Educational Status and HIV Disparities in Cameroon: Are Uneducated Women at Reduced Risk of HIV Infection?

by

Joyce N. Mumah, M.A.[†]

Eric N. Reither, Ph.D.[‡]

[†] Joyce N. Mumah is a Ph.D. student in Sociology at Utah State University, 0730 Old Main Hill, Logan UT, 84321, jnmumah@cc.usu.edu

[‡] Dr. Reither is Assistant Professor of Sociology at Utah State University, 0730 Old Main Hill, Logan UT, 84321, ereither@hass.usu.edu, (435) 797-1217.

Abstract

The socioeconomic gradient in health and mortality is a persistent finding in social epidemiology. Indicators of socioeconomic status (SES) such as wealth and education are routinely found to be strongly and inversely related to various health outcomes. However, data from the 2004 Cameroon Demographic and Health Survey (DHS) show that educational status is positively associated with HIV prevalence, particularly among women. In this investigation, we analyzed data from 5,287 women in the 2004 Cameroon DHS to explore possible demographic, socioeconomic and behavioral mechanisms that could account for this association. After controlling for variables such as age, marital status, region of residence, and partner's educational attainment, the association between education and HIV was not merely attenuated, but essentially eliminated. This research contributes to a growing body of literature on SES and HIV in sub-Saharan Africa, which has the potential to improve our collective understanding and refine current social policies.

Introduction

The socioeconomic gradient in health and mortality is among the most robust and persistent findings in social epidemiology (Lynch and Kaplan 2000; Williams and Collins 1995; Adler et al 1994). In most epidemiologic investigations, indicators of socioeconomic status (SES) such as wealth, income and education are strongly and inversely associated with a wide assortment of deleterious health outcomes, including diseases of the heart (Kivimaki et al 2007, Marmot et al 1991), various types of cancer (MacKinnon et al 2007, Sanderson et al 2006, Faggiano et al 1997), obesity (Robert and Reither 2005, Sobal 1991), functional limitations (Zimmer and House 2003), psychiatric disorders (Williams et al 1992, Robins and Reiger 1991) and premature mortality (Reither et al 2006, Preston and Elo 1995, Kitagawa and Hauser 1973).

Consistent with this literature, research in the United States has reported inverse associations between SES and the likelihood of HIV infection (Bozzette et al 1998). Empirical demonstrations of the inverse association between SES and HIV/AIDS combined with the widespread belief that factors like poverty and lack of education worsen HIV risk profiles has produced sweeping generalizations, as illustrated by the following statement. "Socioeconomic status is [an] important factor in the incidence of HIV/AIDS, as it is widely accepted that lower socioeconomic status makes a group more susceptible to various health problems, including HIV/AIDS" (Okigbo et al 2002:631).

Despite such assertions, recent studies in several African nations, including Cameroon, call into question the presumption that low SES increases the risk of HIV infection. In an overview of 36 studies on SES and HIV status from nations across Africa, Wojcicki (2005) reported that only eight found that low SES is a risk factor for contracting HIV. The remainder of these studies either found no association or a *positive* association between SES and the

likelihood of HIV infection. A positive association between wealth and HIV infection was recently confirmed in analyses of DHS data for several nations in sub-Saharan Africa, including Cameroon (Mishra et al 2007). Even after controlling for a substantial number of demographic, socioeconomic and behavioral factors, the wealthiest quintile of men in Cameroon were over three times more likely than the poorest quintile of men to test positive for HIV. Mishra et al (2007) reported similar effects for Cameroonian women in zero-order models, but found that incorporating control variables eliminated statistically significant effects of education on HIV status.

In addition to counterintuitive findings with regard to wealth, there is evidence that uneducated Cameroonians may be at reduced risk for HIV infection. In the 2004 Cameroon DHS, the prevalence of HIV among women and men with no formal education was 3.4 and 2.7 percent, respectively (DHS 2005a). By comparison, the prevalence of HIV among women and men with at least a secondary education was 8.2 and 4.3 percent. Sexual behaviors among educated men are consistent with this finding, as they are significantly less likely to use condoms, more likely to initiate sexual activity before age 18 and more likely to have multiple sexual partners (Kongnyuy et al 2006). Unfortunately, this intriguing study did not examine sexual behaviors among women.

Although these findings from the 2004 Cameroon DHS are persuasive, they do not examine whether sexual behaviors or other mechanisms (e.g., age or region of residence) confound or mediate the relationship between educational status and HIV infection. Moreover, the basic DHS finding that education is positively associated with HIV infection is disputed by Glynn et al (2004), who report that educated women in Yaoundé are less likely to test positive for HIV after adjusting for age, ethnicity and religious affiliation. Given the disputed nature of

the association between education and HIV infection in Cameroon and the lack of research that examines mechanisms that may account for the association between education and HIV infection, additional research on the association between education and HIV status is warranted.

This study will address these issues through analysis of data from the 2004 Cameroon DHS. Because (1) the bivariate association between education and HIV status is particularly strong among women in Cameroon, (2) extant research on Cameroonian women has produced contradictory findings regarding this association, and (3) the mechanisms underlying this association likely differ for women and men, we focus on the association between education and HIV status among women in the present investigation. Upon completion, this study will fill an important gap in the current literature, thereby making a useful contribution to the growing body of research on SES and HIV status in sub-Saharan Africa.

Methods

Data

This study utilized data from the 2004 Cameroon Demographic and Health Survey (DHS). The 2004 DHS used a complex cluster sampling design to achieve a nationally representative sample of 10,462 households in Cameroon (DHS 2005b). Within these households, 5,280 men (ages 15-59) and 10,656 women (ages 15-49) were interviewed, with response rates well in excess of 90 percent (Mishra et al 2007). Survey participants provided information on a variety of issues germane to our investigation, including demographic characteristics (e.g., marital status and ethnicity), socioeconomic status (e.g., education and assets), location of residence, knowledge of HIV prevention strategies and personal sexual practices (e.g., condom use).

Measures

The two main measures in this investigation are HIV status and educational attainment. The DHS determined HIV status via dried blood spot tests, which were conducted for a subsample of 5,098 men and 5,287 women. Educational attainment was reported in four categories: no formal education, primary education, secondary education or higher education. In the interest of preserving sufficient statistical power, we collapsed secondary and higher education into a single category.

Basic demographic indicators used in our study include age, marital status, household head and number of children ever born. To account for the possibility of a curvilinear relationship between age and HIV status, we included a quadratic term for age. Marital status was arranged into the following series of indicator variables: married, never married, cohabiting and separated/widowed/divorced. Household head was separated into two indicator variables: head and not head.

Characteristics of the respondents' place of residence were determined via two variables from the DHS. First, we created an indicator variable for urban versus rural residence. Second, we created a series of indicator variables for the twelve provinces in Cameroon: Adamaoua, Centre, Douala, Est, Extreme Nord, Littoral, Nord, Nord Ouest, Ouest, Sud, Sud Ouest, and Yaoundé.

We estimated cultural and economic conditions via measures of religious affiliation and purchasing power. Religious affiliation was separated into indicator variables for Catholic, Protestant, Muslim and other faiths (including no religious faith). Purchasing power was estimated via four indicator variables for personal ownership of a radio, television, car and

telephone. An additional category, not *de jure* resident, was included because these individuals were not asked this particular set of questions.

Sexual attitudes, knowledge and practices were measured with four variables from the DHS. First, we used the question "Should children be taught about condoms?" as an indicator of sexual attitudes that are relevant to the spread of HIV. Responses to this question were separated into two indicator variables: yes and no/don't know. Second, we used the question "Can a person avoid AIDS by using a Condom?" as a indicator of sexual knowledge, again with relevance to the spread of HIV. Responses were separated into two indicator variables: yes and no/don't know. Third, we used questions about contraception and age at first intercourse to measure sexual practices. Current method of contraception was divided into three indicator variables: condom, no contraceptive and other contraceptive. Age at first intercourse was collapsed into the following indicator variables: never had intercourse, 8-13 years of age, 14-16 years of age, 17-19 years of age, 20-33 years of age and a variable for missing data.

Finally, we sought to control for attributes of the respondents' sexual partners. As a rough indicator of such attributes, we created a series of variables for partner's educational attainment, which were divided into the same categories used for the respondent (i.e., no education, primary education, and secondary or more education). In addition, to avoid data loss we created an indicator variable that included women without sexual partners and women who did not respond to this particular question.

Analyses

We used SAS 9.1 in this investigation to manage and analyze data. First, using the PROC FREQ procedure, we examined basic sample characteristics, including HIV prevalence.

Second, using the PROC LOGISTIC procedure, we conducted a series of logistic regression analyses to determine the log odds of testing positive for HIV. In Model 1, we examined the zero-order association between level of education and HIV status. In Model 2, we examined this association while controlling for basic demographic indicators. In Model 3 through Model 6, we progressively added control variables for residential characteristics (Model 3), cultural and economic factors (Model 4), sexual attitudes, knowledge and practices (Model 5) and partner's educational attainment (Model 6). Because our analyses made use of several key variables used in the DHS weighting scheme, we opted not to weight our analyses in this investigation.

Results

Our descriptive findings (not weighted) closely resemble weighted findings reported elsewhere (e.g., DHS 2005a). For instance, we found that 3.9 percent of women with no formal education, 7.0 percent of women with primary education and 8.0 percent of women with secondary or more education tested positive for HIV in Cameroon (see Table 1). Similarly, we found that 3.5 percent of never married women, 4.8 percent of married women, 11.7 percent of cohabiting women and 18.0 percent of separated/widowed/divorced women tested positive for HIV. In addition, we found that the prevalence of HIV was much higher among women who were household heads (13.5 percent) than among women who were not household heads (5.9 percent). Table 1 also shows substantial differences in HIV status by region of residence and partner's educational attainment. Curiously, while urban/rural residence, religious affiliation, purchasing power, method of birth control and age at first intercourse do exhibit differences in HIV prevalence, these differences are, generally speaking, not very large.

Consistent with descriptive findings, Model 1 shows that the odds of testing positive for HIV are 1.84 (95% confidence interval (ci) = 1.29-2.63) times higher among women with primary education and 2.12 (95% ci = 1.49-3.03) times higher among women with secondary or more education than among women with no education (see Table 2). The addition of basic demographic controls in Model 2 causes this association to attenuate substantially; women with primary and secondary or more education are 1.47 (95% ci = 1.01-2.14) and 1.42 (95% ci = 0.96-2.09) times more likely, respectively, than women with no education to test positive for HIV. As anticipated, the relationship between age and the log odds of testing positive for HIV is significant and non-linear. Model 2 also shows that cohabitation, separation/widowhood/ divorce, and serving as household head significantly increase the odds of HIV. Relative to married women, women who cohabit (odds ratio (OR) = 2.20; 95% ci = 1.63-2.97) or are separated/widowed/divorced (OR = 3.56; 95% ci = 2.57-4.93) appear to be at particularly high risk for testing positive for HIV. Interestingly, with each additional child ever born, the odds of testing positive for HIV declines by about 14 percent (OR = 0.86; 95% ci = 0.81-0.91).

Model 3 adds urban/rural residence and region of residence, which causes such attenuation in the association between education and HIV status that significant differences between educational categories are no longer detected (see Table 2). Urban dwellers are 1.39 (95% ci = 1.07-1.82) times more likely than residents of rural areas to test positive for HIV. Substantial, statistically significant differences were also detected between various provinces. For instance, residents of Adamaoua, the Northwest and the Southwest provinces were all over *four times* more likely than residents of the extreme north to test positive for HIV.

Somewhat to our surprise, neither the addition of cultural and economic controls in Model 4 nor the addition of sexual attitudes, knowledge and practices in Model 5 resulted in

substantial changes to the association between education and HIV status (see Table 2). Also to our surprise, significant differences in HIV status were not detected among members of different religious groups, women with differential purchasing power, or women with varying attitudes and knowledge toward HIV-relevant sexual behaviors. It was not surprising, however, to find that women not using any form of contraception were 1.72 (95% ci = 1.14-2.59) times more likely than women using condoms to be HIV positive. Also unsurprising were the findings that lack of sexual experience significantly reduced the odds of HIV and early sexual initiation significantly increased them.

In Model 6, we added partner's educational attainment to previous models. The addition of this set of indicator variables essentially eliminated any hint of a relationship between respondents' educational attainment and HIV status (see Table 2). Although none of the coefficients for partner's educational attainment achieved the criterion of statistical significance, they suggest that women with educated partners are at higher risk of HIV than women with uneducated partners.

Discussion

Through this investigation, we sought to determine whether uneducated women in Cameroon were indeed at reduced risk of HIV infection, as suggested by previously published descriptive findings. Certainly, our research strongly suggests that there is no direct association between educational attainment and HIV status among women in Cameroon. However, while our results answer this important question, they raise at least two others: First, does the association disappear because the control variables in our models intervene between education and HIV status, or does it disappear because the association is spurious? Second, might the

addition of control variables not accounted for in this study cause a *negative* association between educational status and the log odds of HIV to emerge, as found by Glynn et al (2004) among women in Yaoundé?

With respect to the first question, it certainly seems plausible that educational attainment could affect HIV status indirectly via mechanisms such as partner's level of education. For instance, educated women might tend to seek out educated male sexual partners, which could in turn place educated women at increased risk of HIV infection. Such an explanation is consistent with the finding reported by Kongnyuy et al (2006), that educated men in Cameroon are more likely than their uneducated counterparts to engage in high-risk sexual activities (e.g., multiple sexual partnerships without the use of condoms). With respect to other control variables such as age and residential characteristics, it seems likely that both educational attainment and HIV status are influenced by these statistical controls. For instance, women living in urban areas are much more likely to receive secondary education, but are also more likely to contract HIV. Given these potential explanations, both confounding and mediation seem plausible. Therefore, although our research successfully eliminated the direct association between HIV status, additional theoretical and empirical work is necessary before it is possible to state with confidence that this relationship is spurious among women in Cameroon.

The second question may be addressed empirically through further research that considers the influence of control variables not examined in our study. For example, the addition of ethnicity (one of the control variables considered by Glynn et al (2004)) could cause further alteration in the relationship between educational attainment and HIV status among women in Cameroon. Indeed, preliminary results (not shown) from models with ethnicity as a control variable show that women with primary education and women with secondary or more education

are at about 15% *less* risk of HIV infection than women with no formal education. Unfortunately, SAS warns that the results from this model are unstable, likely due to the very large number of ethnic categories (fifty) included by the DHS for Cameroon, several of which contain very few women. Although collapsing ethnic groups with small numbers would be an obvious and efficient methodological solution to the problem, we believe it is important to think carefully about the theoretical implications of merging particular ethnic groups to avoid arbitrary combinations.

The failure to account for ethnicity is one of several limitations of the present iteration of this investigation. Another important limitation is, of course, that we focus only on women in this study. It is instructive to consider that Mishra et al (2007) found that control variables eliminated the relationship between wealth and HIV status among women, but not men in Cameroon. Given the possibility that the positive, direct relationship between educational attainment and the log odds of HIV status among men in Cameroon could survive the threat of spuriousness, it seems important that we either expand the present investigation or perhaps launch a twin study. Another rather obvious limitation of the present investigation is that we do not account for the complex DHS sampling design in our analyses. Although we believe that this is unlikely to alter our main conclusions, it could, for instance, alter the statistical significance of certain coefficients through enlarged standard errors. This is another limitation that should be taken into consideration in future drafts.

Because our research is still in its developmental stages, it is difficult (and perhaps even dangerous) to make policy recommendations at this point. However, a handful of policy implications emerge from our work that we believe will be confirmed by additional research. First of all, while general education does not appear to be a risk factor for HIV as implied by

descriptive results, it does not appear to afford much protection, either. Even in the preliminary models that include ethnicity, the protective effect of primary and secondary education is quite modest. This suggests that targeted educational strategies may be more effective in producing behavioral changes that reduce the likelihood of contracting HIV. For example, the prevalence of condom use varies substantially across various provinces in Cameroon. Targeting regions where HIV prevalence is high but condom use is low (e.g., Adamaoua) for educational interventions could encourage safer sexual practices among women in those provinces. Second, our analyses suggest that vulnerable women (e.g., widows) are at particularly high risk for contracting HIV. Public health campaigns and social policies designed specifically to educate and assist vulnerable women in Cameroon could prove effective in reducing rates of HIV infection.

This investigation has dispelled the notion that educational attainment is positively associated with the likelihood of HIV infection among women in Cameroon. Other variables such as age, marital status, residential characteristics and partner's educational attainment account entirely for this association. Furthermore, preliminary research into the influence of ethnicity suggests that educational attainment might even have a slight protective effect, consistent with the socioeconomic gradient in health typically found in epidemiologic research. Further research is necessary to make this determination, and also to account for other shortcomings in our current investigation. The association between educational attainment and HIV status in Cameroon and other parts of Africa is intriguing and important from both epidemiologic and public health perspectives. Our hope is that improved understanding of this association will lead to improved social policies, ultimately reducing incident cases of HIV infection in this part of the world so adversely affected by the AIDS pandemic.

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Table 1. Descriptive Statistics for Selected Indicator Variables in Logistic Regression Models, Demographic and Health Survey (DHS), Cameroon 2004

		Percent	
	n	of Women in DHS Sample	HIV Positive
Educational Attainment			
None	2,141	20.09	3.93
Primary	4,307	40.42	6.98
Secondary or More	4,208	39.49	7.99
Marital Status			
Never Married	2,534	23.78	3.50
Married	5,423	50.89	4.80
Cohabiting	1,754	16.46	11.66
Separated/Widowed/Divorced	945	8.87	18.04
Household Head			
Head	1,182	11.09	13.48
Not Head	9,472	88.91	5.89
Urban/Rural Residence			
Urban	5,270	49.46	8.22
Rural	5,386	50.54	5.43
Region of Residence			
Adamaoua	783	7.35	9.90
Centre	890	8.35	5.87
Douala	1,016	9.53	5.60
Est	723	6.78	8.82
Extreme Nord	1,039	9.75	2.02
Littoral	836	7.85	6.57
Nord	955	8.96	1.37
Nord Ouest	869	8.16	11.76
Ouest	1,097	10.29	3.33
Sud	751	7.05	7.73
Sud Ouest	778	7.30	11.14
Yaounde	919	8.62	10.22
Religious Affiliation			
Catholic	4,106	38.57	7.34
Protestant	3,638	34.18	7.90
Muslim	1,779	16.71	5.17
Other	1,122	10.54	3.04

Table 1 (continued). Descriptive Statistics for Selected Indicator Variables in Logistic Regression Models, Demographic and Health Survey (DHS), Cameroon 2004

		Percent	
	n	of Women in DHS Sample	HIV Positive
Purchasing Power			
Owns Radio	6,899	64.77	6.54
No Radio	3,753	35.23	7.22
Owns Television	2,905	27.28	7.44
No Television	7,745	72.72	6.53
Owns Car	715	6.72	6.63
No Car	9,923	93.28	6.77
Owns Telephone	225	2.12	5.00
No Telephone	10,412	97.88	6.80
Method of Birth Control			
Condom	1,006	9.44	7.66
No Contraceptive Used	7,794	73.14	6.68
Other Contraceptive	1,856	17.42	6.67
Age at First Intercourse			
Never Had Intercourse	1,322	12.43	0.83
8-13 Years	1,123	10.56	9.89
14-16 Years	4,761	44.75	6.49
17-19 Years	2,587	24.32	8.57
20 Years and Older	474	4.46	8.37
No Information	371	3.49	6.93
Partner's Educational Attainment			
None	1,665	14.74	3.47
Primary	2,491	22.06	7.32
Secondary or More	3,463	30.67	9.74
No Partner (or missing data)	3,673	32.53	5.37

Table 2. Effects of Education and Other Respondent Characteristics on the Log-Odds of Testing Positive for HIV, Demographic and Health Survey (DHS), Cameroon 2004 (Women Only)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Educational Attainment (none)						
Primary	0.609 **	0.384 *	0.168	0.213	0.218	0.043
Secondary or More	0.753 **	0.349	0.107	0.172	0.213	0.039
Age		0.427 **	0.400 **	0.401 **	0.385 **	0.385 **
Age-squared		-0.006 **	-0.006 **	-0.006 **	-0.006 **	-0.006 **
Marital Status (married)						
Never Married		0.050	-0.066	-0.044	0.353	0.333
Cohabiting		0.786 **	0.902 **	0.894 **	0.904 **	0.905 **
Separated/Widowed/Divorced		1.269 **	1.286 **	1.259 **	1.278 **	1.292 **
Household Head (not head)						
Head		0.384 *	0.358 *	0.337 *	0.332 *	0.324
Number of Children Ever Born		-0.153 **	-0.131 **	-0.129 **	-0.130 **	-0.128 **
Urban/Rural Residence (rural)						
Urban			0.332 *	0.328 *	0.358 *	0.348 *
Region of Residence (Extreme Nord)						
Adamaoua			1.493 **	1.411 **	1.421 **	1.388 **
Centre			0.549	0.509	0.491	0.417
Douala			0.266	0.276	0.340	0.279
Est			1.167 **	1.112 **	1.177 **	1.099 **
Littoral			0.690	0.650	0.702	0.639
Nord			-0.335	-0.331	-0.264	-0.253
Nord Ouest			1.582 **	1.511 **	1.591 **	1.524 **
Ouest			0.093	0.106	0.170	0.099
Sud			0.804 *	0.759	0.722	0.654
Sud Ouest			1.411 **	1.408 **	1.445 **	1.371 **
Yaounde			0.979 *	0.955 *	1.019 *	0.959 *
Religious Affiliation (Catholic)						
Protestant				0.004	0.015	0.004
Muslim				0.067	0.062	0.171
Other				-0.382	-0.393	-0.390
Purchasing Power (does not own)						
Owns Radio				-0.072	-0.051	-0.062
Owns Television				-0.011	0.007	0.001
Owns Car				0.088	0.074	0.060
Owns Telephone				-0.400	-0.293	-0.298
Not De Jure Resident				-0.002	0.022	0.010
Avoid AIDS with Condom? (no, dk)						
Yes					0.188	0.176
Teach Children about Condoms? (no, dk)						
Yes					0.190	0.185
Method of Birth Control (condom)						
No Contraceptive Used					0.541 **	0.538 *
Other Contraceptive					0.119	0.113
Age at First Intercourse (20-33 years)						
Never Had Intercourse					-1.443 **	-1.467 **
8-13 Years					0.893 **	0.904 **
14-16 Years					0.072	0.072
17-19 Years					0.129	0.133
No Information					-0.107	-0.103
Partner's Educational Attainment (none)						
Primary						0.515
Secondary or More						0.514
No Partner (or missing data)						0.541
Sample Size (n)	5154	5152	5152	5131	4992	4992
-2 Log Likelihood	2533.3	2315.6	2225.5	2209.2	2147.0	2143.5

Note: Reference groups are shown in parentheses.

**p<.05; **p<.01*