

# The Interaction Between Health and Education

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*Analysis of data on work disability from the 1970 Decennial Census 5-percent sample reveals that, even after standardizing for age, increased education is associated with lower levels of disability. In addition, differences in educational attainment are an important factor in explaining racial differences in the proportion of the population who are disabled. Standardizing for age and education simultaneously explains 63 percent of the racial differences for men and 23 percent of these differences for women.*

MANY OBSERVERS HAVE postulated a relationship between health and education. Their hypothesis has been that people with higher levels of education should experience better health. In their seminal work on labor-force participation, William Bowen and T. Alden Finegan, for example, find "that there is a powerful interaction among health, schooling, and labor-force participation."<sup>1</sup> These relationships are quite complex, and it is difficult to establish causation. A person may have little education because he was in poor health or he may be in poor health because his education was meager.

Michael Grossman, using a human capital approach in his health demand model, hypothesized and found a positive and statistically significant education coefficient.<sup>2</sup> According to that study the amount of "healthy time," which "is measured either by the complement of the number of restricted activity days due to illness and injury or by the complement of the number of work loss days," increases with the level of education. In the same manner, one would expect to find a lower prevalence of disability among the better educated.

Another study, using data from the National

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<sup>1</sup> See William Bowen and T. Alden Finegan, *The Economics of Labor-Force Participation*, Princeton University Press, 1969, pages 62-66.

<sup>2</sup> Michael Grossman, *Demand for Health* (Occasional Paper 119), National Bureau of Economic Research, 1972.

Center for Health Statistics, found "the evidence at times suggests that level of education is a causal factor in individual health status and medical care utilization."<sup>3</sup> In fact, according to the study, "the observed correlation between income and medical deprivation appears to be a consequence of education's relationship with both variables."

## EDUCATION AND DISABILITY RATES

The 1970 Decennial Census 5-percent sample, which contained a question on work-related health conditions, is a fertile source for further exploration of these relationships.<sup>4</sup> Some insight can be gained from an analysis of the data in a Decennial Census report on persons with work disability.<sup>5</sup> The findings of that report are studied here.

One can observe from table 1 that for men and women the proportion with any work disability<sup>6</sup> and the proportion with complete work disability both decline as the years of schooling increase. The only exception is among men with 1-3 years of college for whom the proportion with any disability is above that for high school graduates. Thus the data support the a priori assumption

<sup>3</sup> Myron J. Lefcowitz, "Poverty and Health: A Re-examination," *Inquiry*, March 1973, pages 3-13.

<sup>4</sup> For a description of the sample, see Bureau of the Census, *1970 Census of Population, Detailed Characteristics: U.S. Summary* (Final Report PC(1)-D1), 1973, Introduction and Appendix B.

<sup>5</sup> Bureau of the Census, *1970 Census of Population, Subject Reports: Persons With Work Disability* (Final Report PC(2)-6C), January 1973. It should be noted that the 1970 Census was conducted primarily through self-enumeration using a mail questionnaire. Whether a person was identified as disabled depended on the self-perception of that person or of the family member completing the form.

<sup>6</sup> *Ibid.*, table 7. A person was classified as with "partial work disability" if he reported a health or physical condition that limited the kind or amount of work he was able to do but would not or did not keep him from holding a job. A person was classified as with "complete work disability" if his health or physical condition did prevent him from working at a job

TABLE 1.—Years of school completed for the experienced civilian labor force aged 18–64: Number and percentage distribution, by presence of work disability and sex, 1970

Years of school completed	Total number	Percentage distribution by work disability status				
		Total	Without work disability	With work disability		
				Total	Partial	Complete
Men						
Total.....	46,065,616	100 0	91 2	8 8	8 2	0 5
Elementary:						
Less than 8.....	4,601,546	100 0	85 5	14 5	13 2	1 2
8.....	4,241,046	100 0	88 0	12 0	11 1	9
High school						
1-3.....	9,084,803	100 0	90 2	9 8	9 2	7
4.....	15,277,869	100 0	92 6	7 4	7 0	.4
College						
1-3.....	6,241,873	100 0	92 1	7 9	7 5	.3
4 or more.....	6,618,479	100 0	94 7	5 3	5 1	.2
Women						
Total.....	28,533,093	100 0	94 2	5 8	5 2	.5
Elementary						
Less than 8.....	1,910,908	100 0	88 2	11 8	10 6	1 2
8.....	1,950,734	100 0	90 7	9 3	8 4	1 0
High school						
1-3.....	5,418,271	100 0	92 6	7 4	6 6	.8
4.....	12,148,263	100 0	95 5	4 5	4 1	.4
College						
1-3.....	3,985,984	100 0	95 5	4 5	4 1	.3
4 or more.....	3,118,933	100 0	96 6	3 4	3 2	.2

Source: Bureau of the Census, 1970 Census of Population, Subject Reports: Persons With Work Disability (Final Report PC(2)-6C), table 7.

tion that health is directly related to the level of education.

There is a systematic difference between the sexes in the relative frequency of disability. For each educational level the overall proportion disabled is lower for women than it is for men. Among those with complete work disability, the proportion is about equal for men and women at each educational level.

Another way of looking at these data is presented in table 2. Here it becomes evident that persons without work disability have substantially more schooling than those with work disabilities. Thus, 62 percent of the nondisabled men but only 49 percent of those with work disabilities had a high school diploma or better. Twenty-nine percent of the men with work disabilities had no high school education at all, compared with 18 percent for healthy men. It should be emphasized that those figures are for the experienced civilian labor force and hence exclude those disabled too early in life to ever have worked.

A higher proportion of women than men, with disability or without, are high school graduates,

but more of the men either had graduated from college or had some college. In all cases, it still remains true that those with work disability have less schooling than those without work disability.

It would, however, be fallacious to assume that the variations in the relative frequency of disability observed in tables 1 and 2 are due solely to differences in the level of education. It is well known, and to be expected, that younger people experience less disability. At the same time there is a negative correlation between educational attainment and age. Thus the better-educated are also younger than the rest of the population and the lower proportion with disability results from two effects: age and education. The data in table 3 show, for example, that 70 percent of men college graduates were aged 18–44, but only 63 percent of the total male population were in this age group. Eleven percent of the male college graduates were aged 55–64, compared with 16 percent of all men. Similar differences hold for women.

In order to separate the effects of age and education on disability rates the education groupings

TABLE 2.—Presence of work disability for the experienced civilian labor force aged 18–64: Number and percentage distribution, by years of school completed and sex, 1970

Years of school completed	Total	Work disability status			
		Without work disability	With work disability		
			Total	Partial	Complete
Men					
Total number.....	46,065,616	42,021,190	4,044,426	3,797,024	247,392
Total percent....	100 0	100 0	100 0	100 0	100.0
Elementary:					
Less than 8.....	10 0	9 4	16 5	16 0	23 1
8.....	9 2	8 9	12 6	12 4	15 3
High school					
1-3.....	19 7	19 5	22 1	21 9	24 9
4.....	33 2	33 7	28 1	28 3	23 7
College:					
1-3.....	13 5	13 7	12 1	12 4	8 3
4.....	14 4	14 9	8 6	8 9	4 7
Women					
Total number.....	28,533,093	26,890,241	1,642,852	1,490,687	152,165
Total percent....	100 0	100 0	100 0	100 0	100 0
Elementary					
Less than 8.....	6 7	6 3	13 8	13 6	15 5
8.....	6 8	6 6	11 1	11 0	12 3
High school:					
1-3.....	19 0	18 7	24 3	24 0	27 2
4.....	42 6	43 1	33 4	33 7	31 2
College:					
1-3.....	14 0	14 2	10 9	11 1	8 8
4.....	10 9	11 2	6 5	6 7	5 0

Source: See table 1.

in table 1 were standardized on the age distribution of the population of college graduates.<sup>7</sup> It was expected that such a standardization would diminish the differences between the education groups since college graduates form a relatively young group. The results are presented in table 4. Here, it may be noted that even after standardizing for age, increased schooling is associated with better health. Once again it is clear that the proportion of men with some college educa-

tion and any disability was still higher than the rate for high school graduates. The reader is cautioned that table 4, unlike tables 1 and 2, includes persons without civilian labor-force experience. The proportions with disability shown in table 4 tend to be higher than those in table 1.

As expected, standardizing by the age distribution of college graduates had the effect of narrowing the differences in the relative frequency of the occurrence of disability between educational classes. Before standardization, 18.0 percent of men who were elementary school graduates but only 5.9 percent of the college graduates were disabled—that is, they were three times as likely to become disabled. Adjusting for the differences in the age distribution of these two groups reduced

<sup>7</sup> For discussions of standardization methodology, see W. Allen Wallis and Harry V. Roberts, *Statistics*, The Free Press, 1956, pages 290-302, and John H. Mueller, Karl F. Schuessler, and Herbert L. Costner, *Statistical Reasoning in Sociology* (2d ed.) Houghton, Mifflin Co., 1970, chapter 7.

TABLE 3.—Presence of work disability for the population aged 18-64: Number and percentage distribution, by race, sex, and years of school completed, 1970

Sex, age, and years of school completed	Total population						White						Black					
	Total number (in thousands) <sup>1</sup>	Percentage distribution, by work disability status					Total number (in thousands)	Percentage distribution, by work disability status					Total number (in thousands)	Percentage distribution, by work disability status				
		Total	Without work disability	With work disability				Total	Without work disability	With work disability				Total	Without work disability	With work disability		
				Total	Partial	Complete				Total	Partial	Complete				Total	Partial	Complete
Total.....	112,290	100 0	89 2	10 8	6 4	4 4	99,625	100 0	89 6	10 4	6 3	4 1	11,228	100 0	85 5	14 5	7 1	7 4
No years completed.....	779	100 0	67 6	32 4	8 0	24 4	573	100 0	66 8	33 2	8 0	25 2	160	100 0	66 8	33 2	8 5	24 7
Elementary.....	10,146	100 0	75 9	24 1	10 5	13 6	7,629	100 0	76 1	23 9	10 6	13 2	2,349	100 0	74 8	25 2	10 3	14 9
1-7.....	9,668	100 0	82 4	17 6	9 0	8 6	8,581	100 0	82 5	17 5	9 1	8 4	989	100 0	81 1	18 9	8 4	10 5
8.....	22,762	100 0	87 8	12 2	7 2	5 0	9,320	100 0	87 9	12 1	7 3	4 8	3,194	100 0	86 7	13 3	7 0	6 2
High school.....	41,114	100 0	92 5	7 5	5 2	2 4	37,552	100 0	92 5	7 5	5 2	2 3	3,124	100 0	91 5	8 5	5 2	3 3
1-3.....	15,623	100 0	92 7	7 3	5 5	1 8	14,485	100 0	92 7	7 3	5 5	1 8	923	100 0	92 0	8 0	5 5	2 5
4 or more.....	12,197	100 0	94 6	5 4	4 3	1 1	11,485	100 0	94 6	5 4	4 4	1 1	490	100 0	94 2	5 8	4 2	1 7
College.....	54,181	100 0	88 3	11 7	8 0	3 7	48,396	100 0	88 5	11 5	8 1	3 4	5,086	100 0	85 8	14 2	7 8	6 4
Men.....	34,402	100 0	92 4	7 6	5 9	1 7	30,512	100 0	92 6	7 4	5 9	1 5	3,398	100 0	90 6	9 4	6 0	3 4
Aged 18-44.....	202	100 0	66 2	33 8	8 3	25 5	156	100 0	64 3	35 7	8 5	27 2	39	100 0	71 1	28 9	7 4	21 5
No years completed.....	2,091	100 0	84 3	15 7	9 4	6 3	1,594	100 0	84 0	16 0	9 8	6 1	463	100 0	85 0	15 0	8 0	7 0
Elementary.....	1,882	100 0	88 7	11 3	7 9	3 4	1,627	100 0	88 8	11 2	8 0	3 2	233	100 0	88 3	11 7	7 0	4 7
1-7.....	6,537	100 0	91 3	8 7	6 6	2 1	5,415	100 0	91 4	8 6	6 7	1 8	1,040	100 0	90 6	9 4	6 2	3 2
8.....	12,521	100 0	93 6	6 5	5 4	1 0	11,257	100 0	93 6	6 4	5 5	9	1,117	100 0	92 8	7 2	5 2	2 0
High school.....	6,037	100 0	93 3	6 7	5 8	9	5,591	100 0	93 3	6 7	5 9	.8	352	100 0	93 1	6 9	5 5	1 4
1-3.....	5,131	100 0	95 7	4 3	3 9	4	4,872	100 0	95 7	4 3	4 0	.4	154	100 0	95 1	4 9	3 9	1 0
4 or more.....	11,029	100 0	85 2	14 8	10 4	4 4	9,961	100 0	85 6	14 4	10 4	4 0	950	100 0	81 1	18 9	10 2	8 7
College.....	83	100 0	65 6	34 4	11 6	22 8	57	100 0	63 8	36 2	12 1	24 1	20	100 0	68 5	31 5	10 7	20 8
No years completed.....	1,446	100 0	75 7	24 3	13 8	10 6	1,075	100 0	75 2	24 8	14 6	10 3	362	100 0	77 2	22 8	11 4	11 4
Elementary.....	1,332	100 0	82 2	17 8	11 8	6 1	1,204	100 0	82 2	17 8	12 0	5 8	116	100 0	82 1	17 9	9 4	8 6
1-7.....	2,337	100 0	84 3	15 7	11 2	4 5	2,089	100 0	84 5	15 5	11 3	4 2	227	100 0	82 2	17 8	10 0	7 8
8.....	3,292	100 0	88 0	12 0	9 4	2 6	3,109	100 0	88 0	12 0	9 5	2 5	160	100 0	86 3	13 7	8 4	5 3
High school.....	1,150	100 0	87 4	12 6	10 2	2 4	1,090	100 0	87 6	12 4	10 2	2 3	49	100 0	84 1	15 9	11 4	4 5
1-3.....	1,389	100 0	92 3	7 7	6 8	1 0	1,338	100 0	92 3	7 7	6 8	1 0	36	100 0	90 7	9 3	7 4	1 9
4 or more.....	8,761	100 0	75 8	24 2	13 5	10 8	7,923	100 0	76 3	23 7	13 5	10 1	738	100 0	69 6	30 4	13 1	17 3
College.....	107	100 0	60 8	39 2	12 6	26 6	72	100 0	61 7	38 3	12 3	26 1	28	100 0	55 4	44 6	14 0	30 6
No years completed.....	1,846	100 0	65 8	34 2	15 4	18 8	1,423	100 0	65 6	34 4	15 9	18 5	392	100 0	66 0	34 0	14 0	20 0
Elementary.....	1,670	100 0	74 3	25 7	13 7	12 0	1,564	100 0	74 4	25 6	13 9	11 7	95	100 0	72 6	27 4	11 4	16 0
1-7.....	1,778	100 0	76 2	23 8	14 1	9 8	1,649	100 0	76 3	23 7	14 2	9 5	117	100 0	74 5	25 5	12 5	13 0
8.....	1,824	100 0	81 0	19 0	12 4	6 6	1,744	100 0	81 1	18 9	12 5	6 4	65	100 0	77 2	22 8	11 8	11 0
High school.....																		
1-3.....																		
4.....																		

See footnotes at end of table

TABLE 3.—Presence of work disability for the population aged 18-64: Number and percentage distribution, by race, sex, and years of school completed, 1970—Continued

Sex, age, and years of school completed	Total population						White						Black					
	Total number (in thousands) <sup>1</sup>	Percentage distribution, by work disability status					Total number (in thousands)	Percentage distribution, by work disability status					Total number (in thousands)	Percentage distribution, by work disability status				
		Total	Without work disability	With work disability				Total	Without work disability	With work disability				Total	Without work disability	With work disability		
				Total	Partial	Complete				Total	Partial	Complete				Total	Partial	Complete
<i>Men—Continued</i>																		
College:																		
1-3.....	727	100 0	80 7	19 3	13 3	6 0	699	100 0	80 9	19 1	13 2	5 9	22	100 0	77 0	23 0	13 4	9 6
4 or more.....	798	100 0	86 8	13 2	13 3	3 6	772	100 0	86 8	13 2	9 7	3 5	19	100 0	85 2	14 8	8 5	6 3
Women.....	58,108	100 0	90 1	9 9	4 8	5 0	51,230	100 0	90 7	9 3	4 6	4 7	6,142	100 0	85 3	14 7	6 5	8 2
Aged 18-44.....	36,431	100 0	94 3	5 7	3 4	2 3	31,731	100 0	94 8	5 2	3 2	2 0	4,151	100 0	90 9	9 1	4 9	4 3
No years completed.....	195	100 0	72 5	27 5	4 7	2 8	146	100 0	70 5	29 5	4 7	24 8	36	100 0	76 1	23 9	4 2	19 7
Elementary:																		
1-7.....	1,789	100 0	85 3	14 7	6 1	8 6	1,311	100 0	85 9	14 1	5 8	8 3	415	100 0	82 9	17 1	7 2	9 9
8.....	1,704	100 0	89 4	10 6	5 4	5 2	1,406	100 0	90 0	10 0	5 1	4 8	270	100 0	86 2	13 8	6 5	7 3
High school:																		
1-3.....	7,348	100 0	92 4	7 6	4 3	3 2	5,937	100 0	93 0	7 0	4 1	2 9	1,311	100 0	89 7	10 3	5 6	4 8
4.....	16,423	100 0	95 6	4 4	2 9	1 4	14,734	100 0	95 9	4 1	2 8	1 3	1,497	100 0	93 5	6 5	4 0	2 5
College:																		
1-3.....	5,643	100 0	96 3	3 7	2 8	1 0	5,132	100 0	96 4	3 6	2 7	.9	420	100 0	94 7	5 3	3 7	1 6
4 or more.....	3,350	100 0	97 1	2 9	2 2	.7	3,064	100 0	97 2	2 8	2 2	.6	202	100 0	98 5	3 5	2 5	.9
Aged 45-64.....	11,935	100 0	87 0	13 0	6 5	6 6	10,894	100 0	87 9	12 1	6 2	5 9	1,123	100 0	78 6	21 4	9 1	12 3
No years completed.....	82	100 0	70 9	29 1	6 6	22 5	61	100 0	70 9	29 1	6 6	22 5	15	100 0	65 2	34 8	7 1	27 7
Elementary:																		
1-7.....	1,277	100 0	75 8	24 2	8 9	15 3	918	100 0	76 8	23 2	8 4	14 7	339	100 0	72 7	27 3	10 4	16 9
8.....	1,332	100 0	83 3	16 7	7 3	9 4	1,173	100 0	84 1	15 9	7 1	8 9	146	100 0	77 4	22 6	9 2	13 4
High school:																		
1-3.....	2,663	100 0	84 9	15 1	7 5	7 6	2,319	100 0	85 7	14 3	7 2	7 0	322	100 0	79 2	20 8	9 5	11 2
4.....	4,559	100 0	90 5	9 5	5 4	4 1	4,316	100 0	90 8	9 2	5 3	3 9	203	100 0	84 6	15 4	7 5	7 9
College:																		
1-3.....	1,182	100 0	90 6	9 4	6 0	3 4	1,122	100 0	90 9	9 1	5 9	3 2	50	100 0	85 4	14 6	8 2	6 4
4 or more.....	841	100 0	93 4	6 6	4 5	2 0	785	100 0	93 5	6 5	4 5	2 0	48	100 0	92 0	8 0	5 5	2 4
Aged 65-84.....	9,742	100 0	78 5	21 5	8 1	13 4	8,804	100 0	79 6	20 4	7 9	12 5	868	100 0	67 4	32 6	11 0	21 7
No years completed.....	110	100 0	66 8	33 2	7 4	25 8	81	100 0	68 7	31 3	6 9	24 4	22	100 0	57 8	42 2	9 1	33 0
Elementary:																		
1-7.....	1,176	100 0	67 2	32 8	9 6	23 2	1,307	100 0	68 5	31 5	9 1	22 4	389	100 0	62 3	37 7	11 6	26 0
8.....	1,748	100 0	75 9	24 1	8 4	15 7	1,608	100 0	76 6	23 4	8 2	15 2	129	100 0	67 3	32 7	10 8	21 8
High school:																		
1-3.....	2,099	100 0	77 7	22 3	8 7	13 5	1,911	100 0	78 5	21 5	8 5	13 0	177	100 0	69 9	30 1	11 3	18 8
4.....	2,496	100 0	84 2	15 8	7 2	8 6	2,392	100 0	84 5	15 5	7 1	8 4	91	100 0	76 1	23 9	10 0	18 9
College:																		
1-3.....	885	100 0	84 8	15 2	7 6	7 6	851	100 0	85 1	14 9	7 5	7 4	30	100 0	77 1	22 9	10 1	12 8
4 or more.....	688	100 0	88 9	11 1	6 2	4 9	654	100 0	88 9	11 1	6 2	4 9	30	100 0	87 4	12 6	6 9	5 7

<sup>1</sup> Includes persons of races other than white and black.  
Source: Bureau of the Census, 1970 Census of Population, Subject Reports:

Persons With Work Disability (Final Report PC(2)-6C), table 3.

the proportion of persons with an eighth-grade education who were disabled to 14.1 percent. Age differences therefore explain one-third of the difference between the two groups.

Holding age constant has a similar effect for women. Although the differences in the proportions of persons with some disability are narrowed among various educational groups, they are still large. In fact, in comparing women college graduates with elementary school graduates once again, it appears initially that the latter are more than three and one-half times as likely to be disabled as the former. Standardizing for age explains only 29 percent of the difference. It seems safe to assume that, for both men and women, a significant part of the unexplained difference is the result of education.

## INTERACTION WITH RACE

In studying the relationship between education and health the interaction of this relationship with race was examined next. Table 3 shows, for each age-sex-race category, the presence of disability by years of school completed. As expected, the proportion with work disability declined as education rose for each age-sex-race group.

It is interesting to note that when education is held constant the proportion of black men who were disabled was lower than or equal to the corresponding figure for white men in most cases. Only for college graduates was the proportion for white men lower. How can the higher figure for work disability for black men—14.2 percent, compared with 11.5 percent for white men—be

TABLE 4.—Years of school completed for persons aged 18-64: Percent with work disability, by sex, standardized by age, 1970

Years of school completed	Total number	Percent with work disability					
		Total		Partial		Complete	
		Original	Standardized <sup>1</sup>	Original	Standardized <sup>1</sup>	Original	Standardized <sup>1</sup>
Men							
Total.....	54,181,381	11.7	10.8	8.0	7.7	3.7	3.1
No years completed.....	392,057	35.4	34.5	10.2	9.4	25.2	25.1
Elementary.....	5,383,787	24.3	19.4	12.6	10.9	11.7	8.5
Less than 8.....	4,884,790	18.0	14.1	11.0	9.3	7.0	4.8
8.....	10,682,331	12.8	11.7	8.9	8.3	3.9	3.4
High school.....	17,636,395	8.8	8.8	6.9	6.9	1.9	1.9
1-3.....	7,913,550	8.7	9.2	7.1	7.5	1.6	1.7
4.....	7,318,471	5.9	5.9	5.1	5.1	8	.8
College.....							
1-3.....							
4 or more.....							
Women							
Total.....	58,108,261	9.8	9.1	4.8	4.6	5.0	4.5
No years completed.....	368,753	29.5	28.6	5.9	5.4	23.6	23.2
Elementary.....	4,762,321	23.7	18.9	8.1	7.1	15.6	11.8
Less than 8.....	4,733,582	17.2	13.6	7.0	6.2	10.2	7.4
8.....	12,109,235	11.8	10.9	5.8	5.5	6.0	5.4
High school.....	23,477,688	6.6	6.8	3.9	3.9	2.7	2.9
1-3.....	7,709,700	5.9	6.3	3.8	4.0	2.1	2.3
4.....	4,878,982	4.7	4.7	3.2	3.2	1.5	1.5
College.....							
1-3.....							
4 or more.....							

<sup>1</sup> For both men and women, all education groups were standardized by the age distribution of college graduates—in effect, reducing the average age of the other education groups and thus lowering the proportion with disability. Source: See table 3.

reconciled with the lower proportions for black men in most education categories? The answer lies of course in the differing educational achievements of both groups. A greater proportion of white men were high school graduates—63 percent, compared with only 39 percent of black men. One-fourth of the black men but less than one-tenth of the white men did not complete elementary school.

To eliminate the effect of these differences in levels of education on the proportion disabled, the black population was standardized for years of schooling on the equivalent white age group. Doing this provides an answer to the question "What would happen to the proportion of blacks with disability if they had the same educational attainment as whites?" As table 5 shows, the proportion of black men with some disability was reduced from 14.2 percent to 12.0 percent. Differences in educational achievement—other things being equal—accounted for four-fifths of the higher proportion of blacks with disability.

Even without standardizing for educational attainment, the proportion of black men reporting a partial disability (7.8 percent) was lower than that for white men (8.1 percent). Standardizing only served to increase this gap as the black rate dropped to 7.2 percent. The big difference between races in the proportions disabled was for complete work disability, where the figures were 6.4 percent for blacks and 3.4 percent for whites. This proportion was reduced to 4.8 percent for blacks by standardization—that is, 53 percent of the racial difference was explained by educational differences.

Among black women, 14.7 percent reported some disability; among white women, the proportion was 9.3 percent (table 3). Unlike the pattern for men, disability occurred relatively more often among black women for almost all age-education groupings, both for partial and complete work disability, except for a small group—black women aged 18-44 with no schooling at all. This finding leads one to suspect that, for women, differences in educational attainment are not very significant in explaining the racial differences observed in disability rates. Indeed, as table 5 reveals, standardizing for educational attainment reduces the proportion of black women with disability to 12.4 percent. Thus, educational differences accounted

TABLE 5.—Presence of work disability for persons aged 18-64: Percent with work disability, by race, sex, and age, standardized by educational attainment, 1970

Age	Percent with work disability					
	White		Black			
	Partial	Complete	Partial		Complete	
			Original	Standardized <sup>1</sup>	Original	Standardized <sup>1</sup>
Men						
Total.....	8.1	3.4	7.8	7.2	6.4	4.8
18-44.....	5.9	1.5	6.0	5.5	3.4	2.4
45-54.....	10.4	4.0	10.2	9.4	8.7	6.4
55-64.....	13.5	10.1	13.1	12.1	17.3	13.6
Women						
Total.....	4.6	4.7	6.5	6.0	8.2	6.4
18-44.....	3.2	2.0	4.9	4.4	4.3	3.2
45-54.....	6.2	5.9	9.1	8.3	12.3	9.5
55-64.....	7.9	12.5	11.0	10.4	21.7	17.7

<sup>1</sup> The black group was assigned the same education distribution as the equivalent white age-sex group.

Source: See table 3.

for only 43 percent of the racial difference for women in comparison with 81 percent for men.

Earlier, it was noted that younger people tend to have less disablement than those in the older ages. This tendency must be taken into account when racial differences in disability are analyzed. Table 3 shows that the black population tends to be younger than the white population: 67 percent of black men, for example, are aged 18-44, but only 63 percent of the white men are in that age group. One would therefore expect that for blacks—because of their younger age—the proportion with disability would be lower than that for whites. The data in table 3 have been standardized in table 6 by the age distribution of whites. As anticipated, the relative number of blacks reporting disability was thus increased to 15.4 percent for men and 16.4 percent for women. The relative increase—11.6 percent—was greater for women than men—8.5 percent. For black men the proportion with partial disability also rose—to 8.3 percent.

To summarize, standardizing for educational attainment in table 5 reduced the rates for blacks and standardizing for age distribution in table 6 raised the rates for blacks. In other words, age and educational attainment have opposite effects on the proportion of blacks with disability in comparison with that for whites.

The data have been standardized, in the tabulation that follows, for age and education simultaneously—that is, it was assumed that blacks had the same educational attainment and age distribution as whites. It can then be observed

Race	Percent with work disability					
	Men			Women		
	Total	Partial	Complete	Total	Partial	Complete
White.....	11.5	8.1	3.4	9.3	4.6	4.7
Black.....	14.2	7.8	6.4	14.7	6.5	8.2
Black, standardized <sup>1</sup> .....	12.5	7.4	5.1	13.2	6.2	7.0

<sup>1</sup> The black group was assigned the same age and education distribution as the equivalent white sex group.  
Source: See table 3.

that the educational effect dominates and that rates for blacks drop in comparison with those for whites. As the technical note on page 00 shows, the approximate standard error for these percentages is .25 percent. Thus the results—both the reduction in the proportion for blacks produced

TABLE 6.—Years of school completed for persons aged 18-64: Percent with work disability, by race and sex, standardized by age, 1970

Year of school completed	Percent with work disability					
	White		Black			
	Partial	Complete	Partial		Complete	
			Original	Standardized <sup>1</sup>	Original	Standardized <sup>1</sup>
Men						
Total.....	8.1	3.4	7.8	8.3	6.4	7.1
No years completed.....	10.2	26.3	10.3	9.7	24.3	23.7
Elementary:						
1-7.....	13.2	11.5	10.9	11.0	12.5	12.7
8.....	11.2	6.9	8.6	9.2	8.1	9.8
High school:						
1-3.....	9.1	3.7	7.3	8.2	4.8	6.0
4.....	7.0	1.8	5.9	6.5	2.8	3.6
College:						
1-3.....	7.2	1.5	6.6	7.1	2.2	2.6
4 or more.....	5.1	.8	5.0	5.1	1.6	1.8
Women						
Total.....	4.6	4.7	6.5	7.1	8.2	9.3
No years completed.....	5.7	24.2	6.3	6.2	25.3	25.1
Elementary:						
1-7.....	7.7	15.2	9.6	9.7	17.5	17.7
8.....	6.9	10.0	8.3	8.9	12.4	14.6
High school:						
1-3.....	5.6	5.8	6.8	7.6	7.3	8.9
4.....	3.8	2.6	4.7	5.4	3.7	4.9
College:						
1-3.....	3.8	2.1	4.5	5.2	2.8	3.7
4 or more.....	3.2	1.5	3.6	3.7	1.7	1.9

<sup>1</sup> The black group was assigned the same age distribution as the equivalent white sex-education group.

Source: See table 3.

by standardization and the remaining differences between the black and white ratios—are significant at better than the .001 confidence limit. The only exception occurs for the proportion with partial work disability where the reduction because of standardization is less than two standard errors and the residual racial differences for men is significant at the .005 level.

The net effect of holding age and education constant reduced the proportion of black men with disability to 12.5 percent. Thus, 63 percent of the racial difference in the proportion with disability can be explained by the combined consequence of age and education divergences between the races. For women, age and education explains only 28 percent of the racial disparity.

## CONCLUSION

The findings of this study show that higher levels of educational attainment are correlated

with lower levels of disability and that much of the observed racial differences in the relative occurrence of disability can be explained by differences in educational attainment. The effect of heterogeneity in the age distribution of the various education classes must also be taken into account. Even after accounting for the contribution of age, however, one still finds that years of schooling play a significant role in determining an individual's health status.

In a cross-sectional analysis the observed interaction between health and education cannot be decomposed into cause and effect. One can only speculate on some of the directions of causation. Reasons why increased education may cause better health include:

- (a) Increased education—that is, investment in human capital—increases productivity in nonmarket as well as market activities and hence leads to increased efficiency in consumption;<sup>8</sup>
- (b) the better-educated may work at less physically taxing jobs and not perceive a given limitation to be a work-related disability;
- (c) the less-educated may tend to be in occupations (and industries) that are more prone to result in disability.

In the last two cases, it may be that the education effect observed above is partly a proxy for occupation. Causation leading from health to education may occur when the individual's disability prevents him from continuing his education. In addition, employers may be reluctant (perhaps because of discrimination against persons with a disability) to invest in further training—both formal and on-the-job—for a disabled worker although such assistance may be available for the nondisabled.

## TECHNICAL NOTE\*

### Sampling Variability

The estimates from the 5-percent sample tabulations are subject to sampling variability. The standard errors can be approximated by using

\* Excerpted from the Bureau of the Census, *1970 Census of Population, Subject Reports: Persons With Work Disability* (Final Report PC(2)-6C), January 1973.

<sup>8</sup> See Robert T. Michael, *Effect of Education on Efficiency in Consumption* (Occasional Paper 116), National Bureau of Economic Research, 1972.

TABLE I.—Approximate standard errors of estimated percentages based on 20-percent sample

[Range of 2 chances out of 3, for factors to be applied, see table II and text]

Estimated percentages	Base of percentages						
	500	1,000	2,500	10,000	25,000	100,000	250,000
2 or 98.....	1 3	0 9	0 6	0 3	0 2	0 1	0 1
5 or 95.....	2 0	1 4	9	4	3	1	1
10 or 90.....	2 7	1 9	1 2	6	4	2	1
25 or 75.....	3 9	2 7	1 7	9	.5	.3	.2
50.....	4 5	3 2	2 0	1 0	6	3	2

the data in tables I and II. The chances are about 2 out of 3 that the difference (due to sampling variability) between the sample estimate and the figure that would have been obtained from a complete count of the population is less than the standard error. The chances are about 19 out of 20 that the difference is less than twice the standard error and about 99 out of 100 that it is less than 2½ times the standard error. The amount by which the estimated standard error must be multiplied to obtain other odds deemed more appropriate can be found in most statistical textbooks. The sampling errors may be obtained by using the factors shown in table II in conjunction with table I for percentages. These tables reflect the effect of simple response variance but not of bias arising in the collection, processing, and estimation steps nor of the correlated errors enumerators introduce.

Table I shows standard errors of most percentages based on the 20-percent sample. Linear interpolation will provide approximate results that are satisfactory for most purposes. Table II provides a factor by which the standard errors shown in table I should be multiplied to adjust for the combined effect of the sample size, the sample design, and the estimation procedure.

To estimate the standard error for a given characteristic based on the 5-percent sample, locate in table II the factor applying to the characteristic used to tabulate the data and multiply this factor by the standard error found in

TABLE II.—Factor to be applied to standard error for 5-percent sample<sup>1</sup>

Subject	Factor
Race.....	2 5
Age.....	1 8
Years of school completed.....	2 3
Disability.....	2 4

<sup>1</sup> For cross-classifications of two or more items, use the factor for the item having the largest factor for the given sample rate.

table I. Where data are shown as cross-classifications of two characteristics, use the larger factor.

The standard errors estimated from these tables are not directly applicable to differences between two sample estimates. In order to estimate the standard error of a difference, the tables are to be used somewhat differently in the following situations:

1. For a difference between two sample figures, the standard error is approximately the square root of

the sum of the squares of the standard errors of each estimate considered separately. This formula will represent the actual standard error quite accurately for the difference between estimates of the same characteristics in two different areas, or for the difference between separate and uncorrelated characteristics in the same area. If, however, there is a high positive correlation between the two characteristics, the formula will overestimate the true standard error.

2. For a difference between two sample estimates, one of which represents a subclass of the other, the tables can be used directly with the difference considered as the sample estimate.

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## Notes and Brief Reports

### Compulsory Health Insurance in Hawaii\*

On January 1, 1975, Hawaii became the first State to have a mandated health insurance program in effect. The law, enacted June 12, 1974, requires employers to provide protection against the costs of hospital and medical care for their employees. The employer may purchase an insurance policy or arrange for a medical or nonprofit organization either to furnish services to employees or to defray costs or reimburse employees for the expenses of health care.

#### COVERAGE

In Hawaii, all employers with one or more regular employees are covered by the law except the following: Government employees, agricultural seasonal employees, employees who work less than 20 hours a week or whose monthly wages are less than 86.67 times the prevailing State minimum hourly wage, employees covered by a Federal program or receiving public assistance, individuals who depend on prayer or spiritual means for healing, individuals in family employment, and insurance and real estate salesmen or brokers paid solely on commission. Coverage is compulsory, and workers cannot waive the protection provided by the law.

\* By Alfred M. Skolnik, Division of Retirement and Survivor Studies, Office of Research and Statistics

If an individual works concurrently for more than one employer, the one who pays the most wages will be the principal employer and will be responsible for providing health care coverage. The employee, however, may select a different principal employer if he works at least 35 hours weekly for an employer who does not pay the most wages. If he works for a government agency and a private employer, the former will be deemed the principal employer. If an employee's dependents are themselves employed, they may choose to be covered under the plan at their own place of employment.

#### ELIGIBILITY

A worker is covered as soon as he has had 4 or more consecutive weeks of employment. If an employee is unable to work because he is sick, protection continues for 3 months following the month in which he became ill.

#### BENEFITS

The employer's prepaid group health care plan meets the requirements of the law if it provides health care benefits equal to, or medically reasonably substitutable for, the benefits offered by prepaid health plans of the basic types<sup>1</sup> with the

<sup>1</sup> A prepaid health care plan is (a) any medical group or organization that provides health care benefits (the Kaiser Medical Center, for example), (b) any nonprofit organization that defrays or reimburses in whole or in part the expenses of health care (such as the Hawaii Medical Services Association), or (c) any commercial insurer that defrays or reimburses in whole or in part the expenses of health care (the Aetna Life Insurance Company, for example).