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**Women's empowerment and child mortality in
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Abstract

Over the past decades, international politics have increasingly drawn attention to the importance of women's empowerment, which led to an increase in the number of studies. However, despite this increase in research, the results are not always consistent due to the fluid and context-sensitive conceptualization of women's empowerment is. With this study, we aimed to answer two questions related to women's empowerment in Nigeria: (i) what is the relationship between the different dimensions of women's empowerment and child mortality; and (ii) does the relationship persist when controlled for socio-economic and biodemographic factors? We used a multivariate binary logistic regression to assess whether a higher degree of empowerment of women of reproductive age (15-49 years) in Nigeria is associated with a better survival rate of their children (0-5 years). The results support the hypotheses that women's empowerment and child mortality in Nigeria are related, even when controlling for the socio-economic and bio-demographic factors. Increasing women's empowerment could have a declining effect on child mortality. Children of women who (respectively) are less empowered, especially regarding education and household decision making, who have had many births in the past, have a short birth interval, and belong to poorer households have lower survival rates in Nigeria.

Keywords

Child mortality, Women's empowerment, Nigeria

Introduction

In 2000, 191 countries signed the United Nations Millennium Declaration, committing themselves to the Millennium Development Goals (MDG) which aimed to reduce worldwide poverty and inequality by 2015. The MDG's consisted of eight specific targets: eradicating extreme hunger and poverty; achieving universal primary education, promoting women's empowerment and gender equality, reducing child mortality, improving maternal health, combatting the spread of HIV/AIDS, malaria and other diseases, ensuring a sustainable environment, and build up a global partnership for development (United Nations, 2015). Four out of the eight goals are centered on women and children. Strengthening women's empowerment and reducing child mortality are important goals that strongly determine a country's living standard. First, because the causes of child mortality are strongly related to the general living conditions, social welfare, quality of life and level of economic development (Murray, 1988). Second, because the mother has an important influence on the survival chances of her child as her knowledge, skills, health status, access to resources and socio-economic status are of great importance for childcare and development (Alemayehu et al., 2015).

The importance of women's empowerment was first highlighted at the International Conference on Population and Development in Cairo in 1994. Reinforcing empowerment was seen as a national priority that would lead to an improvement of women's political, social, economic and health status, in its turn essential for achieving sustainable development (UNFPA, 1994). The international awareness of women's empowerment led to an increase in research on the topic and on the relationship with several demographic indicators such as mortality, fertility and health (Boender et al., 2002). However, despite the increase in studies, research results remain inconsistent due to the wide range of definitions and methodologies depending on the social context (Boender et al., 2002). This leaves many questions unanswered concerning the relation between women's empowerment and demographic indicators and child mortality in particular. Researchers agree that both are interrelated. The existence of a correlation does not necessarily imply a causal relationship however as underlying factors, such as household wealth or educational attainment, influence both empowerment and child mortality. Furthermore, there is disagreement as to which dimensions of empowerment are most important in the relationship with child mortality, and to what extent the different dimensions are relevant.

This study aims to address the role of the mother in child survival, taking Nigeria as a case study. More specifically, we aim to answer two questions: (i) what is the relationship between the different dimensions of women's empowerment and child mortality; and (ii) does the relationship persist when controlled for socio-economic and biodemographic factors? Data used for analyses was derived from the 2018 Nigerian Demographic and Health Surveys (National Population Commission, 2019). We chose Nigeria as a case study because it is the most populous country in Africa with over 2000 million inhabitants. The country has the highest absolute number of child deaths in Africa, and the third highest worldwide, after respectively India and Pakistan. In 2016 approximately 733,000 children died before their fifth birthday (UNICEF, 2017); in 2018, Nigeria's child mortality rate was

equal to 132 deaths per 1000. This implies that one in eight Nigerian children die before reaching their fifth birthday.

Background

Child mortality

The mortality of children can be defined in several ways. The general child mortality rate is classified into a number of categories: the under-five mortality rate, the infant mortality rate, the perinatal mortality rate, and the neonatal mortality rate. In the remainder of this study, we continue to speak of the child mortality rate, referring to the mortality of children under 5 years of age per 1000 live births.

Globally, the child mortality rate has decreased significantly, but the numbers remain high in many countries, especially in sub-Saharan Africa (UNICEF, 2017). It is projected that in sub-Saharan Africa, 483 million births will occur in the period 2019-2030, which is an increase of 76 million births compared to the previous period of the same duration (UNICEF, 2019). The Millennium Development Goals set the goal of reducing the global mortality rate of children under five by two-thirds from 1990 levels by 2015 (United Nations, 2015). This target was not met and was adjusted under the United Nations Sustainable Development Goals. By 2030, the child mortality rate is supposed to be 25 per 1,000 live births, implying that 97.5% of all newborns should survive the first five years of their lives (United Nations, 2019). Currently, the global infant mortality rate is 39 deaths per 1,000 live births (UNICEF, 2019).

The main causes of child mortality in sub-Saharan Africa are communicable diseases such as diarrhea, cholera, measles, malaria and respiratory infections (Ezeh et al., 2015). These diseases are both preventable and treatable, if appropriate care and awareness is provided in the child's living environment (Ezeh et al., 2015). A high child mortality rate not only indicates health issues in children, but also reflects lower general living conditions, social well-being, quality of living environment and level of economic development (Murray, 1988). Hence the child mortality rate is frequently used as an indicator of a country's general state of health and level of development (Allotey & Reidpath, 2003).

Mosley & Chen (1984) were among the first authors to emphasize the role of mothers in explaining child mortality. They argue that 97% of all children are ought to survive the first five years of their life in optimal social, economic, biological and environmental factors. Deterioration in children's chances of survival can indirectly result from socio-economic factors at the individual level (traditions, values, level of education, ...), household level (income, wealth, ...) and community level (health care, political economy, ...) (Chen & Mosley, 1984). In their analytical model, Mosley & Chen distinguish a total of fourteen determinants in five categories: i) maternal factors (maternal age, number of births, birth interval); ii) environmental pollution (water, air, food, skin, etc.); iii) malnutrition (calories, proteins, micronutrients); iv) injuries (accidental, incidental); and v) disease control (preventive measures and medical treatment) (Chen & Mosley, 1984). Based on their model, the authors conclude that mothers play a significant role in child survival as their

knowledge, skills and socio-economic status are important for both their own care and that of their children. For example, the level of education is important because of the skills mothers acquire with regard to contraception, nutrition, hygiene and health care (Chen & Mosley, 1984). Furthermore, Mosley & Chen emphasize the role of control over the household: in most traditional societies, mothers often have the full responsibility of caring for their children but do not dispose of the required control and autonomy to ensure proper care (Chen & Mosley, 1984). To date, Mosley & Chen's research still inspires many studies on the proximate determinants of child mortality.

Women's empowerment

As the global effort to combat child mortality grows, so does the focus on enhancing gender equality and empowering women. Women's empowerment is internationally recognized as one of the most important goals for a country's development: the Millennium Development Goals (MDG) emphasize the importance of eliminating all forms of discrimination, exploitation, social harassment, and all conditions that reinforce the violation of women's rights through government policies and decisions, traditional customs, cultural prejudices, and religious extremism (United Nations, 2015). The MDG's address the concepts of gender equality and women's empowerment in the same category, measuring them on three dimensions: gender equality in education, in the labor market, and in politics (United Nations, 2015). The two concepts are also closely related: the position of women and the degree of empowerment are partly determined on the basis of gender relations in society. But the two concepts differ in terms of their focus on different issues. Gender equality refers to the equal rights, responsibilities and opportunities of men and women, while women's empowerment is more related to women's ability to make decisions about their own lives and destinies (Kishor & Subaiya, 2008).

One of the most cited definitions comes from Naila Kabeer (1999, p.437), who defines empowerment as: "the extension of people's ability to make strategic life choices in a context where this ability was previously denied to them". This definition suggests that empowerment is not a fixed state but should be seen as a process: it is about the movement from disempowerment to empowerment (Eerdewijk et al., 2009). Kabeer (1999) conceptualizes empowerment using three dimensions: agency, resources and achievements, with agency referring to the process by which choices are made and implemented (Kabeer, 1999). Similarly, Bogale, Mudhara & Sharaunga (2018) conclude that one can refer to women's empowerment when a woman is able to strengthen her capacities (resources and agency) and utilize them to make certain choices, and in turn transform these choices into the desired actions and outcomes (achievements). The European Institute for Gender Equality (2019, p.1) defines women's empowerment in a similar way, but also emphasizes the aspect of power and control.

A recurrent aspect in the definition of women's empowerment is "the process": empowerment implies a transformation of the current status quo. However, this aspect is rather abstract and complex, as well as complicated to measure if only cross-sectional data is available. Ideally, empowerment should be measured at multiple points in time.

Because women can become empowered in certain areas in a relatively short time, while progress in other empowerment areas can take decades (Boender et al., 2002). Some studies approach women's empowerment through qualitative research, by conducting in-depth interviews and case studies (Boender et al., 2002). However, the majority of studies try to express the complexity of the concept through a quantitative multi-dimensional conceptualization, approaching women's empowerment on a variety of dimensions. The most frequently used dimensions are: i) making decisions at household level: child-related matters, social, household and financial matters; ii) control over and access to resources: income, assets, budget, and participation in gainful employment; and iii) the freedom to go and stand (Boender et al., 2002). In addition, partner violence, political participation, interaction between couples, self-esteem, appreciation in the household, control over the choice of a husband, etc. are dimensions that have been explored as well, although less frequently (Boender et al., 2002). The focus on the first set of dimensions is consistent with Kabeer's (1999) definition that women's empowerment equals recourse, agency and achievement.

The mother's role on child mortality

A considerable number of studies aimed at identifying the determinants of both women's empowerment and child mortality, also in Nigeria. Many proximate determinants, including socio-economic and demographic characteristics such as the mother's marital status, her place of residence, the number of children already born, the mother's age at birth, the birth interval, the child's gender, the child's height and the household wealth seem to have a significant impact on child mortality in Nigeria (Essi et al., 2019). Determinants related to women's empowerment, such as the mother's level of education or her ability to participate in domestic decision-making have proven to be important indicators as well.

Children from mothers with a higher educational level clearly have higher survival chances (Alemayehu et al., 2015; Mondal et al., 2009; Kishor & Subaiya, 2008; Hossain et al., 2015; Boender et al., 2002); maternal education inculcating knowledge of modern health care and improving the effectiveness of healthy behavior (Mondal et al., 2009). Moreover, more than half of the decline in global child mortality between 1970 and 2010 has been attributed to advances in women's education (Cowling et al., 2010). Studies also showed that women's educational attainment is generally accompanied by lower fertility rates, usually associated with a decline in child mortality rates (Becker et al., 2013; Hossain et al., 2007). Schooling enables women to be more socially skilled, can change their attitudes and behavior and safeguard them from traditional values and norms (Alemayehu et al., 2015). In addition, it is postulated that women with a higher educational level have more choice, more control and power over their living conditions and household (Boender et al., 2002).

Research also showed that survival chances are higher for children of mothers who participate in domestic decision-making (Alemayehu et al., 2015; Hossain, 2015). According to the Nigeria Demographic and Health Survey (NDHS), women are considered to participate in household decisions when they can make decisions on: (i) their own

health care, (ii) major household purchases, and (iii) visits to family or relatives (National Population Commission, 2019). Women who can control their own or their children's health care will be able to act more rapidly and appropriately in the event of possible health problems (Caldwell, 1986). Women are usually the primary caregivers of the family and therefore the first to notice health problems with the child (Lesnick et al., 2010). Moreover, it is important that women have a say in the decision-making process regarding household purchases because the appropriate care for children in terms of nutrition, hygiene and health, among other things, often depends on the mother's ability to make decisions (Kabeer, 2012).

To further explore the relationship between women's empowerment and child mortality, this study aims to determine whether a higher degree of empowerment of women of reproductive age (15-49 years) in Nigeria is positively associated with a better survival chance of their children (0-5 years), taking into account the social context: the bio-demographic characteristics of the mother and child and the socio-economic characteristics of the household. Based on the abovementioned literature, we assume that: (i) a higher degree of empowerment in women of reproductive age (15 - 49 years), (ii) a better socio-economic status of the household, and (iii) more favorable biodemographic factors of the mother and child are positively associated with child survival rates.

Context: Nigeria

Nigeria is the most populous country in Africa with over 2000 million inhabitants. Although Nigeria's fertility rate has been declining since 1981, the Nigerian population is expected to grow to approximately 329 million inhabitants in 2050 (United Nations, 2017). The country has a very young population, a high dependency ratio (82%), and a high level of poverty (71%). More than two-thirds of the population lives below the international poverty line of \$1.25 per day with a gross national income is \$1,180 (Ezeh et al., 2015).

The probability of child mortality is high, partly because Nigeria's health care system is insufficient: there are not enough skilled caregivers and medical professionals and there is a lack of modern medical equipment (Welcome, 2011). In addition, there are no successful family planning programs in Nigeria that help reduce the number of births (Central Intelligence Agency, 2019). This is due to the absence of government funding and political commitment and the limited availability and affordability of contraceptives and family planning services (Central Intelligence Agency, 2019).

According to the 2018 NDHS, the Nigerian government is committed to promote gender equality and women's empowerment by implementing a number of institutional and policy measures and by allocating financial resources to programs that promote gender equality (National Population Commission, 2019). Nevertheless, there is still a gap between the Millennium Development Goal (MDG3) aimed at promoting gender equality and women's empowerment and the realization in Nigeria. Contrary to the NDHS, Ejumudo (2013) states that the Nigerian government is characterized by a lack of political

will, a prevailing patriarchal culture, false public investment, and a lack of sufficient capacities that will create opportunities for women's empowerment and development (Ejumudo, 2013). Furthermore, she argues that the government of Nigeria has made efforts to eliminate gender discrimination and ensure gender equality, but the national gender policy remains mainly focused on the problem of gender inequality, and not on strengthening women's empowerment (Ejumudo, 2013).

Methods

Data

This study is based on the 2018 NDHS data. The NDHS is a nationally representative survey that provides data on a wide range of demographic and health-related indicators. The survey was carried out on a random stratified cluster sample of the Nigerian population. A total of 40,427 households and 42,121 women were selected for interviews. Not less than 41,821 women completed the interviews of which 29,992 had at least one child during the ten years prior to the survey. Women who gave birth to children in the 59 months preceding the interviews were excluded from the analysis because their children have not yet been exposed to the risk of dying during five full years. Since only one woman per household was asked about partner violence, the number of respondents in the sample was further reduced. Respondents with missing data for at least one of the variables used in the analysis were also excluded. Finally, analyses were based on 15,404 women, who had a total of 29,090 children between 2008 and 2013. We used the NDHS Birth Recode dataset combined with the Individual Recode dataset as these contain extensive information on all live-born children of the interviewed women, including all the data collected in the Women's Questionnaire and the full birth history of all interviewed women.

Variables

The outcome variable of this study was child mortality. This was measured through the retrospective birth history in the Women's Questionnaire of the NDHS, where all female respondents had to indicate how many children they have given birth to, specifying the date of birth and the current age or age at death. This study focuses on child mortality among women who gave birth in the period 2008 to 2013, thus including all women with children who have been exposed to the risk of dying for at least five years, ten years prior to the survey. Respondents were considered to have experienced child mortality if at least one child died between the ages of 0 and 5 in the period 2008 to 2013 (1 = yes and 0 = no).

The independent variable of this study was women's empowerment. This was assessed by means of three dimensions: (i) attitude towards partner violence, (ii) level of education, and (iii) participation in household decisions. Similar to research by Boender et al. (2002), Stiyaningsih & Wicaksono (2017) and Dube-Mawerewere et al. (2018), the dimension 'participation in domestic decisions' will be used for analysis. Whether or not to approve of partner violence is put forward by the NDHS itself as an important indicator of women's empowerment, and is used in the models of, among others, Busetta & Puglisi (2019). According to the DHS, women are supposed to have an attitude that justifies partner

violence (wife beating) if they state to agree that wife beating is justified in several situations such as burning the food, leaving home without telling her partner, refusing sex, etc. Although agreeing to such statements does not necessarily imply that women approve of such behavior, it does suggest that women accept the values that give men the right to discipline women by force (Kishor & Subaiya, 2008). If women agree with statements justifying partner violence, they are in fact agreeing to standards that maintain gender inequality and put their own say in the hands of their partner (Boender et al., 2002). The importance of the concept of educational attainment in measuring women's empowerment has been demonstrated by Duflo (2012) and Hossain (2015), among others.

First, the respondent was assumed to have an attitude that justifies partner violence (wife beating) if she answered 'yes' at least once to the following statements: "Is it right for a man to beat his wife in the following five circumstances? (i) she burns the food; (ii) she quarrels with her partner; (iii) she leaves the house without telling her partner; (iv) she neglects the children; and (v) she refuses to have sex with him"? (1= no and 0 = yes). Second, the respondent was considered to be higher educated if she has completed secondary or higher education (1 = yes and 0 = no). Third, the respondent was presumed to have a say in household decisions when she takes decisions either alone, together with her spouse or someone else, in all three areas: personal health care, important household purchases and visits to relatives and friends (1 = yes and 0 = no). The variable participation in household decision originally consisted of three separate indicators in the NDHS: participation in own health care, participation in important household purchases and participation in visits to relatives and friends. In this study these items were merged into one variable as the Cronbach alpha coefficient of the three 'participation' indicators measured 0.861, which indicates that the variables had relatively high internal consistency.

The control variables consisted of a range of socio-economic and biodemographic factors. The biodemographic factors of mother and child included: age at first birth (1 = 15 years or younger and 0 = older than 15 years), birth interval (1 = less than 13 months and 0 = 13 months or more), total number of children born alive (1 = more than 3 children and 0 = 3 children or less) and sex of child (1 = boy and 0 = girl). The socio-economic background of the respondent was assessed through the wealth index. The score for this wealth index was derived from the number and type of consumer goods owned by the household, such as a television, a bicycle, sanitary facilities, water supply and the like. In this study, the wealth index was converted into a binary variable: the categories poorest and poorer were combined into one category as are and the categories middle, richer and richest. The respondent was considered to be living in poorer socio-economic conditions when living in a household belonging to the poorer or poorest income group (1 = yes and 0 = no).

Analyses

Exploratory and multivariate regression analyses were used to assess the relationship between women's empowerment and child mortality. In order to gain insight into the

possible relationship between the variables, an exploratory analysis was carried out by means of a cross table (Table 1) with the dependent variables (child mortality) and the independent and control variables (women's empowerment, biodemographic characteristics and socio-economic background). Additionally, chi-square tests were performed.

All variables that showed a significant correlation were subsequently used in the multivariate logistic regression analysis (Table 2). Three models were specified, each relating to the research questions and hypotheses. Model 1 consists of the independent variable women's empowerment. In Model 2 socio-economic factors were added while biodemographic characteristics were added in Model 3. The -2 log likelihood and the Nagelkerke R square were used to test the fit of the model.

Results

Descriptive

In the period 2008 to 2013, a total of 29,090 births took place, of which 3,758 children died before reaching their fifth birthday.

Table 1. Distribution of child mortality according to women's empowerment and socio-economic and bio-demographic control variables

Variables	Total (n=29090)	Child mortality		P-value
		Yes (n=3758)	No (n=25332)	
Women's empowerment				
Attitude towards partner violence				
Not justified	18980	2228 (11.7)	16752 (88.3)	0.000
Justified	10110	1530 (15.1)	8580 (84.9)	
Participation in household decisions				
No participation	20369	2953 (14.5)	17416 (85.1)	0.000
Full or partial participation	8721	805 (9.2)	7916 (90.8)	
Education level				
No	15961	2602 (16.3)	13359 (87.7)	0.000
Primary	5366	618 (11.5)	4748 (88.5)	
Secondary	6263	464 (7.4)	5799 (92.6)	
Higher	1500	74 (4.9)	1426 (95.1)	
Bio-demographic factors				
Age at first birth				
15 years or younger	5857	898 (15.3)	4959 (84.7)	0.000
Older than 15 years	23233	2860 (12.3)	20373 (87.7)	
Birth-interval				
13 months or less	1310	309 (23.6)	1001 (76.4)	0.000
More than 13 months	27780	3449 (12.4)	24331 (87.6)	
Total number of children born alive				
More than 3 children	26430	3588 (13.6)	22842 (86.4)	0.000
1 to 3 children	2660	170 (6.4)	2490 (93.6)	
Sex of child				
Boy	12872	1961(13.2)	12872 (86.8)	0.117
Girl	12460	1797 (12.6)	12460 (87.4)	
Socio-economic factors				
Wealth index				
Poorest to poor	14854	2430 (16.4)	12424 (83.6)	0.000
Middle to richest	14236	1328 (93.3)	12908 (90.7)	

Source: Demographic and Health Surveys, Nigeria 2018.

Note: Relative frequencies are presented between brackets.

Table 1 provides an overview of the distribution of child mortality according to the independent and control variables. The results indicated that women who justify partner violence experienced more child mortality than women who do not justify partner violence (15.1% versus 11.7%). Similarly, women who do not have a say in domestic decisions were more affected by child mortality than women who have a full or partial say, respectively 14.5% versus 9.2%. Furthermore, there was a clear difference within the different levels of education: child mortality decreased when the level of education increased. All independent variables had a p-value of less than 0,000 and were therefore statistically significant. All but one of the control variables were statistically significant: the sex of the child showed no statistically significant relationship. Apart from that, children of mothers with less favorable biodemographic factors, such as a young age at first birth, a low birth interval and a high total number of children born alive showed a higher child mortality. The wealth index showed that children of mothers belonging to the poorest and poorer category were significantly more affected by child mortality than children of mothers belonging to the middle to richest category, respectively 16.4% versus 9.3%.

Multivariate

With the logistic regression analysis, we tested whether empowerment of women and infant mortality are related (Model 1) and whether these relationships remain statistically significant when the influence of socio-economic and biodemographic factors are taken into account (Models 2 and 3).

In the first model, the dimensions associated with women's empowerment showed a significant relationship with child mortality. Children of women who do not have a say in household decisions had an expected odds of child mortality that was 1.33 times higher than children of women who do have full or partial say in household decisions, when the variables educational level and partner violence were constant. Children of women who have no or primary education had an expected odds of child mortality that was 2.11 times higher than children of women with a secondary or higher education degree. Finally, children of women who do justify partner violence had an odds that was 1.14 times higher compared to children of women who do not justify partner violence.

In Models 2 and 3, the relationship between empowerment and child mortality was re-estimated after control for the biodemographic and socio-economic factors. This made the relation between the women's empowerment variables and child mortality slightly less strong, but still significant.

In Model 2, children of women belonging to the poorest or poorer category had an expected odds that was 1.44 times higher than children of women belonging to the middle, richer or richest category, keeping all women's empowerment variables constant. The addition of the wealth index variable caused the odds to decrease slightly in the women's empowerment variables, although the relations remained statistically significant. The -2 Log Likelihood statistic dropped to 21867,396, indicating that this model was better for predicting child mortality than Model 1. Moreover, the addition of

the wealth index increased the explanatory power of the model (Nagelkerke's pseudo R2 of 0.033).

In Model 3, the biodemographic factors were added: total number of children, birth interval, age at first birth and sex of the child. Children of women with three or more children had an odds that was 1.74 times higher than children of women with less than three children. Children of women with birth interval equal to or shorter than 13 months had an odds that was 2.13 times higher than children of women whose birth interval was 13 months or more. In addition, children of women who were aged 15 or younger at their first birth had an odds that was 1.08 times higher than children of mothers who were older than 15 years at childbirth. Finally, the odds for boys compared to girls was 1.06, but this correlation was not statistically significant ($p > 0.05$). The -2 Log Likelihood statistic decreased to 21699,614, allowing the conclusion that Model 3 predicted most accurately child mortality. In addition, Nagelkerke's pseudo R2 has increased to 0.044, which gave Model 3 the most explanatory power of all three models. With the addition of the bio-demographic control variables, the odds on child mortality in the women's empowerment variables decreased more, albeit to a lesser extent than in the previous step of the analyses (from Model 1 to Model 2).

Table 2. Multivariable logistic regression of child mortality, Nigeria (2008 - 2013), N=29.090

	Model 1		Model 2		Model 3	
	OR	S.E.	OR	S.E.	OR	S.E.
<i>Intercept</i>	0.06***	0.05	0.06***	0.05	0.04***	0.09
Women's empowerment						
Partner violence justified (ref. no)	1.14***	0.04	1.10**	0.04	1.08*	0.04
No participation in household decisions (ref. yes)	1.33***	0.04	1.26***	0.05	1.24***	0.05
Educational level: no to primary (ref. secondary to higher)	2.11***	0.05	1.78***	0.05	1.67***	0.06
Socio-economic factors						
Wealth Index: poorest to middle (ref. rich to richest)			1.44***	0.04	1.44***	0.04
Bio-demographic factors						
More than 3 children born alive (ref. 1 to 3 children)					1.74***	0.08
Birth interval 13 months or less (ref. 13+ months)					2.13***	0.07
Age 15 years or younger at first birth (ref. 15+ years)					1.08*	0.04
Sex of child: boy (ref. girl)					1.06	0.04
-2 Log Likelihood	21950.578		21867.396		21699.614	
Nagelkerke R-square	0.028		0.033		0.044	

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Source: Demographic and Health Survey, Nigeria 2018.

Conclusion

The results of the logistic regression support the hypotheses that women's empowerment and child mortality in Nigeria are related, even when controlling for the socio-economic and bio-demographic factors.

First, we see that the three dimensions of empowerment demonstrate a statistically significant relation to child mortality. Among these three dimensions, the level of

education appeared to be the most important: the odds on infant mortality were highest among children of women who do not have any education or primary schooling. This result is in line with the findings of previous studies (Mondal et al., 2009; Ezeh et al., 2014; Alemayehu et al., 2015; Stiyaningsih & Wicaksono, 2017; Adewusi & Nwokocha, 2018). For instance, Azuike et al. (2019) found that having a mother that had minimum of secondary education reduced the odds of child mortality by 26% in south-eastern Nigeria. Furthermore, analysis of the 2013 NDHS show similar results: the child mortality rate was highest (46.0%) among mothers with no education and lowest (13.6%) among mothers with at least tertiary education (Adeolu et al., 2016).

In addition to the level of education, participation in household decisions also appeared to be an important dimension: the odds were significantly higher among children of women who do not have a say in the household, as opposed to those who do have or who have partial participation. Household participation refers to three factors: participation in major purchases, visits to relatives and friends, and own health care. The results are similar to previous studies. Hossain (2015) found that increased mother's participation in household decisions and a higher autonomy in movement are inversely associated with the infant mortality rate in Bangladesh. Women who do have a say in the household can act autonomously and more quickly when it comes to their own personal health care and that of their children, which in turn could lead to a reduction in child mortality (Hossain, 2015). Furthermore, a study in Ethiopia found that the association between woman's education and infant mortality is mediated by woman's empowerment and not by household wealth, which suggests that an increase in women's education could decrease the risk of infant deaths, presumably because of the power it gives a woman in making household decisions rather than the additional wealth it brings to the household (Alemayehu et al., 2015).

The justification or non-justification of partner violence is also associated to child mortality, albeit to a lesser extent than the previous two dimensions. The variable lost significance when socio-economic and biodemographic control variables were added to the model. Nevertheless, the odds of child mortality were higher among women who do justify partner violence compared to those who do not. Although no studies include the justification or non-justification of partner violence in the association with women's empowerment and child mortality, a lot of studies did find a relation between women who have been exposed to intimate partner violence (IPV) and child mortality (Rico et al., 2011; Hossain et al., 2014; Memiah et al., 2020). For instance, Memiah et al. (2020), found newborns, infants and children under five children significantly more likely to die when they were born to women who are IPV survivors.

Finally, this study revealed that a number of biodemographic and socio-economic factors were associated with the survival of children in Nigeria. Children of women who (respectively) had more than 3 children, were 15 years of age or younger at first birth, had a birth interval of 13 months or less, or belonged to the poorest or middle category of the wealth index had a higher odds on child mortality. The odds were highest for children of women who had a smaller birth interval, which is in line with the results of previous

studies (Mondal et al., 2009; Ezeh et al., 2014; Stiyaningsih & Wicaksono, 2017; Biradar et al., 2019) Additionally, the odds of child mortality were relatively high for children of women who had more than three children. Similarly, Mondal et al. (2009) found an increased risk of infant mortality with a higher birth order. An early age at first childbirth showed higher odds but less statistically significant compared to the previous two biodemographic factors. The association with the wealth index suggests that richer families have the ability to take better care of the mother and child, which increases children's chances of survival (Hossain, 2015).

Discussion

In conclusion, we can state that increasing women's empowerment could have a declining effect on child mortality. Children of women who (respectively) are less empowered, especially in regard to education and household decision making, who have had many births in the past, have a short birth interval, and belong to poorer households have lower survival rates in Nigeria.

A number of policy implications derive from these findings. First, as women's empowerment appears to be a crucial factor in reducing child mortality, more effort should be made to enhance women's empowerment, not only to reduce child mortality, but also for the general well-being of women and the entire population. Second, more emphasis is needed on the importance of education for girls and women, as a higher educational level is proven to be beneficial to combat child mortality. Third, the results indicate that women living in poverty are more likely to experience child mortality, it is therefore essential that maternal and child health services are provided to and targeted towards the poorest communities in order to meet their healthcare needs. Finally, policies should invest in family planning programs and ensure sufficient and regular supply of modern contraceptives, to enable women to have longer birth intervals.

This study has some strengths and limitations. First, the cross-sectional nature of the DHS data makes it difficult to correctly grasp the concept of women's empowerment. Women's empowerment should be seen as a process but the data from this study are collected at one point in time, which makes it statistically impossible to establish causality between the various variables. Women who now appear to be empowered have not necessarily always been so. This discrepancy is important to consider when analyzing the results of this study. Second, the quality of the children's mortality estimates depended on the mother's ability to recall the exact date of birth and death of their children (National Population Commission, 2019). There is a possibility some mothers did not remember the exact age of their children's death as they may try to omit these unpleasant events. This results in the underestimation of childhood mortality, a non-sampling error (National Population Commission, 2019). Third, not using sample weights to accommodate for the clustered nature of the DHS data is another limitation of this study. Finally, the dataset used in this study consists solely of married women who gave birth to at least one child in the years 2008 – 2013; creating an important limitation for this study. The use of the DHS dataset is also a strength of this study. The data is nationally representative and thus generalisable to the entire country. Besides, we used the most

recent dataset, which allows us to draw accurate conclusions and provide relevant policy implications.

Future research could focus more on the contextual aspect of empowerment, for example, by conducting a multi-level analysis to implement empowerment variables at both individual and community-level or by conducting time series analyses. Furthermore, more control variables could be included to further explore the extent to which the original relation between women's empowerment and child mortality is affected.

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