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Contextualizing Maternal Education and Child Health in Sub-Saharan Africa: The Role of Intimate Partner Violence

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Abstract: We examined how the relationship between maternal education and child health varies across women's status and safety using pooled Demographic and Health Survey data from 24 sub-Saharan African countries. While maternal education was associated with less child stunting, wasting, and underweight, the effect of maternal education on stunting and underweight was attenuated among women who experienced high levels of intimate partner violence (IPV). Further, the positive influence of maternal education on stunting and underweight was less pronounced among women who lived in communities with higher levels of IPV, even after controlling for women's own IPV. This suggests that the returns of maternal education may be dampened in the presence of IPV. The fact that this link operates at both individual and community levels underscores how gender norms, patriarchy, and gender-based violence stifle progress on children's health. The results also demonstrate how the UN Sustainable Development Goals strengthening maternal education, improving child health, and reducing intimate partner violence must be jointly pursued and the importance of considering how child health outcomes may be tempered by context.

Keywords: maternal education; intimate partner violence; child nutrition; stunting; wasting; underweight; sub-Saharan Africa; sustainable development; SDGs

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1. Introduction

Health and well-being during early childhood have enormous consequences, as the formative years, sometimes called the first 1000 days (from pregnancy through to the child's second birthday), lay the foundation for lifetime development (Daelmans et al. 2017). During this critical time, poor well-being may stunt cognitive and socio-emotional development (Ettinger 2004), diminish academic outcomes (Dilnot et al. 2017), promote internalizing and externalizing behaviors (Kan et al. 2019; Pinquart and Shen 2011), and increase risk for adult health problems (Ettinger 2004). Furthermore, early childhood malnutrition, often manifested through stunting, wasting, and underweight, can decrease human capital and economic productivity in adulthood, leading to decreased socioeconomic attainment (Keeley et al. 2019; Martorell 2017). Thus, determining and understanding the complex relationship between factors underpinning poor child well-being is crucial if we are to achieve truly global sustainable development (United Nations 2016).

Perhaps the most studied and well-established predictor of child health is maternal education (Smith-Greenaway 2020; Gakidou et al. 2010), as maternal education has important implications for cognitive, social, emotional, academic, financial, and health outcomes (Grépin and Bharadwaj 2015; Pamuk et al. 2011; Wamani et al. 2004). Academics,

policymakers, and social service providers alike believe maternal education to be a key policy lever for improving child health and well-being. Consequently, female education and literacy are being vigorously pursued in the United Nations' (UN) Sustainable Development Goals (SDGs, termed the 'blueprint' for addressing the world's most pressing needs; United Nations 2016), and the right to education for all children is further established in the Convention on the Rights of the Child (UN General Assembly 1989) and the African Charter on the Rights and Welfare of the Child (Organization for African Unity 1990).

However, much remains unknown concerning contextual factors that may shape the relationship between maternal education and child health, though recent work by Smith-Greenaway (2020) has begun to explore this question by examining whether romantic relationship union instability in sub-Saharan Africa (SSA) weakened the child health benefits of parental education. In this paper, we focus on intimate partner violence (IPV) for three reasons. First, violence against women is often indicative of women's status and safety because IPV is more prevalent in societies where men and women have very different (and often unequal) roles and statuses; in turn, women's health can decline because social and economic factors affect access to healthcare, nutrition, education, and other resources (Anderson 2005). Second, violence against women is a serious and widely condemned human rights violation and public health issue. Third, it is unfortunately very common, affecting up to a third of women worldwide and up to half of women in SSA (Muluneh et al. 2020; Sardinha et al. 2022).

Understanding these issues is of particular importance in SSA, as the region boasts the world's highest fertility rates (United Nations Department of Economic and Social Affairs 2020), with half of the world's children estimated to live there by the year 2100 (United Nations Department of Economic and Social Affairs 2020). This densely populated region, however, also experiences extremely high levels of intimate partner violence (Muluneh et al. 2020), stubbornly low immunization rates (Uthman et al. 2018), elevated child malnutrition (Akombi et al. 2017), and persistent child poverty (Keeley et al. 2019). We therefore seek to demonstrate how intimate partner violence directed toward mothers, both in individual relationships and the communities in which they live, dampens the positive influence of maternal education on child health in sub-Saharan Africa.

1.1. Bronfenbrenner's Person-Process-Context-Time Model

We conceptualize the interrelationships studied here using Bronfenbrenner's Person-Process-Context-Time model (Bronfenbrenner 1986a, 1986b; Bronfenbrenner and Crouter 1983), which postulates that individual functioning takes place in a variety of systems ranging in scope from a microsystem (children and adults' dyadic-level systems) to macrosystems (larger-level system that influences an individual indirectly through the microsystem) to exosystems (broad, contextual-level systems that influence the individual indirectly through their living environment) and even chronosystems (changes over time). Within these systems, people, other actors, objects, etc., interact with the individual. These interactions (termed "proximal processes"), when repeated over time, gradually influence individual outcomes (such as child well-being). We employ Bronfenbrenner's theory to understand how individual outcomes, such as child well-being and child health, are influenced by microsystems, such as the marital relationship and other macro- and exosystems.

In the context of our analysis, the mother and child dyad constitute a microsystem, with maternal education and child health as clear and important dynamics within that parent-child relationship. Intimate partner violence, as an interconnection, is viewed as part of the mesosystem, whereas the community prevalence of intimate partner violence constitutes an example of the exosystem due to the prevailing features of the macrosystem, such as gendered norms and patriarchy.

1.2. Maternal Education and Child Health

Empirical studies support the notion that maternal education is linked to child outcomes, particularly child health, with many scholars upholding maternal education as

having a positive influence on child health. There are many reasons for this. Maternal education is linked to greater knowledge of developmental processes, providing mothers with the skills required to care for their children (Bacchus et al. 2017). Educated mothers are also more likely to adopt healthy behaviors (Bintabara and Kibusi 2018) and be aware of, have access to, and make use of health and social services (Smith-Greenaway 2020; Sanville et al. 2019).

Educated mothers also often have higher socioeconomic status (Prickett and Augustine 2016; Desai and Alva 1998), are more likely to be married (Gibson-Davis and Rackin 2014), experience higher quality romantic relationships (Matysiak et al. 2014; Woszidlo and Segrin 2013), and experience fewer relationship transitions (Cutts et al. 2011). Further, due to their greater socioeconomic attainment, educated mothers often have greater choice over the communities in which they live, leading to fewer community health risks (Protano et al. 2017; Prickett and Augustine 2016). Maternal education also leads to gender empowerment, which is linked to improved maternal, physical, and mental health (Ewerling et al. 2017) as well as reductions in child mortality (Wu 2022). Consequently, children who grow up in such environments are more likely to be healthy and happy (Carlson 2006; Kelly and Lamb 2003) because each of these processes can improve a child's health and overall well-being.

1.3. Intimate Partner Violence and Child Well-Being

Worldwide, anywhere from 1/4 to 1/3 of women have experienced IPV (Muluneh et al. 2020; Sardinha et al. 2022), though rates in sub-Saharan Africa are markedly higher, with recent evidence suggesting that 44 percent of women in SSA have experienced IPV (Muluneh et al. 2020). Women who experience IPV are more likely to exhibit signs of mental distress and depression (Bonomi et al. 2006; Ellsberg et al. 2008), making it more difficult for mothers to perceive and respond to their children's needs (Miranda et al. 2013; Owen et al. 2009). Further, women who experience IPV seek out medical care for themselves and their children less often than nonabused women, thereby diminishing the child's health both directly (by not receiving necessary care) and indirectly (by reducing the mother's caregiving capacity via poor health) (Ononokpono and Azfredrick 2014). The effects of IPV extend well beyond health, as research has demonstrated that the environments in which children live are less likely to be developmentally salubrious because abused mothers are more likely to experience food and housing instability (Guerrero et al. 2020), increasing children's risk of malnutrition and somatic problems (Lamers-Winkelman et al. 2012; Rico et al. 2011). Further, IPV causes both mothers and children increased stress, negatively influencing their health (Shay-Zapien and Bullock 2010).

Importantly, children do not need to be victims themselves of intimate partner violence to have a detrimental influence because IPV has been linked to attachment disruption, particularly during the early developmental ages considered here (Noonan and Pilkington 2020). Thus, IPV has a profound negative influence on children's health and well-being (Boynton-Jarrett et al. 2010; Rico et al. 2011), whether a child personally witnesses the abuse or not (Wood and Sommers 2011). Together, this suggests that IPV may dampen the positive impact of maternal education on child health.

1.4. Community-Level IPV and Child Well-Being

Child well-being can also be influenced by broader contextual factors, as such factors may indirectly influence the proximal processes between mother and child (Smith-Greenaway 2017). Further, community-level gender norms are an insightful window into women's status, safety, and power. In these regards, IPV prevalence within the community may, as an exosystem, impact the relationship between maternal education and child health.

Although we know of no studies that bear directly on this topic, there is ample evidence that living in areas with high levels of community and neighborhood violence can influence children's health and well-being by stunting their growth and development (Proctor 2006; Sampson 2003). Exposure to violence may result in more aggressive parenting practices (Zhang and Anderson 2010) and greater internalizing and externalizing

behaviors (Bacchini et al. 2011). Further, recent research has demonstrated that justification of IPV is high in SSA (and Southeast Asia), particularly in areas with restricted economic opportunities, lower literacy rates, and poor political representation for women (Sardinha and Catalán 2018).

1.5. Importance of the Question

The question we pose here—whether IPV can alter the relationship between maternal education and child health—has clear policy implications. When seeking to improve child mortality, health, and well-being, policymakers across sub-Saharan Africa and around the globe often turn to education as a key policy lever. The SDGs prominently feature these constructs. SDG 4 advocates for universal primary education, currently rare among mothers in SSA (70 percent of mothers in our data have less than primary education), with the expectation that the improvement in child well-being will be measurable, positive, and sizable. SDG 5 highlights gender equality and seeks to eradicate gender-based violence (5.2). SDG 3 focuses on ensuring that all people, including children, enjoy healthy lives that lead to well-being.

Together, the achievement of these three SDGs, along with the other 14, would dramatically improve life for everyone, especially women and children. If, however, intimate partner violence dampens the positive and sizeable influence of maternal education on child health, the results may be underwhelming. The fact that these three goals are intertwined is both familiar and vitally indispensable, underscoring the interconnected nature of both of the goals themselves and their correlated outcomes—improvements in one domain are likely to prove beneficial for other goals. Conversely, stunted progress in one could make achieving the others more difficult.

1.6. Current Study

This study builds on the current literature in several ways and represents a novel examination of how IPV alters the well-established relationship between maternal education and child health in a setting, sub-Saharan Africa, where IPV is far too common. We address four key questions. First, how are maternal education and child health linked? Second, how does IPV alter or change this relationship? Third, are community levels of IPV associated with the individual-level relationship between maternal education and child health? As a final, purely exploratory question, we briefly ask whether these relationships differ for girls and boys in light of abundant evidence of sex differences in child health (Thurstans et al. 2020).

2. Materials and Methods

2.1. Data

The data for this study are from mothers in a formal or informal union and their children under 5 in the Demographic and Health Surveys (DHS; N = 105,920; see Table 1). DHS data have become the standard source for studying health outcomes throughout SSA and other low- and middle-income countries because they are nationally representative, cross-sectional surveys generally fielded by each country's national statistics bureau in conjunction with ICF International. Using a stratified random sampling approach with clusters as the primary sampling units, a cross-sectional random sample of households that together are representative of the country's population is taken, typically every 5 years.

Each member of a selected household is recorded on the household member file, and special care is taken to ensure participation of all women of childbearing age (typically 15–45) and children under 18. Researchers can select datasets that have women, men, children, and households as their primary units of analysis. We combined information from the household, women's, and children's datasets to create the unique dataset employed here using the most recent DHS for every country in sub-Saharan Africa that employed the domestic violence module. Countries include Angola (n = 8236), Burkina Faso (n = 9715), Benin (n = 4498), Burundi (n = 7771), Côte d'Ivoire (n = 4420), Cameroon

(n = 4064), Ethiopia (n = 3996), Gabon (n = 2905), Ghana (n = 1364), The Gambia (n = 3490), Kenya (n = 3539), Comoros (n = 2171), Liberia (n = 3114), Mali (n = 3531), Malawi (n = 4073), Mozambique (n = 4693), Nigeria (n = 8872), Senegal (n = 2349), Sao Tome et Principe (n = 1362), Togo (n = 4708), Tanzania (n = 6458), South Africa (n = 865), Zambia (n = 6060), and Zimbabwe (n = 3846).

2.2. Variables

Maternal education was measured by educational attainment (0 *no education*, 1 *incomplete primary*, 2 *complete primary*, 3 *incomplete secondary*, 4 *complete secondary*, and 5 *higher*). The variables used to measure intimate partner violence were measured with 9 questions that asked whether (0 *no*, 1 *yes*) the woman's husband/partner had ever engaged in violent behavior toward her, including pushing, slapping, punching, kicking, strangling, threatening her with a gun, twisting her arm or hair, forcing her to perform an unwanted sexual act, or having unwanted sex. These variables were entered into the latent class analysis. See the section on Analytic Strategy below for additional information. Child health was operationalized using data calculated by the data provider using World Health Organization standards (https://www.who.int/publications/i/item/9789240025257; accessed 6 June 2022) and included stunting (height-for-age), wasting (weight-for-height), and underweight (weight-for-age). The raw variables present standardized scores for each child on each outcome. Following previous research (ibid.), we created dummy variables for when children met each threshold for being stunted, wasted, and underweight by assigning a value of 1 when the children were two or more standard deviations below the established standard. These variables are commonly studied outcomes of child health, often thought to be the result of malnutrition and other environmental factors (Ziaei et al. 2014).

All models control for children's age (and its square and cube; preliminary evidence suggested a cubic relationship between age and stunting, wasting, and underweight, respectively; 0–4); biological sex (1 = *female*); household wealth quintile (1 *poorest* to 5 *richest*); rural residence (1 = *yes*); whether the mother's relationship is a marriage or cohabitation (1 = *yes*); age at mother's first union; year of interview; mother's age; three standardized measures of women's empowerment, including mother's attitude toward violence, autonomy, and decision-making scores, based on Ewerling et al.'s (2017) SWPER index; the number of age-adjusted immunizations the child has received; whether (0 *no*, 1 *yes*) the child had diarrhea in the past 2 weeks; and whether the child experienced an acute respiratory infection in the past 2 weeks (0 *no*, 1 *yes*). The last two measures were included as controls to ensure that children's stunting, wasting, and underweight were not due to acute, recent health challenges.

2.3. Analytic Strategy

We employed multiple imputation for all regression-based models (missing data were generally less than 5 percent and never more than 10 percent) because missing data can influence the estimation procedures used to obtain coefficients and standard errors (Acock 2005) by reducing sample size through listwise deletion (thereby increasing the probability of making Type II errors). We generated five datasets of values representing a distribution of plausible values under the assumption of missing data at random. Consequently, our estimates are less biased and more efficient than they would have been with listwise deletion (Johnson and Young 2011). These datasets were jointly analyzed, adjusting both the coefficient and standard errors for possible bias due to missing data and the variability introduced through the imputation process. We checked the data before and after imputation for irregularities that may have occurred during the imputation process; no evidence of irregularities was found for means, standard deviations, or ranges.

Table 1. Proportions and Means for Key Variables by Country.

	# Sample Size	Stunting (0–1)	Wasting (0–1)	Underweight (0–1)
Angola 7	8236	0.18	0.03	0.09
Burkina Faso 6	9715	0.17	0.08	0.13
Benin 7	4498	0.29	0.05	0.16
Burundi 7	7771	0.20	0.02	0.10
Cote d'Ivoire 6	4240	0.14	0.04	0.07
Cameroon 7	4064	0.20	0.03	0.08
Ethiopia 7	3996	0.37	0.10	0.23
Gabon 6	2905	0.10	0.02	0.04
Ghana 5	1364	0.23	0.08	0.12
The Gambia 6	3490	0.09	0.04	0.06
Kenya 6	3539	0.25	0.04	0.11
Comoros 6	2171	0.25	0.09	0.13
Liberia 5	3114	0.34	0.06	0.16
Mali 7	3531	0.25	0.09	0.17
Malawi 7	4073	0.35	0.03	0.11
Mozambique 6	4693	0.41	0.06	0.15
Nigeria 7	8872	0.36	0.07	0.22
Senegal 7	2349	0.16	0.09	0.14
Sao Tome and Principe 5	1362	0.21	0.08	0.10
Togo 6	4708	0.13	0.03	0.08
Tanzania 7	6458	0.33	0.05	0.13
South Africa 7	865	0.08	0.01	0.01
Zambia 7	6060	0.33	0.05	0.11
Zimbabwe 7	3846	0.25	0.03	0.07
Total	105,920	0.25	0.05	0.12
	Maternal Education (0–5)	Low IPV (0–1)	Moderate IPV (0–1)	High IPV (0–1)
Angola 7	1.43	0.82	0.13	0.05
Burkina Faso 6	0.28	0.95	0.04	0.01
Benin 7	0.67	0.88	0.09	0.03
Burundi 7	0.91	0.76	0.19	0.05
Cote d'Ivoire 6	0.59	0.84	0.12	0.04
Cameroon 7	1.71	0.78	0.17	0.05
Ethiopia 7	0.56	0.86	0.10	0.04
Gabon 6	2.40	0.69	0.22	0.10
Ghana 5	1.69	0.89	0.10	0.02
The Gambia 6	1.00	0.90	0.09	0.01
Kenya 6	1.98	0.77	0.18	0.05
Comoros 6	1.32	0.97	0.02	0.01
Liberia 5	0.80	0.75	0.19	0.06
Mali 7	0.61	0.80	0.17	0.03
Malawi 7	1.45	0.86	0.11	0.03
Mozambique 6	0.90	0.81	0.16	0.03
Nigeria 7	2.00	0.90	0.08	0.02
Senegal 7	0.65	0.91	0.07	0.02
Sao Tome and Principe 5	1.60	0.81	0.12	0.06
Togo 6	1.15	0.86	0.12	0.02
Tanzania 7	1.65	0.76	0.19	0.06
South Africa 7	3.41	0.88	0.10	0.02
Zambia 7	1.95	0.79	0.16	0.05
Zimbabwe 7	2.67	0.86	0.12	0.03
Total	1.27	0.84	0.13	0.03

Note: Estimates are weighted. IPV = Intimate partner violence. Estimates are proportions (stunting, wasting, underweight, and IPV categories) and means (maternal education). Variable ranges shown in parentheses. Source: Demographic and Health Surveys. Numbers next to country names represent DHS phase of data release.

Our statistical strategy for categorizing IPV employed latent class analysis, a type of semiparametric mixture model (Nagin and Tremblay 2005). In contrast to traditional regression-based models, this approach does not assume that the variables measuring IPV form a linear distribution. Rather, it assumes that the population in question consists of a number of groups with distinct patterns of IPV. We based our decision on the number of groups on several factors, especially the substantive interpretability of the model, informed by previous research on intimate partner violence. Additional factors included entropy (the extent to which cases can be unambiguously separated into a given number of groups), ranging from 0 to 1, with higher numbers indicating less ambiguity; the Akaike and Bayesian information criterion (AIC/BIC), where smaller numbers indicate better fit; and two likelihood ratio tests (LRTs), the Vuong–Lo–Mendell–Rubin (VLMR) LRT and the Lo–Mendell–Rubin (LMR) adjusted LRT, both of which compare a model with k classes (e.g., three classes) with k-1 classes (e.g., two classes). We also examined whether a class was particularly small (e.g., less than 3 percent). We used all available selection criteria to ensure that the best model was selected, as BIC does not always select the correct number of groups (Nylund et al. 2007). To calculate the community level of IPV, we estimated the percentage of mothers in the high IPV category for each DHS cluster.

We adjusted the estimates for the DHS complex survey design prior to outputting the results of the latent class analysis into Stata for further use in the binary logistic regression models. For the binary logistic regressions, we employed country fixed-effects in all analyses and adjusted for the complex survey design using Stata's svy suite of commands to account for survey design effects including weights, sampling strata, and PSUs. We did not include year fixed-effects because each country only collected data during a single time period; we opted instead for the statistically equivalent and more parsimonious approach via controlling for year.

3. Results

We first present the results of the latent class analysis and then move to the survey-adjusted, binary logistic regressions with country fixed-effects. Using Mplus 8, we placed all nine indicators of physical and sexual violence into a latent class analysis (further technical details of the process are available from the authors upon request). The results (Table 2) suggested that a 3-class solution fit the data best, as the results were more theoretically interpretable than other options (including high, moderate, and low classes while avoiding excessively small classes consisting of residual observations), showed statistical improvement over the previous model, had a lower log likelihood as well as information criteria, and displayed good separation between the classes (i.e., entropy > 0.80; Nylund-Gibson and Choi 2018).

Table 2. Measures of Model Fit for Latent Class Analysis.

	Log Likelihood	AIC	BIC	Adjusted BIC	Entropy	VLMR LRT	LMR adj. LRT	Small Classes?
2-class	−593,124.67	1,186,287.34	1,186,489.75	1,186,429.37	0.899	0	0	N
3-class	**−578,766.93**	**1,157,591.86**	**1,157,900.80**	**1,157,808.64**	**0.852**	**0**	**0**	**N**
4-class	−574,483.98	1,149,045.95	1,149,461.42	1,149,337.48	0.867	0	0	Y
5-class	−572,719.05	1,145,536.11	1,146,058.11	1,145,902.38	0.864	0	0	Y
6-class	−571,608.52	1,143,335.03	1,143,963.56	1,143,776.06	0.858	0	0	Y
7-class	−571,163.88	1,142,465.76	1,143,200.82	1,142,981.54	0.855	0	0	Y

Note. Bold type indicates selected model. AIC = Akaike information criterion; BIC = Bayesian information criterion; VLMR = Vuong–Lo–Mendell–Rubin likelihood ratio test for k-1 (Ho) versus k classes; LMR = Lo–Mendell–Rubin adjusted likelihood ratio test; Entropy assesses extent to which cases can be unambiguously separated into a given number of groups.

The model results are shown in Figure 1 (missing data was dealt with using Full Information Maximum Likelihood). As can be clearly seen, the vast majority of mothers in the 24 countries are in either the 'Low' (80 percent) or 'Moderate' (15 percent) classes. Only 5 percent of the sample reported experiencing high levels of IPV. While 80 percent of the sample is in the Low category, this does not mean that IPV is rare in this group because (a) we only have information over a limited period of time rather than throughout the remainder of her (as yet unobserved) life course and only among mothers, so these numbers are not strictly comparable to other levels and (b) IPV is still far too common, with a probability of 0.08 of reporting being slapped and 0.03 of being forced to have sex. Although these numbers are low by comparison, IPV is still unacceptably high among these women.

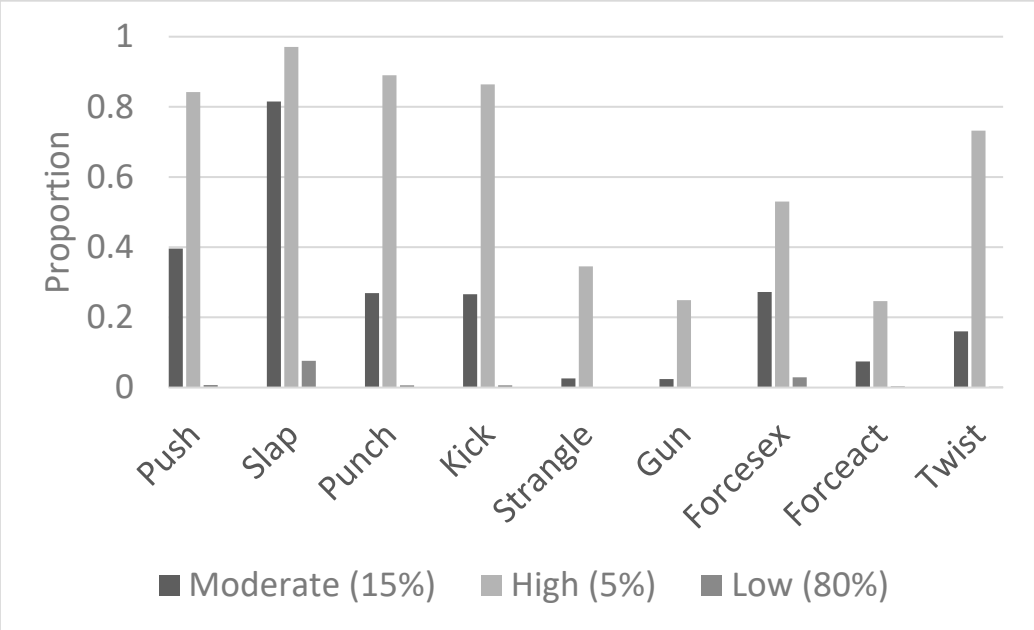

Figure 1. Three groups of IPV among women in sub-Saharan Africa.

For the Moderate group, which constituted 15 percent of the sample, both pushing (prob. = 0.40) and slapping (0.82) were quite common, along with punching, kicking, and being forced to have sex, although this experience was less common than in the High group (5 percent of the sample). In this last group, women reported being slapped, pushed, punched, kicked, or twisted in nearly universal terms. The probability of being forced to have sex against their will was over 0.5, while being strangled (0.35) or threatened with a gun (0.25) were also quite high. We exported the most likely class membership of each woman from Mplus into Stata for further analysis. We explicitly incorporated the uncertainty associated with class membership assignment by weighting all future analyses by the probability of being in the most likely class membership (James 2015).

Table 3 displays the results of the multiply imputed, survey-adjusted binary logistic regression models with country fixed-effects (we initially considered using a DAG model, but the multilevel nature of the data made this infeasible). In all, we estimated six different models predicting each outcome (stunting (height-for-age), wasting (weight-for-height), and underweight (weight-for-age)) with maternal education interacted with IPV at both the individual and community levels. We omit the display of the country fixed-effects included in each model, given the number of countries included. Initial results suggested that maternal education is positively associated with child health—better-educated mothers were less likely than more poorly educated mothers to have stunted, wasted, or underweight children. However, when using women's individual experiences with IPV as the moderator between maternal education and stunting, we found that while maternal education was

linked to a lower probability of child stunting, wasting, and underweight, the coefficient for maternal education and stunting/underweight significantly differed by IPV group (but not for wasting). This interaction is displayed in Figure 2 (and the 1st, 3rd, and 5th panels of Table 3), which shows how IPV attenuates the link between maternal education and child stunting/child underweight[1].

Table 3. Multiply Imputed, Survey-Adjusted, Binary Logistic Regressions with Country Fixed-Effects for the Relationship Between Maternal Education, Intimate Partner Violence (IPV), and Child Health (Stunting, Wasting, and Underweight) at both the Individual and Community Levels.

	Stunting		**Wasting**		**Underweight**	
	Individual	***Community***	***Individual***	***Community***	***Individual***	***Community***
Maternal Education	−0.16 ***	−0.16 ***	−0.10 ***	−0.10 ***	−0.17 ***	−0.17 ***
	(0.01)	(0.01)	(0.03)	(0.03)	(0.02)	(0.02)
Lowest IPV	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Moderate IPV	0.01	0.03	−0.09	−0.04	−0.04	0.02
	(0.04)	(0.03)	(0.08)	(0.06)	(0.05)	(0.04)
Highest IPV	−0.15 *	−0.04	−0.18	−0.08	−0.12	0.08
	(0.08)	(0.06)	(0.15)	(0.12)	(0.10)	(0.07)
Lowest IPV * Maternal Education	0.00		0.00		0.00	
	(.)		(.)		(.)	
Moderate IPV * Maternal Education	0.02		0.04		0.05	
	(0.02)		(0.05)		(0.03)	
Highest IPV * Maternal Education	0.10 *		0.01		0.13 *	
	(0.04)		(0.11)		(0.06)	
Community IPV		−0.23		−0.78 *		−0.83 ***
		(0.19)		(0.37)		(0.24)
Maternal Education * Community IPV		0.20 *		0.24		0.37 **
		(0.09)		(0.18)		(0.12)
Child Age	1.40 ***	1.40 ***	0.29 **	0.28 **	0.69 ***	0.69 ***
	(0.06)	(0.06)	(0.10)	(0.10)	(0.07)	(0.07)
Child Age * Child Age	−0.53 ***	−0.53 ***	−0.46 ***	−0.45 ***	−0.34 ***	−0.34 ***
	(0.04)	(0.04)	(0.07)	(0.07)	(0.04)	(0.04)
Child Age * Child Age * Child Age	0.06 ***	0.06 ***	0.08 ***	0.08 ***	0.05 ***	0.04 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Child is Male	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Child is Female	−0.21 ***	−0.21 ***	−0.21 ***	−0.21 ***	−0.19 ***	−0.19 ***
	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)
Household Wealth Index	−0.17 ***	−0.17 ***	−0.10 ***	−0.11 ***	−0.19 ***	−0.19 ***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Urban	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Rural	0.10 **	0.10 **	−0.10	−0.11	0.04	0.03
	(0.03)	(0.03)	(0.06)	(0.06)	(0.04)	(0.04)
Living with Partner	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Married	0.02	0.02	0.07	0.07	−0.04	−0.04
	(0.03)	(0.03)	(0.07)	(0.07)	(0.04)	(0.04)
Maternal Age @1st Union	−0.01 *	−0.01 *	−0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Year	0.02	0.02	−0.02	−0.02	0.04	0.04
	(0.04)	(0.04)	(0.08)	(0.08)	(0.05)	(0.05)
Maternal Age	−0.01 ***	−0.01 ***	0.00	0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Std autonomy SWPER score	−0.00	−0.00	0.08	0.08	−0.00	−0.00
	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)

Table 3. *Cont.*

	Stunting		Wasting		Underweight	
	Individual	*Community*	*Individual*	*Community*	*Individual*	*Community*
Std attitude to violence SWPER score	−0.02	−0.02	−0.02	−0.02	−0.04 *	−0.04 *
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Std decision making SWPER score	−0.02	−0.02	−0.04	−0.04	−0.04 *	−0.04 *
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Child Immunizations	0.01	0.01	−0.03 **	−0.03 **	−0.01 *	−0.01 *
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Child Had Diarrhea Past 2 Weeks	0.16 ***	0.16 ***	0.30 ***	0.30 ***	0.29 ***	0.29 ***
	(0.03)	(0.03)	(0.05)	(0.05)	(0.03)	(0.03)
Child Had Acute Respiratory Infection Past 2 Weeks	0.01	0.01	−0.03	−0.03	0.03	0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Constant	−45.38	−45.72	31.19	38.47	−87.48	−81.31
	(82.56)	(82.55)	(156.78)	(156.43)	(110.57)	(110.15)
Observations	105,692	105,692	105,692	105,692	105,692	105,692

Source: Demographic and Health Surveys. All models include country fixed-effects (not shown). Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

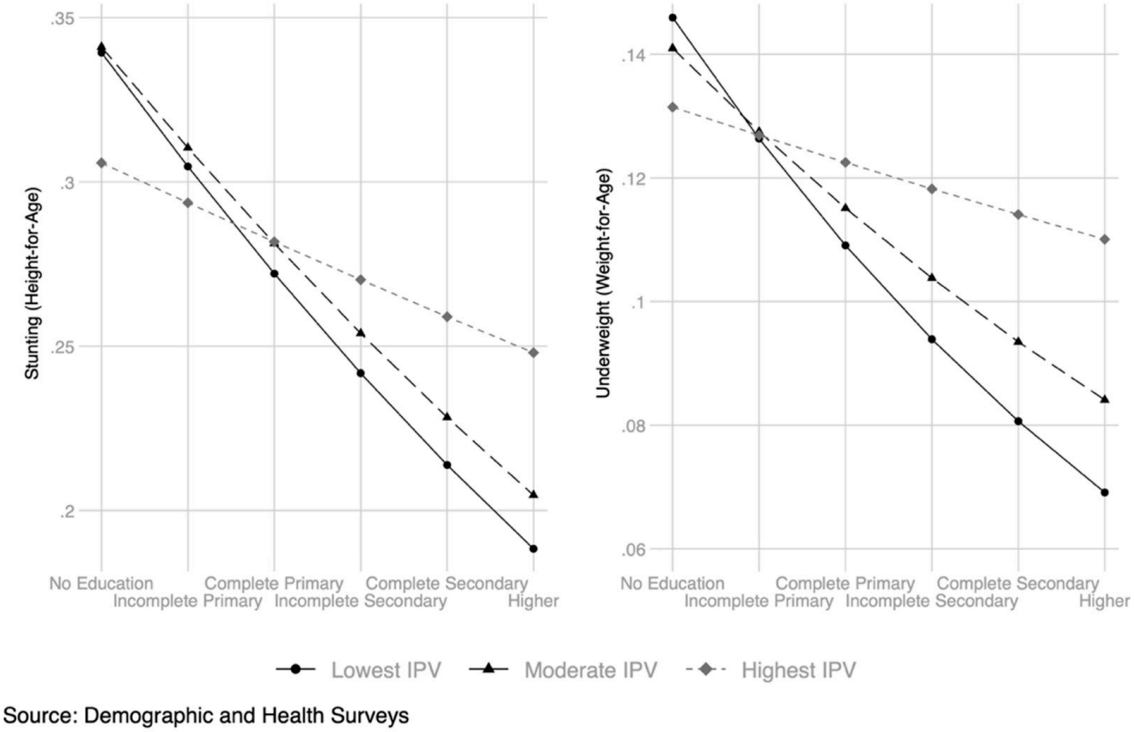

Figure 2. IPV Attenuates the Link Between Maternal Education and Child Stunting and Child Underweight.

Figure 2 displays how the predicted probabilities of child stunting and child underweight changed with increasing levels of maternal education. This can be most clearly seen by comparing the slopes of the respective groups to one another. For the highest IPV group, children whose mothers have no formal education have a predicted probability of about 0.31 of stunting, whereas children in the same group but whose mothers have a higher education have a predicted probability of stunting of about 0.25, a reduction of 19 percent. In contrast, children whose mothers were in the lowest IPV group had a predicted probability of about 0.34 of stunting,

However, this number decreased to 0.18 for children whose mothers had a higher education (a reduction of 47 percent). We observed a similar pattern when predicting whether a child was underweight. Those in the highest IPV group moved from a probability

of 0.13 to 0.11 (a 15 percent change) with increasing education, but those in the lowest IPV group moved from 0.15 to 0.07 (a 53 percent change). The influence of maternal education was most strongly felt among children whose mothers were in the lowest IPV group.

Importantly, at the individual level, maternal education was positively associated with child health. However, the positive benefits of maternal education for child stunting and child underweight are significantly reduced when the child's mother was the subject of abuse by her intimate partner. We next explored whether the dampening of IPV on the relationship between maternal education and child health was also occurring at the community level. That is, we asked if the influence of maternal education on child health was muted among women who lived in communities with high levels of IPV (estimated by calculating the percentage of women in each cluster in the high IPV group), even after accounting for a women's individual experience with IPV. These results are displayed in Table 3 (in the "Community" columns) and graphically portrayed in Figure 3.

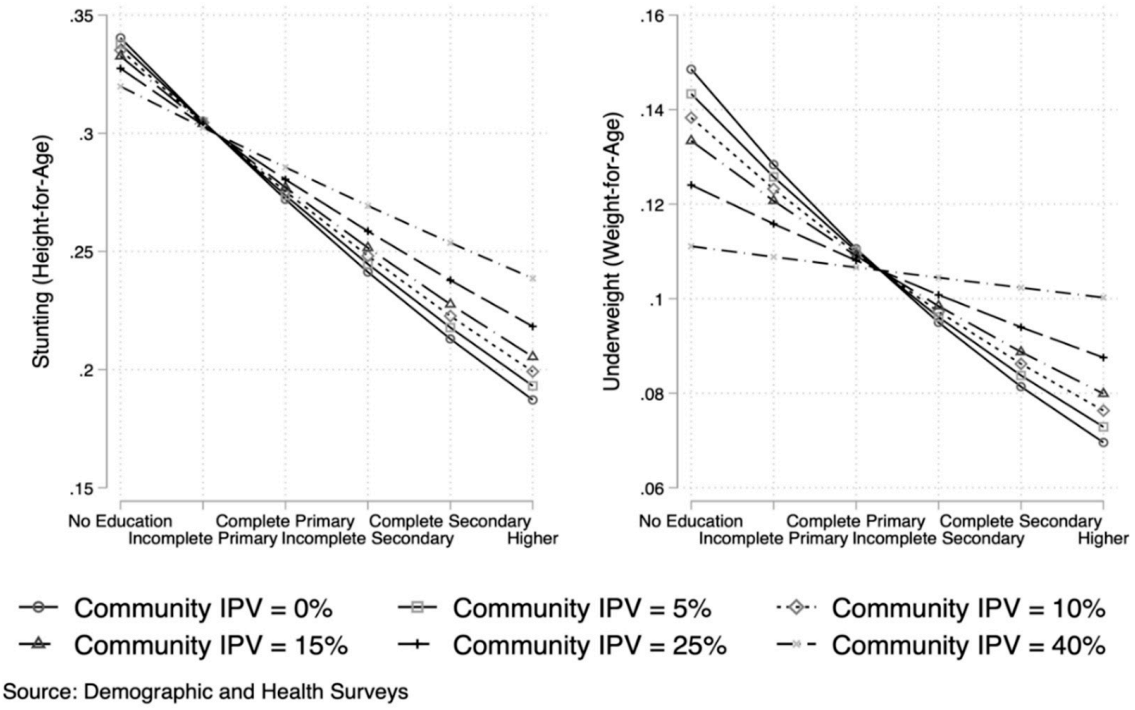

Figure 3. The Prevalence of IPV in the Community Attenuates the Link Between Maternal Education and Child Stunting and Child Underweight.

The results at the community level further reinforced those found at the individual level. Specifically, the slope of maternal education on both stunting and underweight (but not wasting) was significantly lower in communities with higher levels of IPV, even after we controlled for whether the individual herself had experienced IPV. For illustration purposes, Figure 3 presents the slopes of maternal education on child stunting and child underweight separately for communities with no women in the High IPV group (community IPV = 0 percent), 5 percent of the women in the High IPV group, 10 percent, 15 percent, 25 percent, and 40 percent[2]. In both panels of Figure 3, as community levels of IPV increase, the positive relationship between maternal education and child health flattens.

Finally, by way of exploration, we examined whether any of these relationships differed according to the biological sex of the child. The results (not shown) for three-way interactions (maternal education by individual/community IPV by child sex) showed no significant differences, suggesting that the IPV attenuation of maternal education for child stunting and underweight operates similarly for girls and boys.

4. Discussion

The robust relationship between maternal education and child health has led to a near-universal recognition of maternal education's place in academic, policy, and civic dialogue (Dursun et al. 2017; Grépin and Bharadwaj 2015; Güneş 2015). Studying this link in sub-Saharan Africa is particularly crucial because roughly half of the world's children will live there by 2100 (United Nations Department of Economic and Social Affairs 2020). We examined whether intimate partner violence (IPV) shapes the relationship between maternal education and child health. We utilized nationally representative data from every sub-Saharan African country that collected information on maternal education, IPV, and child health from the Demographic and Health Surveys. For our statistical analysis, we employed latent class analysis and binary logistic regression models (with multiply imputed, survey-adjusted pool data and including country fixed-effects).

Consistent with prior literature (Akombi et al. 2017; Wolde et al. 2015), maternal education was linked with less stunting, wasting, and underweight. However, our results indicated that this association was not straightforward; the positive relationship between maternal education and child stunting and underweight (but not wasting) was less positive among women who experienced high levels of IPV.

These results also fit with the results of previous empirical studies examining maternal education and child health in sub-Saharan Africa (Smith-Greenaway 2020), although this is the first time, to our knowledge, that the influence of maternal education on child health has been shown to change based on the specific contextual factor of IPV. Nevertheless, previous research has found that IPV can increase the risk of child stunting and underweight (Mondal and Paul 2020; Rico et al. 2011; Ziaei et al. 2014). One study, for example, found contextualized evidence that higher maternal education levels were associated with higher levels of stunting and wasting (Emina et al. 2011). However, other research has suggested that, at least in Kenya, education can be seen as a potential exit from abusive relationships (Njue et al. 2014).

Critically, the same dampening phenomenon was also found among women who lived in communities with high levels of IPV, even after controlling for the woman's individual experience with IPV. This important finding responds to previous calls (VanderEnde et al. 2012) for a more global approach to studying community correlates of IPV with a particular eye toward the role of gender norms and inequality and speaks to previous research reporting that living in a violent area can hamper child development (Proctor 2006; Sampson 2003). Consistent with the PPCT model and prior empirical work, this strongly suggests the importance of considering how factors at an even broader, exosystemic level may stifle progress (Smith-Greenaway 2017). For example, higher community levels of IPV may dilute maternal resources, as women spend time caring for those experiencing violence and have less time and energy to devote to other worthy causes (Barbarin et al. 2001; Brody and Flor 1998). Further, IPV and acceptance of IPV in the community may be related to even broader, systemic issues prevalent in sub-Saharan Africa, such as patriarchy and gender-based norms. Such influences are, in turn, related to macrosystemic issues such as restricted economic opportunities, lower literacy rates, and poor political representation for women (Sardinha and Catalán 2018). These broader issues then likely impact the mother as well as the proximal processes between mother and child, thereby contributing to the child's well-being.

Interestingly, we found no evidence that the tempering of the link between maternal education and child health by IPV works differently for girls and boys. That this issue is acutely problematic for all children suggests the importance of addressing it because intimate partner violence is detrimental for all children. However, we do not wish to overstate these results, as our treatment of the topic is merely exploratory. Children who observe violence between their parents/parental figures may be more susceptible to gendered socialization processes that normalize violence and other destructive behaviors, potentially teaching girls to accept or even expect violence in their relationships and boys to believe that such behaviors are acceptable (Bedi and Goddard 2007). Furthermore, there

is evidence of gender differences in the relationship between childhood maltreatment and subsequent perpetration and victimization of intimate partner violence (Gratz et al. 2009; Fang and Corso 2008; Gass et al. 2011). However, other research found more gender conformities than contrasts in the link between childhood IPV exposure and subsequent violence and drug use (Fagan and Wright 2011). Importantly, children do not need to be victims themselves of intimate partner violence to have a detrimental influence because IPV has been linked to attachment disruption, particularly during the early developmental ages considered here (Noonan and Pilkington 2020).

When considered jointly, these results demonstrate that the expected positive returns of maternal education may be muted in the presence of individual and community levels of IPV. Thus, policymakers, academics, and child welfare advocates may expect that efforts to improve maternal education will lead to observed improvements in child health, but these improvements may not be as large as expected, especially when IPV prevails. Gender norms, patriarchy, and gender-based violence may stand in the way of these expected outcomes. Additionally, even if IPV is addressed at the individual level, the gender-based context around IPV can also diminish the expected returns to maternal education. Special attention must be paid to IPV and its antecedents in patriarchy and gender-based violence to obtain the desired outcomes at the policy level.

We make several methodological contributions as well. We used nationally representative data from every sub-Saharan African country for which the Demographic and Health Surveys (DHS) had information on maternal education, IPV, and child stunting, wasting, and underweight to paint a more complete picture of the interrelationship between these factors. By using country fixed-effects in our models, we control for all time-invariant characteristics that differ between countries. Further, we used latent class analysis to classify women into naturally occurring groups of IPV.

These results also speak to the interconnectedness of the Sustainable Development Goals (Le Blanc 2015). These results speak specifically to SDGs 3 (good health and well-being), 4 (quality education), and 5 (gender equality) and indirectly to SDG 1 (no poverty) and SDG 10 (reduced inequalities), among others. Together, these results suggest that progress on one development goal must occur in light of its effects on and correlations with progress on other development goals (Costanza et al. 2016), especially because achieving the goals around gender equality may be particularly difficult without clear recognition of this interconnectedness (McGowan et al. 2019). In short, these three development goals, and certainly many others, must be jointly pursued to reach the stated objectives.

The fact that gender-based violence, typically though not always with men as the perpetrator, moderates the relationship between maternal education and child health speaks to men's contributions to sustainable development and gender equity. Recent work has emphasized that gender equality and equity must include both women and men. This includes both empowering women and deconstructing the patriarchal gender and social norms that lead to inequality that harm everyone (Glinski et al. 2018).

Academics should also look to examine how relational paths, such as the path linking maternal education and child well-being, might be contextualized. The presence of IPV is unlikely to be the only mechanism that problematizes this link. Future studies should examine other factors that might impinge on the relationships as well as the specific mechanisms through which maternal education improves child health and examine how IPV plays into that relationship.

Notwithstanding our rigorous methods and novel conceptualization, this study has important limitations. Firstly, and most notably, is the cross-sectional nature of the data. Accordingly, our results cannot determine causality and should only be seen as providing evidence of a correlational relationship between these three variables. Future studies should act on the suggestive nature of these data by conducting longitudinal analyses to determine whether the relationship between maternal education, IPV, and child health is causal and in which direction. Because the model we present, while methodologically rigorous, is interactive, it is equally valid to say that the negative effect of IPV becomes less negative as

maternal education improves, an idea that merits its own line of research. Indeed, some evidence exists suggesting that the link between children's exposure to traumatic events and verbal ability is mediated by maternal education (Graham-Bermann et al. 2010), but this evidence is thin as the models do not properly control for alternative explanations and the sample comes from a small, non-representative group of children in two counties in Michigan, U.S.A. We chose to focus on how the influence of maternal education on child health is dampened by IPV because we believe it to be the most straightforward case (maternal education is linked to improved child outcomes) that is easily understood by a wide range of interested parties, including academics, policymakers, child welfare experts, and non-governmental representatives, as well as being supported by prior research. Another limitation is the fact that we were limited in the dimensions of IPV. Ideally, we would have included a greater focus on other dimensions, including psychological and economic violence. An additional limitation lies in the fact that we aggregated data from across the sub-continent, and the results are likely to differ when disaggregated by region or within sub-regions of countries. Future research should seek to examine these relationships at increasingly refined geographic levels. A final limitation was that countries had to agree to administer both the DHS and the domestic violence modules, and there are likely systematic differences between the sub-Saharan African countries that chose to administer the domestic violence module and those that did not. Social, political, economic, educational, and legal contexts vary widely across the subcontinent. Consequently, our findings may not apply in all contexts.

5. Conclusions

We used nationally representative data from 24 countries across sub-Saharan Africa and advanced statistical methods, including latent class analysis and multiply imputed, survey-adjusted pooled binary logistic regression models with country fixed-effects to examine how maternal education, IPV, and child health are linked. We found that high levels of IPV can reduce the positive association between maternal education and child health. Importantly, this occurs at both the individual and community levels, suggesting the importance of patriarchal gender norms in stifling progress on children's health as well as underlining the role that men play in achieving gender equity. We have shown how the Sustainable Development Goals seeking to strengthen maternal education, improve child health, and reduce intimate partner violence are interlaced and must be jointly pursued, and we have demonstrated that academics, child welfare advocates, non-governmental organizations, and policymakers must consider how child health outcomes might be tempered depending on context.

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Data Availability Statement: Publicly available datasets were analyzed in this study. All data can be found at https://dhsprogram.com (accessed on 1 February 2023).

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Conflicts of Interest: The authors declare no conflict of interest.

Notes

[1] Note that it is equally valid to say that Figure 2 shows how maternal education attenuates the link between IPV and child stunting and child underweight, respectively.

[2] These numbers correspond approximately to the 70th (70 percent of clusters had no women in the High IPV group), 75th, 80th, 90th, 95th, and 99th percentile of community IPV.

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