Brief Report

Educational attainment and self-rated health among African-Americans in Pitt County, NC

Eeshwar K Chandrasekar, MPH[1,2], Zimo Z Banta, MPH[2], Kathleen R Ragan, MSPH, CHES[2], Michelle M. Schmitz, MSPH[2], and Sherman A James, PhD[2]

[1]Emory University School of Medicine, Atlanta, GA and [2]Emory University Rollins School of Public Health, Atlanta GA

Corresponding Author: Eeshwar K. Chandrasekar • 1648 Pierce Drive NE, Atlanta, GA 30307 • eeshwar.chandrasekar@emory.edu

ABSTRACT

Background: To help fill the knowledge gap regarding relationships between educational attainment and self-rated health (SRH) in minority populations, we analyzed the data of a community-based cohort of African-Americans residing in Pitt County, NC, between 1988 and 2001.

Methods: Data from the Pitt County Study (a community-based, longitudinal survey of risk factors for hypertension and related disorders disproportionately affecting African-Americans) were used to explore associations between educational attainment and SRH, stratified by sex, in a cohort of individuals from 1988 (n=1,773), 1993 (n=1,195), and 2001 (n=1,117) using continuous, ordinal, and binary correlated data analyses.

Results: For males and females with less than a high school education, the odds of reporting poor or fair health (compared to excellent, very good, or good health) were 2.75 (95% CI: 1.54-4.91) and 1.78 (95% CI: 1.15-2.75) times greater, respectively, than among those who completed a college degree or higher.

Conclusions: Across all analyses, individuals with lower educational attainment reported lower SRH scores, and the association differed by sex. Social support may be a factor in these differences. More research is needed, however, to assess relationships between educational attainment, social support, and SRH for African-Americans and other minority populations.

Key words: Education, Pitt County Study, Self-rated health, African-American, Health Disparities

Statement of Student-Mentor Relationship: The authors of this report, Eeshwar Chandrasekar, Zimo Banta, Kathleen Ragan, and Michelle Schmitz, were mentored by Dr. Sherman James, senior author, as part of graduate coursework at the Rollins School of Public Health at Emory University.

https://doi.org/10.21633/jgpha.6.2s15

INTRODUCTION

Self-rated health (SRH) is a predictor of health utilization and all-cause mortality (Benjamins et al., 2004; Idler et al., 1997). Although education is a predictor of biological health, there is a dearth of evidence about how it affects motivations to seek routine health care services, and whether social support affects this relationship (Caetano et al., 2013). Further literature on this topic from US racial/ethnic minority cohorts is scarce. By exploring relationships between educational attainment, social support, and SRH, we identified opportunities to address factors contributing to

health disparities and motivations among African-Americans in Pitt County, NC, a community with a high burden of chronic disease.

METHODS

Details regarding participant recruitment, eligibility, study setting, data collection methods, and survey instruments have been previously described (James et al., 2006). This study, declared exempt by the Emory University Institutional Review Board, included 1,773 participants at baseline in 1988, 1,195 in 1993, and 1,177 in 2001. At baseline, participants

ranged from 24 to 51 years old. The average SRH score in 1988 was 26.39 (SD = 6.02), similar to the average of 26.31 (SD = 6.10) in 1993. Table 1 contains demographic factors.

Table 1. Characteristics of Participants in Pitt County, NC Longitudinal Study (1988, 1993, 2001).

Characteristic	Level	1988		1993		2001	
		No.	%	No.	%	No.	%
Sex	Female	1112	62.7	780	65.3	760	64.6
	Male	661	37.3	415	34.7	417	35.4
Age (years)	<24	18	1.0	-	-	-	-
	25-29	391	22.1	18	1.5	-	-
	30-34	426	24.0	301	25.2	-	-
	35-39	382	21.6	323	27.0	88	7.5
	40-44	276	15.6	239	20.0	278	23.6
	45+	280	15.8	314	26.3	811	68.9
Education	Less than HS	547	30.9	345	28.9	364	30.9
	HS or GED	709	40.0	484	40.5	463	39.3
	Vocational	181	10.2	133	11.1	123	10.5
	Some College	190	10.7	133	11.1	126	10.7
	4-Year Degree+	146	8.2	100	8.4	101	8.6
Self-Rated Health	Poor	78	4.4	58	4.9	63	5.4
	Fair	151	8.5	106	8.9	240	20.4
	Good	518	29.3	331	27.7	457	38.8
	Very Good	545	30.8	374	31.3	324	27.5
	Excellent	477	27.0	325	27.2	93	7.9
Social Support	1 Low	37	2.1	34	2.9	34	2.9
	2	352	19.9	238	19.9	224	19.0
	3	880	49.6	521	43.6	450	38.2
	4 High	504	28.4	402	33.6	469	39.9

Abbreviations: HS= High School; GED= General Educational Development

As educational attainment was not measured in 2001, analyses were conducted with the five-category baseline measure ranging from (1) less than high school education (LTHSE) to (5) college degree or higher (CDH). Since SRH was assessed by use of 9 questions in only 1988 and 1993, aggregate measure was used to convert the data into the five-category Likert scale used to measure SRH in 2001. For analyses with a dichotomous SRH outcome, an overall *good health* category was created by combining *excellent*, *very good*, or *good* categories; an overall *bad health* category was created by combining the *fair* or *poor* categories.

After assessing covariates for temporality and evaluating unstructured, AR-1, and Toeplitz correlation structures, we tested for model convergence with and without random effects and subsequently conducted tests for independence. To assess goodness-of-fit of the different correlation structures, the pseudo-Hannan and Quinn information criterion (pseudo-HQIC), pseudo-Akaike information criterion (pseudo-AIC), and the pseudo-Bayesian

information criterion (pseudo-BIC) were utilized. After assessing for collinearity, interaction, and confounding, the final models considered age, education, and social support. With an unbalanced dataset, linear, categorical, and ordinal binomial models were analyzed with SAS 9.4 (Cary, NC). Confidence intervals were calculated with alpha of 0.05, unless otherwise noted.

RESULTS

In the continuous outcome analyses, male and female participants with LTHSE reported SRH scores that were 1.94 and 1.41 units lower than their counterparts with CDH, respectively. For both sexes, significant differences existed only between the lowest and highest education categories. For each 1-unit increase in social support score, the average SRH score increased by 0.22 units for males and 0.19 units for females. For each additional year in age, the average estimated SRH score decreased by 0.14 units for males and 0.19 units for females.

In the ordinal outcome analyses, males and females with LTHSE had 2.75 (1.54 - 4.91) and 1.78 (1.15 - 2.75) times the odds of reporting poor or fair health (relative to excellent, very good, or good health) compared to those with CDH, respectively. The results show that, for both sexes, any education level greater than or equal to high school completion increased the odds of higher SRH.

For the binary outcome analyses, the odds of reporting good health (relative to bad health) for males with LTHSE were 0.31 (0.14 - 0.69) times the odds of males with CDH. Among males, odds ratios for other education levels compared to those with CDH were not statistically significant. The odds of reporting good health for females with LTHSE were 0.37 (0.21 - 0.66) times the odds for females with CDH. Additionally, the odds of reporting good health for females who completed high school or a GED were 0.55 (0.31 - 0.98) times the odds for females with CDH. Among females, odds ratios comparing the other levels of education to CDH were not statistically significant.

Table 2. Results of continuous, ordinal, and binary logistic analyses for participants in Pitt County, NC study (1988, 1993, 2001).†

			Male	Female
			Estimate	Estimate
Continuous [estimate, (SE)]				
		Education	-1.94 (0.79)*	-1.41 (0.62)*
		Social Support	0.22 (0.03)*	0.19 (0.03)*
		Age	-0.14 (0.03)*	-0.19 (0.02)*
Ordinal [OR, (95% CI)]				
	Education	Less than high school compared to college degree or higher	2.75 (1.54-4.91)*	1.78 (1.15-2.75)*
		Less than high school compared to some college	1.47 (0.90-2.40)	1.66 (1.10-2.50)*
		Less than high school compared to vocational school	1.81 (1.03-3.17)*	1.78 (1.20-2.62)*
		Less than high school compared to high school or GED	1.69 (1.19-2.41)*	1.56 (1.19-2.05)*
Binary Logistic [OR, (95% CI)]				
	Education	Less than high school compared to completed college or higher	0.31 (0.14-0.69)*	0.37 (0.21-0.66)*
		High school or a GED compared to completed college or higher	0.54 (0.24-1.22)	0.55 (0.31-0.98)*

Abbreviations: SE= standard error; OR= odds ratio; 95% CI= 95% confidence interval; * p-value < 0.05

† Additional results in appendix.

DISCUSSION/CONCLUSIONS

This study is one of the first to explore the gender-specific effects of education on SRH in a longitudinal cohort of African-Americans. The analyses suggest that higher educational attainment is associated with higher SRH and that these results differ by sex. In addition, the findings suggest that social support increases SRH; however, due to collinearity, we were unable to explore its interaction with education. A possible mechanism that explains the findings is that higher educational attainment increases economic stability, financial resources, and perceived sense of control, all of which can lead to greater SRH. These factors may be involved in decision-making regarding seeking routine and preventive healthcare services. However, the

strength of associations between education and SRH varied by sex across modeling strategies. Therefore, additional research is necessary to understand these relationships.

The analyses were limited by inconsistencies in the survey instrument across all three waves of data. Moreover, due to temporality concerns, we could not control for the complete set of covariates initially considered. As in most investigations collecting self-reported data, the results may be subject to self-report bias, recall bias, or social desirability bias. However, the study has several strengths. Primarily, the methodology involved three distinct modeling strategies to analyze a relationship in a longitudinal dataset; current practice in epidemiology often includes only one. The

results differed between the modeling approaches, providing evidence supporting the use of multiple modeling strategies in analysis of longitudinal data. Additionally, an unbalanced dataset was used, allowing us to use all observations in this large, 13-year longitudinal study. Future studies could consider controlling for a fuller set of health-related influences, including biological factors and interactions with social support, which may further elucidate the relationship between education and SRH.

References

Benjamins, MR, Hummer, RA, Eberstein, IW, and Nam, CB. Self-reported health and adult mortality risk: An analysis of cause-specific mortality. *Soc Sci Med*, 2004. 59(6): p. 1297-1306.

Caetano, SC, Silva, CM and Vettore, MV. Gender differences in the association of perceived social support and social network with self-rated health status among older adults: a population-based study in Brazil. *BMC Geriatr*, 2013. 13: p. 122-122.

Idler, E. L. & Benyamini, Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav,* 1997. 38(1): p. 21-37.

James, S. A., Van Hoewyk, J., Belli, R. F., Strogatz, D. S., Williams, D. R., & Raghunathan, T. E. (2006). Life-Course Socioeconomic Position and Hypertension in African American Men: The Pitt County Study. *Am J Public Health*, *96*(5), 812–817.

APPENDIX
Detailed Results

Continuous Outcome

The final model selected for the continuous analysis was:

$$SRH = \beta_0 + \sum_{a=1}^{4} \beta_a Edu_a + \gamma_1 Age + \gamma_2 SS + E_{ij}$$

where $i = 1, 2…., K$ (number of subjects)
    $j = 1, 2$ (timepoint)
    Edu_a: $a = 1,2,3,4$, where:
    Edu1: 1 = participant completed high school, 0 otherwise
         Edu2: 1 = participant completed vocational school, 0 otherwise
    Edu3: 1 = participant completed some college, 0 otherwise
         Edu4: 1 = participant completed college or above, 0 otherwise
          (Note: referent group was participant completed less than high school)
    Age: continuous age of participant, in years
    SS: continuous social support score, (9-36, where 9 was the worst social support and 36 was the best social support)
    E_{ij}: error term

Figure 1a. Continuous analysis results for males.

Solution for Fixed Effects									
Effect	kemzedu	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
Intercept		27.6225	1.4957	656	18.47	<.0001	0.05	24.6855	30.5594
kemzedu	1	-1.9433	0.7919	656	-2.45	0.0144	0.05	-3.4984	-0.3883
kemzedu	2	-0.3409	0.7737	656	-0.44	0.6597	0.05	-1.8601	1.1784
kemzedu	3	-0.3751	0.9736	656	-0.39	0.7001	0.05	-2.2869	1.5366
kemzedu	4	-0.2029	0.9088	656	-0.22	0.8234	0.05	-1.9873	1.5816
kemzedu	5	0	.	.	.	.	.	.	.
ContSS		0.2229	0.03471	656	6.42	<.0001	0.05	0.1548	0.2911
ContAge		-0.1446	0.02610	656	-5.54	<.0001	0.05	-0.1959	-0.09337

Among males, participants who completed less than high school education reported an SRH score that was, on average, 1.94 units lower compared to participants who completed college or above (Figure 1a). There were no significant differences between participants who completed college or greater and any other education level. Average SRH score increased by 0.22 units for every 1-unit increase in the continuous social support score. For every additional year in age, the average estimated SRH score decreased by 0.14 units.

Figure 1b. Continuous analysis results for females.

Effect	kemzedu	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper
Intercept		28.2719	1.1294	1106	25.03	<.0001	0.05	26.0560	30.4879
kemzedu	1	-1.4118	0.6182	1106	-2.28	0.0226	0.05	-2.6248	-0.1989
kemzedu	2	-0.2704	0.5882	1106	-0.46	0.6459	0.05	-1.4245	0.8838
kemzedu	3	0.3291	0.7050	1106	0.47	0.6408	0.05	-1.0543	1.7124
kemzedu	4	-0.1650	0.7250	1106	-0.23	0.8200	0.05	-1.5876	1.2576
kemzedu	5	0	.	.	.	.	.	.	.
ContSS		0.1853	0.02558	1106	7.24	<.0001	0.05	0.1351	0.2354
ContAge		-0.1881	0.02053	1106	-9.16	<.0001	0.05	-0.2283	-0.1478

Among females, individuals who had completed less than high school reported an SRH score that was, on average, 1.41 units lower when compared to individuals who had completed college or above (Figure 1b). All other education categories did not significantly differ when compared to the "college degree or above" stratum. A single-unit increase in social support score was associated with an estimated 0.19 unit increase in SRH score. With every one-year increase in age, there was an estimated 0.19 unit decrease in SRH score.

Ordinal Outcome

The final model selected for the ordinal analysis was:

$$\ln\left(\frac{P(SRH \geq g | Edu, SS, Age)}{P(SRH < g | Edu, SS, Age)}\right) = \alpha_g + \sum_{a=1}^{4} \beta_a Edu_a + \gamma_1 Age + \gamma_2 SS + b_{i0} + E_{ij}$$

where $g = 1, 2, 3, 4$; $\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4$
$i = 1, 2...., K$ (number of subjects)
$j = 1, 2, 3$ (timepoint)
Edu_a: $a = 1,2,3,4$, where:
     Edu1: 1 = participant completed high school, 0 otherwise
     Edu2: 1 = participant completed vocational school, 0 otherwise
     Edu3: 1 = participant completed some college, 0 otherwise
     Edu4: 1 = participant completed college or above, 0 otherwise
     (Note: referent group was participant completed less than high school)
Age: continuous age of participant, in years
SS: continuous social support score, (9-36, where 9 was the worst social support and 36 was the best social support)
b_{i0}: random intercept (subject-specific)
E_{ij}: error term

Figure 2a. Ordinal analysis results for males.

Odds Ratio Estimates									
kemzedu	ContSS	ContAge	_kemzedu	_ContSS	_ContAge	Estimate	DF	95% Confidence Limits	
1	26.465	40.827	2	26.465	40.827	1.689	824	1.187	2.405
1	26.465	40.827	3	26.465	40.827	1.810	824	1.032	3.173
1	26.465	40.827	4	26.465	40.827	1.473	824	0.904	2.399
1	26.465	40.827	5	26.465	40.827	2.745	824	1.536	4.905
2	26.465	40.827	3	26.465	40.827	1.071	824	0.622	1.847
2	26.465	40.827	4	26.465	40.827	0.872	824	0.547	1.389
2	26.465	40.827	5	26.465	40.827	1.625	824	0.922	2.864
3	26.465	40.827	4	26.465	40.827	0.814	824	0.430	1.541
3	26.465	40.827	5	26.465	40.827	1.516	824	0.742	3.099
4	26.465	40.827	5	26.465	40.827	1.864	824	0.965	3.601
	27.465	40.827		26.465	40.827	0.906	824	0.883	0.929
	26.465	41.827		26.465	40.827	1.102	824	1.084	1.119
Effects of continuous variables are assessed as one unit offsets from the mean. The AT suboption modifies the reference value and the UNIT suboption modifies the offsets.									

SAS modeled the probabilities of levels of SRH having lower ordered values (poorer health) in the numerator. Therefore, the OR interpretations estimate the odds of poorer health vs. better health.

Among males, those with less than high school education had 2.75 (95% CI: 1.54 - 4.91) times the odds of reporting poor or fair health (compared to excellent, very good, or good health) compared to those who had completed a college degree or higher (Figure 2a). The OR was lower when comparing education levels that were not as far apart. Those with less than high school education has 1.69 (95% CI: 1.19 - 2.41) times the odds of reporting poor or fair health (compared to excellent, very good, or good health) compared to those who had completed high school/GED, and 1.81 (95% CI: 1.03 - 3.17) times the odds of reporting poor or fair health (compared to excellent, very good, or good health) compared to those who had completed vocational school. All other comparisons between other education levels were not statistically significant.

Figure 2b. Ordinal analysis results for females.

Odds Ratio Estimates									
kemzedu	ContSS	ContAge	_kemzedu	_ContSS	_ContAge	Estimate	DF	95% Confidence Limits	
1	26.811	40.834	2	26.811	40.834	1.561	1534	1.189	2.051
1	26.811	40.834	3	26.811	40.834	1.775	1534	1.201	2.622
1	26.811	40.834	4	26.811	40.834	1.656	1534	1.098	2.498
1	26.811	40.834	5	26.811	40.834	1.777	1534	1.146	2.753
2	26.811	40.834	3	26.811	40.834	1.137	1534	0.785	1.646
2	26.811	40.834	4	26.811	40.834	1.061	1534	0.717	1.569
2	26.811	40.834	5	26.811	40.834	1.138	1534	0.748	1.730
3	26.811	40.834	4	26.811	40.834	0.933	1534	0.578	1.507
3	26.811	40.834	5	26.811	40.834	1.001	1534	0.606	1.654
4	26.811	40.834	5	26.811	40.834	1.073	1534	0.640	1.799
	27.811	40.834		26.811	40.834	0.930	1534	0.914	0.947
	26.811	41.834		26.811	40.834	1.090	1534	1.077	1.102
Effects of continuous variables are assessed as one unit offsets from the mean. The AT suboption modifies the reference value and the UNIT suboption modifies the offsets.									

Among females, those with less than high school education had 1.78 times the odds of self-reporting poor or fair health (compared to excellent, very good, or good health) compared to both those who completed a college degree or higher (95% CI: 1.15 - 2.75) and those who completed vocational school (95% CI: 1.20 - 2.62) (Figure 2b). Those with less than high school education had 1.66 (95% CI: 1.10 - 2.50) times the odds of reporting poor or fair health (compared to excellent, very good, or good health) compared to those who completed some college. Those with less than high school education had 1.56 (95% CI: 1.19 - 2.05) times the odds of reporting poor or fair health (compared to excellent, very good, or good health) compared to those who had completed high school or a GED. Since the ORs for all education levels were significant, yet similar, it appears that any education level greater than or equal to high school completion increased the odds of higher SRH.

Binary Outcome

The final model selected for the binary analysis, using a Toeplitz correlation structure, was:

$$logit(SRH|Edu, SS, Age) = \beta_0 + \sum_{a=1}^{4} \beta_a Edu_a + \gamma_1 Age + \gamma_2 SS + E_{ij}$$

where   i = 1, 2…., K (number of subjects)

j = 1, 2, 3 (timepoint)

Edu_a: a = 1,2,3,4, where:

     Edu1: 1 = participant completed high school, 0 otherwise

     Edu2: 1 = participant completed vocational school, 0 otherwise

     Edu3: 1 = participant completed some college, 0 otherwise

     Edu4: 1 = participant completed college or above, 0 otherwise

     (Note: referent group was participant completed less than high school)

Age: continuous age of participant, in years

SS: continuous social support score (9-36, where 9 was the worst social support and 36 was the best social support)

E_{ij}: error term

kemzedu	ContAge	ContSS	_kemzedu	_ContAge	_ContSS	Estimate	DF	95% Confidence Limits	
	41.827	26.465		40.827	26.465	0.919	827	0.902	0.937
	40.827	27.465		40.827	26.465	1.095	827	1.058	1.133
1	40.827	26.465	5	40.827	26.465	0.310	656	0.140	0.687
2	40.827	26.465	5	40.827	26.465	0.536	656	0.235	1.218
3	40.827	26.465	5	40.827	26.465	0.450	656	0.165	1.229
4	40.827	26.465	5	40.827	26.465	0.858	656	0.307	2.403

Odds Ratio Estimates

Effects of continuous variables are assessed as one unit offsets from the mean. The AT suboption modifies the reference value and the UNIT suboption modifies the offsets.

Figure 3a. Binary results analysis for males.

The odds of reporting good health (vs. bad health) for men who completed less than high school education were 0.31 (95% CI: 0.14, 0.69) times the odds of males who completed college or higher (Figure 3a). ORs for all other education levels compared to those who completed college or greater were not statistically significant.

Figure 3b. Binary results analysis for females.

kemzedu	ContAge	ContSS	_kemzedu	_ContAge	_ContSS	Estimate	DF	95% Confidence Limits	
	41.834	26.811		40.834	26.811	0.939	1537	0.927	0.951
	40.834	27.811		40.834	26.811	1.059	1537	1.038	1.080
1	40.834	26.811	5	40.834	26.811	0.369	1106	0.207	0.658
2	40.834	26.811	5	40.834	26.811	0.548	1106	0.307	0.977
3	40.834	26.811	5	40.834	26.811	0.631	1106	0.315	1.263
4	40.834	26.811	5	40.834	26.811	0.616	1106	0.307	1.238

Odds Ratio Estimates

Effects of continuous variables are assessed as one unit offsets from the mean. The AT suboption modifies the reference value and the UNIT suboption modifies the offsets.

The odds of reporting good health (vs. bad health) for women who completed less than high school education were 0.37 (95% CI: 0.21, 0.66) times the odds of women who had completed college or higher (Figure 3b). Additionally, the odds of reporting good health (vs. bad health) for women who completed high school or GED were 0.55 (95% CI: 0.31, 0.98) times the odds of women who completed college or higher. ORs comparing the other levels of education to the completion of college or higher were not statistically significant.