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Association between spousal violence and the incidence of acute respiratory infection among children under five: random-effect modelling using data from Nigeria and Bangladesh

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Abstract

Acute respiratory infection (ARI) is a major cause of mortality among children under the age of five in developing countries. This paper examines Demographic and Health Survey (DHS) data on maternal recall of episodes of ARI in the contrasting settings of Bangladesh and Nigeria, where about 11.1% and 3.3% of under-5 children, respectively, are reported to have symptoms of ARI. The surveys found that about 25.6% of married Bangladeshi women and 15.4% of married Nigerian women reported experiencing spousal violence in the past year. To test the proposition that women's experience of intimate partner violence (IPV) is associated with adversity in their children, the study examined the relationship between spousal violence in the past year and childhood ARI in the past 2 weeks among children under the age of five in Bangladesh and Nigeria. Data were taken from a nationally representative sample of mothers aged 15–49 years obtained from the 2007 Bangladesh DHS and 2008 Nigeria DHS. Random-effects multiple logistic regression models were estimated to assess the association of maternal exposure to IPV with the incidence of ARI in the past 2 weeks among under-5 children after controlling for the potentially confounding effects of maternal social and demographic characteristics. Results from Nigeria suggest that the odds of ARI incidence among children of mothers who were IPV victims were almost two times higher than among their counterparts whose mothers had not experienced IPV (OR = 1.78; 95% CI: 1.45–2.19; $p < 0.001$). Similarly, the odds for the children of Bangladeshi IPV victims were elevated one and half times (OR = 1.61; 95% CI: 1.21–2.14; $p < 0.001$). The findings suggest that under-5 children suffer indirect health consequences of gender-based violence.

Keywords: Spousal Violence; Acute Respiratory Infection; Under-Five Children

Introduction

International concern about intimate partner violence (IPV) has gained currency in recent years. This public health problem transpires when two individuals who are currently in, or who have previously been in, an intimate relationship engage in physical violence, sexual violence, intimidation of physical or sexual violence or emotional abuse (Kernic *et al.*, 2000; Rennison & Welchans, 2000; World Health Organization, 2012). Intimate partner violence frequently results in emotional distress, which compounds physical harm. Although the terms domestic violence and IPV are frequently used interchangeably, domestic violence refers to any act of abuse, including IPV and violence against older people and children, whereas IPV is limited to cases whereby the abuser is a current or past intimate partner of the victim (Cronholm *et al.*, 2011).

Intimate partner violence has been shown to affect not only maternal health outcomes but also child health outcomes (Ackerson & Subramanian, 2009). According to a study conducted by the World Health Organization on the incidence of physical, sexual or combined IPV across different countries, the prevalence of lifetime IPV (in women who have ever experienced IPV) ranges between 15 and 71% (Ellsberg *et al.*, 2008). Several studies have documented the association of IPV with childhood morbidity and mortality (Bogat *et al.*, 2006; Silverman *et al.*, 2007). Under-5 children who witness vicious behaviour are at greater risk of impaired intellectual development and social psychological factors that impinge on childhood survival (Adam, 2006). For example, a study conducted in northern India found that the risk of child mortality during the perinatal and neonatal periods was more than two times higher among the children of mothers who experienced IPV during pregnancy compared with those who did not (Ahmed *et al.*, 2006).

Intimate partner violence has been shown to have indirect effects on maternal health. Women exposed to IPV also lack social and financial autonomy, which in turn impedes the mobility and authority to seek health care for their children (Åsling-Monemi *et al.*, 2009). Maternal exposure to IPV has been linked to depression in women, traumatic brain injury, sexually transmitted diseases and other poor health outcomes (Campbell & Lewandowski, 1997; Åsling-Monemi *et al.*, 2009; Gibbs *et al.*, 2018).

According to the World Health Organization, South Asia has the highest regional rate of IPV in the world (43%) (García-Moreno *et al.*, 2013). A study conducted in the six largest states in India reported even higher rates (52%) of IPV among women (Nanda *et al.*, 2014). Research in Afghanistan has found that about 50% of women have experienced IPV in their lifetime (Gibbs *et al.*, 2018). The rate of IPV has also been found to be very high in Bangladesh (Silverman *et al.*, 2009). Bangladesh has a high infant mortality rate, with 50–60 per 1000 children dying before their first birthday (Åsling-Monemi *et al.*, 2009). Although this represents an improvement over levels observed in the past, infant mortality remains high in comparison to levels observed in most other developing countries. UNICEF reported that the under-5 mortality rate in Bangladesh in 2016 was 34 per 1000 live births (UNIGME, 2017). A recent study in Bangladesh found a high prevalence of under-5 mortality among women who experienced IPV compared with those who did not (Hossain *et al.*, 2014). Another study by Ziaei and colleagues (2014) found that IPV against women was associated with stunting, wasting and underweight in children under the age of five. Social equity contributes to risk. For example, while Silverman *et al.* (2009) reported a mortality rate of 77 per 1000 live births among children aged 5 years and under, a similar study among uneducated Bangladeshi mothers reported a rate that was double this level for under-5 female children of uneducated mothers (Åsling-Monemi *et al.*, 2009).

The prevalence of currently married Bangladeshi women who have ever experienced IPV in the past 12 months has been estimated at about 18% (NIPORT *et al.*, 2009). According to the results of a multi-country study on the health of women and IPV, the lifetime prevalence of women who have ever experienced IPV was 69% in a sample of 1500 ever-married Bangladeshi women (Ellsberg *et al.*, 2008). A recent study estimated the prevalence of physical violence against women by husbands in Bangladesh to vary between 30% and 50% (Khan *et al.*, 2017). Another study in Bangladesh found that 2 in 5, i.e. almost 43%, of married women with at least one child aged 5 years or younger had experienced IPV in the year before the survey (Silverman *et al.*, 2009).

Intimate partner violence is also very high in African countries like Morocco, Nigeria, Uganda, Namibia and Tanzania (Shamu *et al.*, 2011; Olayanju *et al.*, 2013). It also poses a serious problem in Nigeria. Ezechi *et al.* (2004), in their studies on domestic violence against pregnant women in Nigeria, found that most violence was committed by intimate partners (78.7%). The prevalence of IPV experience among currently married women in the past 12 months preceding the 2009 Nigeria Demographic and Health Survey (NDHS) was 15% (National Population Commission & ICF Macro, 2009). Other risk factors that have been found to be associated with

IPV include women's young age, low socioeconomic status, poor educational level, and personal or spousal alcohol, tobacco and other substance abuse (Adesina *et al.*, 2011). Adesina *et al.* (2011), in a study to assess the prevalence of IPV among women attending antenatal care (ANC) in Ibadan, Nigeria, found that 17% of pregnant ANC patients reported their husbands as being common perpetrators, with the greatest problem being threats of abuse. Antai (2011) found a lifetime prevalence of 63% among married women in Nigeria, with women claiming that their spouses controlled their behaviour with threats of violence. It appears that the control of wives by husbands with threats is the most common type of IPV reported in Nigeria. This high prevalence of controlling behaviour may be because other kinds of abuse take place within the context of control.

Intimate partner violence affects not only the physical health of women but also their mental health through direct pathways such as injury, and indirect pathways like chronic health problems that may arise from prolonged stress (World Health Organization (WHO), 2012). According to the WHO, abused women are twice as likely to experience depression than non-abused women, and also suffer higher levels of anxiety and phobias (García-Moreno *et al.*, 2013). Moreover, IPV has also been found to be associated with physical inactivity, post-traumatic stress disorder, poor self-esteem and self-harm (WHO, 2012). In women IPV can have negative sexual and reproductive health consequences, and studies have found that violence during pregnancy has been associated with late entry into prenatal care, miscarriage, premature labour and birth, fetal injury and low birth weight (Devries *et al.*, 2010; Shamu *et al.*, 2011; WHO, 2012). Several studies have demonstrated that low birth weight is a risk factor for severe respiratory tract infection and death in children (Rudan *et al.*, 2008; Grant *et al.*, 2011).

An association has been found between IPV against women and health and social problems among children, including depression, anxiety and poor school performance (WHO, 2012). Furthermore, studies in developing countries, including Bangladesh, have found that children of abused mothers have higher rates of diarrhoeal disease, lower rates of immunization and are at higher risk of under-5 death (Silverman *et al.*, 2009; WHO, 2012).

Pneumonia and respiratory infection are leading causes of morbidity globally (Anjum *et al.*, 2017), with African countries being more affected (Gessner, 2011; Breiman, *et al.*, 2015). Lower respiratory tract infections are a common cause of death among under-5 children. Pneumonia, the most common lower respiratory tract infection, accounts for 19% of deaths in this population, with 70% of these occurring in sub-Saharan Africa and South-East Asia. Risk factors for ARI in these countries include lack of access to basic amenities such as adequate housing, electricity and clean running water, lack of exclusive breastfeeding, undernutrition, indoor air pollution, low birth weight and lack of measles immunizations (Rudan *et al.*, 2004, 2008). Evidence from Bangladesh and Nigeria has consistently shown that children in both countries experience high rates of ARI. The incidence of ARI in developing countries has been estimated to be 150.7 million new cases every year and about 6 million each have been reported for Nigeria and Bangladesh (Rudan *et al.*, 2004; Rudan *et al.*, 2008).

Many clinical and socioeconomic factors have been reported to contribute to the deaths of children, especially those living in developing countries (Ziaei *et al.*, 2014). More studies are now examining the social determinants of child mortality and morbidity with several showing an association between maternal abuse and poor child health outcomes. For example, Ziaei (*et al.*, 2014) found that maternal physical abuse was associated with infant death in Bangladesh. However, the association between IPV and ARI has not been substantially studied, particularly in countries where both problems are rampant. To the authors' knowledge, only one study has examined this association in Bangladesh and none has been conducted in Nigeria. Silverman *et al.* (2009) assessed Bangladeshi women's exposure to IPV from self-reported survey of their husbands who were also the perpetrators. This may not have yielded accurate results because the perpetrators of IPV may under-report it or victims may conceal the practice. The authors found an increased risk for ARI, pneumonia and diarrhoea among children whose mothers have

experienced IPV, as reported by their husbands. The present study utilized reports from women's self-reported experience of IPV.

The present study aimed to examine the association between the prevalence of IPV exposure (in the year preceding the survey) among ever-married women in Nigeria and Bangladesh with the reported fortnightly incidence of ARI among their under-5 children.

Methods

Theoretical framework

The posited pathway for the effect of IPV on the health of under-5 children is given in Figure 1. The framework adapts the general process model of Repetti *et al.* (2002) to articulate the possible direct and indirect pathways by which IPV against mothers may affect a child's growth, morbidity and survival. The social determinants of health are well known and have been consistently demonstrated in social epidemiological research (pathways 'A' in Fig. 1). A mother's experience of IPV may initiate behavioural risks as well as psychological (anxiety, depression), physical (injury, disability, fatigue) and nutritional (anaemia, poor weight gain) symptoms, which may prevent her from taking care of an under-5 child's health, leading to the effects posited by pathways 'B'. Since exogenous factors are inter-correlated (pathways labelled 'C') and co-vary with pathways 'A', multivariate models must adjust for multiple indicators of relative household poverty and parental educational attainment.

Data

The study data were extracted from the 2008 Nigeria Demographic and Health Survey (NDHS) (National Population Commission & ICF Macro, 2009) and the 2007 Bangladesh Demographic and Health Survey (BDHS) (NIPORT *et al.*, 2009). All DHS surveys aim to provide up-to-date information on: fertility levels; nuptiality; sexual activity; fertility preferences; awareness and use of family planning methods; breastfeeding practices; nutritional status of mothers and young children; early childhood mortality and maternal mortality; maternal and child health; and awareness and behaviour regarding HIV/AIDS and other sexually transmitted infections. The Bangladesh and Nigeria surveys contained identical modules for the assessment of domestic violence.

The 2007 BDHS was a nationally representative survey of 10,996 women aged 15–49 and 3771 men aged 15–54 covering 361 clusters throughout Bangladesh, of which 134 were located in urban areas and 227 in rural areas. The survey was conducted under the authority of the National Institute for Population Research and Training (NIPORT) in the Ministry of Health and Family Medicine and used a multi-stage cluster sample based the 2001 Bangladesh Census. Data collection occurred over a 5-month period from March to August 2007. A total of 10,819 house-

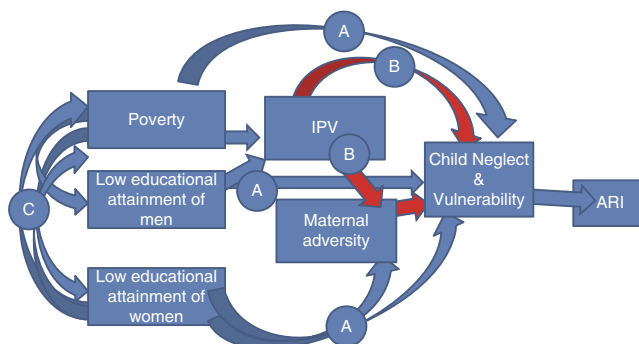


Figure 1. A framework for the role of IPV as a determinant of ARI. See text for explanation of A–C.

holds were selected for the survey, of which 10,461 were found to be occupied, and interviews were successfully completed in 10,400 households (99.4%). All ever-married women aged 15–49 and all ever-married men aged 15–59 who slept in the selected households the night before the survey were eligible for the survey. About 11,178 eligible women were identified in these households and 10,996 were successfully interviewed, producing a response rate of 98.4%. Eligible male participants were selected in every second household (for every two households sampled for women); of 4074 males identified, 3771 were successfully interviewed leading to a response rate of 92.6%. Details of data collection and the sampling method are described elsewhere (NIPORT *et al.*, 2009).

The 2008 Nigeria NDHS data were collected by the National Population Commission over the period June to October 2008. This was a nationally representative survey of over 36,298 households of which 34,644 were occupied; 34,596 women were identified to be eligible for individual interview and 97% were successfully interviewed. Details of data collection and the sampling methods are documented elsewhere (National Population Commission & ICF Macro, 2009).

For both countries, a woman was randomly selected from each household to be asked additional questions about domestic violence. A total of 19,165 (Nigeria) and 2455 (Bangladesh) women were asked questions about domestic violence; data from women were matched with the data from their husbands and husband–wife dyads were created.

Although Nigeria has collected IPV data since the 2008 NDHS, the Bangladesh BDHS has not collected any new data on this since the 2007 BDHS. Considering the time (year) of data collection, the NDHS-2008 and BDHS-2007 surveys were used for the present study. In addition, research in this field using Nigerian data is very limited.

According to the World Health Organization, the global prevalence of physical and/or sexual intimate partner violence among all ever-partnered women is 30.0%, and the prevalence is highest in the African (36.6%) and South East Asian regions (37.7%). Bangladesh and Nigeria were chosen for the study as these two countries are highly populated and have similar, very high rates of IPV (WHO, 2012).

Variables

Dependent variable

The dependent or outcome variable was the incidence of ARI among children aged 5 years or under in the 2 weeks before the survey. This was assessed by asking mothers whether their under-5 children had been ill in the 2 weeks preceding the survey with a cough accompanied by short, rapid breathing or a breathing difficulty the mother considered to be chest-related. These symptoms are considered to be a proxy for pneumonia, and a ‘yes’ to any of these questions indicated the presence of ARI. If a mother reported their child had a cough, short/rapid breaths and/or had fever in last 2 weeks this was given a score of 1; otherwise ‘0’ (absence of ARI).

Independent variables

The independent variable of interest was wife’s report of violence perpetrated by her husband/partner (IPV) in the year before the survey. This was assessed using a shortened (modified) version of the Conflicts Tactics Scale (CTS) containing the following eight questions: [Does/did] your [last] husband ever do any of the following things to you: a) Push you, shake you, or throw something at you? b) Slap you?; c) Twist your arm or pull your hair?; d) Punch you with his fist or with something that could hurt you? e) Kick you, drag you, or beat you up? f) Try to choke you or burn you on purpose? g) Threaten or attack you with a knife, gun, or any other weapon? h) Physically force you to have sexual intercourse with him even when you did not want to? The first seven questions (a–g) were used to estimate the prevalence of physical violence while the last question (h) assessed sexual violence. Currently women married were asked to respond to the questions with respect to their current partners while formerly but not currently married women

were asked to respond with reference to their most recent husband. A 'yes' on any of the first seven questions represented physical violence, and a 'yes' to the last question sexual violence. For each 'yes' response, currently married women were asked about the frequency of such acts in the 12 months preceding the survey. Women who were formerly but not currently married were asked about their lifetime experience of violence, not the past 12 months. For the current study, 'domestic violence' is used interchangeably with 'IPV' given that the data collected for domestic violence only reflected abuse perpetrated by a current or former intimate partner or spouse.

Child's age, women's employment status, partner's educational attainment, women's educational attainment, duration of marriage and socioeconomic status (SES) were used, among others, as control variables. In addition, a geographic region variable in the case of Bangladesh, and ethnicity in the case of Nigeria, were used as control variables. These were treated as categorical variables. Four dummy variables for ethnicity were created for Nigeria: Hausa, Igbo, Yoruba and 'other' (reference category). Six dummy variables for geographic region were created for Bangladesh: Chittagong, Barisal, Khulna, Rajshahi, Sylhet and Dhaka (reference category). Dummy variables for child's age were created and were categorized as follows: 1–12 months, 12–23 months, 24–35 months 36–47 months and 48–59 months (reference category). Women's employment status was treated as a dichotomous variable, with 1 meaning 'working' and 0 meaning 'not employed'. Three dummy variables for partner's education were created: 'no education', 'primary education' and 'above primary education'. Dummy variables for women's educational attainment were created: 'no education', 'primary education' and 'above secondary education'. For duration of marriage, three dummy variables were generated: 1–10 years, 10–19 years and 20 years or more. Socioeconomic status (SES) was determined and three dummy variables (high, medium and low) were created using the wealth index (quintiles) category generated during the survey.

Statistical analysis

Unadjusted and adjusted random-effect logistic regression models were estimated to predict the relationship between women's experience of violence from her spouse or partner in the past 12 months and her under-5 child's incidence of ARI in the past 2 weeks. Domestic violence was coded as a dichotomous variable corresponding to 1 if a respondent answered 'yes' to at least one of the abuse questions and 0 otherwise. By estimating models with random intercepts, random heterogeneity was assumed in women's propensity or underlying risk of experiencing spousal/partner violence that persisted across primary sampling unit.

Results

Table 1 shows the demographic characteristics of study participants by country. About 26% and 15% of women ever experienced IPV in Bangladesh and Nigeria, respectively. The prevalence of IPV was found to be considerably higher in Bangladesh than in Nigeria. Women in Bangladesh were equally distributed across the three educational level groups (no education, primary, above primary), while nearly half of the women in the Nigerian sample reported having no education. Despite higher levels of illiteracy among the Nigerian respondents, a higher percentage of Nigerian women reported that they were employed in the past 12 months compared with the Bangladesh women (Table 1).

In Nigeria, the rate of past-year IPV experienced by the mother was significantly higher if she had a son who was under 5 years of age (Table 2). However, in Bangladesh the rate was similar irrespective of the sex of the under-5 child. There was a significant ($p < 0.001$) association between women's education and IPV experience in Nigeria and Bangladesh. There was a positive association between women's employment status and IPV experience in both countries, but this was only significant ($p < 0.001$) in the case of Nigeria. The rate of IPV was higher for women who were currently employed compared with their unemployed counterparts (17.5% vs 11.6% in

Table 1. Socio-demographic characteristics of the study sample, Bangladesh BDHS 2007 and Nigeria NDHS 2008

Variable	Bangladesh 2007		Nigeria 2008	
	<i>n</i>	%	<i>n</i>	%
Mother ever experienced IPV				
Yes	627	25.6	2893	15.4
No	1823	74.4	15,889	84.6
Child had ARI in last 2 weeks				
Yes	272	11.1	623	3.3
No	2178	88.9	18,159	96.7
Sex of under-5 child				
Female	1214	49.6	9290	49.5
Male	1236	50.4	9492	50.5
Age of child				
<12 months	474	19.4	4348	23.1
12–23 months	478	19.5	3758	20.0
24–35 months	498	20.3	3480	18.5
36–47 months	499	20.4	3729	19.9
48–59 months	501	20.4	3467	18.5
Mother's level of education				
No education	722	29.5	8912	47.5
Primary	754	30.8	4328	23.0
Above primary	974	39.7	5542	29.5
Mother's employment status				
Working in past 12 months	603	24.6	12,110	64.5
Not working in past 12 months	1847	75.4	6672	35.5
Spouse/partner's level of education				
No education	1364	55.7	8003	42.6
Primary	233	9.5	3317	17.7
Above primary	853	34.8	7462	39.7
Marital duration				
<10 years	1287	52.4	9742	50.7
≥10 years	1168	47.6	9472	49.3
SES				
Low	819	33.4	6252	33.3
Medium	818	33.4	6256	33.3

Table 1. Continued

Variable	Bangladesh 2007		Nigeria 2008	
	<i>n</i>	%	<i>n</i>	%
High	813	33.2	6274	33.4
Bangladeshi region				
Chittagong	358	14.6	—	—
Barisal	482	19.7	—	—
Dhaka	539	22.0	—	—
Khulna	282	11.5	—	—
Rajshahi	382	15.6	—	—
Sylhet	407	16.6	—	—
Nigerian ethnicity				
Hausa	—	—	4911	26.7
Igbo	—	—	2084	11.4
Yoruba	—	—	2416	13.2
Other	—	—	8930	48.7
Sample size (currently married women)	2453	100.0	18,890	100.0

Nigeria; 26.0% vs 25.5 in Bangladesh). Socioeconomic status was also significantly ($p < 0.001$) associated with women reporting IPV in the past year (Table 2).

The random-effect logistic regression results indicate that if a woman has experienced IPV in the past year, the odds of her under-5 child having ARI in the past 2 weeks were about two times higher in Nigeria (OR = 1.78; 95% CI: 1.45–2.19, $p < 0.001$) and one and a half times higher in Bangladesh (OR = 1.63; 95% CI: 1.22–2.14, $p < 0.001$) compared with mothers who did not experience IPV, after controlling for the effect of women's other socio-demographic and economic indicators (Table 3). Infants (OR = 2.47, $p < 0.001$), young children aged 12–23 months (OR = 2.04, $p < 0.01$) and children aged 24–35 months (OR = 1.82, $p < 0.01$) had significantly higher odds of developing ARI compared with children aged 48–59 months in Bangladesh, while in Nigeria only children younger than 12 months (OR = 1.41, $p < 0.05$) and those aged 12–23 months (OR = 2.26, $p < 0.001$) had significant higher odds of developing ARI compared with children aged 48–59 months. In the Nigerian sample, women whose spouses had no education were less likely to have under-5 children who had ARI (OR = 0.69, $p < 0.01$) compared with Bangladesh, where women whose spouses had primary education were significantly more likely to have a child who had had ARI in the past 2 weeks (OR = 1.75, $p < 0.05$). Interactions were observed between IPV and sex of the child, IPV and age of the women, IPV and the education of the women, IPV and the age of the husband/partner and between IPV and husband's/partner's education. None of the interactions was significant, which allows return to the main-effect models.

Discussion

This study identified an association between maternal exposure to IPV and the incidence of ARI among children under the age of five in Bangladesh and Nigeria. Given that IPV has a high

Table 2. Incidence of IPV in the past 12 months among married Bangladeshi and Nigerian mothers of under-5 children by demographic characteristics

Characteristic	Bangladesh 2007		Nigeria 2008	
	% IPV	<i>p</i> -value	% IPV	<i>p</i> -value
Sex of under-5 child		0.949		0.019
Female	25.5		14.8	
Male	25.7		16.0	
Age of child		0.326		0.043
<12 months	23.2		14.0	
12–23 months	28.0		16.4	
24–35 months	24.7		15.6	
36–47 months	27.7		15.7	
48–59 months	24.4		15.5	
Mother's level of education		<0.001		<0.001
No education	28.8		10.9	
Primary	28.7		21.7	
Above primary	20.8		17.8	
Women's employment status		0.773		<0.001
Working in past 12 months	26.0		17.5	
Not working in past 12 months	25.5		11.6	
Spouse/partner's level of education		<0.001		<0.001
No education	29.2		11.3	
Primary	26.2		19.1	
Above primary	19.7		18.1	
Marital duration		0.005		<0.001
<10 years	28.3		15.5	
10–19 years	22.3		16.1	
>19 years	23.9		12.8	
SES		<0.001		<0.001
Low	31.9		13.2	
Medium	27.4		17.1	
High	17.5		15.9	
Bangladeshi region		<0.001		—
Chittagong	27.0		—	
Barisal	33.8		—	

Table 2. Continued

Characteristic	Bangladesh 2007		Nigeria 2008	
	% IPV	<i>p</i> -value	% IPV	<i>p</i> -value
Dhaka	23.4		—	
Khulna	29.4		—	
Rajshahi	24.6		—	
Sylhet	17.9		—	
Nigerian ethnicity		—		<0.001
Hausa	—		6.0	
Igbo	—		20.3	
Yoruba	—		13.8	
Other	—		19.7	

prevalence in developing countries, and that ARI is one of the leading causes of death in children under the age of five, this association suggests that IPV does not just affect women, but also young children. Although many studies have reported mental health, school and emotional/adjustment problems, as well as externalizing and internalizing behaviours, as adverse health outcomes of children exposed to violence in the home, ARI has not been readily included in this list (Moore, 1975; Levine, 1975; Gil-González *et al.*, 2007; Hungerford *et al.*, 2010). The current study found that younger children (<12 months and 12–23 months) were more likely to have experienced ARI than older ones, suggesting that very young children may be much more vulnerable to, and impacted by, IPV.

This finding has serious implications, especially for children younger than 12 months. Studies on the influence of IPV on child health outcomes have often only included older children (Carpenter & Stacks, 2009). This may partly be due to the challenges in conducting accurate assessments on this population. It is, however, vital that this group be included in order to intervene early. Infant mortality has persistently posed a great public health problem globally, especially in developing countries. In countries like Nigeria and Bangladesh, ARI among children under the age of five is a leading cause of death. In addition, as shown by Ziaei *et al.* (2014), the association between IPV and impaired growth and development of under-5 children may be a possible mechanism through which IPV influences the health of children. Malnourished children have depressed immune systems, which makes them susceptible to more diseases and ill health conditions compared with their well-nourished counterparts.

The present results are similar to the findings of Silverman *et al.* (2009), although their odds of ARI incidence (OR = 1.37, $p < 0.05$) were slightly lower than reported here. This may be because reports of IPV against women were collected from their spouses and not from the women themselves. Men may have under-reported the occurrence of IPV. The present findings are also in line with those of Ackerson (2009), who reported an association between maternal physical abuse and child mortality, bearing in mind that ARI is a leading cause of death in the two countries included in this study.

The mechanism through which exposure to IPV may influence ARI risk may be through disruption of the maternal schedule and a woman's ability to provide appropriate care for her children. Women in abusive relationships may experience mental and physical health problems that impact on their care-giving roles (Sharps *et al.*, 2013). In addition, societal and cultural

Table 3. Multilevel logistic regression odds ratios and 95% confidence intervals for the relationship between women's experience of IPV and her under-5 child's incidence of ARI in the past 2 weeks, Bangladesh and Nigeria

Covariate	Bangladesh 2007		Nigeria 2008	
	OR	95% CI	OR	95% CI
Bivariate model				
Mother experienced IPV in past 12 months				
Yes	1.73***	1.31, 2.28	1.83***	1.49, 2.23
No (Ref.)	1.00	—	1.00	—
Random parameter	Intercept	SE	Intercept	SE
	0.51*	0.131	0.99***	0.07
Multivariate model				
Mother experienced IPV in past 12 months				
Yes	1.61***	1.21, 2.14	1.78***	1.45, 2.19
No (Ref.)	1.00	—	1.00	—
Sex of under-5 child				
Female vs male	0.84	0.65, 1.09	0.97	0.82, 1.14
Age of child				
<12 months	2.47***	1.60, 3.82	1.41*	1.06, 1.87
12–23 months	2.04**	1.31, 3.16	2.26***	1.72, 2.96
24–35 months	1.82**	1.17, 2.83	1.32	0.98, 1.78
36–47 months	1.15	0.72, 1.85	1.09	0.80, 1.48
48–59 months (Ref.)	1.00	—	1.00	—
Mother's level of education				
No education	1.21	0.80, 1.82	1.31	0.96, 1.80
Primary	1.38	0.96, 1.98	1.13	0.86, 1.49
Above primary (Ref.)	1.00	—	1.00	—
Women's employment status				
Working in past 12 months	1.27	0.93, 1.74	1.10	0.91, 1.31
Not working in past 12 months (Ref.)	1.00	—	1.00	—
Spouse/partner's level of education				
No education	1.10	0.77, 1.57	0.69**	0.54, 0.89
Primary	1.75*	1.11, 2.77	0.94	0.73, 1.22
Above primary (Ref.)	1.00	—	1.00	—

Table 3. Continued

Covariate	Bangladesh 2007		Nigeria 2008	
	OR	95% CI	OR	95% CI
Marital duration				
<10 years	0.99	0.74, 1.31	1.10	0.92, 1.31
≥10 years (Ref.)	1.00	—	1.00	—
SES				
Low	1.50*	1.01, 2.24	0.91	0.67, 1.24
Medium	1.22	0.83, 1.77	1.08	0.84, 1.40
High (Ref.)	1.00	—	1.00	—
Bangladeshi region				
Chittagong	2.08***	1.33, 3.26	—	—
Barisal	1.57	0.96, 2.57	—	—
Dhaka (Ref.)	1.00	—	—	—
Khulna	1.02	0.57, 1.82	—	—
Rajshahi	1.14	0.69, 1.87	—	—
Sylhet	1.88**	1.18, 3.01	—	—
Nigerian ethnicity				
Hausa	—	—	0.65**	0.50, 0.85
Igbo	—	—	1.14	0.82, 1.58
Yoruba	—	—	0.23***	0.14, 0.39
Other (Ref.)	—	—	1.00	—
	Intercept	SE	Intercept	SE
Random parameter	0.31	0.194	0.81***	0.07
Sample size (currently married women)	2453		18,890	

Ref.: reference category; SE: standard error; OR: odds ratio.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

norms around IPV may play a crucial role in understanding the prevalence of IPV and its subsequent association with ARI. In many developing countries, such as Bangladesh and Nigeria, men are the heads of households and breadwinners, while women assume care-giving roles. Many of the women in this study reported either no education at all or having only primary school education. This limits their financial capability and makes them somewhat financially dependent on their male partners, hence increasing their vulnerability to IPV. Lack of education and employment have been reported as risk factors for IPV (Adesina *et al.*, 2011; Shamu *et al.*, 2011). Furthermore, previous studies have demonstrated that IPV is associated with low birth weight, reduced breastfeeding and premature birth, all of which are associated

with increased odds of child mortality and morbidity, including the incidence of ARI (Rudan *et al.*, 2008).

The results of this study should be interpreted with caution, bearing in mind the limitations of the study. First, secondary data were used, although the DHS dataset is very well known and trusted for its quality. Second, the study was cross-sectional in nature, making it difficult to infer causality. Owing to this, it is not possible to say that maternal IPV causes ARI in under-5 children. Third, given the survey nature of data collection, all information collected was self-reported, which could be a potential source of bias. Contrary to the study by Silverman *et al.* (2009), this study used women's reported IPV, which can be considered to more accurately reflect past-year prevalence of IPV.

In conclusion, this study has demonstrated a significant association between the odds of recent ARI among children and the reported incidence of IPV among their mothers. This finding is consistent with the hypothesis that adversities associated with maternal experience of IPV extend to the children of the affected mothers. The finding attests to the need for research that can identify feasible interventions to prevent and control IPV. The need for IPV interventions is particularly pronounced in settings such as Nigeria and Bangladesh where the prevalences of ARI and IPV are high. While longitudinal studies may be needed to establish causality, intervention trials are also urgently needed. Qualitative studies and psychological research to elucidate the exact mechanisms that generate the association between IPV and ARI are also needed.

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Ethical Approval. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on the human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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