

Rural Liberian Mothers' Helpless 'Health' Decisions

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Abstract

In the fourteen years since the end of Liberia's civil war, Liberian women have experienced many adversities because of continued civil conflict. Empirical studies are lacking; this article fills that gap. Analysis of the 2007 and the 2013 Liberia Demographic and Health Surveys (LDHS) reveal a vast disparity between rural and urban populations. This study focuses on 15 to 19-year-old women in five regions in the 2013 LDHS. The population's Body Mass Index (BMI) is used to identify the nutritional status of Liberian mothers and categorized for ordered logistic regressions. Also, a Monte Carlo (MC) Simulation is performed to show the effect of wealth (based on years of education). Age, literacy, and wealth have positive relationships with BMI. The Cumulative Distribution Function (CDF) Graph after 500 iterations shows a huge wealth gap between the South Central and other four regions of the country. Implications arise from the results that young rural Liberian mothers have been the most disadvantaged in health, education, and wealth. The prevalence of 'traditional' agricultural techniques in rural Liberia causes households to remain impoverished and malnourished. These circumstances might not differ from the pre-war period. They were and remain helpless decision makers in Liberia. This paper will illuminate the possible future impacts of the prevailing conditions in Liberia on not only the country itself but also in other surrounding and far away countries, e.g., internally displaced persons, refugees, and asylees.

Keywords: post conflict, rural Liberia, Liberia Demographic and Health Surveys, mothers, health, education, wealth

Liberia in the pre-, in- and post- conflict

Liberia is a small, multiethnic country on the West African Coast, sharing borders with the Ivory Coast, Guinea, and Sierra Leone. Sixteen indigenous tribes have had constant conflict with Americo-Liberians, descendants of freed American slaves since becoming independent in 1847 (Akpan, 1973). An unequal power distribution -- where a population of 2.5% of Americo-Liberians has led other ethnic groups -- has caused the country to experience several stages of conflict which impacted its residents' economic, food, and health security. Liberians started riots in 1979 after a rice importer, belonging to the family of the Americo-Liberian President Tolbert Jr., raised the price of the staple crop (Okolo, 1981). One year later, Master Sergeant Samuel K. Doe from the Krahn tribe executed the president and his cabinet members. President Doe exercised his power until his successor, a rebel leader and an Americo-Liberian, Charles McArthur Ghankay Taylor, overthrew Krahn in a military coup (Utas, 2005). The country then entered a fourteen-year internal conflict.

Because of a civil war from 1989 to 2003, the national economy deteriorated, e.g., the national Gross Domestic Product (GDP) per capita fell from \$1,458 in 1980 to \$270 in 2003 (constant 2010 USD), a large number of Liberians lost family members, and farms were burned, abandoned, and neglected. Liberia was the wealthiest among average Sub-Saharan African Countries, Ghana, and Senegal, in 1960s and 1970s. Since 2003, the country has not fully restored to its previous national wealth. Appendix A displays the economic trend.

The country also lost human capital due to the conflict. According to Fuest (2008), the war caused approximately 2.5 million Liberians to be displaced. This number

equaled half the entire population. The main helpless victims among groups of people were 15 to 19-year-old Liberian females. The second appendix presents a linear correlation matrix between chosen variables. In the first row, Liberians armed with weapons increased the rate of adolescent fertility by over 50%. Paradoxically, the higher teenage pregnancy rate due to sexual violence lowered the age of life expectancy by more than half, regardless of gender at birth. Swiss et al. (1998) writes about the sexual violence during the internal conflict against women in the reproductive age. Parents could not provide a place of safety for vulnerable infants. The armed forces also negatively influenced not only food production but also community health. Both crop and food production indices plummeted because of the armed forces. Undoubtedly, weapons destroyed Liberian agriculture. Damage was even worse in health care systems. Rebel forces blocked children from receiving universal immunization against childhood diseases. As a result, the government could not expend all efforts on the care of innocent people.

The civil war ended in 2003; however, some unresolved conflict persists. Beekman et al. (2013) provide reasons for barriers to parallel development and social class in post-conflict societies. The Liberian government has tried a piecemeal approach to these various tensions. Political tensions continue while many live from hand-to-mouth. The United Nations Development Program (UNDP) ranks Liberia 177 of 188 countries on the Human Development Index (HDI). UNDP (2016) released the latest HDI in 2015, which shows that Liberia has improved approximately 0.03 since 2003. The lowest 41 countries could not demonstrate well-balanced human development in education, longevity, and the living standard. Among the major

indicators, Liberia earns the least per capita Gross National Income (GNI) after the Central African Republic. The Democratic Republic of Congo records almost an equal GNI (680 USD) to Liberia (683 USD).

Growing Disparity between Rural and Urban Residents

Inequality could trigger socioeconomic disparity (Sohoulande Djebou, Price, Kibriya, & Ahn, 2017). The higher inequality indicator implies that the wealth of the nation is unequally distributed. Most Liberians may not endure conditions of extreme poverty.

Docile, uncertain, and weak regulations for valuable natural resources such as diamonds, rubber, and iron ore may set situations back to the pre-conflict stage. The social and political hierarchy in rural Liberia could be another cause that may not allow households to enjoy prosperity. Community chiefs used to and still allocate intangible and tangible assets (Beekman, Bulte, & Nillesen, 2013). The title is not honorary. Elders recommend a few candidates and community members select one. The government appoints the person as a new chief. Reno (2008) provides cases where leaders exercise power for personal gain. It might become the logic behind the creation of class-based communities and allegations of corruption.

Beekman et al. (2013) note that most Liberians engage in agriculture. A large proportion of agricultural commodities contribute to the national GDP, yet this has annually decreased. Rice and cassava are two dominant staple crops. Nimba, Bong, Lofa, and Grand Bassa Counties account for around 70% of the country's production.

A survey team from the Center on Conflict and Development (ConDev) at Texas A&M University, sponsored by the Howard G. Buffett Foundation, teamed up with the

Liberia Institute of Statistics and Geo-Information Services (LISGIS). Together, ConDev and LISGIS conducted household surveys in rural Liberia and reported in 2013 the prevalence of 'traditional' agricultural techniques dating to the 1970s, including a lack of proper land preparation, few inputs, and no machinery. This resulted in stagnant rice yields of less than two metric tons per hectare that prevailed over four decades (Center on Conflict and Development, 2013). The amount is an average among swamp rice (otherwise called lowland rice); upland rice, traditional varieties, and others were not indicated. Two additional appendices may promote a better understanding than a read-only text. Appendix C presents Liberia's rice yields up to 2013. Productivity was stationary during the period of war. Although rural Liberia recorded the highest kilograms per hectare in 2013, the amount was still lower than the world's average in 1961. If the trend continues, rice production of Liberia may be less than half of the world's average output by around 2040.

Appendix D, adapted from Currens (1976), for showing farming techniques. Among 326 surveyed households in Grand Bassa, Lofa, and Nimba, 87% answered they grow upland rice. Some "blessed" farmers could have two types of land – wetland and dry land – to double-crop rice. Farmers repeated "blessed" in the field. A land conversion, e.g., barren land to swamp, happens due to the laws of nature, not because of irrigation technology. Rice cultivation requires a significant labor force. Scarce resources and inadequate support for infrastructure result in no improvement in agricultural technology and labor availability. Males and females farm through a division of labor approach. Wives and daughters burn fallen trees to get more farm land. They plant rice and scare

birds away together with male members of a family. Also, female members weed out and support harvesting in the season or the end of a rainy season.

Neighbors rotationally share the heavy workload in accordance with the Kuu systems i.e., a cooperative system (Beekman, Bulte, & Nillesen, 2013). The biggest drawback of subsistence grain farming is not only an insufficient amount of supply but also the low-quality output. Rural households are concerned with food shortages and malnutrition, besides poverty.

Sohoulande Djebou et al. (2017) imply that agricultural technology and farm assets are not the only factors to describe hardship of rural households of Liberia, unlike Ghana and Senegal. A suggestion for social scientists is to compare one region to another in Liberia to measure the growing socioeconomic disparity.

Aside from structural problems in rural Liberia, urbanization has exploded since 2003. The population has increased to over 4.5 million and over 30% live in Montserrado County which includes the capital – the city of Monrovia (FAO, n.d.). Nominal GDP has been growing since the end of the civil conflict, albeit slowly between five and six percent based on economic perspectives by the World Bank (2012). The World Bank Group (2016) anticipates that low-income countries may experience six percent annual GDP growth on average until 2019. The rate of economic growth in Liberia may be lower than others in developing nations.

However, life in Monrovia may differ from rural Liberia. Urban people have more opportunities in education, health, and financial resources. Despite this, a high density of population may cause the need for more social infrastructure in a decade.

Purpose of the Study

The purpose of this study is twofold. First, readers may find several critical factors that influence health among the female child-bearing population, i.e., ages 15 to 49. Second, young Liberian women in urban and rural areas ages between 15 and 19 are the narrow subpopulations to show a socioeconomic gap over the next decade. Beekman et al. (2013) list the last two elements that might increase constant tensions in post-conflict societies as age and gender. The study will prove reasons for the importance of studying this population. These two populations are the most vulnerable and yet the most necessary and important to restore the country, an important consideration not only in surrounding countries but also other countries in post-conflict eras. Their health and social empowerment may bring prosperity to their families.

Data Description and Method

The article was written after analyzing the Liberia Demographic and Health Surveys (LDHS). Two separate 2007 and 2013 LDHS data sets were considered to trace and simulate health and socioeconomic status of the target populations. The 1986 LDHS summary report was also referred to reflect findings.

Footman et al. (2015) outline several features of the Demographic and Health Surveys (DHS). The DHS provide health information on females between 15 and 49 years, the reproductive age. The United States Agency for International Development (USAID) has funded over 90 national statistical offices in Low and Middle-Income Countries (LMICs) since 1984. Survey questionnaires cover fertility, gender, nutrition, and maternal and child health. Policy makers, project managers, and researchers in the

world regard the DHS as an essential and reliable data source not only to identify health issues but also to provide better health services.

LISGIS conducted the 2007 and 2013 LDHS and published reports for public information. One key finding of the 2007 LDHS is that approximately 10% of Liberian females were malnourished. In Body Mass Index (BMI), they are under 18.5 kg/m². BMI includes critical personal information of height and weight, and a BMI range of 18.5 kg/m² to 24.9 kg/m² is normal.

The 2007 LDHS report states that another 21% were obese (25 kg/m²<BMI<30 kg/m²) or at the stage of obesity (30+ kg/m²). The proportion of the overweight and obesity grew to 27%, whereas females who are underweight declined by three percent in 2013. In the 2007 LDHS report, LISGIS explains that a group of older women in Monrovia, which is the wealthiest and most educated, was inclined to be overweight. But the 2013 LDHS report omits the relationship between BMI and education, notwithstanding showing a positive correlation between BMI and wealth, and BMI and age in the report. BMI, ages of female interviewees, wealth, education, geographic advantages/disadvantages, and other health-related variables were subdivided into ordered categories to illuminate more complicated relationships.

Appendices E and F are three-way contingency tables to add more information. In 2007, female respondents in rural areas had more chronic energy deficiency than urban interviewees regardless of age. A majority (at least over 50%) responded with a normal BMI range regardless of where they resided. However, two age groups, 25 to 29 and 30 to 34, had more obesity in the city.

The 2013 LDHS had a similar number of respondents. Even though only 10% of female interviewees were under normal BMI, rural residents reported more severe chronic energy deficiency. Urban and rural residents between 45 and 49 years of age showed the widest 'health' gap in 2013. In numerical terms, 26 (81%) were undernourished, while six (19%) in urban areas reported being under normal BMI.

Loaiza and Macro (1997) also consult BMI to evaluate the nutritional state of mothers. After analyzing DHS data for ten Sub-Saharan African Countries, three North African Countries, and five Latin American Countries, the authors conclude that age, education, ethnic communities/religion/language, and socioeconomic status influence BMI. The authors contend that the respondents' residence might or might not impact health status.

In this study, age of mother, education, and socioeconomic status were highlighted. Also, ethnic communities, religion, and language were considered along with education and socioeconomic status.

Fuest (2008) reports a critical social trend in the pre-war and the post-war era. Liberian women, who were educated in urban areas, delay marriage. They preferred to live independently and manage their income. They wanted to achieve equal opportunities in society as men received. They were decision makers.

Since the end of the war, Liberian women have shown a collective action. They are increasingly active in economic and political activities. Urbanization is expediting an active role of Liberian females. Rapid urbanization simultaneously magnifies a side effect. Although female school enrollment in Montserrado reached almost 45% compared to male students, the inequality of education for Liberian girls in rural areas is

neglected. Rural Liberian women have been in the minority without opportunities to be educated.

Two more three-way contingency tables, appendices G and H, show evidence of not only severe 'health' but also a significant 'wealth' gap between rural and urban residents. For instance, 91% of women urbanites who are 40-49 years of age reached the richest wealth index in the 2013 LDHS. Another age group between 20 and 29 showed that 94% of city dwellers (166 and 161 LDHS interviewees) also reached that wealth index. Only ten and 11 rural residents in the same age range responded with the same wealth index. The 2007 LDHS shows that 88% of urbanites were wealthy (205/234) compared to 12% of 25-29-year-old rural residents (29 of 234).

Both the 2007 and the 2013 LDHS indicate urban residents held more wealth and resources than people in the countryside. The trend, however, was steady and more worrisome in 2013. Rural residents did not improve their poor condition. More residents in rural areas moved to an impoverished state than female urbanites. Percentages are presented to compare rural residents to female urbanites in BMI and the wealth index. Gathering all stated information and the 2007 and the 2013 LDHS, two statistical methods were performed to illuminate a 'gap' between the two study populations. First, two generalized linear models for ordinal variables were used. In original LDHS data sets, the BMI variable is continuous. This continuous variable was categorized in order of weight/height. After another age variable became categorized by STATA 14, two independent ordinal logistic regressions were executed. Using the SIMETAR program, a Monte Carlo Simulation was also performed and it displayed the Cumulative Distribution Function (CDF) Graph after 500 iterations were processed.

Findings

The first table displays the statistical relationship between BMI and selected explanatory variables in the 2007 LDHS. The LDHS follows the multistage sampling design. Complex sample designers can anticipate smaller standard of error of population not only for increasing sample size but also due to features of stratification, clusters, and sampling weights (Heeringa, West, & Berglund, 2010). LISGIS stratifies subgroups after they frame by residence and geography. By each stratum, LISGIS randomly selects household clusters in the first stage. The next phase is to interview each family and reflect sampling weights to the target population. Therefore, the estimated design effect includes information of a complex design as well as simple random sampling. According to Heeringa et al. (2010), the results of the cut points are included because they show a probable relationship between the ordered BMI and the explanatory variables.

Odds ratios of the BMI show a tendency to increase when a woman has more wealth. Similarly, older Liberian females give birth to sons and daughters with a higher BMI. Both independent variables have a linear relationship with BMI.

Table 1

Ordered Logistic Regression

Number of Strata = 143		Number of Obs. = 4,171	
Number of PSU = 297		Population Size = 4,291	
		Design Effect = 154	
		F(18,137) = 13.13	
		Prob. > F = 0.00	
BMI		Odds Ratio	95% Confidence Interval
Wealth Index			Lower Higher
Poorest		Ref.	

Poorer	1.23	0.86	1.77
Middle	1.63*	1.12	2.39
Richer	2.68***	1.68	4.29
Richest	3.55***	2.11	5.96
Num. of Children	0.928	0.85	1.01
Age Group			
15-19	Ref.		
20-24	2.05**	1.3	3.24
25-29	2.88***	1.93	4.29
30-34	3.54***	2.3	5.46
35-39	4.18***	2.71	6.43
40-44	4.04***	2.36	6.93
45-49	5.25***	3.15	8.77
Domestic Violence	0.775	0.59	1.02
Num. of Mosquito Nets	0.92	0.82	1.01
Education			
No Education	Ref.		
Primary	0.952	0.79	1.14
Secondary	1.09	0.84	1.41
Higher	1.01	0.58	1.77
Time to Water Source	0.999	0.99	1.00
Urban/Rural	0.73	0.53	1.01
/cut1	-1.53***	-2.28	-0.78
/cut2	2.79***	2.06	3.51
/cut3	3.42***	2.69	4.16

*p < .05, two tailed. **p < .01, two tailed. ***p < .001, two tailed.

Note. In Stata, the `-svyset-` command describes the survey design

Table 2 shows the result of another ordered logistic regression of the 2013 LDHS. Odds ratios of the BMI grow larger with the richer and richest wealth compared to the 2007 LDHS. A new explanatory variable, literacy, partially proves that ability to read a whole sentence empowers a Liberian female to have a higher BMI when considered household data. Likewise, in the 2007 LDHS, the older age group shows a rising pattern when the BMI is categorized underweight, normal weight, overweight, and obesity.

The role of religion, either Christianity or Islam, can strongly influence 15 to 49-year-old Liberian women (p-value = 0.01).

Husbands' education is sorted into the level of achievement and has a linear relationship with the ordered BMI. This may be interpreted to mean that a higher education of a spouse can positively influence weight concerning Liberian mothers' height.

Table 2

Ordered Logistic Regression

Number of Strata = 30	Number of Obs. = 3,076
Number of PSU = 322	Population Size = 2,782
	Design Effect = 292
	F(23,270) = 8.26
	Prob. > F = 0.00

BMI	Odds Ratio	95% Confidence Interval	
		Lower	Higher
Wealth Index			
Poorest	Ref.		
Poorer	1.19	0.9	1.56
Middle	1.57***	1.21	2.04
Richer	2.71***	1.79	4.1
Richest	3.64***	2.11	6.28
Literacy			
No Read at all	Ref.		
Parts of Sentence	0.99	0.61	1.62
Whole Sentence	1.19	0.89	1.58
Num. of Children	0.996	0.91	1.09
Religion (Chr./Muslim)	1.52*	1.11	2.08
Age Group			
15-19	Ref.		
20-24	1.62	0.92	2.86
25-29	2.62***	1.46	4.73
30-34	3.48***	1.85	6.57
35-39	5.04***	2.62	9.71
40-44	5.26***	2.77	9.99

45-49	6.14***	2.98	12.65
Domestic Violence	0.81	0.44	1.5
Num. of Mosquito Nets	1.1	0.89	1.35
Husbands' Education			
No Education	Ref.		
Primary	1.13	0.83	1.54
Secondary	1.43***	1.13	1.83
Higher	2.24***	1.37	3.64
Time to Water Source	1.00	0.99	1.00
Urban/Rural	1.11	0.84	1.46
Minutes to Clinics	0.99	0.99	1.00
Mother's Age when first baby delivered	0.98	0.95	1.01
/cut1	-0.88*	-1.71	-0.04
/cut2	2.99***	2.11	3.87
/cut3	3.57***	2.69	4.45

*p < .05, two tailed. **p < .01, two tailed. ***p < .001, two tailed.

Note. In Stata, the `-svyset-` command describes the survey design

The biggest concern after the ordinal logistic regressions is illiteracy. The 2013 LDHS shows that about 38% of female respondents 15 to 49-year-old could read parts or a whole sentence. Sixty-two percent were illiterate, i.e., 5,692 of 9,210. When the level of literacy is studied in relation to place of residence, the variance becomes larger regardless of age. In comparison with female urbanites, approximately 71% of rural residents could not read even a sentence. On the contrary, around 29% of Liberian women (1,648/5,692) in urban areas were illiterate. The ability to read a whole sentence was significantly different between urban and rural areas, i.e., 65% urban respondents (1,721/2,636) versus 35% (915/2,636) rural respondents.

LISGIS splits Liberia up into five regions in the 2013 LDHS. A total of 1,025 rural and 890 urban residents in the data set whose ages were between 15 and 19 were

considered for performing a Monte Carlo (MC) simulation. Another wealth index 'continuous' variable, not categorized, was a key output variable. Years of educational achievement influence wealth index. Both factors forecasted and transformed into stochastic values for simulation. Individual five regions had 500 iterations (Richardson, Schumann, & Feldman, 2006). The limit of wealth index had the minimum negative level at 127,000 and a maximum level of around 179,000. The maximum wealth was approximately 200,000 lower than the simulation that includes all population between 15 and 49 years of age in the 2013 LDHS.

Figure 1 displays the Cumulative Distribution Function (CDF) Graph after the MC simulation was performed. Table 3 includes information regarding the highest educational attainment in all five regions.

As a consequence, the South Central region, including Montserrado, Grand Bassa, and Margibi Counties, appears to be where the highest wealth accumulation among the five areas is found. More than 80% of the respondents reported that they might be the primary agents of economic activity in a decade. The CDF graph is smooth and notes the maximum wealth index, i.e., 372,634. This trend shows evidence that young females in Monrovia and near the capital have a wide range of possibilities for personal, social, and economic development. Therefore, urbanization may facilitate the development process.

Unfortunately, young mothers in the other four regions may not have the same opportunity compared to the South Central region. Their CDF graphs look much steeper. Over 50% of young female residents may miss economic opportunities.

The North Central region, which shares a border with Cote d'Ivoire, Guinea, and Sierra Leone and the South Central region, has the second lowest accumulation of the poor, albeit at a much lower rate than the South Central region. In comparison with the other non-capital regions, one respondent finished a higher degree in the North Central region. The region, however, had proportionally fewer residents that completed a secondary degree throughout the 2013 LDHS. Interestingly, the region shows the lowest standard deviation of wealth, i.e., 69,970, maybe because approximately 90% completed a primary education and above.

Few residents in the North Western region may accumulate considerable wealth (282,400) over the next decade, but this region may simultaneously have more poverty than the North Central region, meaning that over 60 percent of young female residents may have no income sources. In this region, which includes Bomi, Gbarpolu and Grand Cape Mount Counties, over 70 percent of girls responded either having no education or only completing elementary education in 2013.

The CDF graphs of the South Eastern A and South Eastern B almost overlap each other. South Eastern A, which is adjacent to the South Central region, has the highest accumulation of the poor. While most the residents are poor, approximately 30% may earn a positive income. The maximum wealth accumulation, which is 275,000, is close to the North Western region. Caution in this area is the highest standard deviation of the wealth of 84,210 and is greater than other regions except for the South Central.

Grand Kru, River Gee, and Maryland are in the South Eastern B. This area is the farthest away from Monrovia. 15% of respondents had no education. The mean wealth is negative and the smallest maximum wealth, i.e., 178,000.

These results demonstrate convincingly that the educational levels can influence various patterns of wealth accumulation in all five regions of Liberia.

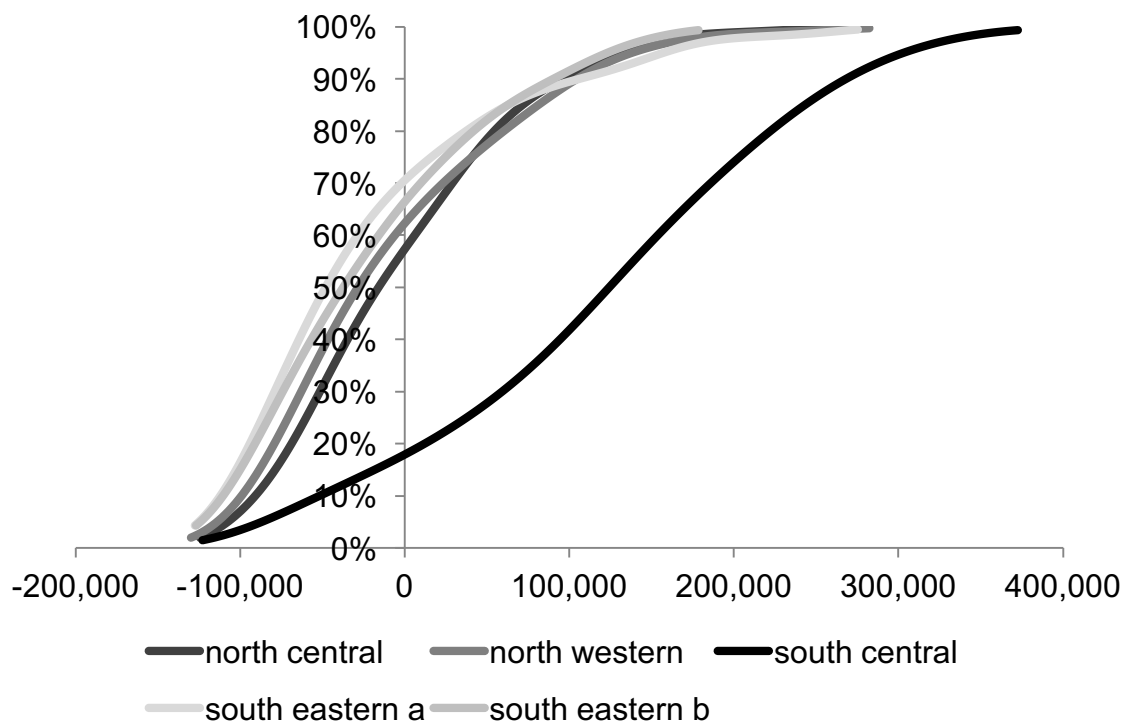


Figure 1. Cumulative Distribution Function (CDF) Graph Wealth by Education Years

Table 3

Education Levels by Region (The 2013 LDHS)

Region	Highest Educational Level (15 to 19-year-old women)				Total
	No Education	Primary	Secondary	Higher	
North Western	25	205	79	0	309
Proportion	8%	66%	26%	0%	100%
South Central	45	366	275	4	690
Proportion	6.5%	53%	39.9%	0.6%	100%
South Eastern A	18	166	48	0	232
Proportion	8%	72%	21%	0%	100%
South Eastern B	43	174	61	0	278

<u>Proportion</u>	15%	63%	22%	0%	100%
North Central	43	278	84	1	406
Proportion	10.59%	68.47%	20.69%	0.25%	100%

Conclusion

The past reflects the future. Since Liberia declared itself an independent state, the country has had several stages of conflict. Almost all Liberians were displaced and suffered physically, emotionally, and economically during the civil war. The Liberian government was paralyzed. Farms were burned and neglected. Weapons destroyed the entire Liberian agriculture.

The vast disparity between Americo-Liberians and other indigenous tribes, rural and urban residents, males and females continues in the post-conflict reconstruction. This paper highlighted Liberian women in reproductive ages. There should be a significant correlation between food security and health. ConDev with LISGIS identified the prevalence of 'traditional' agricultural techniques in 2013. These 'traditional' methods did not differ from when the war began in 1989. Farmers have not benefitted from agricultural technology. Rice production remains lower than the average of the world in 1961. No disposable income might be the reason that mothers and daughters have been underprivileged in rural Liberia. The social and political hierarchy in rural Liberia might deteriorate the situation.

Not all Liberian women have the same social disadvantages. Today, more Liberian women in Monrovia have almost the same level of education, economic, and political opportunities as males in the country. Urbanization has expedited this social change.

Looking into the 2007 and the 2013 LDHS data, this paper showed various nutritional statuses of Liberian mothers. Age, literacy, and wealth had a positive, linear

relationship with the ordered BMI variable. Although the education levels were not statistically significant, the variable in the 2013 LDHS, literacy, enabled another Monte Carlo Simulation Approach for 15-19 year old Liberian female respondents.

Education may not be the most accurate and biggest factor for wealth accumulation. But education will empower young Liberian mothers to decide about economic opportunities, family, and health. Here, education should be a universal right, not a privilege.

Young mothers in Liberia and many countries across the world should be independent decision makers and should have the freedom to choose directions for a better life in a lifetime. However, these young mothers have no such privileges because of the displacement, lack of financial means, and geographic and social disadvantages. This paper illuminates the possible future impacts of the prevailing conditions in Liberia on not only the country itself but also in other surrounding and far away countries, e.g., internally displaced persons, refugees, and asylees. The circumstances and issues also affect on preparing students for international development in U.S. universities to confront and succeed with such challenges that affect the world population.

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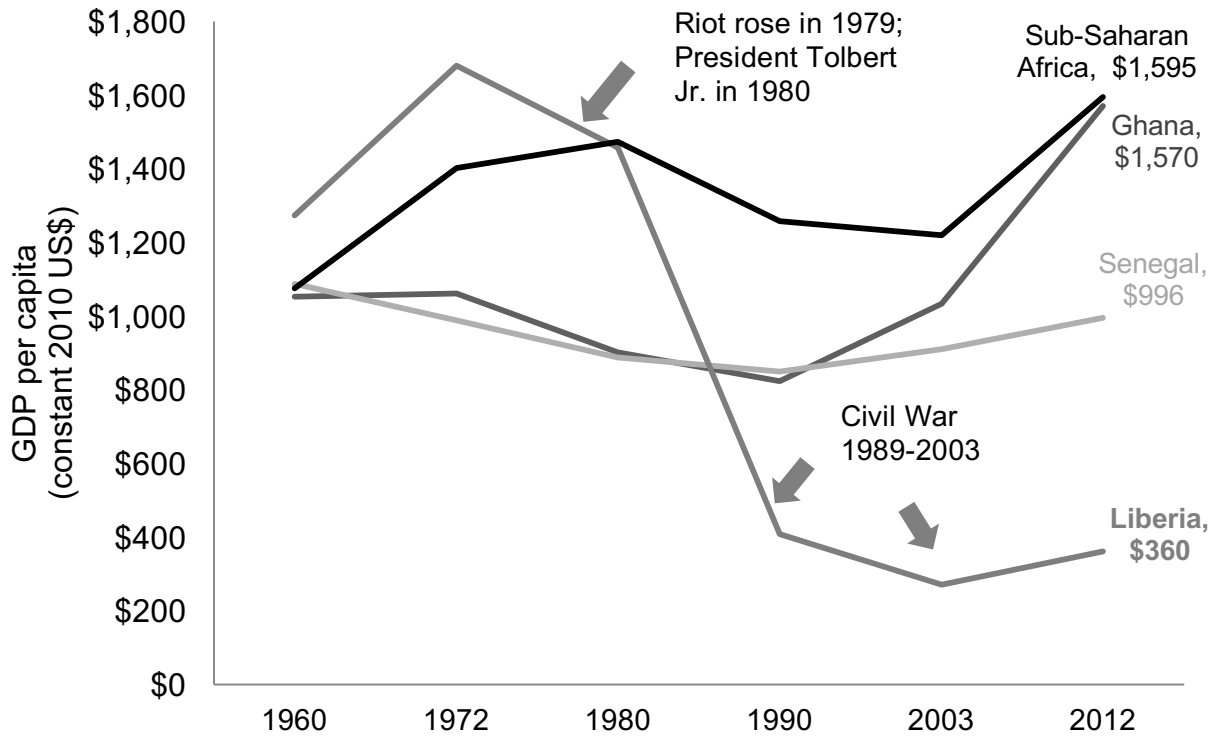
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Appendix A. Gross Domestic Product per Capita for Selected West African Countries.

Source: World Development Indicators.

Appendix B

Correlations for Key Variables

	Armed forces	Adolescent fertility rate	Life expectancy at birth, female	Life expectancy at birth, male	Incidence of tuberculosis	Immunization , measles	Health expenditure	Crop production	Food production index
Armed forces personnel (%of total labor force)		.53*	-.61**	-.54*	-.58**	-.78***	-.82***	-.48*	-.62**
Adolescent fertility rate (births per 1,000 women ages 15-19)			-.97***	-.96***	-.96*	-.61***	-.93***	-.67***	-.90***
Life expectancy at birth, female (years)				.99***	.99***	.69**	.95***	.72***	.93***
Life expectancy at birth, male (years)					.99***	.70**	.96***	.79***	.95***
Incidence of tuberculosis (per 100,000)						.59*	.92***	.78***	.94***

people)			
Immunization , measles (% of children 12-23 months old)	.75**	-.02	.73**
Health expenditure (US\$)		.01	.95***
Crop production Index (2004- 2006 =100)			.88***
Food production index (2004- 2006 = 100)			

*p < .05, two tailed. **p < .01, two tailed. ***p < .001, two tailed.

Note. Years, variables, country chosen from the source for linear correlation matrix

Source: *World Bank*

Appendix C

Rice Productivity

Year	1961	1985	1990	1995	2000	2013	2040
Rice Productivity (kg/ha)		1252*	1028*	1124*	1290*	1923**	
World's Average Rice Productivity (kg/ha)	2070***			3430***			4520***

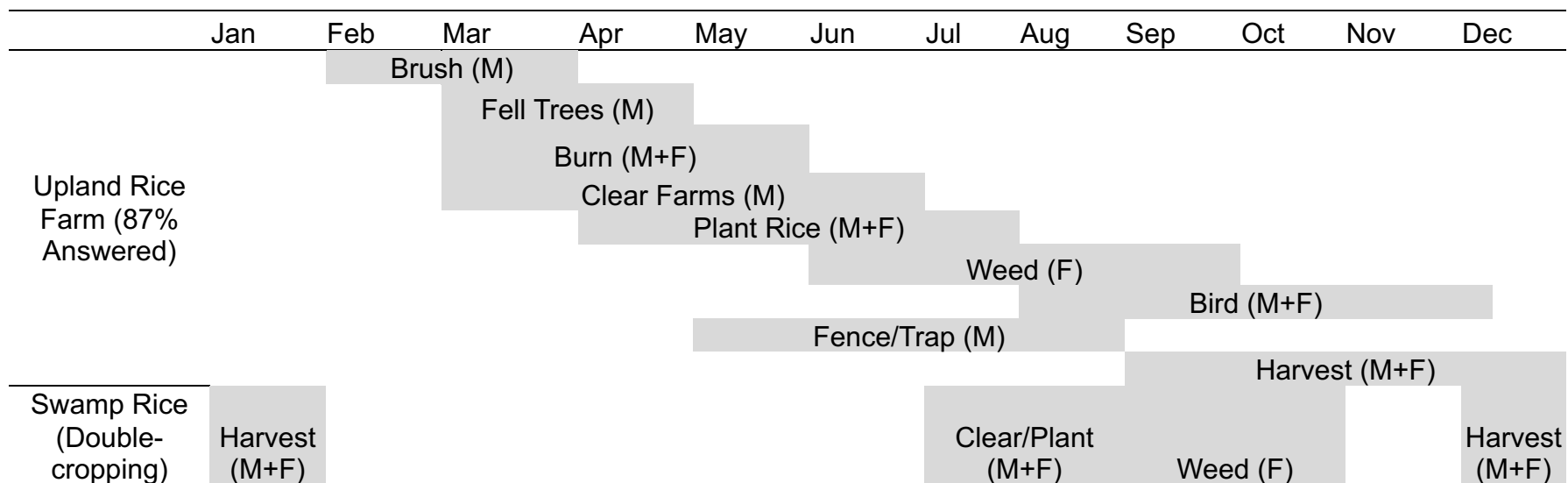
*Source: FAO corporate document repository

**Source: Center on Conflict and Development at Texas A&M University (ConDev)

***Source: FAO stat

Appendix D

Cultivation Cycle of Rice in Liberia



Note. M = male, F = female, M+F = male and female task

Source: Currens (1976), ConDev Food-Security Assessment

Appendix E

Three-Way Contingency Table (The 2007 LDHS)

Categorical BMI	Categorical Age and Residence													
	15-19		20-24		25-29		30-34		35-39		40-44		45-49	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Underweight (BMI<18.5)	17	36	40	55	28	63	22	66	18	37	3	27	2	28
	32%	68%	42%	58%	31%	69%	25%	75%	33%	67%	10%	90%	7%	93%
Normal (18.5-24.9)	117	174	337	430	389	561	233	477	146	311	64	177	41	163
	40%	60%	40%	56%	40%	59%	30%	67%	32%	68%	27%	73%	20%	80%
Overweight (25-29.9)	3	7	28	32	50	42	53	32	23	29	11	13	7	17
	30%	70%	47%	53%	54%	46%	62%	38%	44%	56%	46%	54%	29%	71%
Obesity (BMI of 30 or greater)	2	4	29	9	67	23	85	48	49	52	27	29	23	36
	33%	67%	76%	24%	74%	26%	64%	36%	49%	51%	48%	52%	39%	61%
Total	139	221	434	526	534	689	393	623	236	429	105	246	73	244
	39%	61%	45%	55%	44%	56%	39%	61%	35%	65%	30%	70%	23%	77%

Appendix F

Three-Way Contingency Table (The 2013 LDHS)

Categorical BMI	Categorical Age and Residence													
	15-19		20-24		25-29		30-34		35-39		40-44		45-49	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Underweight (BMI<18.5)	74	88	29	46	15	35	12	34	8	24	10	28	6	26
	46%	54%	39%	61%	30%	70%	26%	74%	25%	75%	26%	74%	19%	81%
Normal (18.5-24.9)	310	396	268	365	236	361	128	268	123	257	64	200	54	177
	44%	56%	42%	58%	40%	60%	32%	68%	32%	68%	24%	76%	23%	77%
Overweight (25-29.9)	16	16	28	19	27	48	22	38	26	32	22	26	16	23
	50%	50%	60%	40%	36%	64%	37%	63%	45%	55%	46%	54%	41%	59%
Obesity (BMI of 30 or greater)	12	7	31	16	46	40	49	60	70	55	60	55	35	55
	63%	37%	66%	34%	53%	47%	45%	55%	56%	44%	52%	48%	39%	61%
Total	412	507	356	446	324	484	211	400	227	368	156	309	111	281
	45%	55%	44%	56%	40%	60%	35%	65%	38%	62%	34%	66%	28%	72%

Appendix G
 Three-Way Contingency Table (The 2007 LDHS)
 Wealth Index/Age/Residence

Wealth Index	Categorical Age and Residence													
	15-19		20-24		25-29		30-34		35-39		40-44		45-49	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Poorest	10	95	17	219	17	226	11	227	7	156	9	102	3	99
	10%	90%	7%	93%	7%	93%	5%	95%	4%	96%	8%	92%	3%	97%
Poorer	17	66	43	148	47	236	39	189	25	140	5	86	13	91
	20%	80%	23%	77%	17%	83%	17%	83%	15%	85%	5%	95%	13%	87%
Middle	34	51	84	126	95	157	67	145	38	99	27	55	20	44
	40%	60%	40%	60%	38%	62%	32%	68%	28%	72%	33%	67%	31%	69%
Richer	53	25	160	63	201	80	137	73	86	51	33	22	25	15
	68%	32%	72%	28%	72%	28%	65%	35%	63%	37%	60%	40%	63%	37%
Richest	37	12	163	21	205	29	160	28	99	17	37	5	18	5
	76%	24%	89%	11%	88%	12%	85%	15%	85%	15%	88%	12%	78%	22%
Total	151	249	467	577	565	728	414	662	255	463	111	270	79	254
	38%	62%	45%	55%	44%	56%	38%	62%	36%	64%	29%	71%	24%	76%

Appendix H
 Three-Way Contingency Table (The 2013 LDHS)
 Wealth Index/Age/Residence

Wealth Index	Categorical Age and Residence													
	15-19		20-24		25-29		30-34		35-39		40-44		45-49	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Poorest	53	376	49	369	45	440	35	343	41	299	30	244	24	241
	12%	88%	12%	88%	9%	91%	9%	91%	12%	88%	11%	89%	9%	91%
Poorer	80	344	72	300	70	294	34	255	73	265	47	198	28	189
	19%	81%	19%	81%	19%	81%	20%	80%	22%	78%	19%	81%	13%	87%
Middle	241	206	197	151	166	164	129	139	103	126	85	110	78	103
	54%	46%	57%	43%	50%	50%	48%	52%	45%	55%	44%	56%	43%	57%
Richer	242	61	216	54	201	33	108	31	131	34	80	30	67	17
	80%	20%	80%	20%	86%	14%	78%	22%	79%	21%	73%	27%	80%	20%
Richest	274	38	166	10	161	11	128	12	115	16	70	7	54	6
	88%	12%	94%	6%	94%	6%	91%	9%	88%	12%	91%	9%	90%	10%
Total	890	1025	700	884	643	942	464	780	463	740	312	589	251	556
	46%	54%	44%	56%	41%	59%	37%	63%	38%	62%	35%	65%	31%	69%