full Scale IQ of 100, the examiner might point out that an IQ of that magnitude surpasses only about 15% of adults in professional and technical occupations (i.e., it's about 1 *SD* below the mean; see Table 4).

Worthy of note in the tables presenting data on occupational groups are the mean IQs (and *SD*s) earned by those in Group 6 subjects not in the labor force. They consistently averaged 100 (with *SD* approximately 15) for the total sample (Table 1), for separate age groups (Table 4), and for separate groups of males and females (Table 5). Whites and blacks not in the labor force earned IQs with means and *SD*s close in magnitude to the values reported for the total samples of whites and blacks (Tables 1 and 5). These results indicate that the large "not in labor force" group is a representative sampling of adults; those who are retired probably were employed in occupational groups in approximate census proportions. Had there been an unrepresentative sample of people not in the labor force (e.g., a preponderance of former professionals), then the norms would have been less accurate and useful.

Educational Differences

As one might expect from the study by Matarazzo and Herman (1984), the highly significant variable of educational level produced the largest discrepancies of any stratification variable, with ranges of about 2 *SD* between college-educated adults and those individuals with 7 or less years of formal schooling (Table 1). Table 6 presents the results of Tukey's HSD post hoc test (Kirk, 1982) to determine which pairs of mean VIQ, PIQ, and FSIQs differed significantly from each other. As shown in the Table 6, the results were quite similar for all three IQs: With one exception, each educational group differed significantly from every other educational group in its mean IQ. The single exception was the nonsignificant difference in PIQ for high school graduates versus those with 9–11 years of education.

Table 7 presents the relationship between educational level and age, sex, and race. To avoid sample cells below 20, the lowest two levels of education (0–7 years and 8 years) were combined, as were the highest two levels (13–15 years and college graduate); in addition, several age groups were combined. An

Table 6
Mean Differences Among IQs for Varying Educational Levels

	6	5	4	3	2	1
Verbal IQ						
6 College grad.	—	8.08	15.46	19.68	25.36	33.64
5 13–15 years		—	7.38	11.60	17.28	25.56
4 H.S. grad.			—	4.22	9.90	18.18
3 9–11 years				—	5.68	13.96
2 8 years					—	8.28
1 0–7 years						—
Performance IQ						
6 College grad.	—	5.63	10.68	13.34	17.84	26.62
5 13–15 years		—	5.05	7.70	12.21	21.00
4 H.S. grad.			—	2.66	7.16	15.95
3 9–11 years.				—	4.50	13.29
2 8 years					—	8.78
1 0–7 years						—
Full Scale IQ						
6 College grad.	—	7.93	15.00	18.82	24.24	32.81
5 13–15 years		—	7.07	10.89	16.31	24.88
4 H.S. grad.			—	3.82	9.24	17.81
3 9–11 years				—	5.42	13.99
2 8 years					—	8.57
1 0–7 years						—

Note. The Tukey Honestly Significant Difference is 3.50 ($p = .05$). The mean differences are based on *N*'s less 24 subjects classified as "others," i.e., nonwhite and nonblack. However, the resulting means are essentially the same as those in Table 1.

Table 7
Means and Standard Deviations of WAIS-R IQs, Education by Age, Sex, Race Variables

		Educational group[a]			
		1	2	3	4
		Verbal IQ			
Age (years)					
16–19	*N*	25	248	103	24
	Mean	82.88	98.43	101.04	113.75
	SD	12.15	14.51	12.24	9.92
20–34	*N*	23	62	205	210
	Mean	76.13	90.56	96.09	109.20
	SD	13.31	12.34	12.52	11.43
35–44	*N*	26	39	106	79
	Mean	79.92	87.56	99.33	110.37
	SD	10.89	11.50	12.06	11.73
45–54	*N*	40	46	100	64
	Mean	85.55	93.91	102.05	113.28
	SD	15.64	10.10	10.17	12.24
55–64	*N*	44	26	59	31
	Mean	86.93	96.81	103.98	113.29
	SD	10.81	12.42	10.61	12.08
65–74	*N*	133	51	79	57
	Mean	90.47	99.29	105.14	116.56
	SD	11.42	12.76	10.39	12.08
Sex					
Male	*N*	151	242	303	244
	Mean	87.72	96.83	100.83	113.18
	SD	12.36	13.98	11.87	11.78
Female	*N*	140	230	349	221
	Mean	85.26	95.25	99.51	109.38
	SD	13.38	13.60	12.18	11.67
Race					
White	*N*	234	405	584	441
	Mean	87.88	97.40	101.07	112.08
	SD	12.89	13.45	11.71	11.53
Black	*N*	53	65	54	20
	Mean	80.87	87.77	91.94	95.80
	SD	11.49	13.12	12.61	9.31

[a] 1 = 0–8 years, 2 = 9–11 years, 3 = 12 years, and 4 = 13–16 years.

interesting pattern emerged for age that was not evident in the data presented by Matarazzo and Herman (1984): Among adults (aged 20–74), all three IQs increased steadily with age in virtually all educational groups. For example, the mean FSIQs of adults with 0–8 years of schooling rose steadily from 76.5 at ages 20–34 to 91.5 at age 65–74; mean FSIQs for those with at least 1 year of

Table 7
Continued

		Educational group[a]			
		1	2	3	4
		Performance IQ			
Age (years)					
16–19	*N*	25	248	103	24
	Mean	87.60	99.02	99.32	110.79
	SD	15.62	14.59	14.89	13.93
20–34	*N*	23	62	205	210
	Mean	80.22	93.63	97.21	107.34
	SD	17.32	16.60	13.25	13.32
35–44	*N*	26	39	106	79
	Mean	83.62	91.15	100.52	107.95
	SD	15.20	15.36	13.47	11.12
45–54	*N*	40	46	100	64
	Mean	86.25	97.59	102.25	107.62
	SD	15.08	13.58	12.38	14.03
55–64	*N*	44	26	59	31
	Mean	87.34	98.11	104.88	108.45
	SD	12.08	12.40	12.78	11.97
65–74	*N*	133	51	79	57
	Mean	93.50	101.49	102.27	109.40
	SD	14.61	13.76	13.29	10.97
Sex					
Male	*N*	151	242	303	244
	Mean	90.03	98.18	100.47	109.34
	SD	15.19	15.17	13.01	12.60
Female	*N*	140	230	349	221
	Mean	88.16	97.27	99.90	106.49
	SD	15.26	14.53	13.90	12.70
Race					
White	*N*	234	405	584	441
	Mean	90.98	99.49	101.21	108.44
	SD	15.08	14.26	13.29	12.65
Black	*N*	53	65	54	20
	Mean	80.96	86.42	90.98	97.50
	SD	13.26	13.13	12.52	10.74

(*continued*)

college rose from 109.3 to 114.9; and so forth. The adolescents (aged 16–19) were not part of this trend, but many of these individuals were still in school and had not yet completed their educations.

The male–female differences are fairly consistent across the educational levels, males tending to score slightly higher on VIQ, PIQ, and FSIQ within each educational category. Differences for blacks across the educational levels tend to be substantial, but are smaller than corresponding differences for

Table 7
Continued

		Educational group[a]			
		1	2	3	4
		Full Scale IQ			
Age (years)					
16–19	*N*	25	248	103	24
	Mean	83.68	98.48	100.31	114.17
	SD	13.20	14.49	12.85	11.01
20–34	*N*	23	62	205	210
	Mean	76.48	90.98	96.07	109.29
	SD	13.95	14.49	12.58	12.18
35–44	*N*	26	39	106	79
	Mean	80.73	88.26	99.72	110.32
	SD	12.35	12.22	12.48	11.76
45–54	*N*	40	46	100	64
	Mean	85.05	95.07	101.87	111.69
	SD	15.69	11.51	10.61	12.84
55–64	*N*	44	26	59	31
	Mean	86.45	96.77	104.59	112.42
	SD	10.65	12.03	11.63	12.52
65–74	*N*	133	51	79	57
	Mean	91.46	100.18	104.70	114.84
	SD	12.70	13.39	11.63	11.85
Sex					
Male	*N*	151	242	303	244
	Mean	88.32	97.21	100.74	112.61
	SD	13.56	14.56	12.27	12.06
Female	*N*	140	230	349	221
	Mean	85.59	95.57	99.43	109.09
	SD	13.82	13.82	12.66	12.17
Race					
White	*N*	234	405	584	441
	Mean	88.60	98.02	101.11	111.61
	SD	13.67	13.77	12.16	11.95
Black	*N*	53	65	54	20
	Mean	80.19	86.34	90.70	95.85
	SD	12.00	12.90	12.10	9.53

whites. Blacks with at least 1 year of college scored 15–16½ IQ points higher than blacks with 0–8 years of schooling; for whites, the IQ differences were 18½–24 IQ points.

It is hard to compare these huge educational differences on the WAIS-R with other studies of adults because mean IQs based on number of years of schooling completed do not seem to be readily available. Birren and Morrison (1961) analyzed educational data for the WAIS standardization sample, but

only reported correlations between education and scores on the separate WAIS subtests.

Wechsler (1958, p. 251) reported correlations between WAIS Verbal, Performance, and Full Scale scores (sums of scaled scores, not IQs) and number of years of schooling for ages 18-19, 25-34, and 45-54 years. He found correlations of .66-.73 with Verbal scale, .57-.61 with Performance scale, and .66-.72 with Full Scale; based on numerous investigations, Matarazzo (1972) states that a correlation of .70 best summarizes the relationship between education and IQ.

To permit WAIS-WAIS-R comparisons of the impact of education on IQ, Matarazzo correlated education level with VIQ, PIQ, and FSIQ for three broad age groups and total sample. We have reported these correlations for each of the nine age groups, separate groups of whites and blacks, and separate groups of males and females (Table 8). The values for the bulk of adults (aged 25-74) are reasonably consistent with WAIS findings and the .70 relationship that summarizes many studies. The one truly aberrant group is ages 16-17, with *r*s of .10-.23, obviously reflecting the fact that many of these adolescents have only partially completed their education. The age-by-age breakdown in Table 8 pinpoints the youngest group as the main determinant in the .28-.39 correlations reported and interpreted by Matarazzo and Herman (1984) for the broad amalgamation of ages 16-24.

Because of the atypical nature of the data for 16- to 17-year-olds, we based the correlations for separate groups of males and females, separate groups of blacks and whites, and the total sample only on individuals aged 18-74. These

Table 8
Correlations Between Educational Level and IQ for Age, Sex, and Race Groups

		IQ		
Group	*N*	Verbal	Performance	Full Scale
16-17 Years	200	.23	.10	.19
18-19 Years	200	.58	.42	.56
20-24 Years	200	.49	.41	.50
25-34 Years	300	.69	.51	.66
35-44 Years	250	.67	.51	.64
45-54 Years	250	.65	.48	.62
55-64 Years	160	.68	.57	.67
65-69 Years	160	.68	.46	.60
70-74 Years	160	.68	.40	.63
Whites (ages 18-74)	1,492	.60	.42	.56
Blacks (ages 18-74)	166	.44	.43	.45
Males (ages 18-74)	840	.63	.47	.59
Females (ages 18-74)	840	.57	.42	.54
Total group (ages 18-74)	1,680	.60	.44	.57

aggregated data, presented in Table 8, reveal that (a) coefficients are slightly higher for males than females for each IQ; (b) coefficients are higher for whites than blacks, but only for VIQ and FSIQ; and (c) coefficients for the total group of 18- to 74-year-olds (.60 for VIQ, .45 for PIQ, .57 for FSIQ) are each about .04 higher than the corresponding coefficients reported by Matarazzo and Herman (1984) for the entire 16- to 74-year-old sample, and more truly represent the relationship between education and IQ within the adult population.

Overall, the relationship between education and IQ is striking. Whether the strong relationship is found because schooling impacts upon intelligence test performance, or because people with lower intelligence have less opportunity to continue with their formal education than people with higher levels of intelligence is unclear. Certainly both factors are important in creating the relationship. Despite a lack of knowledge regarding why IQ and educational attainment are so related, it is clear that examiners must take a person's educational level into account when interpreting WAIS-R scores. A Full Scale IQ of 110, for example, means something quite different for people with differing educational backgrounds. Using the means and *SD*s presented in Table 1 for the total sample, we can compute that a Full Scale IQ of 110 corresponds to the 97th percentile rank for a person with only 0–7 years of schooling, the 79th percentile rank for a high school graduate, and the 34th percentile rank for a college graduate. This supplementary type of analysis will give school psychologists and other clinicians important interpretive information for making meaningful recommendations based on a WAIS-R assessment.

CONCLUSIONS

The following conclusions can be drawn from this study.

1. On the basis of WAIS-R data, the stratification variables of sex, region, and urban–rural residence were not significantly related to VIQ, PIQ, or FSIQ for adolescents and adults aged 16–74 years. Hence, these variables are not important for examiners to consider when interpreting WAIS-R profiles.

2. The stratification variables of race, education level, and occupational group were significantly and strikingly related to the IQs and may be taken into account when interpreting WAIS-R profiles.

3. The results of this study add greatly to our understanding of the relationship of background variables to IQ in adults, since most previous similar studies have been based on samples of preschool or school-age children.

4. The data presented here for adults are strikingly similar to research findings involving the WISC-R (Kaufman & Doppelt, 1976), WPPSI (Kaufman, 1973), and other tests for children.

5. The significant relationships obtained in this study held true for VIQ, PIQ, and FSIQ. The finding of significant correlations for PIQ, which mea-

sures fluid abilities, and not just VIQ (a measure of the more crystallized, school-related abilities), is extremely noteworthy, especially regarding its relationship to educational attainment. However, it is still important to point out that the range of IQ means across educational and occupational categories, although substantial in magnitude for PIQ, were still smaller than the corresponding ranges for VIQ and FSIQ.

6. The tables in this article can be used as a kind of supplementary norms to facilitate interpretation of test scores obtained by adolescents and adults on the WAIS-R; tables involving race, occupational group, and educational level may be especially useful for this purpose.

7. Research should be undertaken to try to explicate the primary causal factors in the relationship between IQ and education, and to try to explain the increasing IQs, within different educational levels, as age increases across the 20- to 74-year range.

REFERENCES

Anastasi, A. (1958). *Differential psychology* (3rd ed.). New York: Macmillan.

Barona, A., Reynolds, C. R., & Chastain, R. L. (in press). Estimating premorbid IQ on the WAIS-R. *Journal of Consulting and Clinical Psychology.*

Birren, J. E., & Morrison, D. F. (1961). Analysis of the WAIS subtests in relation to age and education. *Journal of Gerontology, 16*, 363–369.

Jensen, A. R. (1980). *Bias in mental testing.* New York: Free Press.

Kaufman, A. S. (1973). The relationship of WPPSI IQs to SES and other background variables. *Journal of Clinical Psychology, 29*, 354–357.

Kaufman, A. S., & Doppelt, J. E. (1976). Analysis of WISC-R standardization data in terms of the stratification variables. *Child Development, 47*, 165–171.

Kaufman, A. S., & Kaufman, N. L. (1973). Black-white differences at ages $2^1/_2$–$8^1/_2$ on the McCarthy Scales of Children's Abilities. *Journal of School Psychology, 11*, 196–206.

Kaufman, A. S., & Kaufman, N. L. (1975). Social-class differences on the McCarthy Scales for black and white children. *Perceptual and Motor Skills, 41*, 205–206.

Kaufman, A. S., & Kaufman, N. L. (1983). *K-ABC interpretive manual.* Circle Pines, MN: American Guidance Service.

Kirk, R. E. (1982). *Experimental design, procedures for the behavioral sciences* (2nd ed.). Belmont, CA: Wadsworth.

Matarazzo, J. D. (1972). *Wechsler's measurement and appraisal of adult intelligence* (5th ed.). New York: Oxford University Press.

Matarazzo, J. D., & Herman, D. O. (1984). Relationship of education and IQ in the WAIS-R standardization sample. *Journal of Consulting and Clinical Psychology, 52*, 631–634.

McNemar, Q. (1942). *The revision of the Stanford-Benet scale.* Boston: Houghton-Mifflin.

Reynolds, C. R., & Brown, R. T. (Eds.). (1984). *Perspectives on bias in mental testing.* New York: Plenum.

Seashore, H., Wesman, A., & Doppelt, J. (1950). The standardization of the Wechsler Intelligence Scale for Children. *Journal of Consulting Psychology, 14*, 99–110.

Tyler, L. E. (1965). *The psychology of human differences* (3rd ed.). New York: Appleton-Century-Crofts.

Wechsler, D. (1955). *WAIS Manual; Wechsler Adult Intelligence Scale.* New York: Psychological Corporation.

Wechsler, D. (1958). *Measurement and appraisal of adult intelligence* (4th ed.). Baltimore: Williams & Wilkins.

Wechsler, D. (1981). *WAIS-R Manual; Wechsler Adult Intelligence Scale-Revised.* New York: Psychological Corporation.