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ABSTRACT

While researchers have devoted considerable attention to the impact of individual-level factors on child mortality, less is known about how community characteristics affect health outcomes for children, even though they have a prominent role in theoretical models. Using data from the latest round of Demographic Health Surveys (DHS) for all countries in sub-Saharan Africa, this study uses multivariate and multilevel discrete-time event history analysis to systematically examine the impact of contextual factors on the risk of dying before age five, and their relative importance in relation to individual factors. The results indicate that some attributes of the community influence the mortality risks of children, over and above the intermediate factors included in this investigation. For instance, in half of the countries under study a 1% increase in the proportion of children fully immunized in the community is associated with a decrease of 17-79% in the odds of dying before age five. The proportion of women in the community completing secondary school also significantly increases child survival. In some countries, this effect is in addition to the positive individual-level effect of the child's own mother being educated. Net of individual and household characteristics, higher community-level ethnic homogeneity is associated with decreased odds of dying before age five, in some countries. Overall, the results of this study suggest that the challenge to reduce under-five mortality goes beyond addressing individual factors, and requires a better understanding of contextual factors.

Keywords: child mortality; individual-level effects; community-level effects; multilevel modeling; sub-Saharan Africa

INTRODUCTION

Disparities in child health between and within countries have persisted and widened considerably during the last few decades (Bryce et al. 2006; Moser et al. 2005). The reduction of these disparities is a key goal of most developing countries' public health policies, as outlined in the Millennium Development Goals 2015 (Lawn et al. 2007). It is well recognized that disparities in child health outcomes may arise not only from differences in the characteristics of the families that children are born into but also from differences in the socioeconomic attributes of the communities where they live (Fotso and Kuate-Defo 2005; Griffiths et al. 2004; Kravdal 2004; Ladusingh and Singh 2006; Montgomery and Hewett 2005; Robert 1999; Sastry 1996). Indeed, the incorporation of community-level factors in the analysis of child mortality provides an opportunity to identify the health risks associated with particular social structures and community ecologies, which is a key policy tool for the development of public health interventions (Pickett and Pearl 2001; Stephenson et al. 2006).

Nonetheless, while researchers have devoted considerable attention to the impact of individual-level factors on child mortality, less is known about how community characteristics affect health outcomes for children, even though they have a prominent role in theoretical models (most notably Mosley and Chen 1984; Schultz 1984). Existing studies generally have a limited focus (a single country) and are quite heterogeneous in the data, definitions, and methods adopted (Rajaratnama et al. 2006; Schaefer-McDaniel et al. 2010). To my knowledge, there are no recent studies that systematically examine contextual influences on child mortality cross-nationally.

The present study takes advantage of the most recent national survey data to reexamine the issue of contextual effects on childhood mortality in sub-Saharan Africa. In doing so, it contributes to the literature that explores the implications of contextual factors for child mortality by examining the effects of community context on the risk of dying before age five, net of the effect of individual factors. In many respects, the analysis updates previous work by Desai and Alva (1998), Gakidou and King (2002), and Rutstein (2000). However, it adds importantly to this stream of literature by providing consistent and comparable results from a multilevel analysis of the factors associated with child mortality in sub-Saharan Africa.

LITERATURE REVIEW

Despite the insights provided by the rare analyses of African data (Balk et al. 2004; Gakidou and King 2002), scientific knowledge on how community-level factors influence child survival remains fragmentary. Existing studies have been restricted to the analysis of clustering at a single level (family or community), and thus have ignored the complete hierarchical structure of the data (Gibbons and Hedeker 1997). I go beyond previous efforts in this field by developing a multilevel model to quantify the magnitude and importance of clustering mortality risks at the family and community levels. My model explicitly accounts for the unobserved heterogeneity by using—simultaneously—family and community random effects with a cross-level correlation structure (Manda 1998).

In this section, I summarize the literature that indicates how the community environment matters for the health of children. I also discuss the possibility of endogeneity bias when analyzing this relationship and provide an overview of the ways in which endogeneity has been addressed in the literature.

Community-Level Effects on Child Mortality

Mosley and Chen's (1984) well-known framework of the proximate causes of child mortality links outcomes to socioeconomic determinants at individual, household, and community levels. Several theoretical and practical considerations support the idea that the community where a child is born is important for the child's health and survival, particularly in Africa (Ellen et al. 2001; Entwisle et al. 2007; Huie 2001; Robert 1999).

In many areas of African countries, families cannot easily access routine health services, and health outcomes depend on community-based services and norms (WHO 2005). It follows that "place and health are intimately linked, given that goods and services, exposure to hazards, and the availability of opportunities are all spatially distributed" (Do and Finch 2008). Generally, community is considered to be spatially-referenced and bounded, and its role in determining the health of individuals who live in a community becomes evident, as most government and non-government activities are spatially organized (Arguillas 2008). Provision of health care and other

public services, such as water supply, electricity, and sanitation are implemented at the level of a geographically defined community. The availability of a health infrastructure in the community has the potential to improve the survival chances of young children, because it provides more opportunities for health care and reduces the costs of obtaining health-related goods and services (The Cebu Study Team 1991). The prevailing norms and attitudes about health behaviors could also influence the health care decisions made by individuals (Rutenberg and Watkins 1997). Similarly, the quality of the physical environment in the community where children live has important consequences for their health.

Studies during the past two decades have increasingly used multilevel methods to examine the independent effect of contextual factors on child mortality, as distinct from the more widely investigated individual factors. In particular, communities' educational and literacy levels have been found to have a strong effect on children's health outcomes (Kravdal 2004; Parashar 2005). The level of socioeconomic development also appears to have a positive effect on child health and nutritional status (Boyle et al. 2006; Fotso and Kuate-Defo 2005; Montgomery and Hewett 2005), as well as on access to health care and health infrastructure (Andes 1989; Macintyre et al. 2002; Matteson et al. 1998; Pickett and Pearl 2001). Finally, variation in child health outcomes can be framed by contextual issues relating to culture (Say and Raine 2007), such as ethnic composition (Weeks et al. 2006) and polygyny (Omariba and Boyle 2007).

In sum, several physical and social attributes of the community have been shown to affect the health of young children, regardless of the household context that the children are born into (Arguillas 2008). Thus, in this analysis I take a holistic approach by simultaneously examining several dimensions of the community environment that have the potential to influence the risk of a child dying before age five (Kravdal 2004; Macintyre et al. 2002; Matteson et al. 1998; Mosley and Chen 1984; Stephenson et al. 2006).

Methodological Issues and Endogeneity Bias

Separating the variations in health outcomes that may be due to area-level factors from those that may be due to the characteristics of individuals and families requires appropriate modeling, and poses methodological challenges (Angeles et al. 2005; Diez Roux 2004). The

primary methodological challenge in estimating the causal effect of community-level characteristics on individual health status is the endogeneity of residential location for health outcomes (Do and Finch 2008). This is because community characteristics are determined by the individual characteristics of their residents (Diez Roux 2004: 1956). An additional source of endogeneity is that certain community characteristics, such as a developed infrastructure or the availability of health services, may be purposively placed in areas with particularly poor health, or where there is higher demand for services, and more influence over governmental decisions (Burgard 2002).

It is widely recognized that cross-sectional studies of community context and health are subject to upward biases due to unobserved heterogeneity, and to downward biases due to over-adjustment for potential mediators in the pathway between community context and individual health (Do and Finch 2008: 611). A number of options are available to address the biasing effect of endogeneity (Kawachi and Subramanian 2007). For instance, Pritchett and Summers have carried out extensive econometric analysis using a range of instrumental variables to identify the "pure" income effect on infant and child mortality, isolated from reverse causation or incidental association (Pritchett and Summers 1996). Other analytic methods that have been used to adjust for endogeneity bias in cross-sectional analysis include propensity score matching (Do and Finch 2008) and structural model estimation (Guilkey and Riphahn 1998).

These techniques are beyond the scope of the present analysis and the readily available software. Rather, I compare three practical approaches that researchers can choose to produce a more accurate estimate of their standard errors: clustered robust estimation, fixed-effects modeling, and multilevel modeling (Allison 2009; Rabe-Hesketh and Skrondal 2006). This is in order to overcome the bias due to unobserved heterogeneity at the household and community levels, and to take into account the hierarchical structure in the data. I advocate using these three methods together because they complement one another, and each one contributes evidence that is missing from the other two (described in detail in the next section). Comparative analysis will reveal the robustness of the results.

DATA AND METHODS

Data Sources

The study uses data from all most recent Demographic and Health Surveys (DHS) available (as of July 2010) for sub-Saharan Africa: Benin (2006), Burkina Faso (2003), Cameroon (2004), Chad (2004), Congo Brazzaville (2005), Congo Democratic Republic (2007), Ethiopia (2005), Gabon (2000), Ghana (2008), Guinea (2005), Kenya (2008-2009), Lesotho (2004), Liberia (2007), Madagascar (2008-2009), Malawi (2004), Mali (2006), Mozambique (2000-2001), Namibia (2003), Niger (2006), Nigeria (2008), Rwanda (2003), Senegal (2005), Sierra Leone (2008), Swaziland (2006-2007), Tanzania (2004-2005), Uganda (2006), Zambia (2007), and Zimbabwe (2005-2006).

For all 28 countries, information on child mortality is derived from full birth histories collected from women of reproductive age. The analysis is restricted to children born in the five-year period before the survey, because of the availability of information on maternal and child health. Details regarding sample design and data collection procedures can be found in the individual country reports. The number of children included in the analysis ranges from 2,829 in Swaziland to 28,100 in Nigeria (Table 1). Table 1 also gives the average number of births per family and community, by country.

Table 1: Total number of births, average number[1] of births in families and communities, and under-five mortality rate: DHS in 28 countries in sub-Saharan Africa, 2001-2007

Country and Region	Year of survey	Total number of births during the 5 years before the survey[1]	Average number of births[1]		Under-five mortality (5q0)*
			Family	Community	
Western Africa					
Benin	2006	15,929	1.7	21.4	124.9
Burkina Faso	2003	10,852	1.9	27.0	183.7
Ghana	2008	2,909	1.5	6.9	80.0
Guinea	2005	6,370	1.8	21.8	163.2
Liberia	2007	5,594	1.6	19.5	109.5
Mali	2006	14,420	1.8	35.9	190.5
Niger	2006	9,954	1.9	29.1	197.6
Nigeria	2008	28,100	1.8	30.8	156.9
Senegal	2005	10,530	2.2	27.0	121.3
Sierra Leone	2008	5,811	1.6	16.6	139.8
Middle Africa					
Cameroon	2004	8,097	1.8	17.6	143.6
Chad	2004	5,989	1.8	32.3	190.6
Congo Brazzaville	2005	4,948	1.6	23.2	116.6
Congo Democratic Republic	2007	8,999	1.8	30.8	147.9
Gabon	2000	4,031	1.8	15.8	88.6
Eastern Africa					
Ethiopia	2005	11,163	1.6	20.4	123.5
Kenya	2008-2009	5,852	1.6	15.1	114.6
Madagascar	2008-2009	12,686	1.6	21.2	93.9
Malawi	2004	10,771	1.5	18.7	133.2
Mozambique	2000-2001	10,620	1.6	16.8	152.4
Rwanda	2003	8,715	1.6	18.9	152.4
Tanzania	2004-2005	8,725	1.7	18.0	112.0
Uganda	2006	8,423	1.8	23.1	127.6
Zambia	2007	6,435	1.7	20.1	118.7
Zimbabwe	2005-2006	5,231	1.4	13.1	82.5
Southern Africa					
Lesotho	2004	3,572	1.3	8.6	112.8
Namibia	2003	5,003	1.5	10.4	69.4
Swaziland	2006-2007	2,829	1.6	10.7	119.9

[1] Weighted.

Note: * Probability of dying between birth and age 5, refer to a 5-year period before the survey, and they are expressed as a rate per 1,000 live births.

Source: Macro International Inc, 2010. MEASURE DHS STAT compiler. http://www.measuredhs.com, April 26 2010.

Analytical Strategy

In this study I attempt to separate individual-level and household-level factors from contextual factors associated with child survival by using multivariate and multilevel event history models to account for right-censoring in the estimation of exposure time (Allison 1982; Reardon et al. 2002; Sear et al. 2002). The outcome variable of interest is the risk of death in childhood (0-59 months), measured as the duration from birth to the age at death, or censored. Children who were still alive at the time of the interview were right censored. Since in the DHS age at death (reported in days and months) is subject to heaping at certain ages, a discrete formulation of time is preferred to a continuous one. Discrete-time hazard models require that episodes be split into periods of risk (Singer and Willett 2003). Five exposure periods are defined here: 0, 1-5, 6-11, 12-23, and 24-59 months.

The analytical strategy for the study relies on estimating three sets of models for each country (Table 2).

Table 2: Summary of procedure and decision rules for variables entered and included in the multivariate and multilevel event history models

Model	Estimation Technique	Independent Variables	Procedure and Software
Model 1	Standard logit discrete-time model accounting for within-cluster correlation by using the Huber-White procedure	Conventional logistic regression predicting children's probability of dying by their fifth birthday with only individual-level variables as predictors.	*logit in Stata*
Model 2	Conditional logit discrete-time model or fixed-effects logit model	Model 2 adds to Model 1 cluster-level fixed effects to control for unobserved community-level characteristics. The covariates are same as in Model 1.	*clogit in Stata*
Model 3	Multilevel discrete-time logit models with three-level (community, family, child) random intercepts	The multilevel analysis uses a sequential approach to model building. First, I created an unconditional model (model 3a) in order to determine the proportion of variance in the outcome that is attributed to within- and between-group differences. Then, in model 3b I added individual-level variables (child and family characteristics) as predictors. Finally, in model 3c I added community-level characteristics.	*Markov Chain Monte Carlo (MCMC) procedure in MLwin (version 2.16)*

First, I estimate "naïve" logistic regression models predicting children's probability of dying by their fifth birthday, accounting for within-cluster correlation by using the Huber-White procedure (Huber 1967; Rogers 1993)[1]. The basic formulation of the standard discrete-time model is:

$$\text{Logit}[p_{ti}] = \alpha_t + \beta X_{ti}$$

where p_{ti} is the probability of having an event (i.e., death) at time t, given that the event has not occurred before t. The logit function of p_{ti} is modeled by predictors X_{ti} and corresponding coefficients β. In this step, covariates include only individual-level characteristics, as in many previous studies. This "naïve" model provides a baseline against which to compare the results of more complex models, to be estimated as indicated below.

In the second step, I estimate cluster-level fixed-effects models, which include a linear effect for unobserved community-level factors on the risk of dying before age five. The fixed-effects approach has been used to analyze the role of individual, family, and community factors in determining infant mortality in other social contexts, using DHS data (Desai and Alva 1998; Frankenberg 1995). In their study exploring the causal effect of mother's education on infant mortality, Desai and Alva (1998) used a fixed-effects logit model in order to understand the potential biases from omitted community unobservables. I follow the same approach in this step. The model is given by:

$$\text{Logit}[p_{tij}] = a_j + \alpha_{tj} + \beta X_{tij}$$

Here, j indexes clusters (i.e. the primary sampling units (PSUs)), i (i=1, 2) indexes matched children within each cluster, and a_j represents cluster effects (i.e. the effects of all unmeasured variables that are specific to each cluster but constant over time). Note that no time-invariant covariates are included in the model, as their effects are absorbed into the a_j term. An indication of the extent to which the data for the present analysis are clustered is that each family contributes more than one child to the samples. As can be seen in Table 1, in 23 of the 28 countries included in the analysis the average number of births per family is about two. Overall, the average number of births per community ranges from 7 in Ghana to 36 in Mali (Table 1).

[1] The Huber-White procedure produces results identical to those of the svylogit procedure (not shown), which is the specific Stata routine recommended to account for the DHS complex survey design.

PSUs, or clusters, are administratively-defined areas used as proxies for "neighborhoods" or "communities" (Diez Roux 2001), and are relevant when the hypothesis involves policies (Pearl et al. 2001: 1874). They are small and designed to be fairly homogenous units with respect to the population's social and demographic characteristics, economic status, and living conditions, and they are made up of one or more enumeration areas (EAs), which are the smallest geographic units for which census data are available in the country (Montgomery and Hewett 2005: 402). Generally, a rural community spans one village or settlement, whereas an urban community is a part of a city (Montgomery and Hewett 2005). As do Desai and Alva (1998: 73), I use the terms communities and clusters interchangeably.

One important question about community-level effects that motivates this paper is whether they have a significant impact on the risk of death in poorly-equipped contexts, as in sub-Saharan Africa (WHO 2005). The fixed-effects logit estimates proposed here provide information with which to answer that question, conditional on the underlying specification. The fixed-effects models clarify which community variables affect mortality, the direction of the effects, and the magnitude of the effects on relative mortality risks (Frankenberg 1995). This specification allows for the possibility that unobserved heterogeneity affects child survival (Sastry 1997b).

I estimate fixed effects logit regressions by relying on conditional logits (Allison 2009). This method is also known as the case-control technique (Chamberlain 1980), which requires that we must first pair children within clusters. Thus I randomly selected pairs of children from each cluster, consisting of one death reported during five years preceding the survey (cases) and one birth that survived during the same time period (controls). All pairs in which both children had an identical value for the dependent variable (death or alive), therefore, are excluded from the estimation of the fixed-effects logit model. Such exclusion leads to a reduction in the sample size, which can be quite substantial and may affect the precision of the estimated effects of the covariates. Here, the comparison of more than one estimation method indicates that the results are robust in spite of this issue. In addition, because of this approach, the effect of any variable that does not vary between children in the cluster (for example, urban/rural residence) cannot be estimated in this model.

By using DHS data, it is possible to construct appropriate community-level measures for selected covariates of interest, and, in some cases, the surveys even directly provide information

on community-level characteristics (Van de Poel et al. 2009). On the basis of these measures (described in detail in the next section), in the final step of the analysis I apply logit discrete-time models with three-level random intercept to correctly account for the hierarchy in the DHS data, and properly assess the impact of community-level factors on child mortality net of individual-level factors. The hierarchical structure of the data presents children (level 1), as nested within mothers (level 2), who are in turn nested within communities (level 3).

The multilevel modeling strategy accommodates the hierarchical nature of the data and corrects the estimated standard errors to allow for clustering of observations within units (Goldstein 2003). A significant random effect may represent factors influencing the outcome variable that cannot be quantified in a large-scale social survey. A random effects model thus provides a mechanism for estimating the degree of correlation in the outcome that exists at the family level and community level, while also controlling a range of child-level, family-level, and community-level factors that may potentially influence the outcome.

Assuming a logit link between the hazard rate and the explanatory variable, the three-level random-effects discrete-time hazard model can be expressed as:

$$\text{Logit}[\ (p_{tijk}/(1- p_{tijk})] = \alpha_t + \mathbf{X}_{tijk}\beta + \mu_{jk} + \nu_k$$

where p_{tijk} is the probability that child i in household j in community k observed in the time interval t dies within that interval; $\mathbf{X}_{tijk}$ is a vector of community and family-child level explanatory variables; β is a vector of unknown regression parameters associated with the explanatory variables $\mathbf{X}_{tijk}$; α_t is a function of time and is defined for age; and μ_{jk} [$\sim N(0,\sigma^2_\mu)$] and ν_k [$\sim N(0,\sigma^2_\nu)$] are error terms at the mother and community levels, respectively, that give an indication of the variation after controlling for the individual-level characteristics (Manda 1998). The error terms are standardized to have mean zero and variance of σ^2_μ and $\sigma^2_{\nu,}$ respectively, and are assumed to be uncorrelated. In this paper, the variances can be interpreted in terms of intra-class correlations (ρ_ν and ρ_μ; for the community and family, respectively) in a latent variable reflecting the unobserved factors that are shared among children in the same community or in the same family[2]. (See Manda (1998) for an explanation of how this expression for the intra-class

[2] These intra-class correlations (ICC) are defined as $\rho_\nu = \sigma_\nu^2/[\sigma_\nu^2 + \sigma_\mu^2 + 3.29]$ and $\rho_\mu = (\sigma_\nu^2 + \sigma_\mu^2)/[\sigma_\nu^2 + \sigma_\mu^2 + 3.29]$ at the community and family levels, respectively; where σ^2_μ and σ^2_ν represent the variance at the family and community levels, respectively, and 3.29 represents the fixed individual variance, which is $\pi^2/3$ (Snijders and Bosker 1999).

correlation is derived.) The estimated variance represents the extent to which children in the same community are exposed to the same conditions (sanitation, hygiene, availability of services) even if they have different individual characteristics (Larsen and Merlo 2005). We can then interpret this as evidence of differential mortality levels between groups, for instance births in poor communities relative to rich communities. The higher the estimated variance, the higher is the level of inequality between groups.

The analytical strategy in the case of multilevel analysis consists of applying three models for each country. The first model is the empty model, i.e., a model without covariates fitted to test random variability in the intercept and to estimate the intra-class correlation coefficient. The second model includes only the individual-level variables as predictors. The third model includes both the individual-level and the community-level variables. This approach allows the sequential measurement of the relative contributions of each set of variables to the community-level variance. Reduction in the intra-class correlations (ICC) relative to unadjusted analysis is evidence for explaining geographic variation by the variables included in a multilevel model.

Fixed effects models are fitted using Stata 11.1 (Stata Corporation 2009). MLwiN version 2.16 is used for the multilevel analysis. The multilevel logistic regression models are estimated with Markov Chain Monte Carlo (MCMC) methods in MLwiN. The MCMC procedure is used to fit multilevel models because it produces less biased estimates of variance parameters than quasi-likelihood methods for binary response models (Browne 2009). The default settings in MLwiN are used for the analyses, i.e., chains of length 5000 after a burn-in of 500. Bayesian deviance information criterion (DIC) is used to estimate the goodness of fit of consecutive models. Spiegelhalter et al. (2002) proposed using the DIC as a Bayesian equivalent of Akaike's Information Criterion (AIC)[3] for hierarchical models. A lower value on DIC indicates a better fit of the model (Spiegelhalter et al. 2002). As suggested by Browne, I fitted the model using first-order marginal quasi-likelihood (MQL) to generate starting values for the MCMC process (Browne 2009: 6).

[3] The AIC is appropriate for comparing non-nested models such as those estimates here. The AIC is calculated as -2 (loglikelihood of fitted model) +2p, where p is number of parameters in the model. The AIC values for each model are compared and the model with the lowest value is considered the better one (Maddala 1988).

Fixed estimates presented in the results section are those of the full models. The β coefficients (standard errors) have been converted into odds ratios and are presented alongside 95% confidence intervals. Estimates for the three analytical methods are presented side by side in the tables to facilitate comparisons.

Individual-Level and Community-Level Control Variables

Individual-level and household-level factors considered in this study are a set of standard covariates that have been identified by previous studies as important determinants of child mortality, and that are available for all countries considered (Hobcraft et al. 1985; Rafalitnanana and Westoff 2000; Rutstein 2000). They include: the age of the child (in months); the child's sex; the duration of the preceding birth interval; the mother's age at the child's birth; the mother's education; whether the birth of the index child received skilled attendance (doctor, nurse, or midwife) at delivery; and household wealth.

Community-level characteristics are not directly available for most surveys included in the analysis. Instead, they are constructed by aggregating individual-level and household-level characteristics at the cluster level (i.e. the primary sampling units for the DHS). They include: the type of place of residence (urban/rural); the cluster's socioeconomic status (defined as the proportion poor in the cluster); the proportion of women in the cluster with secondary or higher education; the cluster's level of ethnic fractionalization (defined as the probability that two individuals selected at random from a cluster will be from different ethnic groups) (Fearon 2003); and the percentage of children who are fully immunized in the community (that is, who have received BCG, measles, and three doses of DPT and polio vaccines)[4]. The last predictor is a continuous variable, whereas all others variables at the community level are dummy variables, representing discrete factors coded using the reference cell method. All variables and their operational definitions are described in detail in Appendix Table 1.

[4] It is not possible to include individual-level indicators of variables like immunization status and nutrition as predictors of mortality, since values are missing for deceased children. Rather, the DHS questionnaire collects information on vaccination status, height, and weight of each surviving child who was born in the 3/5 years before the survey date.

RESULTS

Levels of Under-Five Mortality Rates and Samples' Characteristics

Table 1 reports observed under-five mortality rates (U5MR) for each country included in the analysis, in the most recent five-year period. Globally, child mortality rates remain higher in sub-Saharan Africa (SSA) than in other regions. Within SSA, however, there is a large variation in U5MR among countries, from a high of 197.6 deaths per 1,000 live births in Niger to a low of 69.4 deaths per 1,000 live births in Namibia. Overall, the highest SSA child mortality levels are in West Africa, except for Ghana, where the U5MR is 80.0 deaths per 1,000 live births. Other countries with relatively low child mortality rates include Gabon, Madagascar, and Zimbabwe, all with U5MR below 100 deaths per 1,000 live births.

Disparities in U5MR at the national level between countries probably reflect the socioeconomic and health care contexts of the countries. Appendix Table 2 presents country-specific demographic, socioeconomic, and health behavior data relevant to the analysis, providing a picture of the broader context for the 28 countries. The figures presented are weighted percentages, with weighted column totals presented at side. As shown in Appendix Table 2, there are large differences in the covariates between countries, but these differences seldom form clear regional patterns. In many countries most of the children live in rural areas (more than 60% in 24 out of 28 countries). There is substantial variation across countries in the use of health services. The proportion of births attended by a skilled health provider (doctor, nurse, or midwife) ranges from under 6% in two countries—Chad and Ethiopia—to 81.6% in Namibia. The proportion of births in the five years before the survey delivered in a health facility ranges from 5.7% in Ethiopia to 87.1% in Gabon. Levels of education remain relatively low in most sub-Saharan countries. In 9 of the 28 countries studied, the majority of children were born to uneducated mothers, and in 17 of the countries, more than 50% of children live in communities where the level of women's education is low.

Unobserved Heterogeneity at Family and Community Levels in Under-Five Mortality

Table 3 shows the estimates of the family and community level variances, together with the intra-family and intra-community correlation coefficients for the 28 separate models, after adjusting for the child-level, family-level, and community-level characteristics. This analysis supports the numerous other studies that have found that children of the same family have correlated probabilities of survival. The between-family variance is highly significant (p-value <0.01) in almost all countries. It is less significant in Rwanda (p-value <0.05) and Cameroon (p-value <0.10). The intra-family correlation coefficients range from 2% (Cameroon) to 38% (Lesotho). This result suggests that a significant unobserved heterogeneity exists in the under-five mortality risks between families. Overall, unobserved mother heterogeneity explains a substantial part of the random variance in the child mortality across countries. For instance, the intra-family correlation is 0.33 in Zambia, indicating that 33% of the variation in mortality risks is the result of unobserved family-level factors.

Table 3: Variance estimates between family and community, and intra-correlations coefficients for the discrete-time multilevel models of probability of dying before age 5, by country

	Variance and level of significance				Intra-unit correlations[a]	
Country	**Family**		**Community**		**Family**	**Community**
Benin	0.480	***	0.141	***	0.159	0.036
Burkina Faso	0.533	***	0.141	***	0.170	0.036
Cameroon	0.002	*	0.056	ns	0.017	0.017
Chad	0.580	**	0.113	**	0.174	0.028
Congo (Brazzaville)	1.198	***	0.063	ns	0.277	0.014
Congo Demo. Rep.	0.794	***	0.23	***	0.237	0.053
Ethiopia	0.833	***	0.113	**	0.223	0.027
Gabon	1.129	***	0.139	ns	0.278	0.030
Ghana	1.152	***	0.216	ns	0.294	0.046
Guinea	0.582	***	0.061	ns	0.163	0.016
Kenya	1.627	***	0.273	**	0.366	0.053
Lesotho	1.976	***	0.044	ns	0.380	0.008
Liberia	1.140	***	0.039	ns	0.264	0.009
Madagascar	1.205	***	0.085	ns	0.282	0.019
Malawi	0.740	***	0.085	**	0.200	0.021
Mali	0.888	***	0.126	***	0.236	0.029
Mozambique	0.953	***	0.039	ns	0.232	0.009
Namibia	0.719	***	0.02	ns	0.183	0.005
Niger	0.377	***	0.13	***	0.134	0.034
Nigeria	0.949	***	0.084	***	0.239	0.019
Rwanda	0.436	**	0.167	***	0.155	0.043
Senegal	0.480	***	0.141	***	0.159	0.036
Sierra Leone	0.654	***	0.304	***	0.226	0.072
Swaziland	1.171	***	0.034	ns	0.268	0.008
Tanzania	0.582	***	0.128	**	0.178	0.032
Uganda	0.475	***	0.04	ns	0.135	0.011
Zambia	1.608	***	0.012	ns	0.330	0.002
Zimbabwe	1.340	***	0.052	ns	0.297	0.011

*** p-value < 0.001; ** p-value < 0.01; * p-value < 0.05; + p-value < 0.10; ns = not significant if at 10%.

[a] Intra-group correlation coefficients measure the degree of clustering and include random intercepts with both individual- and community-level as predictors. Intra-community correlation (ρ_v), which measures the proportion of the total variance which is between communities, expresses similarity of children in probability of dying before age 5 from the same community. Intra-family correlation coefficient (ρ_μ) expresses similarity of children in probability of dying before age 5 from the same household (and by definition, from the same community). These intra-class correlations (ICC) are calculated as $\rho_v = \sigma_v^2/[\sigma_v^2 + \sigma_\mu^2 + \sigma_e^2]$ and $\rho_\mu = (\sigma_v^2 + \sigma_\mu^2)/[\sigma_v^2 + \sigma_\mu^2 + \sigma_e^2]$ at the community and family levels, respectively; where σ_v^2 denotes community-level variance, σ^2_μ denotes family-level variance and σ_e^2 denotes individual-level variance, with this latter variance set to $\pi^2/3$ (equal to 3.29).

The community variance is significant at the 5% level or lower in half of the countries under study. Intra-community variation associated with the risk of dying before age five ranges from below 5% in 11 countries to 7% in Sierra Leone. Overall, the results show that the variance between communities is smaller than the variance between families.

The community variance and the family variance are jointly significant in 14 of the 28 countries, providing evidence that the variation in under-five mortality in a number of countries in sub-Saharan Africa is produced by the interaction between the family and geographic environment of the children. Thus the variation in mortality risks in these countries is simultaneously attributed to unobserved heterogeneity at the household and community levels, after accounting for child-level, household-level, and community-level characteristics.

The much larger magnitude of the intra-family correlations than the intra-community correlations suggests that residence in a particular community may be a less important determinant of child survival across sub-Saharan African countries than is membership in a particular family.

Individual-level and Community-level Effects on the Risk of Dying before Age Five

Table 4 presents the adjusted odds ratios and 95 percent confidence intervals of predictor variables on the risk of dying before age five, in the three sets of models fitted for each country.

As one would expect, fixed-effects discrete-time models (model 2) show a better adjustment than "naïve" discrete-time hazard models (model 1). In all countries, the AIC (at the bottom of the Table 4) of fixed-effects models is smaller, suggesting that the conditional logit estimation approach is probably better. This empirical finding demonstrates the need to take context into account while examining factors affecting child survival. However, this fixed-effects approach does not take into account the possibility that one particular community factor might influence child mortality. As mentioned above, these latter two sets of estimates, which include only individual variables, serve the purpose of comparing methods.

This study is focused on contextual effects, and it addresses an important related question: what characteristics of the community are associated with the risk of child death, net of individual characteristics? Thus discussion of the results is based only on the multilevel discrete-

time hazard models (model 3), which include both individual-level and community-level variables, and family and community random effects.

The results reveal that individual-level and community-level effects on the risk of dying before age five vary across the 28 countries.

Table 4: Odds ratios (OR) and 95 percent confidence intervals (95% CIs) for the effect of individual-level and community-level factors on under-five mortality, by country

	Benin					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.47	0.40 - 0.57	0.48	0.40 - 0.58	0.49	0.41 - 0.58
6–11 months	0.64	0.53 - 0.76	0.66	0.55 - 0.78	0.67	0.57 - 0.78
12–23 months	0.58	0.48 - 0.70	0.62	0.51 - 0.74	0.62	0.53 - 0.73
24+ months	0.68	0.56 - 0.82	0.73	0.60 - 0.88	0.74	0.62 - 0.88
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.34	1.04 - 1.72	1.15	0.88 - 1.50	1.25	0.98 - 1.59
2-3 and 24+ months	0.74	0.61 - 0.90	0.70	0.57 - 0.86	0.71	0.60 - 0.84
4+ and < 24 months	1.39	1.08 - 1.79	1.19	0.92 - 1.55	1.28	1.01 - 1.60
4+ and 24+ months	0.88	0.72 - 1.07	0.80	0.65 - 0.99	0.83	0.69 - 0.99
Child's sex						
Female[ref]						
Male	1.10	0.98 - 1.23	1.14	1.01 - 1.28	1.10	0.99 - 1.22
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.94	0.77 - 1.14	1.01	0.83 - 1.23	0.96	0.79 - 1.16
35 years or more	0.92	0.70 - 1.22	1.03	0.76 - 1.39	0.93	0.71 - 1.21
Mother's education						
No education[ref]						
Primary	1.06	0.90 - 1.24	1.07	0.89 - 1.28	1.07	0.91 - 1.27
Secondary or higher	0.67	0.48 - 0.96	0.71	0.49 - 1.03	0.69	0.50 - 0.95
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.01	0.84 - 1.21	0.99	0.82 - 1.20	1.04	0.88 - 1.23
3rd quintile	1.10	0.93 - 1.31	1.01	0.84 - 1.23	1.08	0.91 - 1.29
4th quintile	0.95	0.78 - 1.16	0.96	0.74 - 1.23	0.93	0.76 - 1.15
5th quintile (Richest)	0.69	0.53 - 0.89	0.71	0.49 - 1.02	0.73	0.55 - 0.96
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.88	0.76 - 1.03	0.95	0.79 - 1.13	0.92	0.80 - 1.06
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.90	0.77 - 1.05
Proportion of households poor						
Low						
High					0.89	0.76 - 1.05
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.99	0.84 - 1.16
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.04	0.90 - 1.21
Proportion of children fully immunized[d]					0.63	0.44 - 0.91
Intercept	-3.24	-3.49 - -2.99			-3.33	-3.64 - -3.02
AIC/DIC (multilevel model) of full models	12,919		10,568		12,955	

Cont'd..

Table 4: Cont'd

	Burkina Faso					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.80	0.64 - 1.00	0.81	0.65 - 1.02	0.83	0.70 - 0.99
6–11 months	0.85	0.66 - 1.10	0.88	0.68 - 1.13	0.92	0.77 - 1.10
12–23 months	1.39	1.14 - 1.69	1.45	1.20 - 1.76	1.40	1.18 - 1.65
24+ months	1.43	1.13 - 1.82	1.55	1.22 - 1.96	1.58	1.32 - 1.88
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.27	0.89 - 1.81	1.17	0.80 - 1.70	0.99	0.74 - 1.31
2-3 and 24+ months	0.90	0.71 - 1.13	0.90	0.71 - 1.15	0.83	0.68 - 1.02
4+ and < 24 months	1.59	1.21 - 2.09	1.45	1.10 - 1.93	1.32	1.01 - 1.73
4+ and 24+ months	0.87	0.66 - 1.15	0.86	0.65 - 1.15	0.75	0.60 - 0.93
Child's sex						
Female[ref]						
Male	1.00	0.88 - 1.13	1.00	0.88 - 1.14	1.00	0.88 - 1.13
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.85	0.67 - 1.06	0.90	0.71 - 1.14	0.82	0.66 - 1.01
35 years or more	0.88	0.65 - 1.20	0.96	0.70 - 1.32	0.90	0.69 - 1.17
Mother's education						
No education[ref]						
Primary	0.81	0.64 - 1.03	0.84	0.66 - 1.07	0.92	0.72 - 1.16
Secondary or higher	0.72	0.47 - 1.10	0.86	0.54 - 1.37	0.72	0.47 - 1.10
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.95	0.76 - 1.18	1.00	0.80 - 1.24	0.96	0.80 - 1.15
3rd quintile	0.83	0.66 - 1.03	0.83	0.66 - 1.04	0.84	0.70 - 1.01
4th quintile	0.82	0.65 - 1.04	0.85	0.66 - 1.08	0.91	0.73 - 1.12
5th quintile (Richest)	0.73	0.53 - 1.01	0.84	0.55 - 1.30	0.73	0.54 - 0.98
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.93	0.78 - 1.10	1.01	0.84 - 1.23	0.94	0.80 - 1.10
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.87	0.65 - 1.18
Proportion of households poor						
Low						
High					1.01	0.86 - 1.19
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.17	0.93 - 1.46
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.97	0.83 - 1.12
Proportion of children fully immunized[d]					0.49	0.34 - 0.70
Intercept	-3.13	-3.41 - -2.86			-3.19	-3.46 - -2.93
AIC/DIC (multilevel model) of full models	11,853		9,714		11,273	

Cont'd..

Table 4: Cont'd

	Cameroon					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.64	0.51 - 0.82	0.66	0.52 - 0.83	0.65	0.54 - 0.80
6–11 months	0.96	0.76 - 1.20	0.99	0.79 - 1.24	0.91	0.76 - 1.11
12–23 months	0.97	0.78 - 1.21	1.03	0.83 - 1.28	0.96	0.79 - 1.17
24+ months	0.92	0.70 - 1.20	1.00	0.77 - 1.31	0.83	0.66 - 1.04
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.45	1.07 - 1.97	1.46	1.04 - 2.05	1.40	1.06 - 1.83
2-3 and 24+ months	0.80	0.63 - 1.03	0.82	0.63 - 1.08	0.85	0.68 - 1.06
4+ and < 24 months	1.17	0.83 - 1.67	1.06	0.73 - 1.55	1.19	0.88 - 1.61
4+ and 24+ months	0.82	0.62 - 1.08	0.80	0.59 - 1.10	0.85	0.66 - 1.10
Child's sex						
Female[ref]						
Male	1.04	0.89 - 1.21	1.02	0.86 - 1.20	1.08	0.94 - 1.24
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.88	0.71 - 1.10	0.92	0.72 - 1.18	0.86	0.71 - 1.05
35 years or more	1.12	0.83 - 1.53	1.21	0.85 - 1.72	1.10	0.81 - 1.49
Mother's education						
No education[ref]						
Primary	1.19	0.96 - 1.47	1.25	0.96 - 1.64	1.23	1.01 - 1.48
Secondary or higher	0.98	0.75 - 1.26	1.11	0.81 - 1.53	1.02	0.79 - 1.32
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.88	0.70 - 1.11	0.88	0.69 - 1.12	0.87	0.72 - 1.07
3rd quintile	0.92	0.73 - 1.15	0.93	0.69 - 1.26	0.90	0.72 - 1.13
4th quintile	0.87	0.67 - 1.12	0.95	0.65 - 1.40	0.94	0.72 - 1.24
5th quintile (Richest)	0.65	0.47 - 0.89	0.68	0.42 - 1.10	0.75	0.53 - 1.05
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.88	0.72 - 1.07	1.01	0.79 - 1.28	0.90	0.76 - 1.07
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.84	0.67 - 1.05
Proportion of households poor						
Low						
High					0.89	0.70 - 1.14
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.93	0.76 - 1.14
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.95	0.78 - 1.15
Proportion of children fully immunized[d]					0.63	0.43 - 0.93
Intercept	-3.32	-3.60 - -3.05			-3.08	-3.43 - -2.73
AIC/DIC (multilevel model) of full models	7,531		6,245		7,678	

Cont'd..

Table 4: Cont'd

	Chad					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.68	0.51 - 0.89	0.69	0.52 - 0.90	0.63	0.50 - 0.79
6–11 months	0.89	0.65 - 1.21	0.91	0.67 - 1.25	1.00	0.80 - 1.24
12–23 months	0.85	0.61 - 1.19	0.90	0.65 - 1.25	0.90	0.71 - 1.13
24+ months	1.05	0.78 - 1.41	1.13	0.84 - 1.51	1.12	0.87 - 1.44
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.91	0.64 - 1.30	0.83	0.57 - 1.22	0.82	0.58 - 1.14
2-3 and 24+ months	0.69	0.53 - 0.90	0.67	0.50 - 0.89	0.65	0.49 - 0.87
4+ and < 24 months	1.36	0.93 - 1.99	1.29	0.84 - 1.98	1.13	0.81 - 1.59
4+ and 24+ months	0.56	0.40 - 0.80	0.54	0.38 - 0.78	0.57	0.41 - 0.78
Child's sex						
Female[ref]						
Male	1.24	1.04 - 1.47	1.25	1.04 - 1.50	1.12	0.95 - 1.31
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.91	0.70 - 1.20	0.91	0.67 - 1.22	0.86	0.68 - 1.09
35 years or more	1.09	0.75 - 1.58	1.08	0.70 - 1.65	0.96	0.66 - 1.40
Mother's education						
No education[ref]						
Primary	1.23	0.92 - 1.64	1.21	0.91 - 1.60	1.00	0.80 - 1.26
Secondary or higher	0.93	0.61 - 1.44	0.93	0.58 - 1.48	0.71	0.47 - 1.07
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.23	0.91 - 1.66	0.84	0.49 - 1.45	1.33	0.97 - 1.82
3rd quintile	0.91	0.63 - 1.30	0.61	0.32 - 1.18	0.95	0.67 - 1.35
4th quintile	1.35	1.02 - 1.80	0.89	0.50 - 1.58	1.43	1.01 - 2.02
5th quintile (Richest)	1.03	0.77 - 1.39	0.66	0.33 - 1.34	1.20	0.77 - 1.89
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.85	0.54 - 1.36	1.03	0.67 - 1.59	1.10	0.74 - 1.62
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.65	0.46 - 0.92
Proportion of households poor						
Low						
High					0.88	0.64 - 1.20
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.30	1.01 - 1.68
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.77	0.58 - 1.01
Proportion of children fully immunized[d]					0.44	0.18 - 1.09
Intercept	-3.21	-3.57 - -2.84			-3.19	-3.70 - -2.68
AIC/DIC (multilevel model) of full models	6,671		5,362		6,178	

Cont'd..

Table 4: Cont'd

	Congo (Brazzaville)					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.63	0.41 - 0.97	0.65	0.42 - 0.98	0.53	0.40 - 0.71
6–11 months	0.66	0.46 - 0.95	0.69	0.48 - 0.98	0.59	0.44 - 0.81
12–23 months	0.48	0.34 - 0.68	0.51	0.36 - 0.73	0.59	0.43 - 0.81
24+ months	0.40	0.23 - 0.70	0.44	0.25 - 0.76	0.44	0.29 - 0.66
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.85	0.52 - 1.42	0.83	0.47 - 1.44	0.77	0.46 - 1.31
2-3 and 24+ months	0.78	0.54 - 1.12	0.87	0.59 - 1.28	0.69	0.50 - 0.95
4+ and < 24 months	1.04	0.60 - 1.82	1.01	0.57 - 1.79	0.68	0.37 - 1.24
4+ and 24+ months	0.73	0.44 - 1.19	0.80	0.47 - 1.34	0.79	0.55 - 1.15
Child's sex						
Female[ref]						
Male	1.00	0.79 - 1.26	1.00	0.80 - 1.26	1.09	0.88 - 1.36
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.01	0.72 - 1.43	0.92	0.63 - 1.33	0.98	0.71 - 1.36
35 years or more	1.27	0.75 - 2.16	1.05	0.60 - 1.86	1.07	0.65 - 1.76
Mother's education						
No education[ref]						
Primary	0.86	0.59 - 1.25	0.91	0.60 - 1.38	1.07	0.72 - 1.58
Secondary or higher	0.59	0.40 - 0.85	0.67	0.43 - 1.05	0.73	0.50 - 1.08
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.21	0.93 - 1.56	1.46	1.05 - 2.03	1.09	0.76 - 1.56
3rd quintile	0.97	0.68 - 1.37	1.21	0.80 - 1.82	1.13	0.74 - 1.72
4th quintile	0.92	0.57 - 1.47	1.52	0.81 - 2.83	1.20	0.72 - 2.00
5th quintile (Richest)	0.75	0.47 - 1.19	0.90	0.44 - 1.87	0.94	0.53 - 1.66
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.08	0.82 - 1.42	1.03	0.76 - 1.39	0.95	0.74 - 1.22
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.95	0.64 - 1.40
Proportion of households poor						
Low						
High					1.22	0.83 - 1.79
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.75	0.54 - 1.04
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.05	0.53 - 2.06
Proportion of children fully immunized[d]					0.88	0.45 - 1.73
Intercept	-2.97	-3.45 - -2.50			-3.68	-4.24 - -3.12
AIC/DIC (multilevel model) of full models	3,966		3,048		3,640	

Cont'd..

Table 4: Cont'd

	Congo Democratic Republic					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.55	0.42 - 0.70	0.56	0.43 - 0.72	0.72	0.60 - 0.87
6–11 months	0.64	0.50 - 0.83	0.68	0.53 - 0.87	0.82	0.68 - 0.99
12–23 months	0.54	0.41 - 0.72	0.58	0.43 - 0.77	0.74	0.60 - 0.91
24+ months	0.52	0.36 - 0.75	0.56	0.38 - 0.81	0.69	0.54 - 0.87
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.08	0.76 - 1.54	1.01	0.71 - 1.45	0.77	0.58 - 1.04
2-3 and 24+ months	0.67	0.49 - 0.91	0.66	0.47 - 0.91	0.67	0.52 - 0.85
4+ and < 24 months	1.31	0.91 - 1.91	1.18	0.81 - 1.70	1.16	0.89 - 1.53
4+ and 24+ months	0.63	0.45 - 0.90	0.58	0.41 - 0.83	0.60	0.46 - 0.77
Child's sex						
Female[ref]						
Male	1.22	1.04 - 1.43	1.21	1.02 - 1.44	1.10	0.96 - 1.27
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.98	0.71 - 1.34	1.13	0.80 - 1.60	1.01	0.80 - 1.27
35 years or more	1.19	0.71 - 1.97	1.40	0.84 - 2.34	1.27	0.93 - 1.73
Mother's education						
No education[ref]						
Primary	0.80	0.63 - 1.02	0.74	0.57 - 0.96	0.90	0.75 - 1.08
Secondary or higher	0.68	0.48 - 0.97	0.74	0.52 - 1.05	0.79	0.62 - 1.00
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.99	0.71 - 1.38	1.07	0.73 - 1.57	0.99	0.79 - 1.25
3rd quintile	0.77	0.53 - 1.12	0.84	0.55 - 1.26	0.88	0.69 - 1.14
4th quintile	0.97	0.68 - 1.38	0.98	0.65 - 1.49	1.07	0.79 - 1.45
5th quintile (Richest)	0.60	0.40 - 0.89	0.63	0.30 - 1.31	0.65	0.44 - 0.97
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.76	0.60 - 0.97	0.86	0.65 - 1.15	0.84	0.71 - 0.99
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.77	0.56 - 1.06
Proportion of households poor						
Low						
High					0.98	0.75 - 1.28
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.11	0.87 - 1.42
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.09	0.86 - 1.39
Proportion of children fully immunized[d]					0.57	0.34 - 0.94
Intercept	-2.72	-3.20 - -2.24			-3.31	-3.75 - -2.88
AIC/DIC (multilevel model) of full models	8,400		7,171		8,308	

Cont'd..

Table 4: Cont'd

	Ethiopia					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.62	0.50 - 0.76	0.64	0.52 - 0.79	0.69	0.57 - 0.82
6–11 months	0.36	0.26 - 0.49	0.38	0.28 - 0.51	0.39	0.31 - 0.49
12–23 months	0.32	0.23 - 0.44	0.34	0.24 - 0.47	0.36	0.28 - 0.47
24+ months	0.47	0.34 - 0.65	0.52	0.37 - 0.72	0.60	0.47 - 0.75
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.21	0.86 - 1.71	1.25	0.85 - 1.84	1.09	0.80 - 1.48
2-3 and 24+ months	0.53	0.39 - 0.72	0.49	0.35 - 0.69	0.58	0.45 - 0.76
4+ and < 24 months	1.80	1.25 - 2.60	1.72	1.15 - 2.56	1.53	1.14 - 2.06
4+ and 24+ months	0.67	0.49 - 0.91	0.64	0.45 - 0.91	0.63	0.48 - 0.83
Child's sex						
Female[ref]						
Male	1.23	1.03 - 1.47	1.28	1.05 - 1.56	1.34	1.16 - 1.56
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.66	0.49 - 0.88	0.70	0.51 - 0.96	0.66	0.53 - 0.83
35 years or more	0.74	0.48 - 1.12	0.75	0.48 - 1.18	0.81	0.59 - 1.12
Mother's education						
No education[ref]						
Primary	0.74	0.55 - 1.00	0.79	0.59 - 1.06	0.78	0.61 - 0.99
Secondary or higher	0.35	0.20 - 0.63	0.39	0.19 - 0.80	0.56	0.34 - 0.91
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.14	0.88 - 1.48	1.05	0.79 - 1.40	1.12	0.88 - 1.44
3rd quintile	1.34	1.06 - 1.69	1.26	0.96 - 1.65	1.25	0.97 - 1.61
4th quintile	1.12	0.88 - 1.42	0.98	0.72 - 1.34	1.11	0.85 - 1.45
5th quintile (Richest)	0.89	0.65 - 1.23	0.67	0.43 - 1.05	0.70	0.48 - 1.01
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.63	1.07 - 2.49	1.96	1.14 - 3.37	0.99	0.69 - 1.42
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.14	0.77 - 1.68
Proportion of households poor						
Low						
High					0.81	0.66 - 1.00
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.96	0.74 - 1.24
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.04	0.86 - 1.25
Proportion of children fully immunized[d]					0.60	0.34 - 1.06
Intercept	-2.89	-3.22 - -2.57			-3.28	-3.64 - -2.93
AIC/DIC (multilevel model) of full models	8,377		6,220		7,704	

Cont'd..

Table 4: Cont'd

	Gabon					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.46	0.31 - 0.70	0.49	0.33 - 0.73	0.58	0.42 - 0.81
6–11 months	0.44	0.29 - 0.66	0.47	0.32 - 0.71	0.54	0.38 - 0.77
12–23 months	0.44	0.28 - 0.68	0.48	0.32 - 0.74	0.54	0.37 - 0.79
24+ months	0.57	0.34 - 0.96	0.65	0.39 - 1.08	0.67	0.45 - 1.01
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.66	0.36 - 1.23	0.53	0.27 - 1.04	0.70	0.39 - 1.26
2-3 and 24+ months	0.77	0.50 - 1.19	0.72	0.45 - 1.15	0.69	0.45 - 1.04
4+ and < 24 months	1.29	0.70 - 2.38	1.06	0.49 - 2.32	1.10	0.63 - 1.92
4+ and 24+ months	0.63	0.36 - 1.07	0.57	0.29 - 1.11	0.54	0.33 - 0.87
Child's sex						
Female[ref]						
Male	1.38	1.05 - 1.82	1.48	1.09 - 2.00	1.33	1.02 - 1.74
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.92	0.60 - 1.40	0.96	0.56 - 1.65	1.05	0.70 - 1.59
35 years or more	1.34	0.72 - 2.51	1.51	0.73 - 3.11	1.38	0.76 - 2.52
Mother's education						
No education[ref]						
Primary	0.75	0.41 - 1.36	0.83	0.44 - 1.59	0.87	0.52 - 1.45
Secondary or higher	0.87	0.46 - 1.65	0.84	0.42 - 1.69	0.83	0.48 - 1.42
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.35	0.95 - 1.91	1.05	0.65 - 1.69	1.33	0.91 - 1.93
3rd quintile	1.10	0.74 - 1.64	1.08	0.56 - 2.07	1.42	0.81 - 2.48
4th quintile	1.13	0.68 - 1.86	1.09	0.50 - 2.36	1.25	0.68 - 2.32
5th quintile (Richest)	0.68	0.39 - 1.18	0.76	0.34 - 1.74	0.83	0.40 - 1.72
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.50	0.36 - 0.68	0.47	0.32 - 0.67	0.44	0.32 - 0.61
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.27	0.84 - 1.91
Proportion of households poor						
Low						
High					1.49	0.92 - 2.41
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.36	0.98 - 1.89
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.77	0.47 - 1.26
Proportion of children fully immunized[d]					0.19	0.04 - 0.81
Intercept	-2.92	-3.69 - -2.15			-4.00	-4.79 - -3.21
AIC/DIC (multilevel model) of full models	2,773		2,115		2,777	

Cont'd..

Table 4: Cont'd

	Ghana					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.34	0.22 - 0.54	0.38	0.24 - 0.58	0.40	0.27 - 0.61
6–11 months	0.30	0.18 - 0.48	0.33	0.20 - 0.54	0.30	0.19 - 0.48
12–23 months	0.33	0.20 - 0.54	0.38	0.24 - 0.63	0.37	0.23 - 0.60
24+ months	0.27	0.14 - 0.51	0.34	0.18 - 0.64	0.33	0.18 - 0.59
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.94	0.43 - 2.07	0.69	0.29 - 1.62	0.59	0.25 - 1.37
2-3 and 24+ months	0.71	0.44 - 1.16	0.73	0.41 - 1.30	0.71	0.43 - 1.17
4+ and < 24 months	1.64	0.81 - 3.34	0.93	0.40 - 2.15	1.50	0.73 - 3.08
4+ and 24+ months	0.70	0.41 - 1.20	0.64	0.32 - 1.29	0.72	0.41 - 1.26
Child's sex						
Female[ref]						
Male	1.10	0.78 - 1.55	1.12	0.74 - 1.67	1.11	0.82 - 1.51
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.14	0.60 - 2.18	1.17	0.57 - 2.40	1.14	0.66 - 2.00
35 years or more	1.82	0.80 - 4.12	2.22	0.85 - 5.78	1.77	0.86 - 3.63
Mother's education						
No education[ref]						
Primary	1.19	0.77 - 1.83	1.35	0.79 - 2.29	1.03	0.67 - 1.61
Secondary or higher	0.79	0.49 - 1.26	1.03	0.58 - 1.84	0.85	0.51 - 1.42
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.75	0.46 - 1.22	0.62	0.31 - 1.25	0.74	0.44 - 1.25
3rd quintile	1.17	0.71 - 1.94	0.71	0.26 - 1.90	0.82	0.42 - 1.61
4th quintile	0.93	0.52 - 1.66	0.65	0.23 - 1.86	0.78	0.37 - 1.61
5th quintile (Richest)	0.89	0.45 - 1.77	0.66	0.19 - 2.23	0.81	0.33 - 1.95
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.06	0.72 - 1.57	0.95	0.58 - 1.57	0.95	0.65 - 1.40
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.89	0.54 - 1.48
Proportion of households poor						
Low						
High					0.51	0.30 - 0.87
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.64	0.40 - 1.02
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.04	0.73 - 1.49
Proportion of children fully immunized[d]					0.69	0.30 - 1.56
Intercept	-3.50	-4.22 - -2.77			-3.20	-4.02 - -2.38
AIC/DIC (multilevel model) of full models	1,784		1,241		1,914	

Cont'd..

Table 4: Cont'd

	Guinea					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.65	0.52 - 0.82	0.66	0.53 - 0.83	0.60	0.48 - 0.75
6–11 months	0.58	0.46 - 0.74	0.60	0.47 - 0.76	0.59	0.46 - 0.74
12–23 months	0.59	0.46 - 0.77	0.63	0.49 - 0.80	0.58	0.46 - 0.74
24+ months	0.73	0.54 - 0.99	0.77	0.57 - 1.05	0.76	0.59 - 0.98
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.13	0.78 - 1.65	0.95	0.65 - 1.39	1.12	0.72 - 1.74
2-3 and 24+ months	0.60	0.44 - 0.83	0.56	0.40 - 0.79	0.65	0.48 - 0.89
4+ and < 24 months	1.10	0.74 - 1.61	0.92	0.61 - 1.38	1.13	0.76 - 1.69
4+ and 24+ months	0.73	0.54 - 0.98	0.68	0.49 - 0.94	0.76	0.56 - 1.04
Child's sex						
Female[ref]						
Male	1.26	1.08 - 1.49	1.24	1.05 - 1.47	1.23	1.05 - 1.44
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.02	0.75 - 1.39	1.09	0.79 - 1.50	0.97	0.74 - 1.26
35 years or more	1.26	0.88 - 1.82	1.39	0.95 - 2.06	1.20	0.86 - 1.68
Mother's education						
No education[ref]						
Primary	1.01	0.73 - 1.39	1.18	0.84 - 1.66	1.02	0.74 - 1.41
Secondary or higher	0.64	0.37 - 1.10	0.61	0.33 - 1.14	0.71	0.43 - 1.17
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.82	0.65 - 1.04	0.83	0.64 - 1.09	0.86	0.67 - 1.10
3rd quintile	0.83	0.65 - 1.06	0.77	0.57 - 1.03	0.87	0.67 - 1.12
4th quintile	0.94	0.75 - 1.19	1.05	0.76 - 1.45	1.01	0.73 - 1.41
5th quintile (Richest)	0.61	0.40 - 0.91	1.26	0.67 - 2.35	0.68	0.42 - 1.10
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.96	0.75 - 1.23	0.92	0.69 - 1.21	0.92	0.73 - 1.15
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.97	0.69 - 1.35
Proportion of households poor						
Low						
High					0.92	0.73 - 1.16
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.96	0.76 - 1.22
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.01	0.84 - 1.21
Proportion of children fully immunized[d]					0.70	0.42 - 1.18
Intercept	-2.98	-3.28 - -2.68			-3.13	-3.50 - -2.75
AIC/DIC (multilevel model) of full models	6,306		5,275		6,299	

Cont'd..

Table 4: Cont'd

	Kenya					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.41	0.28 - 0.59	0.43	0.30 - 0.61	0.48	0.36 - 0.64
6–11 months	0.27	0.17 - 0.43	0.28	0.18 - 0.46	0.35	0.25 - 0.49
12–23 months	0.39	0.26 - 0.60	0.43	0.28 - 0.65	0.45	0.33 - 0.63
24+ months	0.17	0.10 - 0.30	0.19	0.11 - 0.34	0.23	0.14 - 0.39
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.85	1.17 - 2.93	1.78	1.10 - 2.88	1.56	0.98 - 2.50
2-3 and 24+ months	1.12	0.70 - 1.80	1.16	0.70 - 1.95	1.18	0.80 - 1.74
4+ and < 24 months	1.68	0.93 - 3.01	1.54	0.79 - 3.00	1.78	1.06 - 2.97
4+ and 24+ months	1.11	0.65 - 1.90	1.18	0.64 - 2.16	1.41	0.90 - 2.20
Child's sex						
Female[ref]						
Male	1.33	1.00 - 1.78	1.44	1.07 - 1.93	1.34	1.06 - 1.69
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.65	0.44 - 0.95	0.69	0.43 - 1.09	0.72	0.50 - 1.04
35 years or more	1.09	0.57 - 2.08	1.12	0.55 - 2.28	0.95	0.55 - 1.61
Mother's education						
No education[ref]						
Primary	1.02	0.66 - 1.57	0.70	0.33 - 1.46	1.23	0.83 - 1.82
Secondary or higher	0.97	0.59 - 1.61	0.77	0.38 - 1.54	1.20	0.74 - 1.94
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.86	0.59 - 1.27	0.75	0.49 - 1.15	1.12	0.75 - 1.68
3rd quintile	0.96	0.60 - 1.55	0.92	0.54 - 1.58	1.24	0.80 - 1.92
4th quintile	0.54	0.32 - 0.93	0.69	0.37 - 1.29	0.76	0.45 - 1.28
5th quintile (Richest)	0.89	0.52 - 1.54	1.51	0.65 - 3.50	1.00	0.55 - 1.82
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.17	0.85 - 1.59	1.22	0.87 - 1.70	1.07	0.81 - 1.41
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.77	0.48 - 1.23
Proportion of households poor						
Low						
High					0.83	0.57 - 1.20
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.94	0.66 - 1.34
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.91	0.68 - 1.22
Proportion of children fully immunized[d]					0.46	0.21 - 1.04
Intercept	-3.44	-4.16 - -2.73			-4.23	-4.89 - -3.57
AIC/DIC (multilevel model) of full models	4,881		3,520		4,398	

Cont'd..

Table 4: Cont'd

	Lesotho					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.62	0.46 - 0.84	0.66	0.49 - 0.89	0.66	0.49 - 0.88
6–11 months	0.45	0.31 - 0.66	0.49	0.34 - 0.72	0.49	0.35 - 0.70
12–23 months	0.22	0.14 - 0.35	0.25	0.15 - 0.39	0.32	0.21 - 0.49
24+ months	0.19	0.10 - 0.34	0.22	0.12 - 0.39	0.22	0.13 - 0.38
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	2.12	1.27 - 3.55	1.70	0.91 - 3.18	1.69	0.98 - 2.89
2-3 and 24+ months	0.82	0.55 - 1.22	0.77	0.50 - 1.19	0.78	0.54 - 1.12
4+ and < 24 months	1.27	0.55 - 2.92	1.05	0.45 - 2.44	1.00	0.47 - 2.11
4+ and 24+ months	0.66	0.39 - 1.11	0.61	0.34 - 1.09	0.58	0.37 - 0.90
Child's sex						
Female[ref]						
Male	1.02	0.79 - 1.34	1.04	0.78 - 1.39	1.09	0.83 - 1.43
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.09	0.76 - 1.55	1.06	0.70 - 1.62	1.19	0.80 - 1.79
35 years or more	1.55	0.83 - 2.90	1.62	0.82 - 3.17	1.72	0.98 - 3.01
Mother's education						
No education[ref]						
Primary	0.56	0.32 - 0.98	0.50	0.26 - 0.96	0.56	0.28 - 1.14
Secondary or higher	0.50	0.27 - 0.92	0.60	0.28 - 1.26	0.53	0.25 - 1.13
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.13	0.77 - 1.65	1.40	0.90 - 2.20	1.17	0.78 - 1.74
3rd quintile	1.34	0.91 - 1.99	1.89	1.11 - 3.21	1.70	1.03 - 2.80
4th quintile	1.28	0.84 - 1.95	1.58	0.87 - 2.88	1.79	1.04 - 3.09
5th quintile (Richest)	1.13	0.73 - 1.75	1.45	0.72 - 2.90	1.74	0.95 - 3.19
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.96	0.70 - 1.32	0.83	0.57 - 1.21	0.84	0.62 - 1.14
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.22	0.78 - 1.91
Proportion of households poor						
Low						
High					1.42	0.91 - 2.20
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.90	0.64 - 1.27
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					1.08	0.57 - 2.06
Intercept	-2.73	-3.40 - -2.07			-4.01	-5.09 - -2.93
AIC/DIC (multilevel model) of full models	3,065		2,191		2,919	

Cont'd..

Table 4: Cont'd

	Liberia					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.66	0.47 - 0.93	0.68	0.48 - 0.95	0.68	0.53 - 0.88
6–11 months	0.49	0.35 - 0.70	0.52	0.36 - 0.74	0.56	0.42 - 0.75
12–23 months	0.44	0.30 - 0.65	0.47	0.32 - 0.68	0.54	0.40 - 0.73
24+ months	0.31	0.20 - 0.48	0.33	0.21 - 0.51	0.42	0.29 - 0.60
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.18	0.64 - 2.15	1.10	0.57 - 2.13	1.30	0.87 - 1.95
2-3 and 24+ months	0.84	0.51 - 1.39	0.87	0.52 - 1.47	0.80	0.59 - 1.10
4+ and < 24 months	1.70	0.95 - 3.05	1.51	0.82 - 2.75	2.05	1.38 - 3.04
4+ and 24+ months	0.92	0.54 - 1.58	0.87	0.50 - 1.53	0.92	0.66 - 1.30
Child's sex						
Female[ref]						
Male	1.21	0.96 - 1.52	1.27	0.97 - 1.67	1.20	0.98 - 1.47
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.58	0.36 - 0.95	0.55	0.33 - 0.90	0.65	0.47 - 0.89
35 years or more	0.71	0.40 - 1.27	0.72	0.40 - 1.29	0.66	0.43 - 1.02
Mother's education						
No education[ref]						
Primary	0.95	0.71 - 1.28	1.09	0.78 - 1.52	0.96	0.76 - 1.23
Secondary or higher	1.00	0.63 - 1.58	1.13	0.67 - 1.92	0.90	0.62 - 1.29
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.78	0.56 - 1.10	0.63	0.44 - 0.91	0.93	0.67 - 1.28
3rd quintile	0.84	0.56 - 1.25	0.71	0.43 - 1.18	1.02	0.70 - 1.49
4th quintile	0.94	0.64 - 1.38	0.81	0.47 - 1.38	0.96	0.62 - 1.49
5th quintile (Richest)	0.79	0.48 - 1.30	0.69	0.36 - 1.30	0.91	0.54 - 1.54
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.99	0.72 - 1.35	1.00	0.66 - 1.50	0.91	0.73 - 1.15
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.24	0.91 - 1.68
Proportion of households poor						
Low						
High					0.88	0.65 - 1.19
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.91	0.68 - 1.23
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.83	0.62 - 1.11
Proportion of children fully immunized[d]					0.78	0.40 - 1.50
Intercept	-2.99	-3.43 - -2.56			-3.60	-4.11 - -3.09
AIC/DIC (multilevel model) of full models	4,352		3,500		4,411	

Cont'd..

Table 4: Cont'd

	Madagascar					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.47	0.36 - 0.60	0.48	0.37 - 0.62	0.51	0.41 - 0.63
6–11 months	0.49	0.38 - 0.62	0.51	0.40 - 0.65	0.54	0.44 - 0.68
12–23 months	0.24	0.17 - 0.34	0.25	0.18 - 0.36	0.30	0.22 - 0.41
24+ months	0.44	0.31 - 0.63	0.47	0.33 - 0.67	0.45	0.34 - 0.60
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.06	0.77 - 1.47	0.98	0.70 - 1.39	0.85	0.61 - 1.20
2-3 and 24+ months	0.80	0.59 - 1.08	0.80	0.58 - 1.10	0.70	0.53 - 0.91
4+ and < 24 months	1.42	0.98 - 2.05	1.33	0.88 - 1.99	1.18	0.86 - 1.63
4+ and 24+ months	0.85	0.60 - 1.21	0.83	0.57 - 1.20	0.76	0.57 - 1.01
Child's sex						
Female[ref]						
Male	1.08	0.88 - 1.33	1.12	0.89 - 1.41	1.19	1.02 - 1.40
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.94	0.69 - 1.27	0.94	0.68 - 1.31	0.89	0.69 - 1.15
35 years or more	1.54	1.02 - 2.31	1.61	1.05 - 2.47	1.38	0.98 - 1.95
Mother's education						
No education[ref]						
Primary	1.05	0.83 - 1.34	0.97	0.74 - 1.26	1.09	0.88 - 1.35
Secondary or higher	1.05	0.67 - 1.63	0.92	0.59 - 1.43	0.97	0.69 - 1.36
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.96	0.74 - 1.25	1.02	0.75 - 1.37	1.09	0.86 - 1.38
3rd quintile	0.86	0.63 - 1.16	0.89	0.61 - 1.30	0.99	0.74 - 1.34
4th quintile	0.81	0.59 - 1.12	0.99	0.68 - 1.43	1.11	0.80 - 1.54
5th quintile (Richest)	0.82	0.52 - 1.30	1.37	0.70 - 2.67	1.14	0.72 - 1.81
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.87	0.70 - 1.08	0.90	0.70 - 1.17	0.85	0.70 - 1.04
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.95	0.68 - 1.33
Proportion of households poor						
Low						
High					1.21	0.95 - 1.54
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.88	0.70 - 1.11
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					1.12	0.72 - 1.76
Intercept	-3.65	-3.99 - -3.31			-4.43	-4.82 - -4.05
AIC/DIC (multilevel model) of full models	3,525		2,353		3,094	

Cont'd..

Table 4: Cont'd

	Malawi					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.87	0.71 - 1.06	0.89	0.73 - 1.09	0.81	0.68 - 0.97
6–11 months	0.92	0.76 - 1.11	0.96	0.80 - 1.16	0.95	0.79 - 1.13
12–23 months	0.76	0.60 - 0.96	0.81	0.64 - 1.02	0.75	0.61 - 0.91
24+ months	0.66	0.50 - 0.88	0.71	0.54 - 0.95	0.63	0.48 - 0.81
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.19	0.87 - 1.62	0.98	0.70 - 1.36	0.97	0.73 - 1.31
2-3 and 24+ months	0.70	0.56 - 0.87	0.62	0.48 - 0.79	0.68	0.55 - 0.83
4+ and < 24 months	1.57	1.15 - 2.16	1.23	0.87 - 1.72	1.31	0.97 - 1.78
4+ and 24+ months	0.63	0.48 - 0.83	0.55	0.41 - 0.74	0.60	0.48 - 0.75
Child's sex						
Female[ref]						
Male	1.24	1.08 - 1.44	1.24	1.06 - 1.45	1.30	1.14 - 1.48
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.92	0.74 - 1.13	0.97	0.77 - 1.22	0.87	0.71 - 1.06
35 years or more	0.92	0.67 - 1.28	1.03	0.74 - 1.45	0.88	0.65 - 1.18
Mother's education						
No education[ref]						
Primary	0.85	0.72 - 1.00	0.79	0.65 - 0.95	0.88	0.76 - 1.03
Secondary or higher	0.59	0.40 - 0.88	0.56	0.37 - 0.85	0.62	0.45 - 0.84
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.04	0.83 - 1.30	0.99	0.77 - 1.28	0.99	0.80 - 1.21
3rd quintile	1.01	0.82 - 1.25	1.02	0.81 - 1.28	0.97	0.79 - 1.20
4th quintile	0.90	0.71 - 1.14	0.86	0.66 - 1.12	0.90	0.72 - 1.14
5th quintile (Richest)	0.80	0.56 - 1.15	0.93	0.65 - 1.34	0.89	0.65 - 1.20
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.83	0.70 - 0.97	0.78	0.65 - 0.93	0.84	0.72 - 0.96
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.70	0.51 - 0.97
Proportion of households poor						
Low						
High					0.96	0.81 - 1.13
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.01	0.85 - 1.19
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.93	0.75 - 1.14
Proportion of children fully immunized[d]					1.06	0.66 - 1.71
Intercept	-3.18	-3.49 - -2.88			-3.41	-3.76 - -3.06
AIC/DIC (multilevel model) of full models	9,324		7,925		9,677	

Cont'd..

Table 4: Cont'd

	Mali					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.53	0.44 - 0.64	0.54	0.44 - 0.65	0.52	0.45 - 0.60
6–11 months	0.58	0.48 - 0.70	0.59	0.49 - 0.71	0.59	0.51 - 0.68
12–23 months	0.72	0.59 - 0.88	0.74	0.60 - 0.91	0.75	0.65 - 0.87
24+ months	0.95	0.79 - 1.14	0.98	0.81 - 1.18	1.01	0.86 - 1.18
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.96	0.76 - 1.22	0.94	0.74 - 1.21	0.88	0.70 - 1.10
2-3 and 24+ months	0.66	0.54 - 0.81	0.67	0.54 - 0.82	0.65	0.53 - 0.78
4+ and < 24 months	1.22	0.97 - 1.53	1.15	0.91 - 1.46	1.14	0.91 - 1.42
4+ and 24+ months	0.71	0.55 - 0.90	0.69	0.53 - 0.89	0.66	0.54 - 0.81
Child's sex						
Female[ref]						
Male	1.02	0.91 - 1.15	1.02	0.90 - 1.15	1.09	0.98 - 1.21
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.85	0.70 - 1.03	0.83	0.67 - 1.03	0.87	0.73 - 1.03
35 years or more	0.80	0.61 - 1.07	0.79	0.58 - 1.07	0.88	0.70 - 1.11
Mother's education						
No education[ref]						
Primary	0.91	0.74 - 1.13	0.95	0.76 - 1.18	0.95	0.78 - 1.16
Secondary or higher	0.54	0.34 - 0.86	0.57	0.34 - 0.94	0.52	0.35 - 0.75
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.03	0.87 - 1.21	1.06	0.88 - 1.26	0.99	0.83 - 1.17
3rd quintile	0.89	0.74 - 1.06	0.89	0.73 - 1.08	0.82	0.69 - 0.98
4th quintile	0.93	0.78 - 1.11	0.98	0.82 - 1.17	0.89	0.73 - 1.07
5th quintile (Richest)	0.65	0.51 - 0.84	0.96	0.69 - 1.32	0.73	0.55 - 0.96
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.86	0.69 - 1.07	0.96	0.77 - 1.19	0.83	0.70 - 0.98
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.92	0.74 - 1.14
Proportion of households poor						
Low						
High					1.16	0.99 - 1.37
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.93	0.79 - 1.11
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.75	0.61 - 0.92
Proportion of children fully immunized[d]					1.38	0.97 - 1.98
Intercept	-2.63	-2.86 - -2.40			-3.20	-3.46 - -2.93
AIC/DIC (multilevel model) of full models	15,774		13,388		14,837	

Cont'd..

Table 4: Cont'd

	Mozambique					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	1.00	0.82 - 1.22	1.03	0.84 - 1.25	1.04	0.88 - 1.23
6–11 months	0.73	0.58 - 0.91	0.77	0.61 - 0.96	0.86	0.72 - 1.03
12–23 months	0.50	0.40 - 0.64	0.55	0.43 - 0.69	0.67	0.55 - 0.83
24+ months	0.52	0.38 - 0.69	0.58	0.43 - 0.78	0.60	0.47 - 0.76
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.06	0.79 - 1.44	0.87	0.62 - 1.21	1.01	0.79 - 1.31
2-3 and 24+ months	0.59	0.47 - 0.75	0.55	0.43 - 0.71	0.59	0.48 - 0.71
4+ and < 24 months	1.40	1.05 - 1.88	1.31	0.94 - 1.82	1.23	0.92 - 1.64
4+ and 24+ months	0.61	0.47 - 0.79	0.57	0.43 - 0.76	0.56	0.44 - 0.71
Child's sex						
Female[ref]						
Male	1.05	0.91 - 1.20	1.04	0.89 - 1.21	1.08	0.95 - 1.23
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.79	0.66 - 0.96	0.88	0.71 - 1.08	0.81	0.66 - 0.99
35 years or more	0.70	0.50 - 0.99	0.71	0.50 - 1.01	0.72	0.54 - 0.96
Mother's education						
No education[ref]						
Primary	0.86	0.72 - 1.04	0.87	0.70 - 1.07	0.90	0.77 - 1.05
Secondary or higher	0.68	0.41 - 1.13	0.82	0.46 - 1.48	0.86	0.58 - 1.27
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.18	0.94 - 1.48	1.01	0.78 - 1.31	1.09	0.89 - 1.34
3rd quintile	1.11	0.90 - 1.36	0.83	0.63 - 1.08	0.99	0.80 - 1.24
4th quintile	0.94	0.73 - 1.22	0.70	0.50 - 0.98	0.92	0.71 - 1.19
5th quintile (Richest)	0.85	0.62 - 1.16	0.68	0.42 - 1.11	0.60	0.43 - 0.83
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.93	0.73 - 1.17	1.04	0.80 - 1.37	0.94	0.79 - 1.13
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.15	0.93 - 1.42
Proportion of households poor						
Low						
High					0.83	0.66 - 1.04
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.03	0.83 - 1.28
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.28	1.10 - 1.49
Proportion of children fully immunized[d]					0.75	0.50 - 1.13
Intercept	-2.82	-3.11 - -2.54			-3.14	-3.50 - -2.79
AIC/DIC (multilevel model) of full models	10,323		8,379		7,704	

Cont'd..

Table 4: Cont'd

	Namibia					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.49	0.34 - 0.69	0.52	0.37 - 0.72	0.59	0.43 - 0.81
6–11 months	0.45	0.31 - 0.67	0.48	0.33 - 0.71	0.54	0.38 - 0.77
12–23 months	0.49	0.33 - 0.72	0.53	0.36 - 0.78	0.59	0.42 - 0.84
24+ months	0.35	0.21 - 0.59	0.39	0.23 - 0.65	0.47	0.30 - 0.73
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.75	0.86 - 3.55	1.35	0.61 - 3.01	1.35	0.78 - 2.35
2-3 and 24+ months	1.35	0.91 - 2.01	1.40	0.92 - 2.12	1.08	0.78 - 1.51
4+ and < 24 months	2.05	0.93 - 4.50	1.79	0.86 - 3.71	1.44	0.76 - 2.75
4+ and 24+ months	1.84	1.12 - 3.02	1.67	1.04 - 2.68	1.36	0.89 - 2.07
Child's sex						
Female[ref]						
Male	1.34	1.03 - 1.75	1.36	1.02 - 1.82	1.26	1.00 - 1.61
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.71	0.42 - 1.22	0.69	0.40 - 1.20	0.77	0.53 - 1.12
35 years or more	0.74	0.39 - 1.40	0.80	0.43 - 1.50	0.98	0.58 - 1.64
Mother's education						
No education[ref]						
Primary	1.59	0.93 - 2.71	1.20	0.64 - 2.26	1.59	1.01 - 2.52
Secondary or higher	1.53	0.85 - 2.75	1.12	0.55 - 2.29	1.45	0.87 - 2.40
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.89	0.59 - 1.32	0.89	0.53 - 1.49	0.92	0.63 - 1.36
3rd quintile	1.01	0.67 - 1.52	1.03	0.58 - 1.83	1.03	0.68 - 1.54
4th quintile	0.77	0.48 - 1.24	0.70	0.33 - 1.47	0.69	0.41 - 1.15
5th quintile (Richest)	0.52	0.28 - 0.97	0.45	0.17 - 1.15	0.58	0.31 - 1.07
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.89	0.61 - 1.28	0.72	0.47 - 1.11	0.76	0.54 - 1.05
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.37	0.95 - 1.96
Proportion of households poor						
Low						
High					1.04	0.73 - 1.49
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.12	0.82 - 1.54
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.15	0.86 - 1.54
Proportion of children fully immunized[d]					1.31	0.67 - 2.54
Intercept	-4.11	-4.81 - -3.42			-4.70	-5.43 - -3.97
AIC/DIC (multilevel model) of full models	2,964		2,148		3,113	

Cont'd..

Table 4: Cont'd

	Niger					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.61	0.46 - 0.81	0.62	0.46 - 0.82	0.64	0.52 - 0.77
6–11 months	0.75	0.58 - 0.99	0.77	0.59 - 1.01	0.74	0.61 - 0.90
12–23 months	1.19	0.96 - 1.47	1.24	1.00 - 1.53	1.17	0.97 - 1.40
24+ months	1.26	1.00 - 1.58	1.33	1.06 - 1.68	1.37	1.12 - 1.68
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.14	0.82 - 1.59	1.05	0.75 - 1.46	1.02	0.76 - 1.37
2-3 and 24+ months	0.81	0.62 - 1.06	0.77	0.59 - 1.00	0.79	0.63 - 1.01
4+ and < 24 months	1.74	1.20 - 2.52	1.60	1.13 - 2.26	1.48	1.12 - 1.95
4+ and 24+ months	0.99	0.68 - 1.43	0.96	0.69 - 1.34	0.87	0.67 - 1.12
Child's sex						
Female[ref]						
Male	1.02	0.90 - 1.16	1.00	0.88 - 1.14	1.13	0.98 - 1.29
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.68	0.48 - 0.96	0.72	0.53 - 0.97	0.69	0.55 - 0.87
35 years or more	0.67	0.44 - 1.02	0.73	0.49 - 1.07	0.72	0.52 - 0.98
Mother's education						
No education[ref]						
Primary	1.00	0.78 - 1.29	0.94	0.70 - 1.27	1.08	0.85 - 1.38
Secondary or higher	0.69	0.33 - 1.43	0.79	0.40 - 1.55	0.67	0.42 - 1.06
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.98	0.77 - 1.26	0.94	0.72 - 1.24	1.10	0.87 - 1.39
3rd quintile	0.97	0.76 - 1.24	0.97	0.74 - 1.27	1.09	0.86 - 1.38
4th quintile	1.12	0.90 - 1.41	1.04	0.79 - 1.36	1.22	0.97 - 1.55
5th quintile (Richest)	0.81	0.58 - 1.11	1.00	0.68 - 1.47	0.92	0.66 - 1.29
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.78	0.62 - 0.99	0.94	0.74 - 1.19	0.89	0.70 - 1.14
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.76	0.55 - 1.06
Proportion of households poor						
Low						
High					1.05	0.86 - 1.28
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.89	0.70 - 1.14
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.80	0.67 - 0.97
Proportion of children fully immunized[d]					1.00	0.59 - 1.67
Intercept	-3.09	-3.37 - -2.80			-3.42	-3.74 - -3.11
AIC/DIC (multilevel model) of full models	9,762		7,339		8,596	

Cont'd..

Table 4: Cont'd

	Nigeria					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.43	0.38 - 0.49	0.44	0.39 - 0.50	0.46	0.41 - 0.51
6–11 months	0.44	0.39 - 0.50	0.45	0.40 - 0.51	0.50	0.44 - 0.56
12–23 months	0.81	0.71 - 0.91	0.84	0.74 - 0.95	0.92	0.83 - 1.02
24+ months	0.82	0.72 - 0.94	0.87	0.76 - 0.99	0.99	0.89 - 1.11
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.60	1.37 - 1.87	1.52	1.29 - 1.79	1.37	1.17 - 1.60
2-3 and 24+ months	0.84	0.73 - 0.98	0.85	0.73 - 0.99	0.76	0.67 - 0.87
4+ and < 24 months	1.99	1.71 - 2.33	1.84	1.55 - 2.18	1.67	1.43 - 1.94
4+ and 24+ months	1.04	0.90 - 1.21	0.99	0.84 - 1.15	0.92	0.80 - 1.06
Child's sex						
Female[ref]						
Male	1.12	1.04 - 1.22	1.14	1.05 - 1.24	1.18	1.09 - 1.28
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.71	0.62 - 0.81	0.76	0.67 - 0.87	0.77	0.68 - 0.87
35 years or more	0.83	0.70 - 0.99	0.89	0.74 - 1.07	0.89	0.75 - 1.05
Mother's education						
No education[ref]						
Primary	0.94	0.84 - 1.05	1.04	0.90 - 1.19	0.99	0.87 - 1.12
Secondary or higher	0.84	0.73 - 0.97	0.90	0.75 - 1.08	0.85	0.72 - 1.01
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.92	0.82 - 1.03	0.87	0.76 - 0.99	0.97	0.87 - 1.08
3rd quintile	0.88	0.77 - 1.01	0.93	0.78 - 1.10	1.03	0.90 - 1.19
4th quintile	0.74	0.64 - 0.85	0.88	0.72 - 1.07	0.94	0.78 - 1.12
5th quintile (Richest)	0.52	0.41 - 0.65	0.73	0.54 - 0.98	0.73	0.59 - 0.91
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.05	0.94 - 1.18	1.24	1.09 - 1.42	1.10	0.97 - 1.24
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.85	0.74 - 0.98
Proportion of households poor						
Low						
High					1.17	1.02 - 1.33
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.87	0.75 - 1.00
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.11	1.00 - 1.23
Proportion of children fully immunized[d]					0.93	0.65 - 1.33
Intercept	-2.94	-3.08 - -2.79			-3.62	-3.81 - -3.42
AIC/DIC (multilevel model) of full models	26,983		23,628		26,471	

Cont'd..

Table 4: Cont'd

	Rwanda					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.65	0.53 - 0.80	0.67	0.54 - 0.81	0.62	0.51 - 0.75
6–11 months	0.67	0.53 - 0.84	0.70	0.55 - 0.88	0.66	0.54 - 0.80
12–23 months	0.62	0.49 - 0.79	0.66	0.52 - 0.85	0.63	0.51 - 0.78
24+ months	0.60	0.47 - 0.76	0.66	0.52 - 0.84	0.63	0.49 - 0.81
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.01	0.76 - 1.34	0.98	0.72 - 1.33	1.00	0.77 - 1.31
2-3 and 24+ months	0.72	0.57 - 0.91	0.74	0.57 - 0.95	0.75	0.59 - 0.94
4+ and < 24 months	1.18	0.88 - 1.58	1.13	0.83 - 1.52	1.19	0.91 - 1.56
4+ and 24+ months	0.58	0.45 - 0.75	0.59	0.44 - 0.77	0.63	0.50 - 0.80
Child's sex						
Female[ref]						
Male	1.01	0.88 - 1.16	0.99	0.85 - 1.15	1.03	0.89 - 1.18
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.75	0.57 - 1.00	0.74	0.55 - 1.00	0.66	0.50 - 0.87
35 years or more	0.83	0.59 - 1.17	0.84	0.58 - 1.21	0.72	0.51 - 1.01
Mother's education						
No education[ref]						
Primary	0.88	0.74 - 1.03	0.89	0.75 - 1.06	0.89	0.75 - 1.04
Secondary or higher	0.62	0.42 - 0.91	0.62	0.41 - 0.94	0.61	0.41 - 0.88
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.83	0.67 - 1.01	0.82	0.66 - 1.01	0.83	0.67 - 1.03
3rd quintile	0.71	0.57 - 0.89	0.74	0.58 - 0.95	0.73	0.57 - 0.94
4th quintile	1.02	0.82 - 1.26	1.03	0.81 - 1.29	1.08	0.87 - 1.35
5th quintile (Richest)	0.62	0.46 - 0.83	0.74	0.53 - 1.04	0.70	0.52 - 0.94
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.79	0.65 - 0.96	0.89	0.71 - 1.10	0.89	0.74 - 1.08
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.70	0.54 - 0.91
Proportion of households poor						
Low						
High					1.08	0.89 - 1.32
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.99	0.83 - 1.17
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					0.49	0.29 - 0.83
Intercept	-2.49	-2.82 - -2.17			-2.32	-2.80 - -1.83
AIC/DIC (multilevel model) of full models	8,156		6,432		7,988	

Cont'd..

Table 4: Cont'd

	Senegal					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.35	0.27 - 0.44	0.36	0.28 - 0.45	0.49	0.41 - 0.58
6–11 months	0.36	0.28 - 0.46	0.38	0.29 - 0.48	0.67	0.57 - 0.78
12–23 months	0.36	0.27 - 0.46	0.37	0.29 - 0.48	0.62	0.53 - 0.73
24+ months	0.75	0.57 - 0.98	0.79	0.60 - 1.04	0.74	0.62 - 0.88
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.79	0.58 - 1.09	0.69	0.49 - 0.97	1.25	0.98 - 1.59
2-3 and 24+ months	0.63	0.47 - 0.84	0.65	0.48 - 0.88	0.71	0.60 - 0.84
4+ and < 24 months	0.97	0.71 - 1.32	0.83	0.59 - 1.18	1.28	1.01 - 1.60
4+ and 24+ months	0.64	0.49 - 0.84	0.61	0.45 - 0.82	0.83	0.69 - 0.99
Child's sex						
Female[ref]						
Male	1.24	1.07 - 1.43	1.28	1.10 - 1.49	1.10	0.99 - 1.22
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.78	0.61 - 1.00	0.86	0.64 - 1.16	0.96	0.79 - 1.16
35 years or more	1.13	0.81 - 1.57	1.29	0.87 - 1.91	0.93	0.71 - 1.21
Mother's education						
No education[ref]						
Primary	0.63	0.47 - 0.83	0.60	0.43 - 0.82	1.07	0.91 - 1.27
Secondary or higher	0.92	0.53 - 1.60	0.84	0.45 - 1.56	0.69	0.50 - 0.95
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.98	0.79 - 1.21	0.96	0.76 - 1.22	1.04	0.88 - 1.23
3rd quintile	0.82	0.60 - 1.13	0.82	0.58 - 1.15	1.08	0.91 - 1.29
4th quintile	0.68	0.49 - 0.94	0.57	0.36 - 0.91	0.93	0.76 - 1.15
5th quintile (Richest)	0.47	0.31 - 0.71	0.35	0.18 - 0.67	0.73	0.55 - 0.96
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.99	0.79 - 1.23	1.04	0.82 - 1.32	0.92	0.80 - 1.06
Community-level variable						
Place of residence						
Rural[ref]						
Urban					0.90	0.77 - 1.05
Proportion of households poor						
Low						
High					0.89	0.76 - 1.05
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.99	0.84 - 1.16
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.04	0.90 - 1.21
Proportion of children fully immunized[d]					0.63	0.44 - 0.91
Intercept	-2.78	-3.03 - -2.53			-3.33	-3.64 - -3.02
AIC/DIC (multilevel model) of full models	7,895		6,501		7,773	

Cont'd..

Table 4: Cont'd

	Sierra Leone					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.64	0.48 - 0.85	0.66	0.50 - 0.88	0.66	0.52 - 0.84
6–11 months	0.67	0.50 - 0.89	0.71	0.54 - 0.95	0.72	0.56 - 0.92
12–23 months	0.48	0.35 - 0.66	0.52	0.38 - 0.72	0.56	0.42 - 0.76
24+ months	0.48	0.32 - 0.73	0.54	0.36 - 0.82	0.51	0.35 - 0.73
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.22	0.80 - 1.86	1.21	0.76 - 1.93	1.17	0.82 - 1.68
2-3 and 24+ months	0.58	0.42 - 0.80	0.58	0.41 - 0.80	0.58	0.43 - 0.78
4+ and < 24 months	1.56	1.02 - 2.38	1.49	0.94 - 2.37	1.67	1.18 - 2.38
4+ and 24+ months	0.78	0.55 - 1.12	0.70	0.48 - 1.01	0.77	0.57 - 1.04
Child's sex						
Female[ref]						
Male	0.88	0.72 - 1.08	0.86	0.70 - 1.06	0.84	0.70 - 1.00
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.85	0.61 - 1.18	0.93	0.66 - 1.31	0.77	0.58 - 1.02
35 years or more	1.01	0.64 - 1.60	1.16	0.73 - 1.85	0.94	0.64 - 1.38
Mother's education						
No education[ref]						
Primary	1.16	0.81 - 1.66	1.14	0.76 - 1.71	1.14	0.86 - 1.50
Secondary or higher	1.11	0.76 - 1.64	1.10	0.71 - 1.70	1.01	0.73 - 1.40
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.57	0.39 - 0.82	0.55	0.37 - 0.81	0.63	0.46 - 0.87
3rd quintile	0.76	0.55 - 1.05	0.74	0.49 - 1.11	0.86	0.63 - 1.18
4th quintile	0.70	0.48 - 1.00	0.58	0.33 - 1.00	0.70	0.48 - 1.03
5th quintile (Richest)	0.87	0.59 - 1.28	0.65	0.34 - 1.25	0.80	0.52 - 1.23
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.81	0.64 - 1.01	0.85	0.65 - 1.11	0.89	0.70 - 1.12
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.73	1.22 - 2.46
Proportion of households poor						
Low						
High					1.00	0.70 - 1.42
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.73	0.55 - 0.98
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					0.86	0.66 - 1.13
Proportion of children fully immunized[d]					1.12	0.60 - 2.08
Intercept	-2.71	-3.07 - -2.36			-3.14	-3.75 - -2.53
AIC/DIC (multilevel model) of full models	4,803		3,816		4,844	

Cont'd..

Table 4: Cont'd

	Swaziland					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	1.89	1.34 - 2.66	1.94	1.39 - 2.72	1.96	1.44 - 2.69
6–11 months	0.95	0.65 - 1.40	1.04	0.71 - 1.52	1.04	0.72 - 1.52
12–23 months	0.75	0.45 - 1.23	0.84	0.51 - 1.38	0.70	0.44 - 1.10
24+ months	0.56	0.30 - 1.03	0.65	0.35 - 1.18	0.67	0.40 - 1.14
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.92	0.47 - 1.81	0.82	0.45 - 1.51	0.79	0.42 - 1.49
2-3 and 24+ months	0.78	0.52 - 1.16	0.77	0.50 - 1.19	0.78	0.53 - 1.14
4+ and < 24 months	1.33	0.79 - 2.26	1.24	0.67 - 2.33	1.34	0.73 - 2.48
4+ and 24+ months	0.83	0.50 - 1.36	0.75	0.44 - 1.28	0.77	0.49 - 1.20
Child's sex						
Female[ref]						
Male	1.00	0.78 - 1.28	1.00	0.75 - 1.35	1.01	0.78 - 1.30
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.13	0.76 - 1.69	1.14	0.73 - 1.76	1.17	0.80 - 1.71
35 years or more	0.86	0.46 - 1.60	0.93	0.47 - 1.83	0.77	0.40 - 1.47
Mother's education						
No education[ref]						
Primary	0.90	0.54 - 1.50	0.99	0.60 - 1.63	0.98	0.62 - 1.56
Secondary or higher	0.73	0.44 - 1.23	0.92	0.56 - 1.52	0.76	0.46 - 1.25
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.85	0.54 - 1.34	1.01	0.61 - 1.68	0.77	0.48 - 1.23
3rd quintile	1.07	0.70 - 1.62	0.96	0.59 - 1.55	0.89	0.54 - 1.44
4th quintile	1.28	0.78 - 2.09	0.95	0.56 - 1.64	0.91	0.54 - 1.52
5th quintile (Richest)	1.19	0.76 - 1.86	0.81	0.46 - 1.45	0.81	0.45 - 1.45
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.00	0.75 - 1.33	1.05	0.77 - 1.42	0.92	0.68 - 1.26
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.27	0.84 - 1.91
Proportion of households poor						
Low						
High					0.80	0.55 - 1.18
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.87	0.63 - 1.20
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					0.65	0.28 - 1.48
Intercept	-3.63	-4.23 - -3.02			-3.61	-4.26 - -2.96
AIC/DIC (multilevel model) of full models	2,527		1,834		2,520	

Cont'd..

Table 4: Cont'd

	Tanzania					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.57	0.45 - 0.72	0.59	0.46 - 0.74	0.56	0.46 - 0.70
6–11 months	0.52	0.40 - 0.69	0.55	0.42 - 0.72	0.54	0.44 - 0.67
12–23 months	0.52	0.38 - 0.72	0.56	0.41 - 0.76	0.57	0.45 - 0.72
24+ months	0.59	0.43 - 0.81	0.64	0.46 - 0.88	0.60	0.46 - 0.78
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	0.94	0.62 - 1.43	0.88	0.55 - 1.38	0.86	0.59 - 1.23
2-3 and 24+ months	0.96	0.72 - 1.28	0.99	0.73 - 1.33	0.90	0.68 - 1.20
4+ and < 24 months	1.56	1.08 - 2.27	1.43	0.97 - 2.12	1.40	0.97 - 2.03
4+ and 24+ months	0.79	0.56 - 1.12	0.82	0.57 - 1.19	0.78	0.56 - 1.08
Child's sex						
Female[ref]						
Male	1.09	0.91 - 1.31	1.11	0.91 - 1.36	1.17	0.98 - 1.38
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.83	0.61 - 1.14	0.79	0.57 - 1.10	0.74	0.56 - 0.98
35 years or more	0.96	0.62 - 1.49	0.83	0.54 - 1.28	0.81	0.55 - 1.21
Mother's education						
No education[ref]						
Primary	0.84	0.68 - 1.03	0.78	0.60 - 1.00	0.91	0.75 - 1.10
Secondary or higher	0.69	0.37 - 1.27	0.70	0.35 - 1.40	0.58	0.38 - 0.88
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.36	1.07 - 1.74	1.26	0.96 - 1.67	1.22	0.95 - 1.55
3rd quintile	1.26	0.97 - 1.64	1.24	0.91 - 1.67	1.13	0.87 - 1.48
4th quintile	0.93	0.69 - 1.26	0.96	0.67 - 1.36	0.93	0.69 - 1.25
5th quintile (Richest)	0.95	0.66 - 1.37	0.99	0.51 - 1.91	0.79	0.53 - 1.18
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	1.05	0.85 - 1.31	1.03	0.77 - 1.37	1.02	0.84 - 1.23
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.05	0.77 - 1.43
Proportion of households poor						
Low						
High					0.99	0.77 - 1.27
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.98	0.78 - 1.24
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					0.63	0.37 - 1.07
Intercept	-3.29	-3.60 - -2.97			-3.35	-3.85 - -2.84
AIC/DIC (multilevel model) of full models	6,984		5,318		6,710	

Cont'd..

Table 4: Cont'd

	Uganda					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.75	0.59 - 0.95	0.76	0.60 - 0.97	0.80	0.65 - 0.98
6–11 months	0.82	0.64 - 1.04	0.84	0.66 - 1.07	0.94	0.77 - 1.15
12–23 months	0.93	0.73 - 1.18	0.98	0.77 - 1.24	1.00	0.80 - 1.24
24+ months	0.51	0.37 - 0.70	0.54	0.40 - 0.74	0.51	0.38 - 0.69
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.09	0.77 - 1.54	1.03	0.71 - 1.51	1.17	0.86 - 1.59
2-3 and 24+ months	0.80	0.59 - 1.09	0.79	0.56 - 1.09	0.76	0.57 - 1.01
4+ and < 24 months	1.20	0.86 - 1.68	1.13	0.78 - 1.63	1.09	0.81 - 1.48
4+ and 24+ months	0.74	0.55 - 0.99	0.72	0.53 - 0.98	0.71	0.54 - 0.95
Child's sex						
Female[ref]						
Male	1.25	1.07 - 1.47	1.27	1.07 - 1.49	1.31	1.13 - 1.52
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.87	0.67 - 1.15	0.93	0.69 - 1.26	0.96	0.74 - 1.24
35 years or more	1.13	0.79 - 1.61	1.19	0.81 - 1.74	1.23	0.87 - 1.75
Mother's education						
No education[ref]						
Primary	0.90	0.71 - 1.14	0.97	0.76 - 1.24	0.98	0.81 - 1.19
Secondary or higher	0.70	0.47 - 1.04	0.77	0.50 - 1.19	0.68	0.49 - 0.95
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	0.97	0.77 - 1.23	0.99	0.74 - 1.32	0.88	0.71 - 1.10
3rd quintile	0.86	0.67 - 1.12	0.88	0.63 - 1.24	0.78	0.59 - 1.02
4th quintile	0.98	0.75 - 1.28	1.01	0.69 - 1.48	0.86	0.66 - 1.13
5th quintile (Richest)	0.87	0.62 - 1.21	0.86	0.55 - 1.34	0.77	0.53 - 1.11
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.90	0.76 - 1.08	0.92	0.76 - 1.12	0.94	0.79 - 1.11
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.05	0.77 - 1.44
Proportion of households poor						
Low						
High					0.95	0.76 - 1.18
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.90	0.75 - 1.08
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					0.45	0.21 - 0.99
Intercept	-3.32	-3.72 - -2.92			-3.49	-3.93 - -3.05
AIC/DIC (multilevel model) of full models	7,109		6,009		7,271	

Cont'd..

Table 4: Cont'd

	Zambia					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	0.49	0.37 - 0.66	0.50	0.38 - 0.68	0.58	0.45 - 0.75
6–11 months	0.52	0.39 - 0.69	0.53	0.40 - 0.71	0.62	0.47 - 0.80
12–23 months	0.51	0.38 - 0.69	0.53	0.40 - 0.71	0.65	0.50 - 0.86
24+ months	0.60	0.44 - 0.83	0.63	0.46 - 0.88	0.65	0.47 - 0.89
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	1.40	0.91 - 2.15	1.20	0.75 - 1.93	1.01	0.66 - 1.54
2-3 and 24+ months	0.74	0.54 - 1.00	0.68	0.49 - 0.94	0.69	0.50 - 0.93
4+ and < 24 months	1.17	0.74 - 1.84	0.95	0.61 - 1.48	0.79	0.50 - 1.23
4+ and 24+ months	0.63	0.43 - 0.92	0.56	0.37 - 0.84	0.56	0.41 - 0.78
Child's sex						
Female[ref]						
Male	1.23	1.01 - 1.50	1.18	0.96 - 1.45	1.26	1.04 - 1.53
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	1.07	0.79 - 1.43	1.07	0.78 - 1.46	1.08	0.80 - 1.45
35 years or more	1.34	0.87 - 2.07	1.36	0.87 - 2.12	1.29	0.81 - 2.04
Mother's education						
No education[ref]						
Primary	1.08	0.80 - 1.46	1.39	0.97 - 1.99	1.05	0.76 - 1.45
Secondary or higher	0.89	0.60 - 1.33	1.18	0.73 - 1.92	0.97	0.64 - 1.46
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.04	0.76 - 1.42	1.25	0.88 - 1.79	1.11	0.81 - 1.52
3rd quintile	1.11	0.82 - 1.49	1.36	0.95 - 1.95	1.28	0.90 - 1.82
4th quintile	1.35	0.97 - 1.89	1.62	0.98 - 2.67	1.54	0.99 - 2.41
5th quintile (Richest)	1.21	0.85 - 1.72	1.01	0.53 - 1.95	1.38	0.81 - 2.34
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.97	0.76 - 1.24	0.96	0.72 - 1.29	0.96	0.77 - 1.20
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.55	1.07 - 2.23
Proportion of households poor						
Low						
High					1.17	0.82 - 1.68
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					0.68	0.51 - 0.90
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous					1.34	0.95 - 1.89
Proportion of children fully immunized[d]					0.82	0.35 - 1.93
Intercept	-3.48	-3.92 - -3.04			-4.33	-4.93 - -3.72
AIC/DIC (multilevel model) of full models	5,301		4,155		5,034	

Cont'd..

Table 4: Cont'd

	Zimbabwe					
	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual-level variables						
Age of the child						
< 1 month[ref]						
1–5 months	1.03	0.77 - 1.38	1.07	0.80 - 1.43	1.05	0.81 - 1.37
6–11 months	0.55	0.39 - 0.76	0.59	0.42 - 0.83	0.61	0.44 - 0.84
12–23 months	0.44	0.30 - 0.66	0.49	0.33 - 0.73	0.50	0.35 - 0.73
24+ months	0.41	0.26 - 0.65	0.45	0.29 - 0.71	0.50	0.33 - 0.77
Birth order and preceding birth interval						
First birth[ref]						
2-3 and < 24 months	2.40	1.44 - 4.01	1.94	1.13 - 3.32	1.69	1.03 - 2.78
2-3 and 24+ months	0.92	0.59 - 1.46	0.92	0.56 - 1.51	0.97	0.70 - 1.34
4+ and < 24 months	3.52	1.76 - 7.05	3.50	1.74 - 7.04	2.29	1.32 - 3.97
4+ and 24+ months	1.03	0.60 - 1.76	1.15	0.65 - 2.04	0.96	0.64 - 1.44
Child's sex						
Female[ref]						
Male	1.02	0.80 - 1.30	1.07	0.82 - 1.39	1.18	0.94 - 1.49
Mother's age at child's birth						
Less than 20 years[ref]						
20-34 years	0.82	0.54 - 1.24	0.82	0.53 - 1.27	0.89	0.63 - 1.26
35 years or more	0.86	0.45 - 1.64	0.88	0.45 - 1.75	1.04	0.59 - 1.83
Mother's education						
No education[ref]						
Primary	1.23	0.65 - 2.32	1.46	0.67 - 3.16	1.12	0.58 - 2.16
Secondary or higher	1.46	0.73 - 2.91	1.73	0.82 - 3.63	1.16	0.58 - 2.31
Household wealth Index						
1st quintile (Poorest)[ref]						
2nd quintile	1.11	0.75 - 1.65	1.06	0.73 - 1.55	1.07	0.76 - 1.50
3rd quintile	1.05	0.66 - 1.66	0.95	0.59 - 1.53	1.08	0.73 - 1.61
4th quintile	0.92	0.60 - 1.40	0.71	0.42 - 1.20	0.81	0.46 - 1.42
5th quintile (Richest)	0.91	0.55 - 1.50	0.71	0.32 - 1.60	0.81	0.40 - 1.66
Skilled attendant at delivery						
Other (incl. none)[ref]						
Doctor, nurse, or midwife	0.75	0.57 - 0.99	0.67	0.47 - 0.95	0.73	0.57 - 0.94
Community-level variable						
Place of residence						
Rural[ref]						
Urban					1.04	0.61 - 1.76
Proportion of households poor						
Low						
High					0.98	0.69 - 1.41
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low						
High					1.10	0.80 - 1.52
Ethnic Homogeneity[c]						
Not homogenous						
Totally homogenous						
Proportion of children fully immunized[d]					0.75	0.40 - 1.38
Intercept	-3.84	-4.63 - -3.05			-4.34	-5.22 - -3.46
AIC/DIC (multilevel model) of full models	3,529		2,673		3,544	

Cont'd..

Table 4: Cont'd

Note: ref= reference category for each variable. n/a = no data available

Model 1: Ordinary discrete-time logistic regression predicting children's probability of dying by their fifth birthday with only individual-level variables as predictors (Age of the child ; Birth order and preceding birth interval; Child's sex; Mother's age at child's birth; Mother's education; Skilled attendant at delivery; Household wealth Index).

Model 2: Conditional discrete-time logistic, adds to Model 1 cluster-level fixed effects to control for unobserved community-level characteristics. The covariates are same as in Model 1.

Model 3: Multilevel logit discrete-time model with three-level random intercept: child (level 1), family (level 2) and cluster (level 3). Included as predictors, both individual- and community-level covariates. The Models were fitted using the Markov Chain Monte Carlo (MCMC) procedure in MLwin (version 2.16). To implement estimation using MCMC procedure, the first-order marginal quasi-likelihood (MQL) model is used to obtain initial start values for the parameter estimates.

[a] Proportion of households poor (two lowest wealth quintiles) in the community.

[b] Dichotomous variables indicating whether the proportion of women aged 15-49 in the community with secondary or higher education is high or low (cut-off at mean proportion).

[c] Based on the measures of the ethno-linguistic fractionalization index (EFL), defined as the probability that two individuals selected at random from primary sampling unit, will be from different ethnic groups. Theoretically, for each cluster, the scale goes from 0 (totally homogenous) to 1 (complete diversity). For the purposes of the present analysis, the resulting scale ethno-linguistic fractionalization Index was then classified into dichotomous variables indicating whether the ethnic composition of the community is totally homogenous (ELF equal 0) categorized as 1; if cluster is not totally homogenous (EFL more than 0), then categorized as 0.

[d] Percentage of children who received full immunization in the community (Child has received BCG, measles, and three doses of DPT and polio vaccines).

At the individual level, the results show that in many countries, consistent with earlier studies, the child's birth order and preceding birth interval are significantly associated with under-five mortality. The combination of a higher birth order and a shorter birth interval increases the odds of dying before age five. Fourth or higher-order births preceded by an interval of less than 24 months have a higher mortality risk than first births; this effect is significant in 11 of the 28 countries studied. Correspondingly, children of second and third birth order and a preceding birth interval of 24+ months have a risk of dying before age five that is 17-42% lower than first-born children (ORs are significant in 19 of 28 countries).

The results show a systematically higher mortality for male children compared to females in all countries except Sierra Leone, and the relationship is significant in 14 of 28 countries. In Sierra Leone, males have 16% lower odds than females of dying before age five ($p < 0.10$).

Mother's older age at birth reduce the odds of the child's dying during the first five years, in 10 of the 28 countries. Older mothers tend to be more experienced than younger mothers and better able to care for a newborn. Children born to mothers age 20–34 have on average 13-35% lower odds of dying in childhood compared to children born to mothers below age 20. In Lesotho and Madagascar, however, children born to mothers age 35 or older are 72% and 38% more likely, respectively, to die before age five than children born to mothers under age 20.

The results show a consistent inverse relationship between maternal education and child mortality—the more schooling a mother has, the less likely her child is to die before age five. Children of mothers who attended primary school are less likely to die young than children of mothers with no education, and children of mothers with a secondary and higher education are the least likely to die before age five. Among the 28 countries, this effect is statistically significant in 4 countries for primary education, and in 13 countries for secondary or higher education. The two education variables are jointly significant only in Ethiopia.

The results also show that maternal education is not significantly associated with under-five mortality in several countries (Burkina Faso, Congo, Ghana, and Lesotho). Many past studies (as in my model 1) have concluded that maternal education is a significant predictor of child survival in these countries (see: Desai and Alva 1998; Gakidou et al. 2010; Hobcraft et al. 1985). Most of those studies, however, have failed to account for many important variables, including household-level and community-level heterogeneity, and community context variables

including community-level maternal education. This present study suggests that failure to account for those factors probably has led to overestimated effects of maternal own education on child survival.

The effect of wealth status is relevant in 11 countries, where children from the richest households have a risk of dying before age five that is 24-57% lower than children from the poorest households.

Regarding the effects of use of health care services, the presence of a skilled attendant at the child's delivery is significantly associated with child survival in 5 of the 28 countries examined. Children delivered by health professionals have an odds of dying before age five that is 17-25% lower than children delivered by others or born at home ($p < 0.05$ in Congo Democratic Republic, Gabon, Malawi, Mali, and Zimbabwe).

This research also contributes to the literature on the implications of community-level factors for child mortality. The results show that in a number of countries some attributes of the community influence mortality risks of children, over and above the intermediate factors included in this investigation. The results are mixed concerning the association between urban residence and the odds of dying before age five. Urban residence is significant in seven countries. In Chad, Malawi, Nigeria, and Rwanda, mortality is lower in urban areas than in rural areas. In Namibia, Sierra Leone, and Zambia, however, urban residence increases the odds of under-five mortality.

The results show that in most countries community-level poverty is not associated with increased risk of dying before age five. In Kenya and Nigeria, clusters with a higher percentage of mothers living in poor households are significantly associated with increased odds of under-five deaths.

Health care context appears to play a major role in child survival in most countries. A 1% increase in the proportion of children fully immunized in the community is associated with a significant decrease of 17-79% in the odds of dying before age five, in 11 of 28 countries under study. The results also show that, even when household-level and community-level factors are controlled, the influence of community-level maternal education on child survival is robust. In Congo, Ghana, and Nigeria, clusters with a higher proportion of women with secondary or higher education are significantly associated with reduced odds of under-five deaths.

The results reveal that, in 7 of 28 countries, the ethnic composition within the community affects mortality risk. In Chad, Kenya, Mali, and Niger, higher levels of community ethnic concentration are significantly associated with decreased odds of dying before age five. In Mozambique, Nigeria, and Zambia, however, higher community-level ethnic homogeneity is significantly associated with increased odds of child mortality.

Finally, in Guinea, Lesotho, Liberia, Madagascar, and Swaziland, none of the community-level factors considered in this analysis is significantly associated with under-five mortality.

DISCUSSION AND CONCLUSIONS

In this paper I have examined the effects of child, family, and community characteristics on the risk of dying before age five, across 28 sub-Saharan African countries. Following the recent applications in this field, this paper develops a new empirical conceptualization of childhood mortality research to explain the strong heterogeneity of mortality risks between families and communities across the sub-Saharan countries. This study is the first, to my knowledge, to have an intra-continental scope, comparing determinants of under-five mortality simultaneously at three levels (child, family, and community) across sub-Saharan Africa countries, using DHS data from the most recent national surveys.

The estimates obtained from the analysis show that under-five mortality is jointly determined by the observed individual demographic and socioeconomic characteristics of the child and mother, and by community-level covariates, as well as unobserved household-level and community-level effects, in most of the countries under study.

The results indicate large residual family-level effects and moderately large and statistically significant community-level effects on the risk of dying before age five, even after controlling for a range of child-level, family-level, and community-level variables. I found systematic evidence of higher child mortality clustering at the family-level compared with the community-level. These results suggest that membership in particular families and in particular communities is a major determinant of the risk of dying before age five, in most countries in sub-Saharan Africa.

Because children's contact with institutions outside of the family during the first five years of life (especially < 2 years) is fairly limited, it is not surprising that very few community attributes are associated with the individual-level mortality risks of children (Arguillas 2008). It also is well recognized that household environment is an important determinant of whether young children are exposed to pathogens and other physical risk factors for ill health (David 1999). At this age, the child is kept within the household and often with the mother. Therefore, family-level effects are stronger than community effects, since the child does not have much exposure to the community's culture, customs, and environment (Manda 1998: 154).

The relative importance of family-level random effects observed in child mortality is not uncommon in health research (Bolstad and Manda 2001; Griffiths et al. 2004; Madise et al. 1999; Van de Poel et al. 2009). Like the present study, Bolstad and Manda (2001) used 1992 Malawi DHS data to investigate the existence of variation in under-five mortality risks at both the household level and community level. They estimated the intra-family correlation of child mortality to be about 28% (variance at the family level was 0.843), and the intra-community correlation to be 18% (variance at the community level was 0.417), after controlling for a large number of observed characteristics of individuals and families (Bolstad and Manda 2001:18). In an investigation of the determinants of weight-for-age among young children in six sub-Saharan countries, Madise et al. (1999:339) reported intra-family correlations that ranged from 24% to 40%, while the intra-community correlation ranged from 1% to 6%.

The finding of this present study, which is robust, implies that there are unmeasured or unmeasurable factors other than those included in my analysis that are causing the clustering of child mortality in some families and communities. In general, unobserved effects reflect a diversity of factors that can be broadly classified as genetic, behavioral, and environmental, occurring at individual, family, and community levels (Omariba et al. 2007; Sastry 1997a). Particularly, the explanations for this clustering have centered on childcare practices, use of health services, and personal attitudes of the mothers (Bolstad and Manda 2001; Curtis et al. 1993; Das Gupta 1990; Madise et al. 1999; Pebley et al. 1996; Sastry 1997a). In addition, the unobserved family-level factors could include cultural practices and such household environmental factors as personal hygiene and general cleanliness (Van Poppel et al. 2002).

Finally, while information on birth weight, breastfeeding, delivery care, and immunization is unavailable for the majority of children, these also are part of the unobserved behavioral factors at the family level (Omariba et al. 2007). Other factors that were not measured but that may have helped to reduce the unobserved household heterogeneity in mortality risk include details of specific practices of the mother regarding childcare and hygiene (for example, changes, if any, in the food or water given to children suffering from fever or diarrhea, regular use of soap after defecation, and frequency of bathing). The introduction of HIV as a factor at the community level also may improve the models in countries with relatively high HIV prevalence (DeRose and Kulkarni 2005).

Despite the presence of both unobserved family and community effects, there are different mechanisms that might also predict variation in under-five mortality risks across countries. Results reveal that the standard relationships between child mortality risks and individual and household covariates hold in the countries examined. I discuss below the key findings concerning the effects of some individual-level and community-level factors.

This study found that child's birth order and preceding birth interval, in combination, are strongly associated with under-five mortality. This association is consistent with findings elsewhere that short preceding birth intervals and high parity largely increase child mortality risk, after accounting for unobserved heterogeneity (Bolstad and Manda 2001; Curtis et al. 1993; Miller et al. 1992; Sastry 1997a). This could be related to maternal depletion syndrome and resource competition between siblings, in addition to a lack of care and attention experienced by high-order children (Rutstein 2005; Zenger 1993).

This point is important because short birth intervals remain relatively common in many sub-Saharan countries (Ngianga-Bakwin and Stones 2005). In addition, use of modern contraceptive methods is quite low—often less than 10%—in many countries, especially in Middle and Western Africa (African Population and Health Research Center and Population Reference Bureau 2008:3). Thus the use of contraception to space births could make an important contribution to reducing the risks of child mortality (Curtis et al. 1993). Recently, one multi-country analysis of pregnancy outcomes found that 12 months of contraception-only coverage in the preceding birth interval can reduce the mortality risk for the next newborn by 31%, while 12 months of contraceptive use overlapping with breastfeeding reduces the risk by 68% (Tsui and Creanga 2009).

Child survival to a large extent also depends on mother's age at the time of the child's birth, in several developing countries studied (Bolstad and Manda 2001; Ladusingh and Singh 2006; Sastry 1997a). The present analysis found that in the most of the 28 countries under study the older the mother, the better the child's probability of survival. A similar result is reported by Forste (1994) who found that, in Bolivia, mother's age at childbirth reduced the risk of death during the first two years. The relationship between mother's age at birth and child mortality is sometime difficult to understand. A variety of relationships have been reported and a number of mechanisms have been proposed to account for them (Hobcraft et al. 1985). Forste (1994:506)

has pointed out that older mothers tend to be more experienced and better able to care for a newborn, than younger mothers.

The results show systematically that male children have higher mortality risks than female children. This finding seems to confirm the theory of male biological disadvantage in early life (Waldron 1998) in sub-Saharan Africa.

Findings regarding the effects of maternal education on child mortality generally indicate a negative relationship between the educational attainment of the mother and her risk of experiencing an infant and child death (see, e.g., Desai and Alva 1998; Kravdal 2004; Ladusingh and Singh 2006). The results of the present analysis confirm the strong relationship between increased maternal education and improved child survival, even after accounting for other measures of individual-level, child-level, and mother-level demographic and socioeconomic characteristics, and community-level covariates. That is, a strong association remains between the level of maternal education and the odds of child survival, independent of wealth. It appears that more educated mothers can use limited resources more effectively than mothers with less education. More educated mothers may also have better information on health and nutrition-related practices that translate to better survival chances for children (Griffiths et al. 2004). There are a number of plausible mechanisms that could link the level of maternal education to under-five mortality, including both mediation and moderation effects (Cleland and van Ginneken 1988; Thrane 2006).

As would be expected, and has been found in a previous study (Fotso and Kuate-Defo 2005), this study also observed a negative association between household wealth and child mortality. Compared to children from the poorest households, children from richer households are less likely to die before their fifth birthday, in more than 10 of the 28 countries studied.

The present analysis provides empirical support that, in many countries under study, uptake of safe delivery practices protects children from dying before age five. As would be expected, medical assistance by skilled medical personnel significantly lowers the risk of under-five mortality (WHO 2005). This finding points to the need to continue to invest resources in health care services that promote child health-seeking behavior.

One of the findings of this study is that certain characteristics of the mother's community have independent effects on the survival chances of their children, even after individual and

household factors are accounted for. In the most of the countries under study, as in other previous findings (Van de Poel et al. 2009), urban residence lowers child mortality risks. In some countries, however, urban residence increases the odds of under-five mortality. While it is widely recognized that child health outcomes are better in urban than in rural areas of developing countries (Van de Poel et al. 2007), recent evidence suggests that infant and child mortality rates are increasing in many urban areas in sub-Saharan Africa (Fotso et al. 2007; Garenne 2010).

The drivers of excess urban mortality are multiple, and may vary over time and across geographic areas (Sastry 2004; Van de Poel et al. 2009). They are probably the result of growing urban poverty in the context of rapid and unplanned urbanization (Brockerhoff and Brennan 1998). In this analysis, Sierra Leone is illustrative, "primarily because of a worsening economic situation in urban areas, in the context of a dramatic recession following the 1991–2002 civil war" (Garenne 2010:4). Vorster et al. reported that the "African population is experiencing rapid urbanization characterized by a double burden of disease in which non-communicable diseases become more prevalent and infectious diseases remain undefeated" (Vorster et al. 1999:341). Historians and demographers have long debated the existence, causes, and consequences of historical differences between urban and rural mortality levels (Woods 2003). The debate continues, because a number of pertinent questions remain unresolved. Many studies have pointed out that the way in which mortality is measured may influence the apparent extent of the differential, as may the way in which "urban" and "rural" are defined (Bloom et al. 2010; Woods 2003).

Some of the effects of the other community-level variables are difficult to understand. For instance, in many of the countries studied, poverty concentration within a community is not significantly associated with increased under-five mortality. Although this finding is consistent with other research (Chen et al. 2007), it is an unexpected result. A study by Chen et al. (2007:174) highlights that the weakness of the relationship between community characteristics and child deaths is probably due to more frequent underreporting of child deaths in poor communities.

As has been found elsewhere (Kravdal 2004), this present research confirms the presence of the community-level effect of mother's education on child mortality, in three of the countries studied. Residence in areas where levels of education are generally high is associated with

decreased odds of dying before age five. In Nigeria, this effect is in addition to the positive individual-level effect of the child's own mother being educated. Most interestingly, even children whose own mothers have little education appear to benefit from the education of other mothers in the community, providing evidence of positive externality (spillover effect) of community-level maternal education in shaping child survival. The effect of community education may operate through a wide range of variables related to health and health care (Kravdal 2004:190). In addition, Gage (2007:1680) highlights the role that high levels of social capital can play as a plausible mechanism through which an area's education level can influence maternal health care-seeking behavior.

This study shows that in some countries an ethnic concentration within a community is predictive of child mortality risks, although it appears likely that neighborhood ethnic composition is a surrogate for neighborhood socioeconomic status and/or other contextual factors (Wight et al. 2010) not examined in this study. Because of higher ethnic diversity in sub-Saharan Africa (Fearon 2003; Obono 2003), the effects of the ethnic composition of the community on child mortality are complex and sometimes difficult to understand. Brockerhoff and Hewett (1998:5) have pointed out that "ethnic child mortality differences probably reflect the heterogeneity of social and ecological settings in Africa." In addition, in many countries child survival is also affected indirectly by the prominence of ethnic groups in the national political economy (Brockerhoff and Hewett 1998:7).

In a number of countries, results of the present study agree with the observations made by Kravdal (2004) in India that low mortality is indicated for children who live in communities where relatively many are members of the same ethnic group (e.g.: scheduled castes or tribes) (Kravdal 2004: 186). However, in some countries my results show that higher community-level ethnic homogeneity is associated with increased odds of child mortality.

Possible explanations for such findings are generally centered on cultural models and social mechanisms (Adams et al. 2002; Brockerhoff and Hewett 1998; Rutenberg and Watkins 1997; Weeks et al. 2006). Cultural factors may play a role in shaping women's decisions about child delivery and related medical care. Studies have demonstrated the existence of ethnic variation in attitudes and norms surrounding childbirth and medicine that have direct effects on maternal and infant mortality outcomes (Glei and Goldman 2000).

In more than half of the 28 countries studied, having a high proportion of children fully immunized in a community is associated with lower under-five mortality. This finding highlights that the importance of preventive health measures such as vaccination in improving child survival (WHO 2005). A country-specific estimate of immunization coverage has been considered to be a proxy for availability and accessibility of maternal and child health services (Ahmed and Mosley 2002). Previous studies have shown that individual maternal and child health-seeking behaviors are strongly influenced by the practices of others in the community (Stephenson et al. 2006).

In Guinea, Lesotho, Liberia, Madagascar, and Swaziland, none of the community-level factors considered in this analysis has a statistically significant effect on the risk of under-five mortality. This finding is not surprising, since the full multilevel models show non-significant community-level random effects for these countries. It suggests either that the individual-level covariates are relatively more important than the community-level factors, or that the variables used in the models are not able to capture the contextual effect. Robert (1999) has stated that, "if the association between community socioeconomic context and health simply reflects the sum of relationships at the individual level, we might choose to improve health by targeting individuals with lower socioeconomic position rather than targeting communities with lower socioeconomic profiles" (Robert 1999: 490-491).

This research has inherent limitations that should be noted when interpreting the results. As discussed in other analyses, using DHS data and considering primary sampling units (clusters) as the community level (Montgomery and Hewett 2005), results may be biased toward a well-functioning population, due to both endogeneity and selection effects (Kravdal 2004:190; Wight et al. 2010:212) (as detailed in the literature review section of this paper). In addition, the use of cross-sectional individual-level data restricts the inferences to associations between independent and dependent individual-level variables, not causal relationships.

There are also limitations associated with the community-level characteristics used in this analysis. With the exception of "urban-rural residence," all community-level variables are constructed by aggregating individual-level and household-level characteristics at the community level (the primary sampling units). That is, the community contextual variables are actually compositional variables, aggregated upwards. There are two potential problems with this

approach (Rajaratnama et al. 2006). First, it could result in multicollinearity, since the same variables used to derive the "contextual" variables are also included as individual variables. Second, the approach is subject to atomistic fallacy, or the problem of making inferences at a higher level based on data collected at a lower level (Duncan et al. 1998).

In addition, the lack of adequate measurement of community-level data (such as distance and travel time to a health facility) has probably reduced the predicting models' power, and hence has contributed to the weakness of the community-level effects on child mortality observed in certain countries.

Finally, although this is a comparative study, the 28 countries could not be fitted with a common statistical model. Each country is unique in its demographic and cultural characteristics, and the DHS data differ significantly by some variables across the countries (e.g., the ethnicity variable was not included in models in seven countries). The lack of the same variables in all the data sets primarily limited our analytical attempts. For this reason, the countries could not be easily compared.

Notwithstanding these limitations, these findings represent a further step toward an improved understanding of the complex determinants of child survival in sub-Saharan Africa. The present study provides empirical evidence for the thesis that information about family and community is essential for a better understanding of inequalities in child mortality. Specially, this study demonstrates that there is no single community influence on child mortality, and the significant community-level factors vary across the 28 study settings, as community-level indicators reflect the socioeconomic context and the health care context, as well as culturally and contextually specific practices. This finding has both theoretical value and important policy implications. Finally, this research suggests that the challenge to reduce under-five mortality goes beyond addressing individual factors, and requires a better understanding of contextual factors.

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APPENDIX Table 1: Description of variables used in the analysis (variable names and definitions)

Names	Description
Individual-level variable	
Age of the child in months	Number of months from time of birth until time of death or censoring (interview) (categorized as 1= 0 month; 2= 1 to 5 months; 3= 6 to 11 months; 4= 12 to 23 months; 5= 24 to 59 months).
Sex	Whether the child is male or female (1 = male; 0 = female).
Birth order and preceding birth interval	Birth order and preceding birth interval were combined in one variable and is classified as follows: first birth, birth order 2-4 with short birth interval (< 24 months), birth order 2-4 with medium birth interval (24 – 47 months), birth order 2-4 with long birth interval (48+ months), birth order 5+ with short birth interval (< 24 months), birth order 5+ with medium birth interval (24 – 47 months), birth order 5+ with long birth interval (48+ months).
Mother's age at child birth	Respondent's age (in years) at child birth (1 = less than 20 years; 2 = 20-34 years; 3 = greater than 35 years.
Mother's education	Categorical variable indicating highest educational level that respondents completed (1 = no education; 2 = primary; 3 = secondary or higher education).
Household wealth Index	Index provided with the dataset is used. DHS program provides a composite index of household amenities based on the principal component analysis (PCA) and classified the population into quintiles: (1st quintile (Poorest); 2nd quintile; 3rd quintile; 4th quintile and 5th quintile (Richest). A quintile is assigned to each household as a measure of its relative socioeconomic level (for details see Rutstein and Johnson 2004).
Place of delivery	Whether the place of delivery is in a health facility categorized as 1; if place of delivery is in home or other then as 0.
Skilled attendant at delivery	Deliveries assisted by either doctor, nurse/midwife categorized as 1; if no assistance then categorized as 0.
Community-level variable	
Urban	Whether the cluster is urban community according the definition of the country categorized as 1; if cluster is rural community then categorized as 0.
Community-level socio-economic status	Proportion of households poor (two lowest wealth quintiles) in the community.
Community-level education	Dichotomous variables indicating whether the proportion of women aged 15-49 in the community with secondary or higher education is high or low (cut-off at mean proportion).
Community-level Ethnic Homogeneity	Measure based on the concept of the index of Ethno-linguistic fractionalization (ELF). Ethno-linguistic fractionalization is the probability that two people randomly drawn from the population are from distinct ethnic groups (Fearon, 2003: 208). This Index is calculated as $ELF = 1 - \sum_i$ (Proportion of Ethno-linguistic group$_i$ in the population)^2. Theoretically, for each primary sampling unit, the scale goes from 0 (totally homogenous) to 1 (complete diversity). For the purposes of the present analysis, the resulting scale ethno-linguistic fractionalization Index was then classified into dichotomous variables indicating whether the ethnic composition of the community is totally homogenous (ELF equal 0) categorized as 1; if cluster is not totally homogenous (EFL more than 0), then categorized as 0.
Community child immunization coverage	Percentage of children who received full immunization in the community (Child has received BCG, measles, and three doses of DPT and polio vaccines).

APPENDIX Table 2: Number and percentage[1] of children by selected characteristics and country: births in the five years preceding the survey

Characteristics	Benin		Burkina Faso		Cameroon	
	Number	%	Number	%	Number	%
Number of children	15,929	100.0	10,852	100.0	8,097	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	3,058	19.3	2,053	18.9	1,902	23.6
2-3 and < 24 months	790	5.0	473	4.4	591	7.3
2-3 and 24+ months	4,804	30.3	2,948	27.2	2,112	26.2
4+ and < 24 months	1,025	6.5	690	6.4	755	9.4
4+ and 24+ months	6,194	39.0	4,673	43.1	2,707	33.6
Child's sex						
Female	7,901	49.6	5,303	48.9	4,060	50.1
Male	8,028	50.4	5,549	51.1	4,038	49.9
Mother's age at child's birth						
Less than 20 years	1,890	11.9	1,667	15.4	1,843	22.8
20-34 years	12,013	75.4	7,260	66.9	5,368	66.3
35 years or more	2,026	12.7	1,924	17.7	886	10.9
Mother's education						
No education	11,940	75.0	9,574	88.2	2,397	29.6
Primary	2,829	17.8	862	7.9	3,462	42.8
Secondary or higher	1,161	7.3	416	3.8	2,238	27.6
Household wealth Index						
1st quintile (Poorest)	3,550	22.3	2,100	19.3	2,058	25.4
2nd quintile	3,248	20.4	2,297	21.2	1,648	20.3
3rd quintile	3,320	20.8	2,900	26.7	1,681	20.8
4th quintile	3,206	20.1	1,972	18.2	1,489	18.4
5th quintile (Richest)	2,605	16.4	1,583	14.6	1,221	15.1
Place of delivery						
Home/Other	3,433	21.6	6,655	61.4	3,237	40.2
Health facility	12,462	78.4	4,187	38.6	4,824	59.8
Skilled attendant at delivery						
Other (incl. none)	4,083	25.7	6,741	62.2	3,293	40.8
Doctor, nurse, or midwife	11,777	74.3	4,104	37.8	4,773	59.2
Community-level variables						
Place of residence						
Rural	10,480	65.8	9,466	87.2	4,547	56.2
Urban	5,450	34.2	1,386	12.8	3,550	43.8
Community-level socio-economic status[a]						
Low	8,297	52.1	5,291	48.8	4,041	49.9
High	7,632	47.9	5,561	51.2	4,057	50.1
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	9,015	56.6	8,227	75.8	4,373	54.0
High	6,915	43.4	2,625	24.2	3,724	46.0
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	11,646	73.1	6,252	57.6	6,525	80.6
Totally homogenous (ELF equal 0)	4,283	26.9	4,600	42.4	1,572	19.4
Community-level child immunization coverage[d]						
Low	5,294	33.2	4,086	37.7	2,893	35.7
Middle	5,439	34.1	3,518	32.4	2,433	30.0
High	5,197	32.6	3,248	29.9	2,772	34.2

Cont'd..

APPENDIX Table 2: Cont'd

Characteristics	Chad		Congo (Brazzaville)		Congo Democratic Republic	
	Number	%	Number	%	Number	%
Number of children	5,989	100.0	4,948	100.0	8,999	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,039	17.4	1,271	25.8	1,850	20.6
2-3 and < 24 months	445	7.4	271	5.5	705	7.9
2-3 and 24+ months	1,385	23.2	1,707	34.6	2,171	24.2
4+ and < 24 months	817	13.7	212	4.3	1,141	12.7
4+ and 24+ months	2,291	38.3	1,474	29.9	3,106	34.6
Child's sex						
Female	2,931	48.9	2,434	49.2	4,589	51.0
Male	3,058	51.1	2,514	50.8	4,410	49.0
Mother's age at child's birth						
Less than 20 years	1,277	21.3	1,009	20.4	1,454	16.2
20-34 years	4,013	67.0	3,320	67.1	6,090	67.7
35 years or more	699	11.7	619	12.5	1,455	16.2
Mother's education						
No education	4,580	76.5	443	8.9	2,117	23.5
Primary	1,164	19.4	1,796	36.3	3,770	41.9
Secondary or higher	245	4.1	2,710	54.8	3,112	34.6
Household wealth Index						
1st quintile (Poorest)	1,019	17.0	1,182	23.9	1,873	20.8
2nd quintile	1,356	22.6	1,119	22.6	2,035	22.6
3rd quintile	1,187	19.8	1,060	21.4	1,864	20.7
4th quintile	1,333	22.3	856	17.3	1,844	20.5
5th quintile (Richest)	1,093	18.3	732	14.8	1,383	15.4
Place of delivery						
Home/Other	5,153	86.2	811	16.5	2,503	28.2
Health facility	827	13.8	4,111	83.5	6,382	71.8
Skilled attendant at delivery						
Other (incl. none)	5,839	97.5	3,404	68.8	5,135	57.8
Doctor, nurse, or midwife	147	2.5	1,545	31.2	3,756	42.2
Community-level variables						
Place of residence						
Rural	4,866	81.2	2,691	54.4	5,509	61.2
Urban	1,123	18.8	2,258	45.6	3,490	38.8
Community-level socio-economic status[a]						
Low	2,222	37.1	2,122	42.9	4,560	50.7
High	3,766	62.9	2,826	57.1	4,439	49.3
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	3,779	63.1	2,805	56.7	4,078	45.3
High	2,210	36.9	2,143	43.3	4,921	54.7
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	4,018	67.1	4,817	97.3	2,841	31.6
Totally homogenous (ELF equal 0)	1,970	32.9	132	2.7	6,158	68.4
Community-level child immunization coverage[d]						
Low	2,733	45.6	1,826	36.9	3,212	35.7
Middle	2,068	34.5	1,632	33.0	2,914	32.4
High	1,188	19.8	1,490	30.1	2,873	31.9

Cont'd..

APPENDIX Table 2: Cont'd

Characteristics	Ethiopia Number	Ethiopia %	Gabon Number	Gabon %	Ghana Number	Ghana %
Number of children	11,163	100.0	4,031	100.0	2,909	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,933	17.3	1,083	27.0	688	23.7
2-3 and < 24 months	754	6.8	297	7.4	157	5.4
2-3 and 24+ months	2,593	23.2	1,063	26.5	946	32.6
4+ and < 24 months	1,219	10.9	332	8.3	153	5.3
4+ and 24+ months	4,661	41.8	1,243	30.9	961	33.1
Child's sex						
Female	5,440	48.7	1,979	49.1	1,399	48.1
Male	5,723	51.3	2,052	50.9	1,510	51.9
Mother's age at child's birth						
Less than 20 years	1,715	15.4	1,069	26.5	333	11.5
20-34 years	7,702	69.0	2,566	63.6	2,079	71.4
35 years or more	1,746	15.6	397	9.8	497	17.1
Mother's education						
No education	8,838	79.2	268	6.6	952	32.7
Primary	1,855	16.6	1,697	42.1	722	24.9
Secondary or higher	470	4.2	2,066	51.3	1,232	42.4
Household wealth Index						
1st quintile (Poorest)	2,440	21.9	811	20.1	744	25.6
2nd quintile	2,356	21.1	926	23.0	641	22.0
3rd quintile	2,486	22.3	857	21.3	549	18.9
4th quintile	2,222	19.9	784	19.4	560	19.3
5th quintile (Richest)	1,660	14.9	653	16.2	415	14.3
Place of delivery						
Home/Other	10,502	94.3	510	12.9	1,223	42.2
Health facility	635	5.7	3,454	87.1	1,675	57.8
Skilled attendant at delivery						
Other (incl. none)	10,505	94.3	671	16.8	1,302	45.0
Doctor, nurse, or midwife	635	5.7	3,330	83.2	1,594	55.0
Community-level variables						
Place of residence						
Rural	10,348	92.7	1,069	26.5	1,806	62.1
Urban	815	7.3	2,962	73.5	1,104	37.9
Community-level socio-economic status[a]						
Low	5,893	52.8	2,710	67.2	1,719	59.1
High	5,270	47.2	1,322	32.8	1,190	40.9
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	8,825	79.1	1,666	41.3	1,336	45.9
High	2,338	20.9	2,365	58.7	1,573	54.1
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	4,923	44.1	3,740	92.8	1,655	56.9
Totally homogenous (ELF equal 0)	6,240	55.9	291	7.2	1,254	43.1
Community-level child immunization coverage[d]						
Low	3,304	29.6	1,214	30.1	1,255	43.1
Middle	4,841	43.4	1,274	31.6	649	22.3
High	3,018	27.0	1,543	38.3	1,005	34.6

Cont'd..

APPENDIX Table 2: Cont'd

Characteristics	Guinea Number	Guinea %	Kenya Number	Kenya %	Lesotho Number	Lesotho %
Number of children	6,370	100.0	6,102	100.0	3,572	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,098	17.3	1,469	24.1	1,238	34.8
2-3 and < 24 months	211	3.3	534	8.8	145	4.1
2-3 and 24+ months	1,751	27.6	1,634	26.8	1,178	33.1
4+ and < 24 months	392	6.2	526	8.6	100	2.8
4+ and 24+ months	2,899	45.6	1,929	31.7	901	25.3
Child's sex						
Female	3,075	48.3	2,992	49.0	1,737	48.6
Male	3,294	51.7	3,110	51.0	1,834	51.4
Mother's age at child's birth						
Less than 20 years	1,140	17.9	1,070	17.5	727	20.3
20-34 years	4,128	64.8	4,287	70.3	2,290	64.1
35 years or more	1,103	17.3	745	12.2	555	15.5
Mother's education						
No education	5,546	87.1	938	15.4	94	2.6
Primary	524	8.2	3,901	63.9	2,318	64.9
Secondary or higher	300	4.7	1,263	20.7	1,160	32.5
Household wealth Index						
1st quintile (Poorest)	1,563	24.5	1,509	24.7	746	20.9
2nd quintile	1,376	21.6	1,271	20.8	861	24.1
3rd quintile	1,323	20.8	1,159	19.0	638	17.9
4th quintile	1,164	18.3	1,032	16.9	721	20.2
5th quintile (Richest)	943	14.8	1,131	18.5	605	17.0
Place of delivery						
Home/Other	4,378	69.1	3,584	58.9	1,623	45.9
Health facility	1,960	30.9	2,498	41.1	1,913	54.1
Skilled attendant at delivery						
Other (incl. none)	4,502	71.1	3,545	58.3	1,556	44.0
Doctor, nurse, or midwife	1,828	28.9	2,536	41.7	1,978	56.0
Community-level variables						
Place of residence						
Rural	4,932	77.4	4,959	81.3	3,069	85.9
Urban	1,438	22.6	1,143	18.7	503	14.1
Community-level socio-economic status[a]						
Low	3,352	52.6	2,868	47.0	1,995	55.8
High	3,017	47.4	3,234	53.0	1,577	44.2
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	4,150	65.1	3,096	50.7	1,733	48.5
High	2,220	34.9	3,006	49.3	1,839	51.5
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	4,140	65.0	3,004	49.2	3,572	100.0
Totally homogenous (ELF equal 0)	2,229	35.0	3,098	50.8	3,572	100.0
Community-level child immunization coverage[d]						
Low	2,250	35.3	1,996	32.7	1,127	31.5
Middle	2,114	33.2	2,153	35.3	1,350	37.8
High	2,005	31.5	1,952	32.0	1,095	30.7

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APPENDIX Table 2: Cont'd

Characteristics	Liberia Number	Liberia %	Madagascar Number	Madagascar %	Malawi Number	Malawi %
Number of children	5,594	100.0	12,686	100.0	10,771	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,266	22.7	2,845	22.5	2,530	23.5
2-3 and < 24 months	326	5.8	969	7.7	622	5.8
2-3 and 24+ months	1,582	28.3	3,375	26.6	3,299	30.7
4+ and < 24 months	436	7.8	1,281	10.1	613	5.7
4+ and 24+ months	1,974	35.3	4,196	33.1	3,684	34.3
Child's sex						
Female	2,682	48.0	6,222	49.0	5,390	50.0
Male	2,911	52.0	6,465	51.0	5,381	50.0
Mother's age at child's birth						
Less than 20 years	956	17.1	2,673	21.1	2,205	20.5
20-34 years	3,702	66.2	8,038	63.4	7,321	68.0
35 years or more	935	16.7	1,975	15.6	1,246	11.6
Mother's education						
No education	2,729	48.9	3,219	25.4	2,785	25.9
Primary	1,951	34.9	7,010	55.3	6,860	63.7
Secondary or higher	906	16.2	2,457	19.4	1,127	10.5
Household wealth Index						
1st quintile (Poorest)	1,254	22.4	3,270	25.8	2,099	19.5
2nd quintile	1,332	23.8	2,839	22.4	2,426	22.5
3rd quintile	1,197	21.4	2,539	20.0	2,446	22.7
4th quintile	1,137	20.3	2,252	17.8	2,091	19.4
5th quintile (Richest)	673	12.0	1,787	14.1	1,709	15.9
Place of delivery						
Home/Other	3,411	61.7	8,082	64.0	3,164	29.4
Health facility	2,113	38.3	4,539	36.0	7,593	70.6
Skilled attendant at delivery						
Other (incl. none)	2,965	53.9	7,058	55.9	4,702	43.8
Doctor, nurse, or midwife	2,539	46.1	5,571	44.1	6,042	56.2
Community-level variables						
Place of residence						
Rural	3,900	69.7	11,309	89.1	9,347	86.8
Urban	1,694	30.3	1,377	10.9	1,425	13.2
Community-level socio-economic status[a]						
Low	2,848	50.9	6,771	53.4	5,499	51.1
High	2,745	49.1	5,915	46.6	5,272	48.9
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	2,901	51.9	6,235	49.1	5,363	49.8
High	2,693	48.1	6,451	50.9	5,408	50.2
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	4,433	79.3	12,686	100.0	8,784	81.5
Totally homogenous (ELF equal 0)	1,160	20.7	12,686	100.0	1,988	18.5
Community-level child immunization coverage[d]						
Low	1,761	31.5	3,798	29.9	3,688	34.2
Middle	1,709	30.6	4,231	33.4	3,560	33.1
High	2,124	38.0	4,657	36.7	3,524	32.7

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APPENDIX Table 2: Cont'd

Characteristics	Mali Number	Mali %	Mozambique Number	Mozambique %	Namibia Number	Namibia %
Number of children	14,420	100.0	10,620	100.0	5,003	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	2,536	17.6	2,303	21.7	1,608	32.3
2-3 and < 24 months	1,009	7.0	599	5.7	271	5.4
2-3 and 24+ months	3,385	23.5	3,037	28.6	1,770	35.5
4+ and < 24 months	1,578	11.0	758	7.1	182	3.7
4+ and 24+ months	5,894	40.9	3,909	36.9	1,148	23.1
Child's sex						
Female	7,104	49.3	5,379	50.6	2,434	48.7
Male	7,316	50.7	5,241	49.4	2,569	51.3
Mother's age at child's birth						
Less than 20 years	2,901	20.1	2,380	22.4	793	15.9
20-34 years	9,494	65.8	6,865	64.6	3,482	69.6
35 years or more	2,026	14.0	1,375	12.9	728	14.5
Mother's education						
No education	12,334	85.5	4,906	46.2	553	11.1
Primary	1,452	10.1	5,315	50.0	1,436	28.7
Secondary or higher	634	4.4	399	3.8	3,014	60.2
Household wealth Index						
1st quintile (Poorest)	2,958	20.5	2,822	26.6	1,072	21.4
2nd quintile	2,985	20.7	2,050	19.3	956	19.1
3rd quintile	3,025	21.0	2,286	21.5	1,121	22.4
4th quintile	2,939	20.4	1,775	16.7	1,041	20.8
5th quintile (Richest)	2,514	17.4	1,687	15.9	813	16.3
Place of delivery						
Home/Other	7,783	54.3	5,370	50.7	933	18.7
Health facility	6,550	45.7	5,214	49.3	4,055	81.3
Skilled attendant at delivery						
Other (incl. none)	10,450	73.0	8,499	80.4	919	18.4
Doctor, nurse, or midwife	3,864	27.0	2,077	19.6	4,071	81.6
Community-level variables						
Place of residence						
Rural	10,529	73.0	7,533	70.9	2,926	58.5
Urban	3,891	27.0	3,087	29.1	2,077	41.5
Community-level socio-economic status[a]						
Low	6,983	48.4	4,556	42.9	2,484	49.6
High	7,438	51.6	6,064	57.1	2,519	50.4
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	8,811	61.1	8,233	77.5	2,329	46.5
High	5,609	38.9	2,387	22.5	2,674	53.5
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	12,639	87.6	6,298	59.3	2,703	54.0
Totally homogenous (ELF equal 0)	1,782	12.4	4,322	40.7	2,300	46.0
Community-level child immunization coverage[d]						
Low	4,779	33.1	4,199	39.5	1,707	34.1
Middle	5,299	36.7	3,418	32.2	1,621	32.4
High	4,343	30.1	3,003	28.3	1,675	33.5

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APPENDIX Table 2: Cont'd

Characteristics	Niger Number	Niger %	Nigeria Number	Nigeria %	Rwanda Number	Rwanda %
Number of children	9,954	100.0	28,100	100.0	8,715	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,544	15.5	5,371	19.1	1,616	18.6
2-3 and < 24 months	603	6.1	2,324	8.3	802	9.2
2-3 and 24+ months	2,146	21.6	6,969	24.8	2,079	23.9
4+ and < 24 months	1,142	11.5	3,071	10.9	841	9.7
4+ and 24+ months	4,503	45.3	10,324	36.8	3,353	38.6
Child's sex						
Female	4,853	48.8	13,811	49.2	4,287	49.2
Male	5,101	51.2	14,289	50.8	4,428	50.8
Mother's age at child's birth						
Less than 20 years	1,848	18.6	4,159	14.8	533	6.1
20-34 years	6,653	66.8	19,636	69.9	6,366	73.1
35 years or more	1,452	14.6	4,305	15.3	1,815	20.8
Mother's education						
No education	8,709	87.5	13,071	46.5	2,470	28.3
Primary	934	9.4	6,521	23.2	5,513	63.3
Secondary or higher	311	3.1	8,508	30.3	732	8.4
Household wealth Index						
1st quintile (Poorest)	2,144	21.5	6,525	23.2	1,845	21.2
2nd quintile	1,989	20.0	6,395	22.8	1,794	20.6
3rd quintile	1,903	19.1	5,417	19.3	1,785	20.5
4th quintile	2,100	21.1	5,003	17.8	1,742	20.0
5th quintile (Richest)	1,818	18.3	4,760	16.9	1,548	17.8
Place of delivery						
Home/Other	8,168	82.6	17,437	62.7	6,139	70.6
Health facility	1,722	17.4	10,377	37.3	2,553	29.4
Skilled attendant at delivery						
Other (incl. none)	8,101	82.2	18,045	65.1	6,212	71.5
Doctor, nurse, or midwife	1,757	17.8	9,660	34.9	2,479	28.5
Community-level variables						
Place of residence						
Rural	8,451	84.9	19,741	70.3	7,487	85.9
Urban	1,503	15.1	8,359	29.7	1,228	14.1
Community-level socio-economic status[a]						
Low	4,146	41.7	15,483	55.1	4,152	47.6
High	5,808	58.3	12,617	44.9	4,563	52.4
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	7,616	76.5	13,075	46.5	4,523	51.9
High	2,337	23.5	15,025	53.5	4,192	48.1
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	6,509	65.4	16,963	60.4	8,715	100.0
Totally homogenous (ELF equal 0)	3,445	34.6	11,137	39.6	8,715	100.0
Community-level child immunization coverage[d]						
Low	4,387	44.1	9,029	32.1	2,875	33.0
Middle	3,251	32.7	8,980	32.0	2,914	33.4
High	2,316	23.3	10,091	35.9	2,926	33.6

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APPENDIX Table 2: Cont'd

Characteristics	Senegal Number	Senegal %	Sierra Leone Number	Sierra Leone %	Swaziland Number	Swaziland %
Number of children	10,530	100.0	5,811	100.0	2,829	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	2,299	21.9	1,148	19.8	890	31.6
2-3 and < 24 months	741	7.0	366	6.3	160	5.7
2-3 and 24+ months	2,767	26.3	1,785	30.8	904	32.1
4+ and < 24 months	845	8.0	459	7.9	141	5.0
4+ and 24+ months	3,860	36.7	2,038	35.2	725	25.7
Child's sex						
Female	5,109	48.5	2,931	50.4	1,401	49.5
Male	5,421	51.5	2,880	49.6	1,428	50.5
Mother's age at child's birth						
Less than 20 years	1,669	15.8	977	16.8	661	23.4
20-34 years	7,236	68.7	4,002	68.9	1,852	65.5
35 years or more	1,625	15.4	832	14.3	315	11.1
Mother's education						
No education	7,577	72.0	4,443	76.5	263	9.3
Primary	2,194	20.8	713	12.3	992	35.1
Secondary or higher	759	7.2	655	11.3	1,574	55.6
Household wealth Index						
1st quintile (Poorest)	2,425	23.0	1,327	22.8	572	20.2
2nd quintile	2,332	22.1	1,220	21.0	603	21.3
3rd quintile	2,238	21.3	1,288	22.2	554	19.6
4th quintile	1,908	18.1	1,102	19.0	554	19.6
5th quintile (Richest)	1,627	15.5	873	15.0	546	19.3
Place of delivery						
Home/Other	3,916	37.4	4,172	73.8	715	25.3
Health facility	6,550	62.6	1,479	26.2	2,110	74.7
Skilled attendant at delivery						
Other (incl. none)	5,780	55.2	3,892	68.6	873	30.9
Doctor, nurse, or midwife	4,683	44.8	1,783	31.4	1,951	69.1
Community-level variables						
Place of residence						
Rural	6,688	63.5	4,226	72.7	2,199	77.7
Urban	3,842	36.5	1,585	27.3	630	22.3
Community-level socio-economic status[a]						
Low	5,686	54.0	2,671	46.0	1,445	51.1
High	4,843	46.0	3,140	54.0	1,384	48.9
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	5,459	51.8	3,414	58.8	1,384	48.9
High	5,071	48.2	2,397	41.2	1,445	51.1
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	9,224	87.6	3,512	60.4	2,829	100.0
Totally homogenous (ELF equal 0)	1,306	12.4	2,299	39.6	2,829	100.0
Community-level child immunization coverage[d]						
Low	3,670	34.9	2,164	37.2	926	33.8
Middle	3,501	33.2	1,788	30.8	946	33.4
High	3,359	31.9	1,860	32.0	2,828	100.0

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APPENDIX Table 2: Cont'd

Characteristics	Tanzania Number	Tanzania %	Uganda Number	Uganda %	Zambia Number	Zambia %
Number of children	8,725	100.0	8,423	100.0	6,435	100.0
Individual-level variables						
Birth order and preceding birth interval						
First birth	1,922	22.1	1,450	17.2	1,270	19.8
2-3 and < 24 months	503	5.8	658	7.8	348	5.4
2-3 and 24+ months	2,620	30.1	1,749	20.8	1,866	29.1
4+ and < 24 months	586	6.7	1,097	13.0	437	6.8
4+ and 24+ months	3,072	35.3	3,458	41.1	2,496	38.9
Child's sex						
Female	4,347	49.8	4,243	50.4	3,231	50.2
Male	4,377	50.2	4,180	49.6	3,204	49.8
Mother's age at child's birth						
Less than 20 years	1,502	17.2	1,436	17.0	1,102	17.1
20-34 years	6,153	70.5	5,857	69.5	4,485	69.7
35 years or more	1,070	12.3	1,131	13.4	849	13.2
Mother's education						
No education	2,318	26.6	1,910	22.7	870	13.5
Primary	6,020	69.0	5,358	63.6	4,089	63.5
Secondary or higher	387	4.4	1,155	13.7	1,477	22.9
Household wealth Index						
1st quintile (Poorest)	1,974	22.6	1,893	22.5	1,524	23.7
2nd quintile	1,857	21.3	1,900	22.6	1,445	22.4
3rd quintile	1,866	21.4	1,676	19.9	1,351	21.0
4th quintile	1,681	19.3	1,604	19.0	1,227	19.1
5th quintile (Richest)	1,347	15.4	1,351	16.0	889	13.8
Place of delivery						
Home/Other	4,599	52.8	4,870	57.9	3,325	51.8
Health facility	4,115	47.2	3,539	42.1	3,092	48.2
Skilled attendant at delivery						
Other (incl. none)	5,030	57.8	4,889	58.1	3,491	54.4
Doctor, nurse, or midwife	3,677	42.2	3,526	41.9	2,924	45.6
Community-level variables						
Place of residence						
Rural	7,034	80.6	7,470	88.7	4,553	70.7
Urban	1,691	19.4	953	11.3	1,883	29.3
Community-level socio-economic status[a]						
Low	4,174	47.8	4,421	52.5	2,969	46.1
High	4,551	52.2	4,002	47.5	3,466	53.9
Proportion of women aged 15-49 in the community with secondary or higher education[b]						
Low	6,361	72.9	4,125	49.0	3,407	52.9
High	2,364	27.1	4,298	51.0	3,028	47.1
Community-level ethnic homogeneity[c]						
Not totally homogenous (EFL more than 0)	8,725	100.0	8,423	100.0	5,664	88.0
Totally homogenous (ELF equal 0)	8,725	100.0	8,423	100.0	771	12.0
Community-level child immunization coverage[d]						
Low	2,944	33.7	2,811	33.4	2,276	35.4
Middle	2,924	33.5	2,827	33.6	2,066	32.1
High	8,725	100.0	8,423	100.0	2,093	32.5

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APPENDIX Table 2: Cont'd

Characteristics	Zimbabwe Number	Zimbabwe %
Number of children	5,231	100.0
Individual-level variables		
Birth order and preceding birth interval		
First birth	1,654	31.7
2-3 and < 24 months	208	4.0
2-3 and 24+ months	1,988	38.1
4+ and < 24 months	159	3.1
4+ and 24+ months	1,210	23.2
Child's sex		
Female	2,563	49.0
Male	2,668	51.0
Mother's age at child's birth		
Less than 20 years	1,070	20.5
20-34 years	3,668	70.1
35 years or more	492	9.4
Mother's education		
No education	213	4.1
Primary	1,922	36.7
Secondary or higher	3,096	59.2
Household wealth Index		
1st quintile (Poorest)	1,296	24.8
2nd quintile	1,093	20.9
3rd quintile	911	17.4
4th quintile	1,091	20.9
5th quintile (Richest)	839	16.0
Place of delivery		
Home/Other	1,627	31.2
Health facility	3,595	68.8
Skilled attendant at delivery		
Other (incl. none)	1,637	31.4
Doctor, nurse, or midwife	3,583	68.6
Community-level variables		
Place of residence		
Rural	3,718	71.1
Urban	1,513	28.9
Community-level socio-economic status[a]		
Low	2,767	52.9
High	2,464	47.1
Proportion of women aged 15-49 in the community with secondary or higher education[b]		
Low	2,489	47.6
High	2,742	52.4
Community-level ethnic homogeneity[c]		
Not totally homogenous (EFL more than 0)	5,231	100.0
Totally homogenous (ELF equal 0)	5,231	100.0
Community-level child immunization coverage[d]		
Low	1,999	38.2
Middle	1,575	30.1
High	5,231	100.0

Cont'd..

APPENDIX Table 2: Cont'd

Note: Percentages may not add to 100 because of missing values.

[1] Weighted percentage. Figures were calculated using appropriate individual country weights.

n/a = Not available. Item not measured

[a] Proportion of households poor (two lowest wealth quintiles) in the community.

[b] Dichotomous variables indicating whether the proportion of women aged 15-49 in the community with secondary or higher education is high or low (cut-off at mean proportion).

[c] Based on the measures of the ethno-linguistic fractionalization index (EFL), defined as the probability that two individuals selected at random from primary sampling unit, will be from different ethnic groups. Theoretically, for each cluster, the scale goes from 0 (totally homogenous) to 1 (complete diversity). For the purposes of the present analysis, the resulting scale ethno-linguistic fractionalization Index was then classified into dichotomous variables indicating whether the ethnic composition of the community is totally homogenous (ELF equal 0) categorized as 1; if cluster is not totally homogenous (EFL more than 0), then categorized as 0.

[d] Percentage of children who received full immunization in the community (Child has received BCG, measles, and three doses of DPT and polio vaccines).