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Household and Community Risk Factors and Child Well-Being in Low- and Middle-Income Countries

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ABSTRACT

This report focuses on the well-being of children age 0-17 using 10 outcomes in four domains: nutrition, health care, schooling, and child protection. The data used in the analysis were obtained from recent surveys conducted by The Demographic and Health Surveys Program, one survey in each of 30 countries selected on the basis of USAID priorities or low levels of the Human Development Index. The analysis describes the relationship between each outcome and risk factors at the levels of the child, household, and sample cluster. The working hypothesis, based on empirical generalizations found in the literature, was that risk factors would correspond with negative outcomes for all indicators in all countries. However, to the contrary, it is found that the effect of most risk factors cannot be generalized across all outcomes or all countries. For example, the effect of household structure, represented by the presence of biological parents and the relationship of the child to the household head, tends to be stronger for the child protection and schooling outcomes than for other outcomes, but this relationship is not consistent across all countries. The index of household crowding—the number of household members per room—has a strong association with most outcomes across all the surveys, but this generalization does not hold for schooling and birth registration. The analysis implies that the impact on child outcomes of household structure and other household-level or community-level variables can vary, sometimes substantially, across countries.

KEY WORDS: Child well-being, household structure, orphanhood status, household risk factors, community level risk factors, nutrition, schooling, child protection, vulnerable children

1 INTRODUCTION

Surveys conducted by The Demographic and Health Surveys (DHS) Program include a great deal of information about children—persons age 17 and younger—in the household population. This report analyzes the relationship between outcomes that relate to child well-being, on the one hand, and background characteristics that potentially measure a child's risk or vulnerability, on the other hand. The scope of the report is as broad as possible, including virtually all indicators of child well-being and child vulnerability that can be extracted from DHS surveys.

The literature on child well-being generally employs five domains: physical, psychological, cognitive, social, and economic (Pollard and Lee 2003). Several studies have used a combination of indicators in different domains to examine child well-being. A study by Kanamori and Pullum (2013) focused on deprivation of children's basic human needs for health, water, sanitation, education, food, information, and shelter, using DHS data from 30 countries in sub-Saharan Africa. These data included child-specific health indicators, such as stunting and vaccination, and household-level indicators, such as source of drinking water and type of shelter. The Child Poverty and Deprivations Study, developed by UNICEF and conducted in 40 countries, uses individual-level data from DHS surveys or Multiple Indicator Cluster Surveys (MICS) to summarize indicators in seven domains: shelter, sanitation facilities, safe drinking water, information, food, education, and health (UNICEF 2007). UNICEF examines these domains through child-level and household-level indicators and publishes country-specific reports aimed at policymakers to highlight children's vulnerability and deprivation in each country, as in Jamaica (UNICEF 2009a), Tanzania (UNICEF 2009b), and Nigeria (UNICEF 2009c).

Other studies have combined multiple indicators from several domains into a child well-being index. The Child and Youth Well-Being Index was developed to track trends over time in the well-being of children and youth in the United States (Land, Lamb, and Zheng 2011; Land et al. 2007). This index uses aggregate-level indicators in seven domains: family economic well-being, health, safety/behavioral concerns, educational attainment, community connectedness, social relationships, and emotional/spiritual well-being. The index combines 28 national indicators, including poverty rates, mortality rates, and mathematics test scores (Land, Lamb, and Zheng 2011; Land et al. 2007). The Child Status Index was developed by O'Donnell et al. (2013) to monitor the situation of children made vulnerable by the HIV/AIDS pandemic, through orphanhood or otherwise. The index covers many of the same domains as in the study by Kanamori and Pullum and in the Child and Youth Well-Being Index. The Child Status Index is constructed by scoring households during home visits in the domains of food/nutrition, shelter and care, protection, health care, psychosocial concerns, and education (O'Donnell et al. 2013).

From our perspective, these studies have examined children's well-being in terms of outcomes and risk factors. The distinction between an outcome and a risk factor is not always clear, as some outcomes are themselves risk factors for other outcomes. For instance, stunting can be viewed as an outcome of household-level risk factors, but it can also be a risk factor for not attending school (Grantham-McGregor et al. 2007). Outcomes and risk factors can be differentiated such that, from a policy and program intervention perspective, outcomes are the end products to be improved and risk factors can be mitigated to help achieve these improvements. Risk factors can cut across several levels related to the child, parents or caregivers, the household, and the community or country where the child lives. Each level has its own risk

factors or vulnerabilities. For instance, orphanhood, an uneducated caregiver, a crowded household, a poor community, and a developing country can all reduce the chance that a child will receive a formal education. In addition, vulnerability at each level may contribute to vulnerability at another level. Household risk factors such as overcrowding, a high dependency ratio, and poverty can be closely tied to the characteristics of the community where the household is located.

An analysis by UNICEF covering nine child outcomes, ranging from vaccination to early marriage, identified a vulnerable child as one whose household is in the bottom two wealth quintiles, who is not living with either parent, who has lost one or both parents, and whose household has no educated adults (UNICEF 2014). Akwara et al. (2010) analyzed 60 nationally representative surveys from 36 countries on three outcomes (wasting, school attendance, and early sex) and several child-level and household-level risk factors. The authors highlighted several household-level variables, such as wealth, education of household head or eldest female, and sanitation, as better measures of child vulnerability than orphanhood status or living with a chronically ill adult.

Previous research has shown that children tend to experience worse outcomes if they are an orphan of any kind (Akwara et al. 2010; Case, Paxson, and Ableidinger 2004; Mishra and Bignami-Van Assche 2008; UNICEF n.d. 2014), if they do not live with both parents (UNICEF 2014), or if they live in a household with few educated adults or low level of literacy (Assaf, Kothari, and Pullum 2015; Hobcraft 1993; Pezzulo et al. 2016; UNICEF 2014), a high level of crowding (Evans 2006; Gove, Hughes, and Galle 1983; Solari and Mare 2012), or a high dependency ratio (Hadley et al. 2011; UNICEF 2014). Boys tend to have worse nutrition outcomes than girls (Assaf, Kothari, and Pullum 2015; Kanamori and Pullum 2013) but better health care (Kanamori and Pullum 2013; Pandey et al. 2002) and schooling (Kanamori and Pullum 2013; Shahidul and Karim 2015; UNESCO 2012; UNICEF 2014). While the education of both the father and mother in the household is important for the child's well-being, the mother's education appears to be more important than the father's for the child's health (Cochrane, Leslie, and O'Hara 1982; Hobcraft 1993; Wamani et al. 2004).

There is evidence that children tend to experience worse outcomes if they live in a community with a low level of development, usually represented in the literature by urban-rural residence or the household wealth index (Assaf, Kothari, and Pullum 2015; Grantham-McGregor et al. 2007; Hadley et al. 2011; Kanamori and Pullum 2013; UNICEF 2014; Victora et al. 2003). Another characterization of development can be produced using spatial data involving the level of nighttime lights or nearness to a major city (Nelson 2008; National Centers for Environmental Information 2015; Uchida and Nelson 2010). These variables are highly correlated with urban-rural residence as well as household wealth quintile or poverty, and are seen as a more accurate measure of development and urban-rural classification (Elvidge et al. 2009; Ghosh et al. 2010; Pezzulo et al. 2016; Uchida and Nelson 2010).

This analysis will treat these empirical generalizations as hypotheses, and will assess their applicability to a range of child outcomes in 30 low- and middle-income countries, using DHS data. The analysis will focus on four domains to measure child well-being: nutrition, health care, schooling, and child protection. Each domain can be measured with several outcomes that span different age groups within the age range 0-17. Due to the nature of DHS samples, this report focuses on children living in a household. It does not include children living in the streets or in orphanages, who may have a greater risk for poor outcomes than children living in a household. The indicators of child well-being used in this report follow the age categories in the

DHS, referring to children age 0-4, children age 5-14, and children (specifically girls) age 15-17. The analysis highlights the household-level and community-level risk factors for adverse childhood outcomes, after controlling for orphanhood and household living arrangements. The findings can be used to identify children, households, and communities with high risk and can provide guidance for programs to improve outcomes for children.

2 DATA AND METHODS

2.1 DHS Data

The analysis uses data from DHS surveys in 30 countries—the most recent survey for each country. The first criterion for selection was high priority for USAID's Center for Children in Adversity. That criterion led to the selection of the most recent DHS surveys in Armenia, Cambodia, Colombia, Moldova, Rwanda, and Uganda, as shown in Table 1. The second criterion was high priority for USAID's activities related to maternal and child health (MCH). The third criterion was a low rank on the Human Development Index—from a possible rank of 1 to 188 (UNDP 2016). The total number of countries was arbitrarily set at 30, for convenience of presentation.

Table 1 List of surveys used in the analysis by HDI rank and USAID priority status

Country	Survey year	HDI rank	Priority country
Armenia	2010	85	CA
Benin	2011-12	166	-
Burkina Faso	2010	183	-
Burundi	2010	184	-
Cambodia	2014	143	CA
Chad	2015	185	-
Colombia	2010	97	CA
Congo Democratic Republic	2013-14	176	MCH
Côte d'Ivoire	2011-12	172	-
Ethiopia	2011	174	MCH
Ghana	2014	140	MCH
Guinea	2012	182	-
Haiti	2012	163	MCH
Kenya	2014	145	MCH
Liberia	2013	177	MCH
Madagascar	2008-09	154	MCH
Malawi	2015-16	173	MCH
Mali	2012	179	MCH
Moldova	2005	107	CA
Mozambique	2011	180	MCH
Myanmar	2015-16	148	-
Nepal	2011	145	MCH
Nigeria	2013	152	MCH
Rwanda	2014-15	163	CA,MCH
Senegal	2015	170	MCH
Sierra Leone	2013	181	-
Tanzania	2015-16	151	MCH
Togo	2013-14	162	-
Uganda	2011	163	CA,MCH
Zambia	2013-14	139	MCH

Notes: HDI - Human Development Index; CA - USAID Children in Adversity priority country; MCH - USAID MCH priority country

2.2 Outcome Variables

Ten outcomes in four domains were used in the analysis. The domains and their related outcomes are:

> **Nutrition:** Stunted, wasted, any anemia (for children under age 5); underweight based on body mass index (BMI), and any anemia (for girls age 15-17)
>
> **Health care:** No treatment sought in a health facility for symptoms of Acute Respiratory Infection, or ARI, possibly pneumonia (for children under age 5)
>
> **Schooling:** Not in school (for children age 5-14)
>
> **Child protection:** Adolescent fertility, first sex before age 15 (for girls age 15-17); no birth registration (for children under age 5)

The outcome "any anemia" was constructed for two age groups: children under age 5 and girls age 15-17. The DHS program does not generally collect biomarker data for boys age 15-17, so "underweight" and "any anemia" for age 15-17 were only available for girls. In addition, "adolescent fertility" and "first sex before age 15" are included for girls age 15-17 but not for boys. The outcome variables were constructed according to the definitions below, in all cases aligned in a negative ("bad outcome") direction.

Children under age 5:

> **Stunting:** The proportion of *de facto* children under age 5 with a height-for-age z-score below the median of the World Health Organization (WHO) 2007 reference population by more than two standard deviations.
>
> **Wasting:** The proportion of *de facto* children under age 5 with a weight-for-height z-score below the median of the WHO 2007 reference population by more than 2 standard deviations.
>
> **Any anemia:** The proportion of *de facto* children age 6-59 months with a hemoglobin level less than 11 grams per deciliter. Hemoglobin levels are adjusted for altitude.
>
> **Care seeking:** Among children under age 5 who had symptoms of ARI in the 2 weeks before the survey, the proportion for whom advice or treatment was sought from a health facility or provider. Excludes treatment sought from pharmacies, shops, or traditional healers. The information for this variable is only available for those children whose mother was alive and living in the same household as the child.
>
> **No birth registration:** The proportion of *de jure* children under age 5 without a birth certificate or birth registration.

Children age 5-14:

> **Not in school:** The proportion of children age 5-14 who did not attend school at any time during the current school year.

Girls age 15-17:

Underweight: The proportion of girls age 15-17 with BMI lower than 18.5. Excludes girls who were pregnant or gave birth in the last 2 months before the survey.

Any anemia: The proportion of girls age 15-17 with a hemoglobin level lower than 12 grams per deciliter, if not pregnant, and lower than 11 grams per deciliter if pregnant. Hemoglobin levels are adjusted for altitude.

Adolescent fertility: The proportion of girls age 15-17 who are currently pregnant or have ever had a birth.

Sex before age 15: The proportion of girls age 15-17 who had sexual intercourse before age 15.

2.3 Risk Factors

The risk factors were divided into variables at child, household, and community levels. The child-level variables include child's sex (male, female), orphanhood status (both parents are alive, mother is alive but father is dead, father is alive but mother is dead, both parents are dead), and household living arrangements (living with both parents, living with mother only, living with father only, living with neither parent but household head is a relative, living with neither parent and household head is not a relative).

The household-level variables include a crowding index, the youth dependency ratio, and the number of women in the household who have had some schooling. The crowding index was computed by taking the number of household members who slept in the household the night before the survey and dividing by the number of rooms used for sleeping. The youth dependency ratio was computed by taking the total number of household members under age 15 and dividing by the total number of household members age 15-64. There was a high correlation between the youth dependency ratio and the total dependency ratio, which includes the number of household members age 65 and above as well as the number below age 15, but only the youth dependency ratio was used in the regression models. The number of educated women in the household was computed as the total number of women in the household age 18 and older with at least a primary education. The variable was categorized as none, one, two, and three or more. The total number of educated adults in the household was highly correlated with the total number of educated women, but only the number of educated women was included in the models.

In the typical design of DHS samples, the primary sampling units, or "clusters," are enumeration areas from the country's most recent census. Enumeration areas can range from villages in rural areas to neighborhoods in urban areas, with boundaries that roughly correspond with those of local administrative units. We will describe the enumeration area or cluster as a "community," but it should be understood that this term is being used loosely. The cluster is a geographically defined context within which DHS data can be aggregated and that can be matched with spatially structured data, but we cannot infer that it has the social or cultural meaning that ideally would be captured by this label.

The community-level variables include the percentage of adult women in a DHS cluster who are educated, the travel time to the nearest city with a population of at least 50,000, and the nighttime lights indicator. These continuous cluster-level variables were found to be highly associated with place of residence and wealth quintile, as described in the introduction, and were used in place of urban-rural residence and

household wealth quintile in the regression models. Any missing values for travel time and nighttime lights were replaced by the median value for the combination of region and place of residence.

The variables on travel time and nighttime lights were obtained from external sources and linked with the DHS data, using the geographic location of the DHS clusters (Burgert et al. 2013). The latitude and longitude of DHS clusters are collected using GPS receivers. These are verified and then geographically masked to protect respondent confidentiality. Geographic spatial data was extracted from the raster datasets. Urban locations use a 2 kilometer (km) buffer around the DHS geomasked location; for rural points the buffer is 10 km. The buffer size accounts for DHS displacement procedures used to protect the confidentiality of the respondents (Perez-Haydrich et al. 2013). Travel time to the nearest city of at least 50,000 people is a measure of accessibility, as described by Nelson (2008). Travel time is measured using a cost-distance algorithm where cost is measured in units of time, taking into consideration the transport network (road, rail, rivers, etc.), environment (land cover and slope), and political factors (borders) that affect travel times between locations. The nighttime lights variable was obtained from the Earth Observations Group in NOAA (National Centers for Environmental Information 2015). This variable is based on observations of the average radiance composite images, eliminating stray light, lightning, lunar illuminations, and cloud-cover before averaging.

2.4 Methods

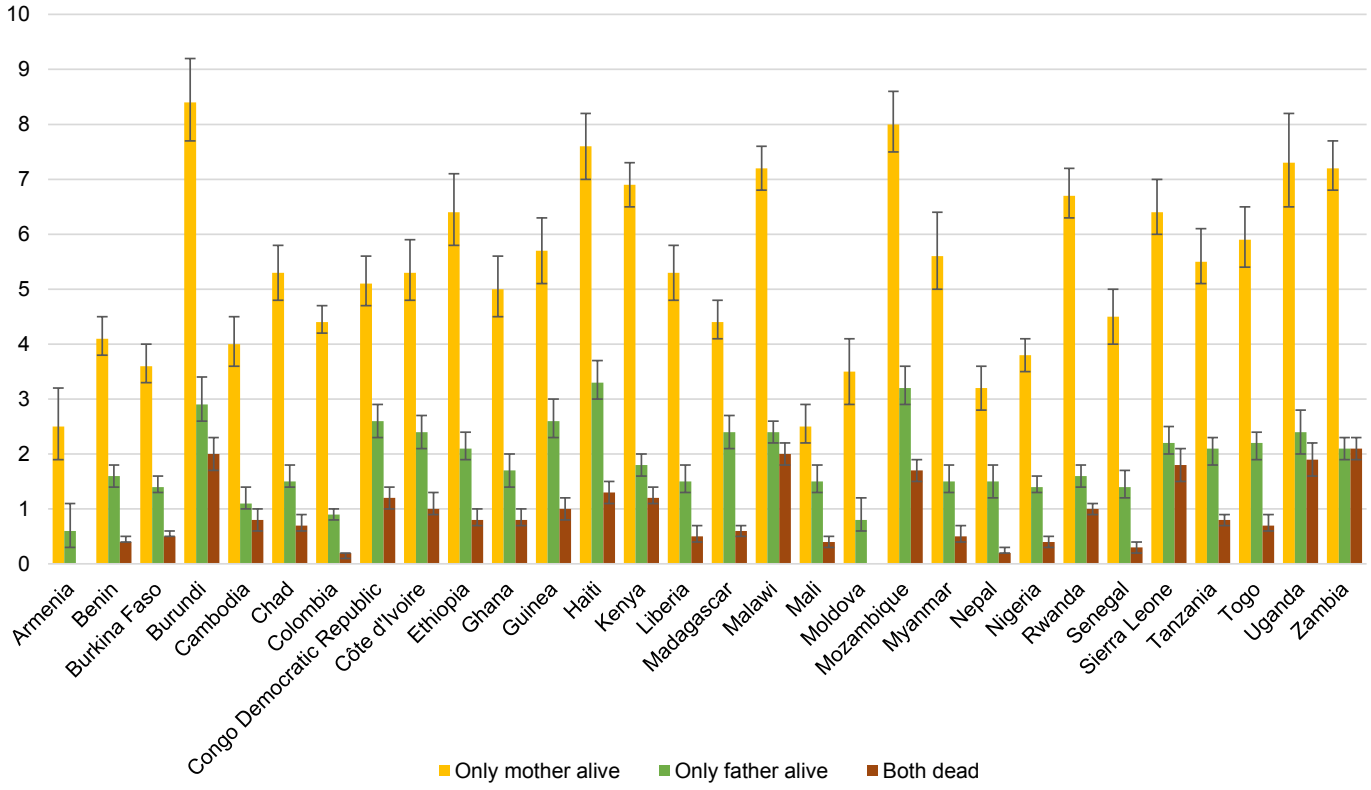
The analysis involves studying the association between the outcomes and the described risk factors at the child, household, and community levels. Adjusted logit regressions were fitted for each survey and each outcome, using all the risk factors. Separate models were estimated for orphanhood status and household living arrangements, as these two variables are highly associated. A meta-analysis was then performed using the metan macro in Stata 14 (Harris et al. 2008). The meta-analysis provided a pooled odds ratio from all the surveys that accounted for the sample size by taking the sample from each survey divided by the total from all the surveys combined. Heterogeneity tests (I^2 tests) were also generated to indicate the level of heterogeneity between the surveys. An I^2 value of 25%-50% is considered to have low heterogeneity, 50%-75% is moderate, and more than 75% is high (Higgin et al. 2003). A non-significant I^2 test would indicate failure to reject the null hypothesis that the surveys are homogenous, a desirable result for this type of analysis. The Results section presents a summary of the regression results to show whether the resulting pooled odds ratio was in the expected direction for the outcomes. Note that a pooled odds ratio can be significant even if only a few countries have a significant odds ratio. All analyses were performed with Stata 14. DHS sampling design and stratification were taken into account in the analysis.

3 RESULTS

3.1 Orphanhood and Household Living Arrangements

In all the surveys studied, close to 90% of children age 0-17 live with both parents (Appendix Table 1). While orphanhood is generally rare, some types of orphanhood are more common than others. Figure 1 shows that in all the surveys the most common type of orphanhood is for children whose father has died but whose mother is alive, with a range from 2.5% of children in Armenia and Mali to approximately 8% in Burundi and Mozambique. The percentage of children whose mother has died but whose father is alive ranges from 1% in Armenia and Moldova to 3% in Haiti and Mozambique. Having both parents dead (double orphanhood) is even rarer, ranging from just 0.2% in Colombia and Nepal to 2% in Burundi, Malawi, Mozambique, Sierra Leone, Uganda, and Zambia. In Cambodia, Malawi, Sierra Leone, Uganda, and Zambia there is no significant difference between double orphanhood and single orphanhood with only the father alive.

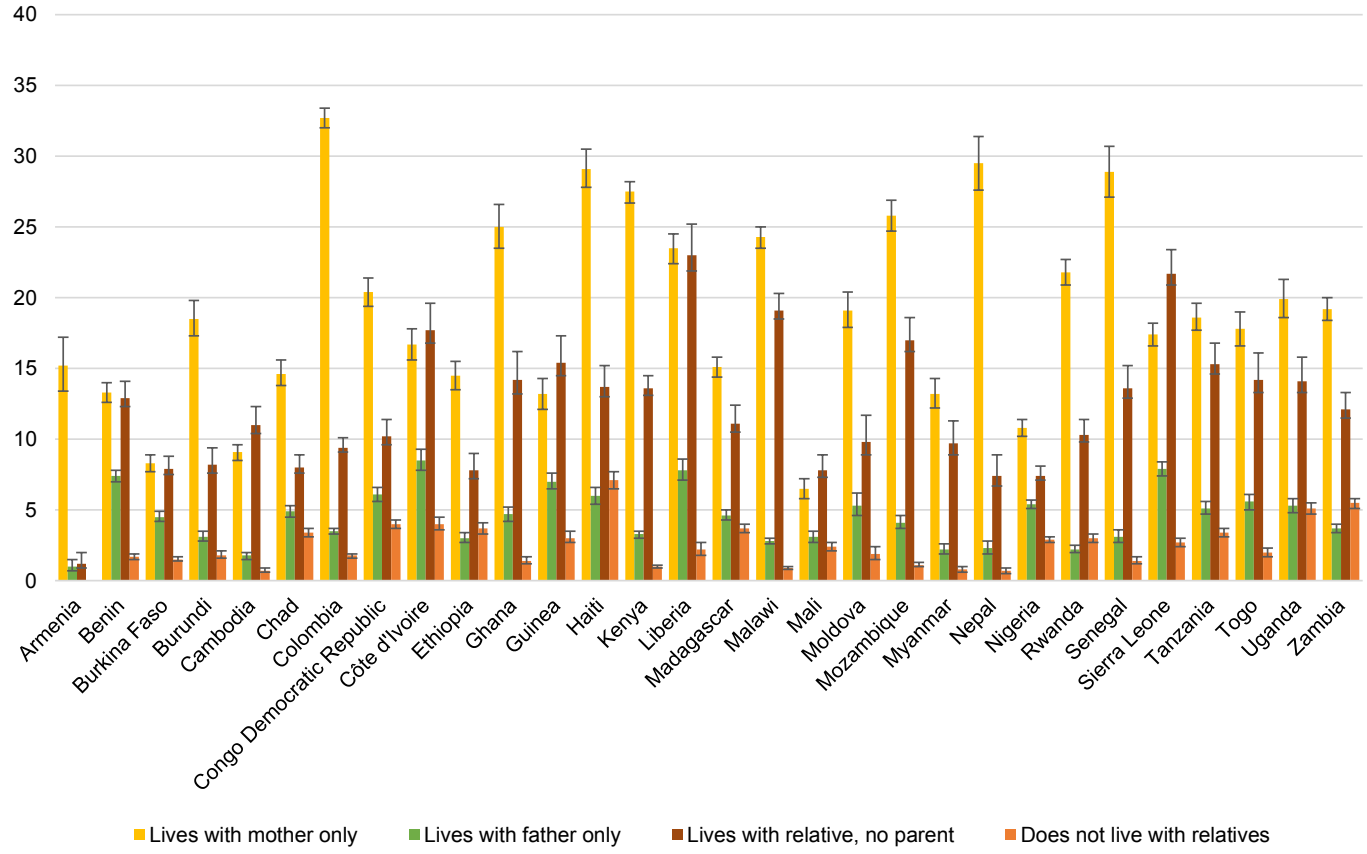
Figure 1 Percentages of orphanhood type among households with children less than age 18



Note: The figure excludes children that have both parents alive.

Household living arrangements are closely linked with orphanhood but also include situations where a parent may be alive but not present in the household. The most common household living arrangement for children is to have both parents present (Appendix Table 2), followed by the mother only, as Figure 2 shows. Colombia has the highest percentage of children living with the mother only (33%), followed by Nepal, Haiti, Senegal, Kenya, and Ghana, all above 25%. In several countries there is no significant percentage difference between children living with the mother only and children living with a relative other than a parent as the household head. For most surveys, the least common household living arrangement for children is to have neither parent present but have a non-relative as the household head. In some countries, however, there is no significant difference between this type of living arrangement and living with the father only. In Zambia the percentage of children living with the father only is significantly lower than the percentage of children living with no relatives.

Figure 2 Percentages of household living arrangements among households with children less than age 18

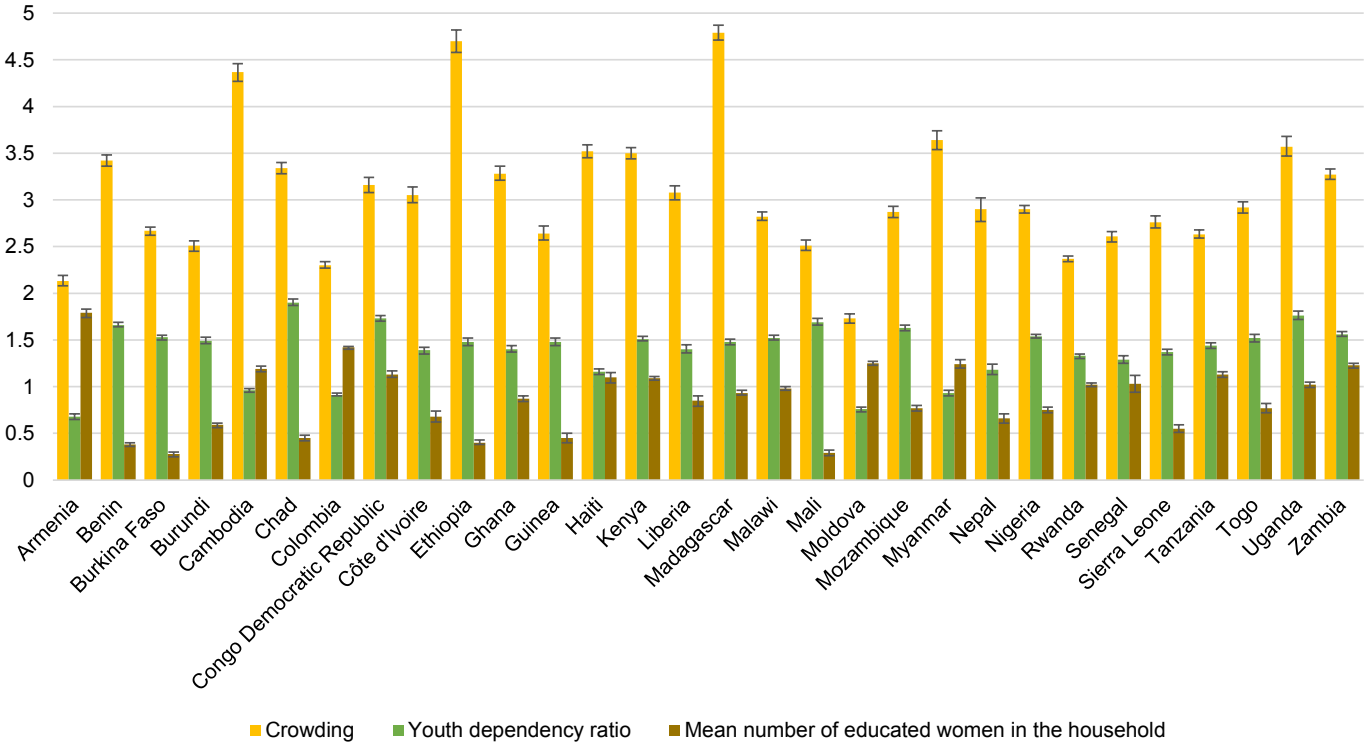


Note: The figure excludes children that are living with both parents.

3.2 Household Risk Factors

Figure 3 summarizes the three household-level variables used in the regression models: the crowding index, the youth dependency ratio, and the number of educated women in the household. The latter was converted into a categorical variable for the regression models. Figure 3 includes several countries with high crowding—highest in Madagascar and Ethiopia, both with a crowding index close to 5. All the countries other than Moldova have a crowding index above 2. The youth dependency ratio, which measures the number of children under age 15 relative to the total number of persons age 15-64 in the household, is close to 1.5 for most countries and reaches almost 2 in Chad. Armenia and Moldova have the lowest youth dependency ratios and also the lowest crowding index. The mean number of educated women in the household ranges from approximately 0.3 in Burkina Faso and Mali to 1.79 in Armenia. Most countries had a mean close to one. (Appendix Table 3 presents the overall dependency ratio and the number of educated adults in the household.)

Figure 3 Household risk factors



3.3 Cluster-level Variables

As mentioned, community-level variables include the percentage of educated women in a DHS cluster, the travel time to the nearest large city, and the nighttime lights indicator. The values for these cluster-level variables are shown in Appendix Table 4. Figure 4 shows the mean for nighttime lights and travel time to the nearest major city. These two variables are generally inversely related—a longer travel time to a major city tends to correspond with a lower value for the nighttime lights indicator. This is most apparent in Colombia and Ethiopia. Zambia is an exception, however, with a relatively high value for travel time but also the third-highest value for nighttime lights. The highest values for travel time are in Ethiopia, Chad, Zambia, and the DRC, and the lowest in Armenia, Moldova, and Colombia. Armenia and Colombia also have the highest values for nighttime lights.

Figure 4 Cluster-level variables

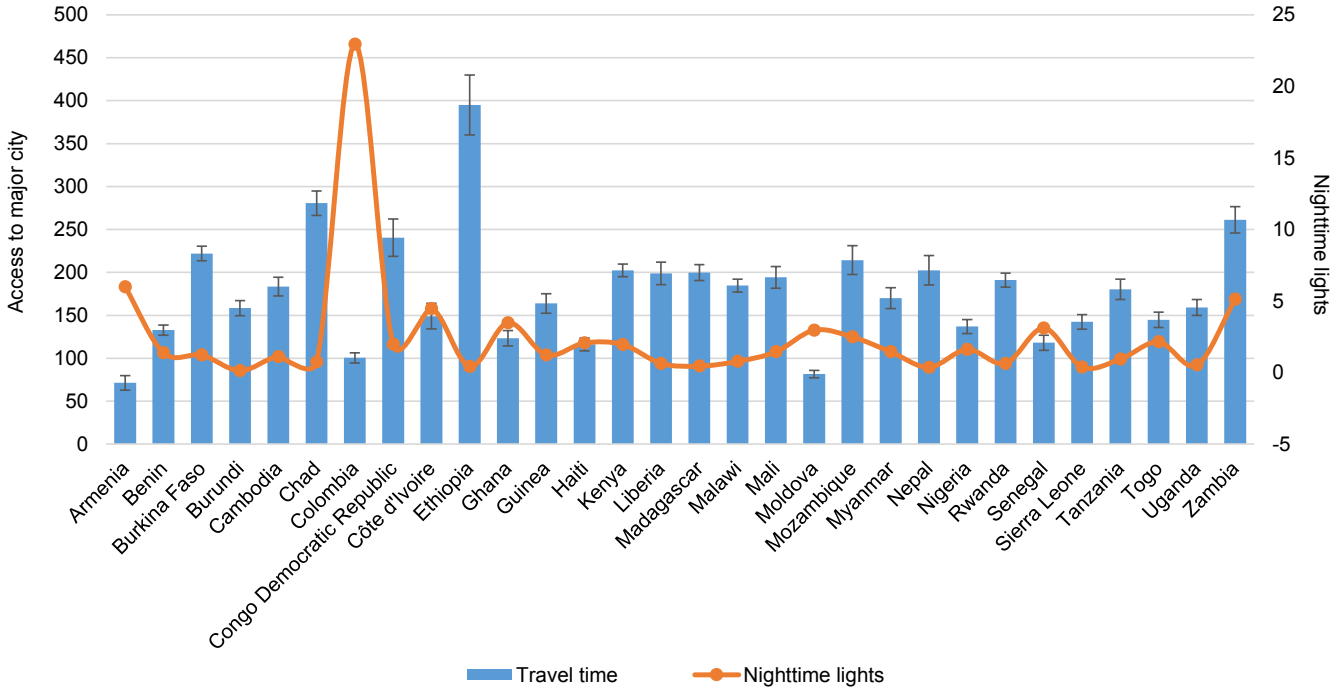
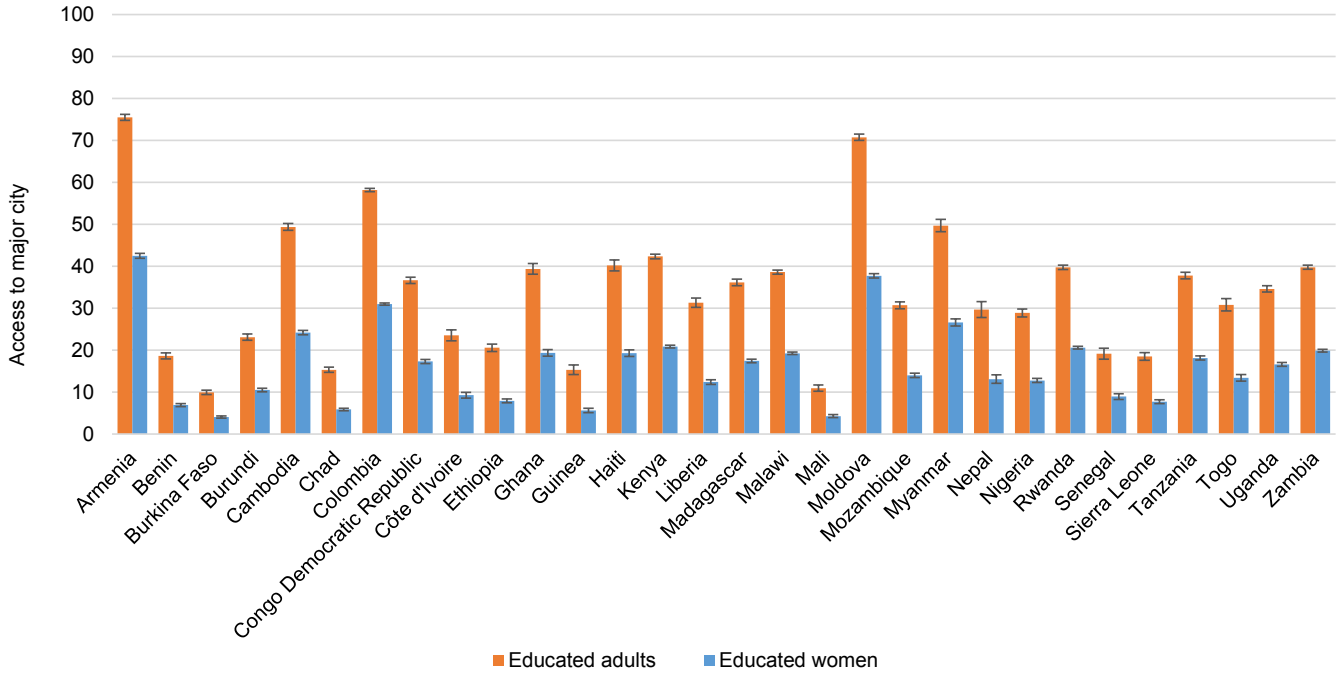


Figure 5 shows the percentage of educated adults and educated women by cluster, averaged for each country. The highest percentage both for all adults and for women is in Armenia, followed by Moldova and Cambodia. The lowest values are in Burkina Faso and Mali. The regression models used only the percentage of educated women.

Figure 5 Mean percentage of educated adults and educated women within clusters



3.4 Outcomes

3.4.1 Children under age 5

Figure 6 summarizes the nutrition indicators for children under age 5. In Burundi and Madagascar nearly half of children under age 5 were stunted, and most countries studied had stunting levels above 30%. Colombia, Ghana, and Armenia had the lowest stunting levels, all below 20%. In Nigeria, Benin, and Burkina Faso over 15% of children under age 5 were wasted, compared with less than 3% in Rwanda and Malawi. A high percentage of children age 6-59 months were anemic. All countries except Rwanda had percentages of anemic children above 40%. In Burkina Faso, Mali, Sierra Leone, Guinea, and Côte d'Ivoire, over 70% of children age 6-59 months were anemic, and in Burkina Faso close to 90%. Appendix Table 5 shows the estimates and confidence intervals for all outcomes for children under age 5. Seven of the 30 countries (Armenia, Chad, Colombia, Kenya, Liberia, Nigeria, and Zambia) did not conduct hemoglobin testing, and therefore the anemia indicator could not be computed. In addition, Madagascar did not have data available to compute wasting.

Figure 6 Nutrition indicators for children under age 5

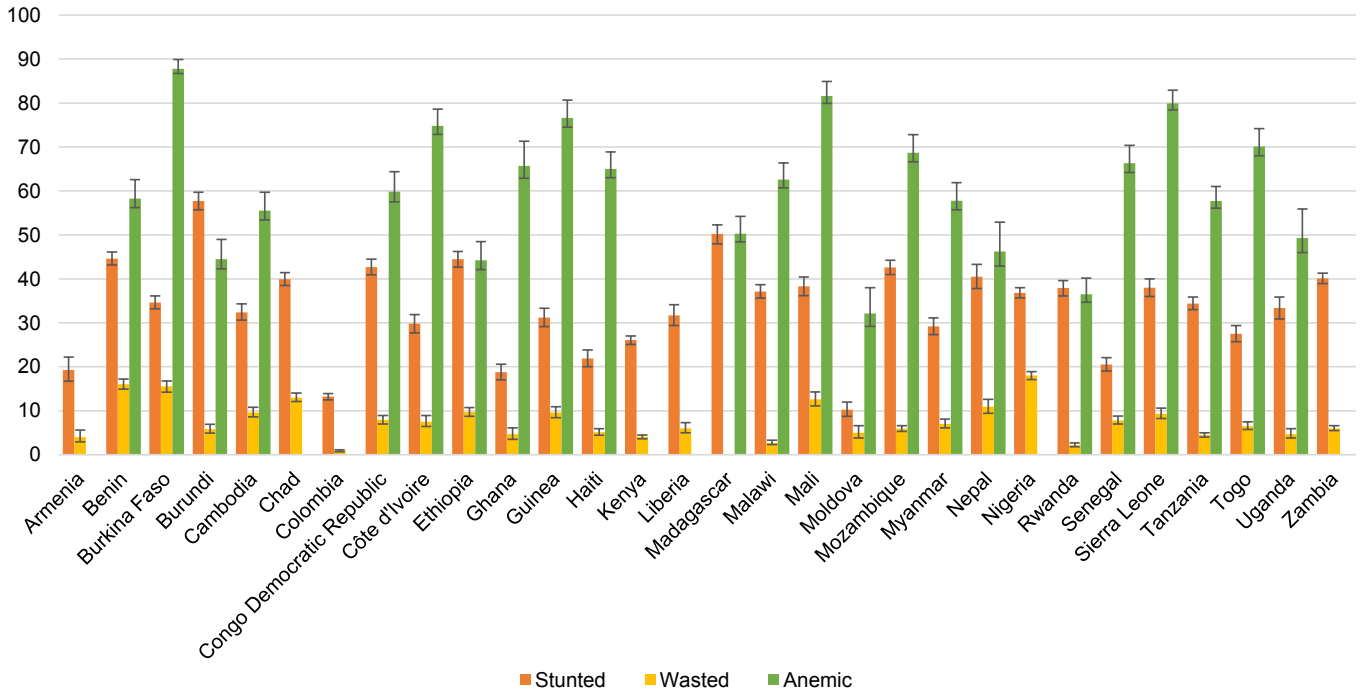
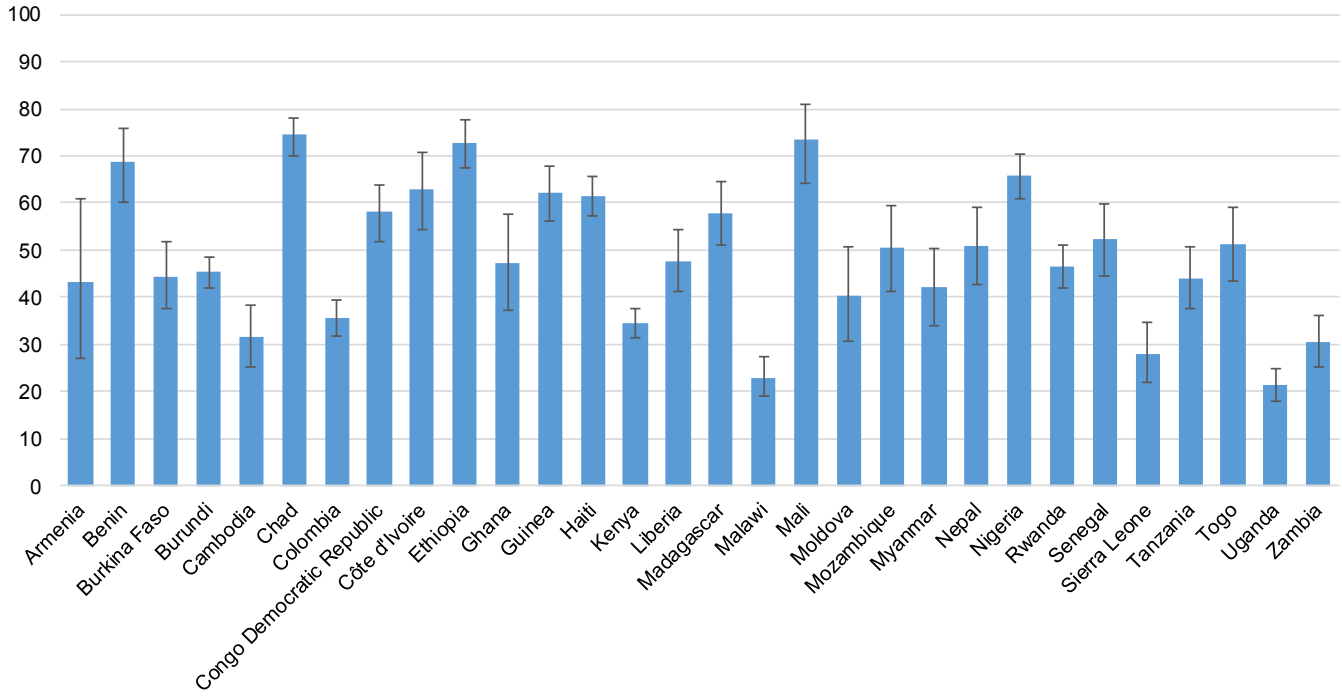


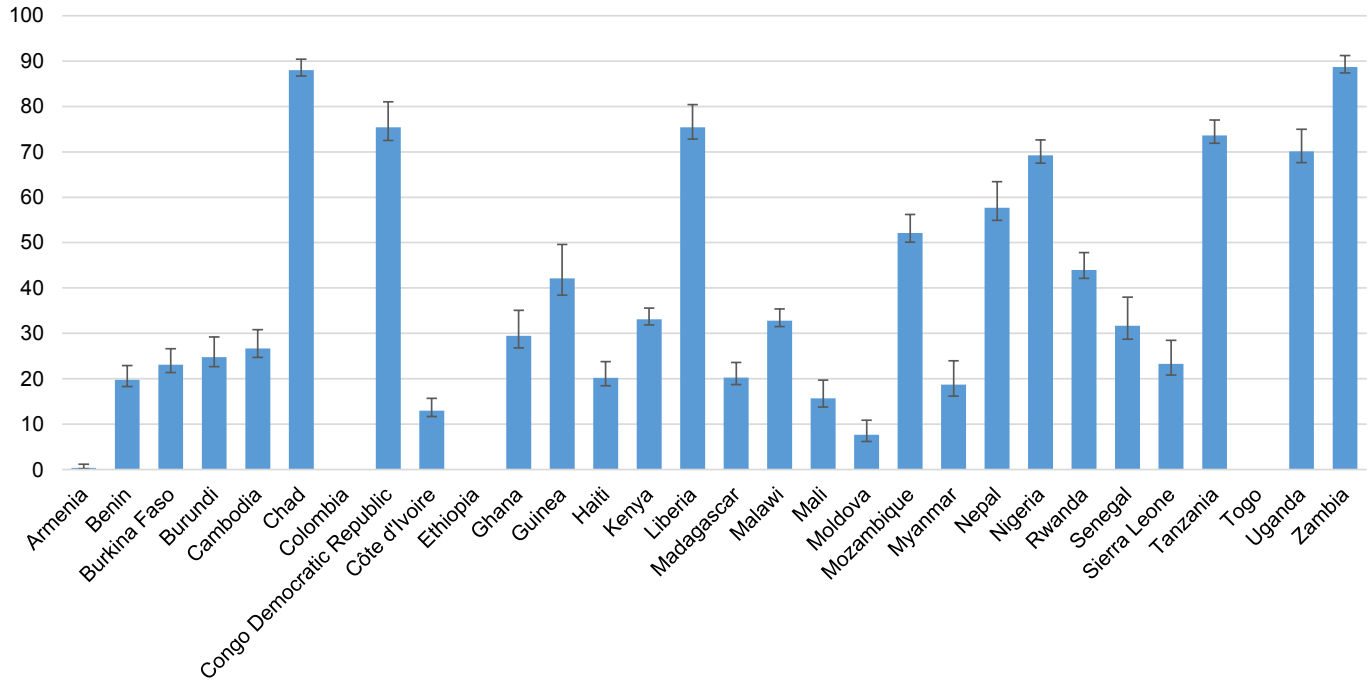
Figure 7 shows that more than 70% of children under age 5 in Chad, Mali, and Ethiopia had no treatment sought for their ARI symptoms. In almost half of the countries, a majority of the children under age 5 did not have treatment sought for their ARI symptoms. Malawi and Sierra Leone had the lowest percentage for this indicator, both under 30%.

Figure 7 No treatment for symptoms of ARI for children under age 5



As Figure 8 shows, in Zambia and Chad close to 90% of children under age 5 did not have their birth registered, or had no birth certificate. The percentage was also high in Liberia, the DRC, Tanzania, Uganda, and Nigeria, all close to 70%. In contrast, only 0.4% of children in Armenia did not have a birth registration or certificate, and less than 10% of children in Moldova. This indicator was not available for Colombia, Ethiopia, and Togo.

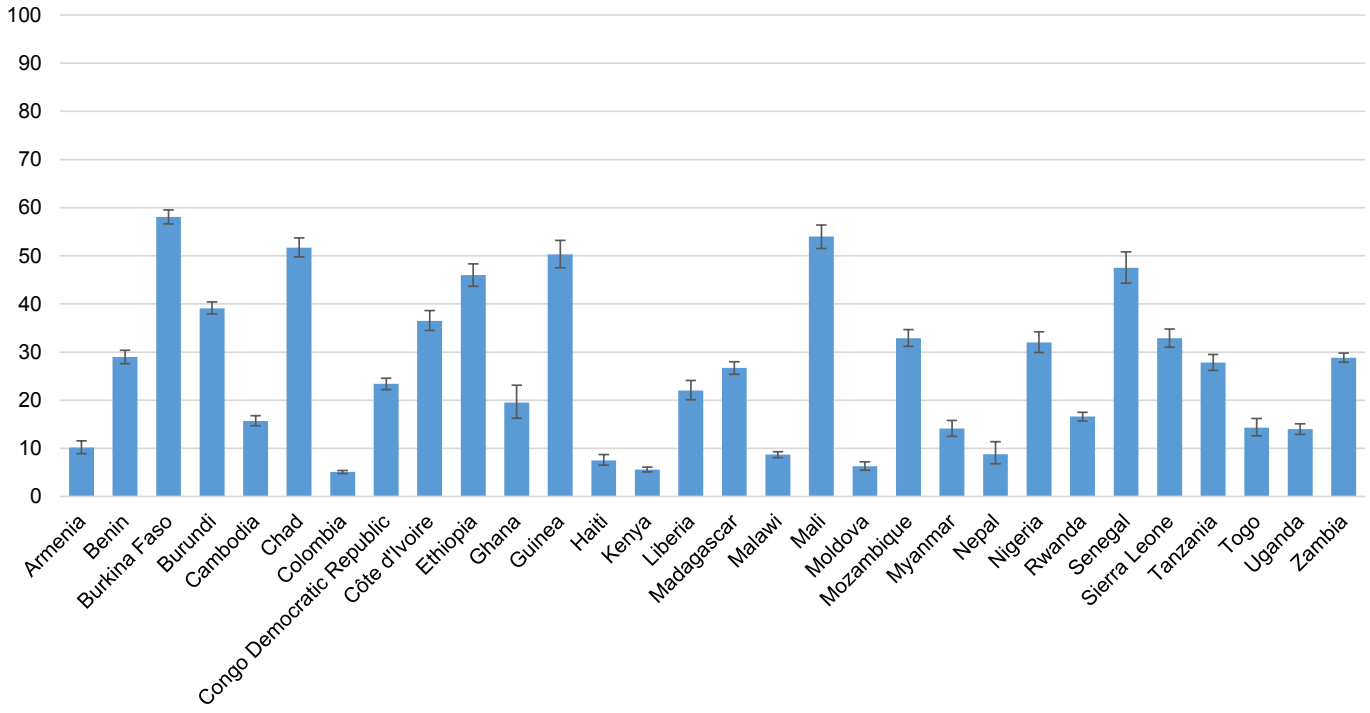
Figure 8 No birth registration or birth certificate for children under age 5



3.4.2 Children age 5-14

As Figure 9 and Appendix Table 6 indicate, more than half of children age 5-14 in Burkina Faso, Mali, Chad, and Guinea did not attend school during the current school year, and in Senegal and Ethiopia more than 40% of children did not. In contrast, in Armenia, Nepal, Malawi, Haiti, Moldova, Kenya, and Colombia, only about 10% or less had no school attendance.

Figure 9 No school attendance for children age 5-14

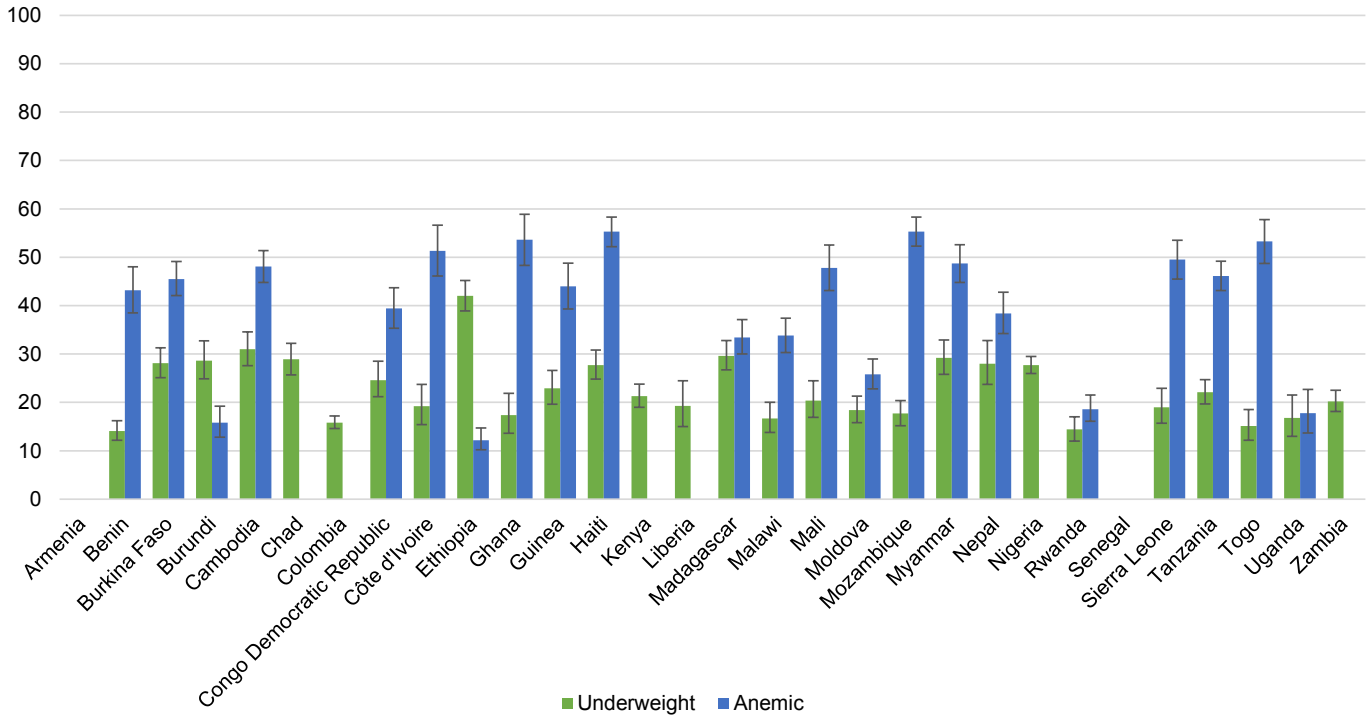


3.4.3 Girls age 15-17

Figure 10 shows that Ethiopia had a significantly higher percentage of girls age 15-17 who were underweight compared with the other countries. In Ethiopia 42% of girls were underweight according to their BMI, while in many other countries the percentages were close to 30%. Benin, Rwanda, and Togo had the lowest percentages of underweight girls, all close to 15%. Armenia and Senegal did not have data available to compute this indicator. (See Appendix Table 7 for all outcomes for girls age 15-17.)

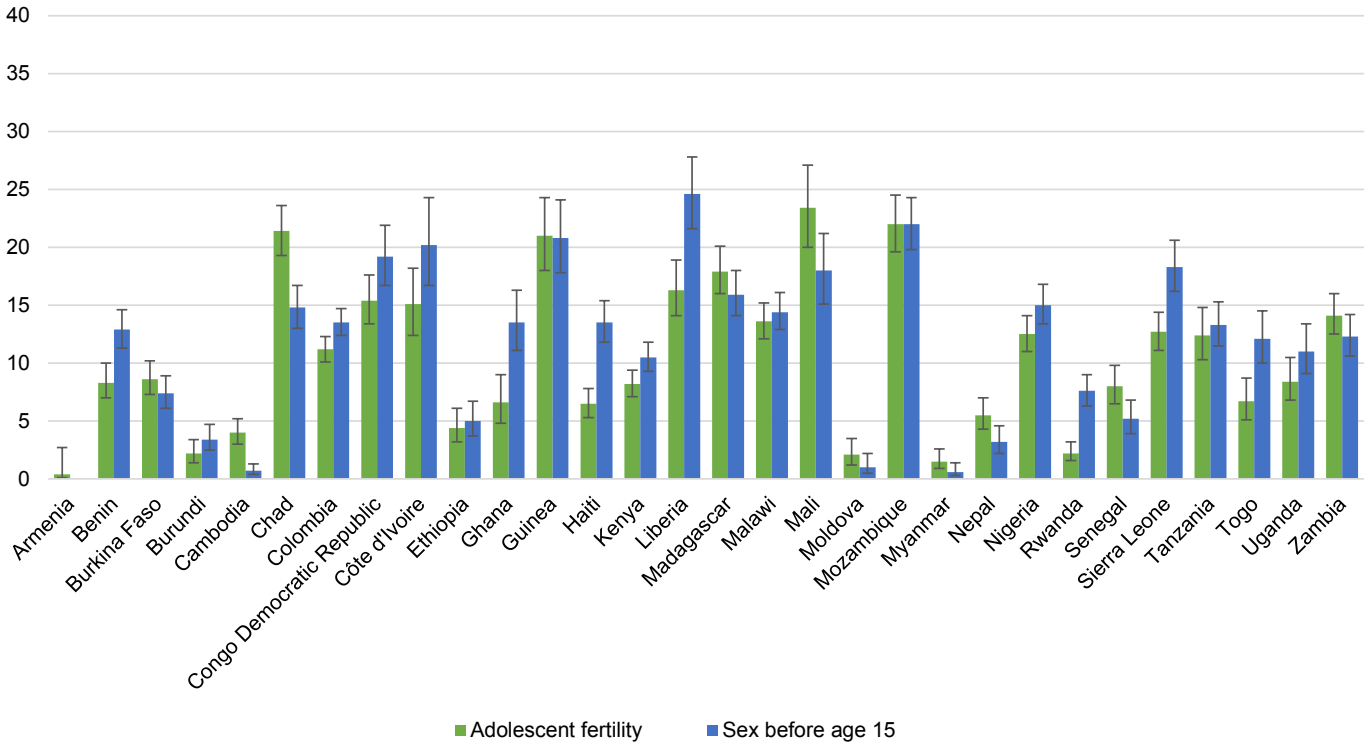
Also, Figure 10 shows that in 25 of the 30 countries more than a third of girls age 15-17 were anemic, and in Mozambique, Haiti, Ghana, Togo, and Côte d'Ivoire more than half of girls. The lowest percentage of anemia among girls age 15-17 was in Ethiopia, at 12%. Data were not available to compute this indicator for eight countries: Armenia, Chad, Colombia, Kenya, Liberia, Nigeria, Senegal, and Zambia.

Figure 10 Nutrition indicators for girls age 15-17



As Figure 11 shows, in Mali, Mozambique, Chad, and Guinea, at the time of the survey more than one in every five girls age 15-17 had begun childbearing. In contrast, in Ethiopia, Cambodia, Rwanda, Burundi, Moldova, Myanmar, and Armenia adolescent fertility was less than 5%. In Liberia, Mozambique, Guinea, and Côte d'Ivoire more than one in every five girls age 15-17 had sex before age 15, and in the DRC, Sierra Leone, and Mali nearly 20%. Myanmar, Cambodia, Moldova, Nepal, and Burundi had low percentages for this indicator, all at 3% or lower. In Armenia, no girls age 15-17 reported having sex before reaching age 15, and adolescent fertility was the lowest of any country, at only 0.4%.

Figure 11 Adolescent fertility and sex before age 15



level of significance. The tables also illustrate whether the result has a significant and high level of heterogeneity (I^2 more than 75%), highlighted by a red box, to indicate that the result is country-specific and cannot be generalized across all the surveys.

3.5.1 Children under age 5

Nutrition outcomes. Table 2 summarizes the pooled regression results of the outcomes for children under age 5. The nutrition outcomes are stunting, wasting, and anemia. Stunting showed results in the expected

direction for all risk factors. In addition, having both parents dead (compared with both parents alive) and living with a non-relative (compared with living with both parents) were the only non-significant predictors of stunting, mainly due to the low counts in these two categories. The pooled odds ratio was significant for almost all the subgroups (see Appendix Figures 1-6). Only the subgroups for child's sex, crowding, and the percentage of women in a household who are educated had significant odds ratios for more than half the countries. For the remaining subgroups, the odds ratios were mainly non-significant. The results of the I^2 test of heterogeneity for child's orphanhood (Appendix Figure 2), household living arrangements (Appendix Figure 3), and the number of educated women in the household (Appendix Figure 4) suggest that the model represents either low level of heterogeneity or for some categories the non-significant I^2 test indicates homogeneity.

The wasting and anemia indicators showed some results opposite to the expected direction, especially for the variables for orphanhood status and household living arrangements. In general, we would expect worse outcomes for any type of orphan (compared with both parents alive), and any living arrangement other than living with both parents. For the wasting outcome, however, children whose mother only was alive (compared with both parents alive) and children living with a relative other than parent or living with father only (compared with living with both parents) had lower significant pooled odds of being wasted. As the forest plot in Appendix Figure 8 shows, this result was found only in Colombia, where the odds ratio of being wasted for children with only the mother alive (compared with both parents alive) was 0.14 (95% C.I. 0.02, 0.98). For the other counties, except Cambodia and the DRC, this result was not significant; hence the low significance level of the pooled odds ratio (i.e. p-value <0.05), as shown in Table 2. This result also had a low level of heterogeneity according to the I^2 test (I^2=44.8%, p-value=0.007).

Appendix Figure 9 shows that children living with mother only were significantly more likely to be wasted than children living with both parents. The I^2 test also indicated that the surveys were homogenous for this result (I^2 =20.6%, p-value=1.162). The odds ratios for children living with the father only and living with a relative and no parents were both in the unexpected direction, and the I^2 test indicated that the surveys were homogenous for both risk factors. However, Appendix Figure 9 shows that for children living with the father only, compared with living with both parents, only Nigeria and Tanzania showed significantly lower odds of being wasted. In addition, only five countries—Burkina Faso, Colombia, Côte d'Ivoire, Mozambique, and Nigeria—showed significantly lower odds of being wasted if the child lived with a relative other than parent, compared with living with both parents. The odds ratios were not significant for the remaining countries for these two categories, except for a significant odds ratio in the expected direction for Nepal and for living with father only. The pooled odds ratio for not living with a relative was not significant for the wasting outcome, but it was highly significant with very high odds ratios in Burundi and Ghana (Appendix Figure 9). However, the wide confidence intervals indicate that there were few observations, and the results should be interpreted with caution.

For anemia, the significance of the pooled odds ratio for double orphans (compared with both parents alive) was based on only a few countries (see Appendix Figure 14). For 17 countries, this category was omitted because there were too few observations, and none of the remaining countries showed a significant odds ratio. The remaining single-orphan categories were not significant predictors of anemia. Seven countries—Burkina Faso, Cambodia, Guinea, Myanmar, Senegal, Tanzania, and Uganda—showed significantly lower odds of children being anemic if they lived with a relative other than parent (compared with living with

both parents). The remaining countries were not statistically significant, while Armenia and Zambia were omitted due to low number of observations in this category.

Table 2 Summary of meta-analysis of the outcomes for children under age 5

	Stunted	Wasted	Anemic	No care-seeking sought for ARI	No birth registration or birth certificate
Child level variables					
Child's sex (female Ref.)					
Male	+++	+++	+++	NS	-
Orphanhood status (both parents alive Ref.)					
Mother alive, father dead	+	-	NS	NS	+++
Father alive, mother dead	++	NS	NS	.	+++
Both parents dead	NS	NS	-	.	+++
Living arrangements (living with both parents Ref.)					
Living with mother, not father	+++	++	++	NS	+++
Living with father, not mother	++	-	NS	.	NS
Living with relative, no parent	+++	---	---	.	+++
Does not live with relatives	NS	NS	NS	.	+++
Household risk factors					
Number of educated women (none Ref.)					
1	--	---	NS	--	---
2	--	---	NS	NS	---
3+	--	-	NS	-	---
Crowding	+++	+++	+++	+	+++
Youth dependency	+++	NS	NS	+++	NS
Community level variables					
Percentage of educated women	---	---	---	---	---
Nighttime lights	---	+	NS	--	NS
Travel time to major city	+++	NS	++	NS	+++

Note: NS - not significant. Green indicates result is in the expected direction, orange indicates a result in the opposite of the expected direction. + indicates an OR above 1 and - indicates an OR below 1. The number of signs indicates the level of significance. A red box indicates a high level of heterogeneity.

Almost all the significant pooled odds ratios for the nutrition outcomes by the remaining risk factors were in the expected direction, with the exception of the nighttime lights risk factor for the wasting outcome. Boys had significantly higher odds than girls of being stunted, wasted, or anemic. For wasting and anemia, the I^2 test was non-significant, indicating that the surveys were homogeneous for this result (see Appendix Figures 7 and 13), and for stunting the I^2 tests results indicated a moderate level of heterogeneity (Appendix Figure 1). Having at least one educated woman in the household, compared with none, showed a significant pooled odds ratio for stunting and wasting, but this risk factor was not significant for being anemic. In addition, the percentage of women in a cluster who are educated showed a protective and highly significant effect against all three nutrition outcomes, although there was high heterogeneity for the stunting and anemia outcomes. Crowding was also highly significant and with a low to moderate level of heterogeneity, with a greater likelihood of being stunted, wasted, or having anemia for children in households with higher levels of crowding. Only the odds of being stunted were significantly higher for children in households with higher levels of the youth dependency ratio. The cluster-level variables of nighttime lights and travel time to major city were significant predictors of stunting and were in the expected direction. The higher the nighttime lights indicator, the lower the odds of stunting; and the greater the travel time to a major city, the higher the odds of stunting. However, as indicated with the red box in Table 2, these results had high heterogeneity. This indicates that the results for these variables are country-specific.

Appendix Figure 6 shows that the odds ratios for the three community-level variables and stunting for all the surveys were either significant in the expected direction or not significant. The nighttime lights indicator was not in the expected direction for wasting but this was only true for Chad, Myanmar, and Nigeria, with the remaining countries showing no statistical significance (see Appendix Figure 12). The nighttime lights indicator was not a significant predictor of anemia, but with a moderate level of heterogeneity for this result. For five countries (Burkina Faso, Cambodia, the DRC, Moldova, and Mozambique), however, the result was significant and in the expected direction. Travel time to a major city was a significant predictor for anemia but not for wasting. For both these outcomes, there was moderate heterogeneity for the pooled odds ratios.

Care-seeking for ARI symptoms. Most of pooled odds ratios for the risk factors predicting no care-seeking for symptoms of ARI were non-significant. This outcome has fewer observations than the remaining outcomes for children under age 5 since it is restricted to children who had ARI symptoms in the last 2 weeks before the survey. There was no significant difference between boys and girls for care-seeking for ARI, with the I^2 test indicating that the surveys were homogenous for this result. As Appendix Figure 19 shows, only Cambodia and Uganda had significant higher odds of no care-seeking for boys compared with girls. In addition, the variables for orphanhood status and living arrangement were either non-significant or were omitted from the regression due to low counts. The results showed several strong predictors of care-seeking for ARI symptoms at the household and cluster levels, however, and all in the expected direction. Having an educated woman in the household, less crowding, and a lower youth dependency ratio were all protective against not seeking care for ARI symptoms. The I^2 value for these risk factors was also not significant, indicating homogeneity between the surveys (see Appendix Figures 22-23). In addition, the higher the percentage of educated women in the cluster, and the higher the nighttime lights indicator, the less likelihood of no treatment sought for ARI symptoms. While the I^2 test indicated that the surveys were homogenous for the pooled odds ratio for percentage of educated women in the cluster, the result was highly heterogeneous for the nighttime lights indicator (I^2=90.5%, p-value<0.001) (see Appendix Figure 24).

Birth registration. All the results for not having a birth registration or birth certificate were in the expected direction. In addition, only a few categories were non-significant. Boys were less likely to not be registered at birth compared with girls; with an I^2 test indicating homogeneity between the surveys. Being any type of orphan or not living with both parents also increased the odds of not having a birth registration or birth certificate. However, there was moderate to high heterogeneity for these two child-level risk factors (see Appendix Figures 26-27). Côte d'Ivoire exhibited an unexpected result—with lower odds of no birth registration for children who are any type of orphan compared with children who have living parents (see Appendix Figure 26), and for all categories of living arrangement except living with mother only (see Appendix Figure 27). This was also the case for double orphans in Haiti and for all categories of living arrangement except for living with mother only. Having an educated woman in the household was protective against not having a registered birth or a birth certificate, while high levels of crowding increased the odds of this outcome. Appendix Figure 29 shows that crowding was significant in several countries (although with high heterogeneity), but the youth dependency ratio was not significant. At the community level, having a higher percentage of educated women in the cluster was a protective factor against not being registered at birth. In addition, the longer the travel time to a major city the more likely the birth would not be registered or have a certificate. Appendix Figure 30 shows that most countries had a significant result for these two cluster variables, although both showed high heterogeneity with I^2 values above 85%, also

highly significant. The pooled odds ratio for nighttime lights was not significant, and the results show mixed findings between the surveys and high heterogeneity according to the I^2 test (Appendix Figure 30).

3.5.2 Children age 5-14

Table 3 summarizes the results for the pooled regression results of not attending school in the current school year. This was the only outcome available for children age 5-14. As expected, the pooled odds ratio showed that boys were less likely than girls to not attend school. However, as Appendix Figure 31 shows, there was very high heterogeneity (I^2=95.5%, p-value<0.001), indicating that this is a country-specific finding, with mixed results among the surveys. Children who were double orphans or whose mother had died but father was alive were significantly more likely not to attend school compared with children with both parents living, according to the pooled odds ratio. As Appendix Figure 32 shows, these results had moderate heterogeneity, and significant odds ratios were found in some surveys, especially for double orphans, while in most countries the results were not significant. All the categories of living arrangement except for living with father only, significantly increased the odds of not attending school compared with the category of living with both parents, but with high heterogeneity. For living with a non-relative, it was almost twice the odds compared to living with both parents based on the meta-analysis, with increased odds found in most countries (Appendix Figure 33).

The household-level variables were also in the expected direction except for youth dependency, which was not significant. Appendix Figure 34 shows that most countries for all the categories of number of educated women in the household (one, two, and three or more educated women) were significant and in the expected direction, but the level of heterogeneity was very high, with I^2 values for all the categories significant and above 90%. This high heterogeneity is most likely due to the finding for Armenia, which had very high odds ratios due to the low counts of children not attending school. As Appendix Figure 35 shows, crowding was significant in all countries except Senegal. The cluster-level variables were also in the expected direction except for nighttime lights, which was highly significant in the opposite direction—that is, the higher the value for nighttime lights, the less likely children were to attend school. In some countries, however—Burundi, Guinea, Rwanda, Tanzania, and Zambia—the result for nighttime lights was in the expected direction (Appendix Figure 36). The figure also shows that in all but two of the countries the percentage of educated women in the cluster was a significant protective factor against not attending school. All the community-level variables had high heterogeneity, with I^2 values all above 90% and significant.

Table 3 Summary of meta-analysis of no schooling for children age 5-14

	Did not attend school
Child level variables	
Child's sex (female Ref.)	
Male	---
Orphanhood status (both parents alive Ref.)	
Mother alive, father dead	NS
Father alive, mother dead	+
Both parents dead	+++
Living arrangements (living with both parents Ref.)	
Living with mother, not father	+++
Living with father, not mother	NS
Living with relative, no parent	+++
Does not live with relatives	+++
Household risk factors	
Number of educated women (none Ref.)	
1	---
2	---
3+	---
Crowding	+++
Youth dependency	NS
Community level variables	
Percentage of educated women	---
Nighttime lights	+++
Travel time to major city	+++

Note: NS - not significant. Green indicates result is in the expected direction, orange indicates a result in the opposite of the expected direction. + indicates an OR above 1 and - indicates an OR below 1. The number of signs indicates the level of significance. A red box indicates a high level of heterogeneity.

3.5.3 Girls age 15-17

Table 4 summarizes the regression results from the meta-analysis of the four outcomes for girls age 15-17. There were several significant findings for the outcomes of adolescent fertility and sex before age 15, all of which were in the expected direction. However, there were only a few significant findings for the underweight outcome, and no significant findings for anemia. For the outcome related to sex before age 15, Armenia had no observations and is therefore not represented in the tables and figures.

Adolescent fertility and sex before age 15. For adolescent fertility, all the significant pooled odds ratios were in the expected direction, as Table 4 shows, with only a few non-significant categories. Girls with only the mother alive, or girls who were double orphans, had significantly higher odds of being pregnant or having a child compared with girls with both parents alive. The I^2 test for only mother alive was also not significant, indicating homogeneity, and the I^2 test for the double orphan category was significant but with low heterogeneity, as Appendix Figure 37 shows. The figure also shows that in many countries these two orphan types were not significant predictors of adolescent fertility. In several countries, however, there was a large effect. For instance, in Guinea and Haiti girls with only mother alive had more than twice the odds of being pregnant or having a child compared with girls with both parents alive. For double orphans, the odds of adolescent fertility were even higher for some countries—for example over six times as high in Cambodia, five times in Guinea, and three times in Mali and Chad—compared with girls with both parents alive. Living with mother only, living with a relative other than parent, and living with no relative all had significantly higher odds of adolescent fertility compared with living with both parents. The pooled odds ratio was almost six (95% C.I. 5.3-6.5) for girls living with a relative other than parent compared with living

with both parents. This is expected, as these girls are more likely living with the father of the child than with their parents (see Appendix Table 10). However, the I^2 value was very high for this category, at 87.5%, with a highly significant p-value, indicating high heterogeneity mainly due to a few non-significant findings for some surveys.

The findings for the household-level and cluster-level variables were all significant and in the expected direction, except that travel time to a major city was not significant. The heterogeneity for these results was low to moderate except for the number of educated women in the household and the nighttime lights indicator, both of which had high levels of heterogeneity.

Sex before age 15. All the significant pooled odds ratios for sex before age 15 were in the expected direction. Girls age 15-17 who were double orphans or whose mother had died but father was alive had significantly higher odds of having sex before age 15 compared with girls with both parents alive. Appendix Figure 42 shows that these two orphanhood categories also had low heterogeneity. The effect of the living arrangement variable was relatively stronger. For girls living with mother only, girls living with a relative other than parent, or girls living with no relatives, the odds of having sex before age 15 were significantly higher compared with girls living with both parents. As Appendix Figure 43 shows, this effect was strongest for girls living with a relative other than parent, where most countries had a significant increased odds of this outcome compared with the reference group, and the pooled odds ratio was above three (see Appendix Table 10). However, this result had high heterogeneity according to the I^2 test. For living with a non-relative, the pooled odds ratio was approximately two compared with girls living with both parents, with moderate heterogeneity.

The number of educated women in a household and the crowding index were also highly significant predictors of having sex before age 15. Many countries had significantly lower odds of this outcome if there was at least one educated woman in the household (Appendix Figure 44). There was also low to moderate heterogeneity. For children in a household with three or more educated women, the I^2 test failed to reject the null hypothesis that the surveys were homogeneous. Also, Appendix Figure 45 shows a higher likelihood of having sex before age 15 with higher crowding levels, with the I^2 test indicating homogeneity between the surveys for this result. The pooled odds ratio of the percentage of educated women in a cluster was also highly significant, with a higher percentage indicating lower odds of the outcome. As Appendix Figure 46 shows, the relationship between having early sex and the number of educated women in the household was significant in several countries, and exhibited moderate heterogeneity, with a significant I^2 test. The remaining two cluster-level variables, nighttime lights and travel time to a major city, were also significant in the expected direction, but significance occurred in fewer countries and heterogeneity was high.

Nutrition outcomes. For girls age 15-17, only the crowding index and the percentage of educated women in a cluster significantly predicted the underweight outcome in the expected direction. For the crowding index, Appendix Figure 50 shows that the I^2 test was not significant, indicating homogeneity between the surveys. The I^2 test was significant for the percentage of educated women in a cluster, but the I^2 value indicated moderate heterogeneity (Appendix Figure 51). Living without a parent and living in a household headed by a relative or a non-relative, compared with living with both parents, gave a significant pooled odds ratio in the opposite of the expected direction. That is, girls age 15-17 in these two living arrangements had lower odds of being underweight than girls living with both parents. Appendix Figure 48 shows a non-

significant I^2 test, indicating homogeneity for these results. None of the remaining subgroups were significant for the underweight outcome.

None of the risk factors showed a significant pooled odds ratio for anemia for girls age 15-17. This is also apparent in Appendix Figures 52-56, where the odds ratios for all the subgroups were non-significant in almost all the countries. The I^2 test results for all the risk factors indicated either a significant but low heterogeneity or a non-significant test, indicating homogeneity between the surveys.

Table 4 Summary of meta-analysis of the outcomes for girls age 15-17

	Adolescent fertility	Had sex before age 15	Underweight	Anemic
Child level variables				
Orphanhood status (both parents alive Ref.)				
Mother alive, father dead	+++	NS	NS	NS
Father alive, mother dead	NS	+	NS	NS
Both parents dead	++	+	NS	NS
Living arrangements (living with both parents Ref.)				
Living with mother, not father	+++	+++	NS	NS
Living with father, not mother	NS	NS	NS	NS
Living with relative, no parent	+++	+++	---	NS
Does not live with relatives	+++	+++	---	NS
Household risk factors				
Number of educated women (none Ref.)				
1	---	---	NS	NS
2	---	---	NS	NS
3+	---	---	NS	NS
Crowding	+++	+++	+++	NS
Youth dependency	+++	NS	NS	NS
Community level variables				
Percentage of educated women	---	---	---	NS
Nighttime lights	--	-	NS	NS
Travel time to major city	NS	+++	NS	NS

Note: NS - not significant. Green indicates result is in the expected direction, orange indicates a result in the opposite of the expected direction. + indicates an OR above 1 and - indicates an OR below 1. The number of signs indicates the level of significance. A red box indicates a high level of heterogeneity.

4 DISCUSSION

This report focused on 10 outcomes in four domains of well-being for children age 0-17—nutrition, health care, schooling, and child protection. The 10 specific outcomes refer variously to ages 0-4, 5-14, and 15-17. No indicator refers to more than one of the age intervals, let alone to all three. The analysis has taken a comprehensive approach to identify risk factors that cut across all outcomes, domains, and age groups, in an attempt to identify a general set of risk factors that tend to be associated with a general set of child outcomes in many countries. The strategy to accomplish this is very different from what would be used if, say, the goal was to identify the risk factors for school attendance by children age 5-14 in a single country. We have been cautious about concluding that a relationship between risks and outcomes is generalizable, or homogeneous across countries, or instead is heterogeneous—that is, found in some countries but not others.

The risk factors that this report has considered are themselves in different domains—apart from the requirement that they must be included in DHS surveys or in spatial data that can be attached to DHS surveys. The three hierarchically structured domains or levels are the child, the household, and the sample cluster, which can be loosely described as the community in which the household is located. The main interest is in risks for individual children that arise from conditions in the household or from the community around it.

The household in which the child lives can potentially be described in many different ways that are relevant to these outcomes, and we have been selective in the choice of household-level variables. We have not included, for example, variables such as source of water, type of sanitary facilities, building materials, access to electricity, or access to the media, which other studies (Kanamori and Pullum 2013) have shown to be associated with child well-being. Rather, the household-level variables constructed for this analysis focus on the context of the child within the household, describing the position of the child relative to the adults who are potentially the primary caregivers. If the child is a single or double orphan, it is hypothesized that the child has greater risk of negative outcomes than if both parents are alive. If the child is not living with a parent, it is hypothesized that the child has greater risk of negative outcomes than if the child is living with both parents. Similarly, if the child is not living with a parent and is not even related to the household head, then risk is further increased.

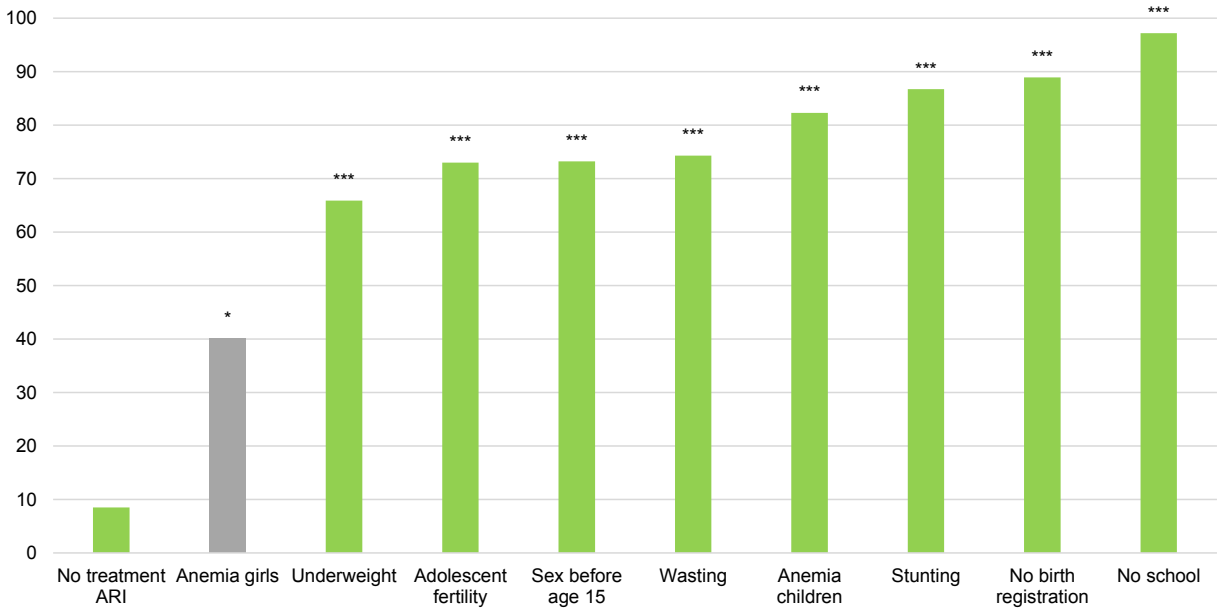
The focus is on adult caregivers to whom the child is biologically related. Whether or not they are orphans, most children who are not living with a parent are living with a relative as the household head, mostly a grandparent or an aunt or uncle. In an effort not detailed in this report, we attempted to infer whether the context for some of those children might be altered by the presence of some other relative who is in the household but is not the household head. It is possible that the child's parents are not in the household, and the child is not related to the household head, but the child's grandmother, or an adult sibling, for example, may be in the household. Unfortunately, such living arrangements cannot be identified definitively with the data currently included in DHS surveys. The surveys include the relationship of every person in the household to the household head, but not to one another. But even if such relationships do exist, they would involve few children—too few for statistically significant inferences.

In addition to variables that describe the presence or absence of primary caregivers in the household, the report has included three other indicators of the child's social context at the household level. An index of crowding or density is calculated as the ratio of household members to sleeping rooms, and a measure of dependency is the ratio of children to adults. A high level of crowding indicates relatively low allocation of household resources per person, and a high dependency ratio indicates a relatively low share of resources per child, in particular. The third household-level indicator selected for its potential relevance to child well-being is the presence of educated adults, particularly women, in the household. This dimension of the household context was found by Akwara et al. (2010) to be an important risk factor in many countries, and was included as a risk factor in an earlier DHS report (Pullum 2015). Women's education is well documented as an important aspect of development and welfare in general. The presence of educated women is also assessed at the cluster level as well as the household level, and is found to be important at both levels.

The other two cluster-level risk factors are distance from a city of 50,000 or more inhabitants and nighttime lights. These variables are peripheral to the central question of the relationship between child outcomes and the position of the child within the household support structure. In a broad interpretation, these are two continuous indicators of access to resources (such as schools and health facilities) and level of development. They are included as coarse controls, or proxies, for a large number of household-level and cluster-level indicators of social and economic infrastructure, including the wealth index, many of which have been included in other research but are omitted here.

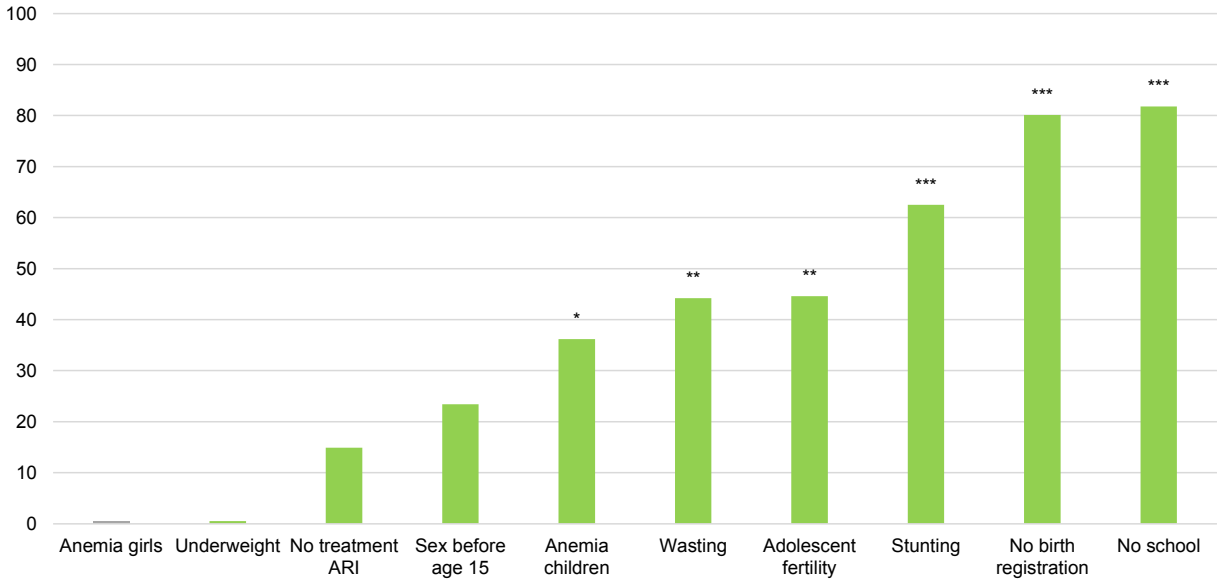
The meta-analysis revealed that most results were in the expected direction, but it is important to examine the results from the heterogeneity tests. The level of heterogeneity indicates whether the result can be generalized across countries or instead is a country-specific finding (when a high level of heterogeneity is found). Across all the outcomes, except for anemia in girls, the strongest effects were for the percentage of educated women in a cluster and the crowding index, but as Figure 12 shows, there was high heterogeneity for the percentage of educated women in a cluster. The figure shows that for seven out of the 10 outcomes, the level of heterogeneity was significant and above 70%. The level of heterogeneity was relatively low only for the no treatment sought for ARI symptoms outcome. In contrast, Figure 13 shows lower levels of heterogeneity for most of the outcomes with the crowding index. There was low heterogeneity detected for the association between crowding and anemia in children, wasting, and adolescent fertility, and no significant heterogeneity for crowding and anemia in girls, underweight girls, no treatment sought for ARI, and sex before age 15. This indicates that the association between crowding and these outcomes can be generalized across the countries in the analysis.

Figure 12 **I^2 values and test of heterogeneity for the pooled odds ratio of proportion of educated women in a cluster**



Note: Green indicates pooled OR was in expected direction and grey indicates not significant. The stars refer to the significance of the I^2 value.

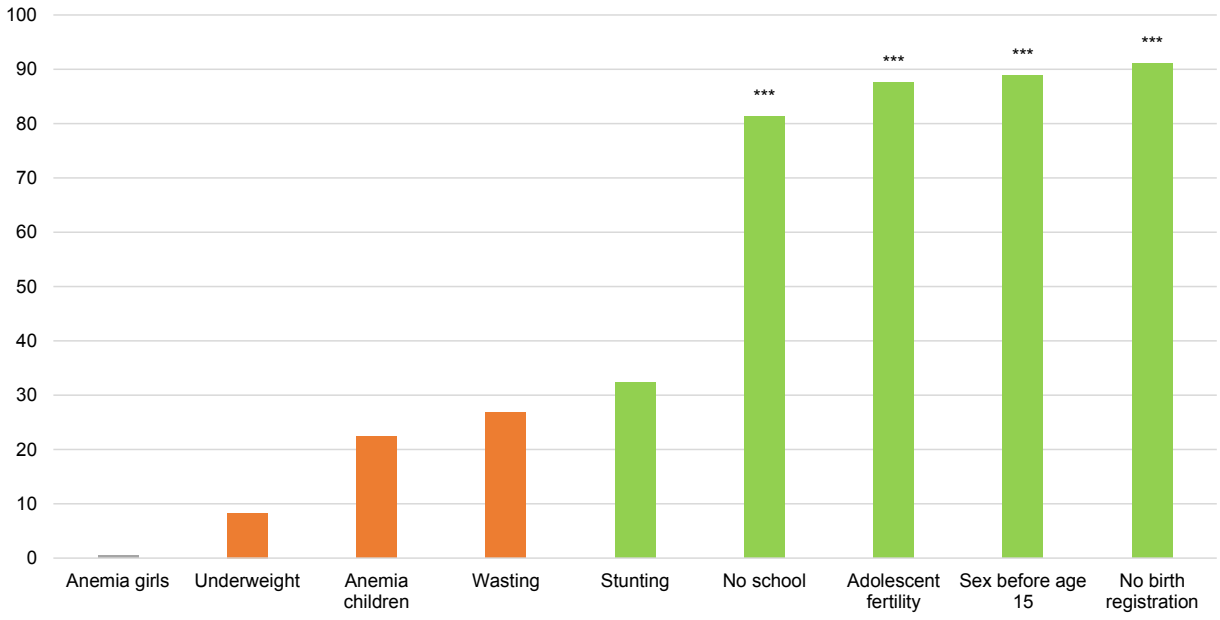
Figure 13 **I^2 values and test of heterogeneity for the pooled odds ratio of crowding**



Note: Green indicates pooled OR was in expected direction and grey indicates not significant. The stars refer to the significance of the I^2 value.

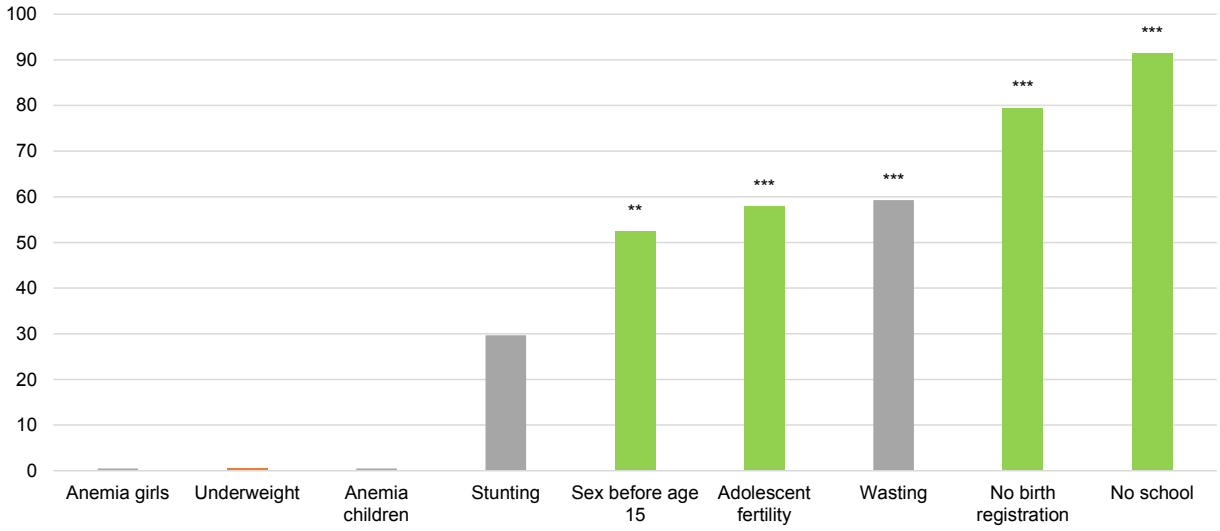
The effect of household structure—represented by the living arrangements variable—appeared to be stronger for the child protection and schooling outcomes. For these outcomes, the magnitude of the pooled odds ratio, as well as the significance level, were high and especially for the categories of living with a relative who is not a parent and living with no relative. However, as Figure 14 shows, there were high levels of heterogeneity for the association between these outcomes and children living with a household head who is a relative but not a parent, compared with children living with both parents. The heterogeneity levels were above 80% for the outcomes of children not in school, adolescent fertility, sex before age 15, and no birth registration, indicating that these findings cannot be generalized. The nutrition outcomes had lower levels of heterogeneity but the pooled odds ratios were in the expected direction only for the stunting outcome. Figure 15 shows the level of heterogeneity for all the outcomes for children living in a household where they are not related to the household head compared with children living with both parents. The outcomes of no birth registration and no schooling had high heterogeneity levels. The remaining outcomes had low to moderate heterogeneity, but only the outcomes of sex before age 15 and adolescent fertility had pooled odds ratios in the expected direction. These findings imply that the expected protective aspect of having a parent in the household is not universal by countries or by child well-being outcomes. It appears that for child well-being, the number of people in the household is more important than the relationships in the household. This is likely due to competition for limited resources in overcrowded households.

Figure 14 I^2 values and test of heterogeneity for the pooled odds ratio of children living with relative compared with children living with both parents



Note: Green indicates pooled OR was in expected direction, orange indicates it was in the opposite of the expected direction, and grey indicates not significant. The stars above the bars refer to the significance of the I^2 value.

Figure 15 I^2 values and test of heterogeneity for the pooled odds ratio of children not living with relative compared with children living with both parents



Note: Green indicates pooled OR was in expected direction, orange indicates it was in the opposite of the expected direction, and grey indicates not significant. The stars above the bars refer to the significance of the I^2 value.

One of the limitations with DHS data is finding appropriate outcomes. Some outcomes develop over a long period of time. For instance, the risk of stunting can begin from pregnancy. By contrast, the risk factors used in the analysis look at the current status of children in their living conditions. It is not possible to find outcomes that extend across all the age groups. The DHS Program does not collect a great deal of information for children age 5-14 or boys age 15-17. Small sample sizes for outcomes such as care-seeking for ARI symptoms and the outcomes for girls age 15-17 gave less power to detect significance in the predictors. Some subgroups of children, such as double orphans, especially under age 5, or children living separately from parents with a household head who is not a relative, are very small. Despite these limitations, the power obtained from pooling the surveys for a meta-analysis provided a view of the important factors that have an effect on the outcomes analyzed and relationships where more in-depth country-specific research is required.

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APPENDICES

Appendix Table 1 Percentage of orphanhood type among households with children under age 18

		Orphan Type			
Country	Year	Both parents alive	Mother alive, father dead	Father alive, mother dead	Both parents dead
Armenia	2010	96.9 [96.1,97.6]	2.5 [1.9,3.2]	(0.6 [0.3,1.1])	ND
Benin	2011-12	93.9 [93.5,94.3]	4.1 [3.8,4.5]	1.6 [1.4,1.8]	0.4 [0.4,0.5]
Burkina Faso	2010	94.4 [94.0,94.8]	3.6 [3.3,4.0]	1.4 [1.3,1.6]	0.5 [0.5,0.6]
Burundi	2010	86.6 [85.7,87.5]	8.4 [7.7,9.2]	2.9 [2.6,3.4]	2.0 [1.7,2.3]
Cambodia	2014	94.1 [93.5,94.7]	4.0 [3.6,4.5]	1.1 [1.0,1.4]	0.8 [0.6,1.0]
Chad	2015	92.5 [91.9,93.0]	5.3 [4.8,5.8]	1.5 [1.4,1.8]	0.7 [0.6,0.9]
Colombia	2010	94.5 [94.2,94.8]	4.4 [4.2,4.7]	0.9 [0.8,1.0]	0.2 [0.1,0.2]
Congo Democratic Republic	2013-14	91.1 [90.4,91.7]	5.1 [4.7,5.6]	2.6 [2.3,2.9]	1.2 [1.0,1.4]
Côte d'Ivoire	2011-12	91.3 [90.7,91.8]	5.3 [4.8,5.9]	2.4 [2.1,2.7]	1.0 [0.9,1.3]
Ethiopia	2011	90.6 [89.8,91.4]	6.4 [5.8,7.1]	2.1 [1.9,2.4]	0.8 [0.7,1.0]
Ghana	2014	92.5 [91.8,93.1]	5.0 [4.5,5.6]	1.7 [1.4,2.0]	0.8 [0.7,1.0]
Guinea	2012	90.7 [89.9,91.4]	5.7 [5.1,6.3]	2.6 [2.3,3.0]	1.0 [0.8,1.2]
Haiti	2012	87.8 [87.1,88.4]	7.6 [7.0,8.2]	3.3 [3.0,3.7]	1.3 [1.1,1.5]
Kenya	2014	90.0 [89.6,90.5]	6.9 [6.5,7.3]	1.8 [1.6,2.0]	1.2 [1.1,1.4]
Liberia	2013	92.7 [92.1,93.3]	5.3 [4.8,5.8]	1.5 [1.3,1.8]	0.5 [0.4,0.7]
Madagascar	2008-09	92.7 [92.1,93.1]	4.4 [4.1,4.8]	2.4 [2.1,2.7]	0.6 [0.5,0.7]
Malawi	2015-16	88.4 [88.0,88.9]	7.2 [6.8,7.6]	2.4 [2.2,2.6]	2.0 [1.8,2.2]
Mali	2012	95.5 [95.1,96.0]	2.5 [2.2,2.9]	1.5 [1.3,1.8]	0.4 [0.3,0.5]
Moldova	2005	95.5 [94.7,96.1]	3.5 [2.9,4.1]	0.8 [0.6,1.2]	ND
Mozambique	2011	87.0 [86.4,87.7]	8.0 [7.5,8.6]	3.2 [2.9,3.6]	1.7 [1.5,1.9]
Myanmar	2015-16	92.3 [91.5,93.0]	5.6 [5.0,6.4]	1.5 [1.3,1.8]	0.5 [0.4,0.7]
Nepal	2011	95.1 [94.6,95.6]	3.2 [2.8,3.6]	1.5 [1.2,1.8]	0.2 [0.2,0.3]
Nigeria	2013	94.3 [94.0,94.7]	3.8 [3.5,4.1]	1.4 [1.3,1.6]	0.4 [0.3,0.5]
Rwanda	2014-15	90.7 [90.2,91.2]	6.7 [6.3,7.2]	1.6 [1.4,1.8]	1.0 [0.9,1.1]
Senegal	2015	93.8 [93.3,94.3]	4.5 [4.0,5.0]	1.4 [1.2,1.7]	0.3 [0.2,0.4]
Sierra Leone	2013	89.6 [88.9,90.2]	6.4 [6.0,7.0]	2.2 [2.0,2.5]	1.8 [1.5,2.1]
Tanzania	2015-16	91.6 [91.0,92.1]	5.5 [5.1,6.1]	2.1 [1.8,2.3]	0.8 [0.7,0.9]
Togo	2013-14	91.2 [90.6,91.8]	5.9 [5.4,6.5]	2.2 [1.9,2.4]	0.7 [0.6,0.9]
Uganda	2011	88.4 [87.3,89.5]	7.3 [6.5,8.2]	2.4 [2.0,2.8]	1.9 [1.6,2.2]
Zambia	2013-14	88.6 [88.1,89.1]	7.2 [6.8,7.7]	2.1 [1.9,2.3]	2.1 [1.9,2.3]

Notes: ND values not displayed because they were based on less than 25 unweighted cases. Values in parenthesis are based on 25-49 unweighted cases.

Appendix Table 2 Percentage of household living arrangements among households with children under age 18

		Living arrangements				
Country	Year	Living with both parents	Living with mother only	Living with father only	Living with relative, no parent	Does not live with relatives
Armenia	2010	82.4 [80.2,84.3]	15.2 [13.4,17.2]	1.0 [0.7,1.5]	1.2 [0.9,1.7]	ND
Benin	2011-12	64.7 [63.7,65.7]	13.3 [12.6,14.0]	7.4 [7.0,7.8]	12.9 [12.3,13.5]	1.7 [1.5,1.9]
Burkina Faso	2010	77.7 [76.7,78.6]	8.3 [7.7,8.9]	4.5 [4.2,4.9]	7.9 [7.5,8.4]	1.5 [1.4,1.7]
Burundi	2010	68.4 [67.0,69.8]	18.5 [17.3,19.8]	3.1 [2.8,3.5]	8.2 [7.6,8.8]	1.8 [1.6,2.1]
Cambodia	2014	77.5 [76.5,78.4]	9.1 [8.5,9.6]	1.8 [1.5,2.0]	11.0 [10.4,11.7]	0.7 [0.6,0.9]
Chad	2015	69.1 [67.9,70.2]	14.6 [13.8,15.6]	4.9 [4.5,5.3]	8.0 [7.6,8.5]	3.4 [3.1,3.7]
Colombia	2010	52.6 [51.9,53.3]	32.7 [32.0,33.4]	3.5 [3.3,3.7]	9.4 [9.1,9.8]	1.8 [1.6,1.9]
Congo Democratic Republic	2013-14	59.3 [58.0,60.7]	20.4 [19.4,21.4]	6.1 [5.6,6.6]	10.2 [9.6,10.8]	4.0 [3.7,4.3]
Côte d'Ivoire	2011-12	53.1 [51.3,54.8]	16.7 [15.6,17.8]	8.5 [7.8,9.3]	17.7 [16.8,18.7]	4.0 [3.6,4.5]
Ethiopia	2011	71.0 [69.7,72.4]	14.5 [13.5,15.5]	3.0 [2.7,3.4]	7.8 [7.2,8.4]	3.7 [3.3,4.1]
Ghana	2014	54.7 [52.9,56.6]	25.0 [23.5,26.6]	4.7 [4.2,5.2]	14.2 [13.2,15.2]	1.4 [1.2,1.7]
Guinea	2012	61.3 [59.6,63.0]	13.2 [12.1,14.3]	7.0 [6.5,7.6]	15.4 [14.5,16.4]	3.0 [2.7,3.5]
Haiti	2012	44.1 [42.6,45.6]	29.1 [27.8,30.5]	6.0 [5.4,6.6]	13.7 [13.0,14.5]	7.1 [6.5,7.7]
Kenya	2014	54.7 [53.8,55.6]	27.5 [26.7,28.2]	3.3 [3.0,3.5]	13.6 [13.1,14.0]	1.0 [0.9,1.1]
Liberia	2013	43.5 [42.0,45.0]	23.5 [22.4,24.5]	7.8 [7.1,8.6]	23.0 [21.9,24.1]	2.2 [1.8,2.7]
Madagascar	2008-09	65.5 [64.4,66.5]	15.1 [14.4,15.8]	4.6 [4.3,5.0]	11.1 [10.5,11.8]	3.7 [3.4,4.0]
Malawi	2015-16	52.9 [52.0,53.9]	24.3 [23.5,25.0]	2.8 [2.6,3.0]	19.1 [18.5,19.7]	0.9 [0.8,1.0]
Mali	2012	80.3 [79.0,81.5]	6.5 [5.8,7.2]	3.1 [2.7,3.5]	7.8 [7.3,8.4]	2.4 [2.1,2.7]
Moldova	2005	63.8 [62.0,65.6]	19.1 [17.9,20.4]	5.3 [4.6,6.2]	9.8 [8.9,10.8]	1.9 [1.5,2.4]
Mozambique	2011	52.0 [50.5,53.4]	25.8 [24.7,26.9]	4.1 [3.7,4.6]	17.0 [16.2,17.8]	1.1 [1.0,1.3]
Myanmar	2015-16	74.1 [72.7,75.4]	13.2 [12.2,14.3]	2.2 [1.9,2.6]	9.7 [8.9,10.5]	0.8 [0.6,1.0]
Nepal	2011	60.1 [58.1,62.1]	29.5 [27.6,31.4]	2.3 [1.9,2.8]	7.4 [6.7,8.2]	0.7 [0.5,0.9]
Nigeria	2013	73.5 [72.6,74.3]	10.8 [10.2,11.4]	5.4 [5.1,5.7]	7.4 [7.1,7.8]	2.9 [2.7,3.1]
Rwanda	2014-15	62.6 [61.5,63.7]	21.8 [20.9,22.7]	2.2 [2.0,2.5]	10.3 [9.8,10.9]	3.0 [2.7,3.3]
Senegal	2015	53.0 [51.0,54.9]	28.9 [27.1,30.7]	3.1 [2.7,3.6]	13.6 [12.9,14.5]	1.4 [1.2,1.7]
Sierra Leone	2013	50.3 [49.0,51.6]	17.4 [16.6,18.2]	7.9 [7.4,8.4]	21.7 [20.9,22.6]	2.7 [2.4,3.0]
Tanzania	2015-16	57.5 [56.2,58.8]	18.6 [17.7,19.6]	5.1 [4.7,5.6]	15.3 [14.6,16.1]	3.4 [3.1,3.7]
Togo	2013-14	60.5 [58.5,62.4]	17.8 [16.6,19.0]	5.6 [5.0,6.1]	14.2 [13.3,15.2]	2.0 [1.7,2.3]
Uganda	2011	55.6 [53.8,57.4]	19.9 [18.6,21.3]	5.3 [4.8,5.8]	14.1 [13.3,15.0]	5.1 [4.7,5.5]
Zambia	2013-14	59.6 [58.6,60.7]	19.2 [18.4,20.0]	3.7 [3.4,4.0]	12.1 [11.5,12.7]	5.5 [5.1,5.8]

Note: ND values not displayed because they were based on less than 25 unweighted cases.

Appendix Table 3 Household risk factors

Country	Year	Mean crowding	Mean dependency ratio	Mean youth dependency	Mean number of educated adults	Mean number of educated women
Armenia	2010	2.13 [2.08,2.19]	0.82 [0.79,0.86]	0.68 [0.65,0.71]	3.17 [3.09,3.24]	1.79 [1.74,1.83]
Benin	2011-12	3.42 [3.36,3.48]	1.77 [1.74,1.81]	1.66 [1.64,1.69]	1.01 [0.97,1.05]	0.38 [0.36,0.4]
Burkina Faso	2010	2.67 [2.62,2.71]	1.61 [1.58,1.63]	1.53 [1.5,1.55]	0.64 [0.59,0.69]	0.28 [0.25,0.3]
Burundi	2010	2.51 [2.45,2.56]	1.54 [1.51,1.58]	1.49 [1.46,1.53]	1.24 [1.19,1.29]	0.59 [0.56,0.61]
Cambodia	2014	4.37 [4.27,4.46]	1.06 [1.04,1.09]	0.96 [0.94,0.98]	2.43 [2.37,2.48]	1.19 [1.16,1.22]
Chad	2015	3.34 [3.28,3.4]	1.98 [1.94,2.01]	1.9 [1.87,1.94]	1.12 [1.06,1.19]	0.45 [0.42,0.48]
Colombia	2010	2.3 [2.27,2.34]	0.99 [0.98,1.01]	0.91 [0.9,0.93]	2.56 [2.54,2.59]	1.42 [1.4,1.43]
Congo Democratic Republic	2013-14	3.16 [3.08,3.24]	1.79 [1.76,1.83]	1.73 [1.7,1.76]	2.29 [2.24,2.35]	1.13 [1.1,1.17]
Côte d'Ivoire	2011-12	3.05 [2.97,3.14]	1.49 [1.45,1.53]	1.39 [1.35,1.42]	1.57 [1.45,1.68]	0.68 [0.62,0.74]
Ethiopia	2011	4.7 [4.58,4.82]	1.56 [1.52,1.6]	1.48 [1.44,1.52]	1.06 [1.01,1.11]	0.4 [0.38,0.43]
Ghana	2014	3.28 [3.21,3.36]	1.51 [1.47,1.54]	1.4 [1.37,1.44]	1.65 [1.6,1.7]	0.87 [0.84,0.9]
Guinea	2012	2.64 [2.57,2.72]	1.61 [1.56,1.65]	1.48 [1.44,1.52]	1.19 [1.08,1.3]	0.45 [0.4,0.5]
Haiti	2012	3.52 [3.45,3.59]	1.27 [1.24,1.31]	1.16 [1.13,1.19]	2.09 [2.01,2.17]	1.1 [1.04,1.15]
Kenya	2014	3.5 [3.44,3.56]	1.59 [1.57,1.62]	1.51 [1.49,1.54]	2.02 [1.99,2.05]	1.09 [1.07,1.11]
Liberia	2013	3.08 [3.0,3.15]	1.51 [1.47,1.56]	1.4 [1.36,1.45]	1.93 [1.83,2.04]	0.85 [0.79,0.9]
Madagascar	2008-09	4.79 [4.71,4.87]	1.55 [1.52,1.58]	1.48 [1.45,1.51]	1.91 [1.86,1.95]	0.93 [0.91,0.96]
Malawi	2015-16	2.82 [2.78,2.87]	1.65 [1.62,1.67]	1.52 [1.5,1.55]	1.9 [1.87,1.93]	0.98 [0.96,1.0]
Mali	2012	2.51 [2.46,2.57]	1.77 [1.74,1.81]	1.69 [1.66,1.73]	0.74 [0.67,0.8]	0.29 [0.26,0.32]
Moldova	2005	1.73 [1.68,1.78]	0.85 [0.82,0.88]	0.76 [0.73,0.78]	2.31 [2.28,2.35]	1.25 [1.23,1.27]
Mozambique	2011	2.87 [2.81,2.93]	1.72 [1.69,1.75]	1.63 [1.6,1.66]	1.6 [1.55,1.65]	0.77 [0.74,0.8]
Myanmar	2015-16	3.64 [3.54,3.74]	1.04 [1.01,1.07]	0.93 [0.9,0.96]	2.34 [2.26,2.42]	1.24 [1.2,1.29]
Nepal	2011	2.9 [2.77,3.02]	1.29 [1.24,1.34]	1.18 [1.13,1.24]	1.46 [1.38,1.55]	0.66 [0.61,0.71]
Nigeria	2013	2.9 [2.86,2.94]	1.62 [1.6,1.64]	1.54 [1.52,1.56]	1.61 [1.55,1.66]	0.75 [0.72,0.78]
Rwanda	2014-15	2.37 [2.34,2.4]	1.4 [1.37,1.42]	1.33 [1.3,1.35]	1.88 [1.85,1.91]	1.02 [1.0,1.04]
Senegal	2015	2.61 [2.55,2.66]	1.4 [1.36,1.44]	1.29 [1.25,1.33]	2.16 [1.98,2.33]	1.03 [0.94,1.12]
Sierra Leone	2013	2.76 [2.7,2.83]	1.5 [1.47,1.54]	1.37 [1.34,1.4]	1.25 [1.18,1.32]	0.55 [0.51,0.59]
Tanzania	2015-16	2.63 [2.59,2.68]	1.55 [1.51,1.58]	1.44 [1.41,1.47]	2.3 [2.25,2.36]	1.13 [1.1,1.16]
Togo	2013-14	2.92 [2.86,2.98]	1.62 [1.58,1.67]	1.52 [1.48,1.56]	1.69 [1.62,1.75]	0.77 [0.72,0.82]
Uganda	2011	3.57 [3.47,3.68]	1.86 [1.81,1.9]	1.76 [1.72,1.81]	2.01 [1.96,2.05]	1.02 [0.99,1.05]
Zambia	2013-14	3.27 [3.22,3.33]	1.64 [1.61,1.67]	1.56 [1.54,1.59]	2.38 [2.33,2.43]	1.23 [1.2,1.25]

Appendix Table 4 Cluster-level variables

Country	Year	Poorest households	Educated adults	Educated women	Nighttime lights	Travel time to major city
Armenia	2010	21.92 [17.96,25.87]	75.47 [74.76,76.18]	42.47 [41.86,43.07]	5.98 [4.69,7.27]	71.35 [62.86,79.85]
Benin	2011-12	21.3 [19.65,22.94]	18.63 [17.93,19.32]	6.9 [6.56,7.23]	1.39 [1.27,1.52]	132.75 [126.77,138.74]
Burkina Faso	2010	21.06 [19.67,22.44]	9.94 [9.4,10.47]	4.03 [3.77,4.29]	1.22 [1.03,1.4]	221.97 [213.51,230.43]
Burundi	2010	20.24 [18.77,21.71]	23.08 [22.35,23.82]	10.49 [10.07,10.92]	0.13 [0.11,0.15]	158.49 [149.7,167.28]
Côte d'Ivoire	2011-12	21.02 [18.1,23.95]	23.54 [22.22,24.86]	9.26 [8.58,9.95]	4.47 [3.9,5.04]	148.99 [134.13,163.85]
Congo Democratic Republic	2013-14	20.34 [18.45,22.22]	36.65 [35.9,37.4]	17.31 [16.82,17.8]	1.97 [1.61,2.33]	240.54 [218.75,262.32]
Colombia	2010	24.08 [22.63,25.54]	58.14 [57.73,58.55]	30.97 [30.69,31.26]	22.95 [22.08,23.82]	100.44 [94.53,106.35]
Ethiopia	2011	20.95 [18.62,23.27]	20.55 [19.66,21.43]	7.89 [7.42,8.36]	0.43 [0.35,0.5]	395.02 [360.05,429.99]
Ghana	2014	22.49 [19.78,25.21]	39.36 [38.1,40.62]	19.32 [18.53,20.1]	3.48 [3.11,3.86]	123.32 [114.5,132.13]
Guinea	2012	20.81 [17.84,23.77]	15.31 [14.19,16.44]	5.59 [5.07,6.12]	1.23 [1.02,1.45]	163.85 [152.39,175.3]
Haiti	2012	22.48 [19.64,25.32]	40.18 [38.88,41.48]	19.27 [18.46,20.09]	2.07 [1.76,2.38]	116.22 [108.74,123.7]
Kenya	2014	23.24 [21.87,24.61]	42.31 [41.75,42.88]	20.87 [20.54,21.2]	1.96 [1.76,2.16]	202.32 [194.94,209.7]
Cambodia	2014	21.73 [19.42,24.03]	49.35 [48.54,50.16]	24.2 [23.66,24.73]	1.12 [0.89,1.36]	183.45 [172.64,194.26]
Liberia	2013	19.82 [17.33,22.3]	31.28 [30.18,32.38]	12.39 [11.83,12.95]	0.64 [0.45,0.83]	198.93 [185.74,212.12]
Moldova	2005	22.3 [19.93,24.68]	70.72 [69.96,71.47]	37.69 [37.17,38.22]	2.96 [2.7,3.22]	81.58 [77.27,85.89]
Madagascar	2008-09	21.11 [19.45,22.77]	36.12 [35.34,36.9]	17.42 [16.97,17.86]	0.45 [0.38,0.52]	199.8 [190.42,209.18]
Mali	2012	20.19 [18.01,22.36]	10.94 [10.17,11.7]	4.28 [3.94,4.62]	1.45 [1.3,1.61]	194.3 [181.64,206.95]
Malawi	2015-16	20.53 [19.54,21.52]	38.6 [38.1,39.09]	19.23 [18.92,19.54]	0.78 [0.69,0.87]	184.6 [177.06,192.14]
Myanmar	2015-16	22.67 [20.52,24.81]	49.66 [48.2,51.13]	26.59 [25.72,27.46]	1.45 [1.14,1.77]	169.96 [157.79,182.12]
Mozambique	2011	20.44 [18.47,22.41]	30.68 [29.84,31.52]	14.01 [13.49,14.53]	2.49 [2.23,2.75]	214.36 [197.61,231.11]
Nigeria	2013	22.09 [19.96,24.22]	28.86 [27.91,29.82]	12.77 [12.28,13.27]	1.62 [1.34,1.9]	136.92 [128.74,145.11]
Nepal	2011	22.36 [18.79,25.93]	29.66 [27.77,31.55]	13.08 [12.07,14.1]	0.37 [0.29,0.45]	202.46 [185.36,219.56]
Rwanda	2014-15	20.53 [19.44,21.62]	39.72 [39.18,40.25]	20.59 [20.24,20.94]	0.64 [0.53,0.74]	191.1 [182.92,199.29]
Sierra Leone	2013	20.21 [18.15,22.27]	18.49 [17.58,19.39]	7.74 [7.28,8.2]	0.39 [0.31,0.48]	142.4 [134.01,150.8]
Senegal	2015	22.35 [19.03,25.66]	19.13 [17.84,20.43]	8.92 [8.22,9.63]	3.1 [2.41,3.79]	118.1 [109.34,126.85]
Togo	2013-14	22.46 [20.33,24.59]	30.8 [29.35,32.25]	13.42 [12.63,14.2]	2.14 [1.86,2.41]	144.74 [135.92,153.56]
Chad	2015	20.37 [18.78,21.96]	15.32 [14.72,15.93]	5.87 [5.56,6.17]	0.74 [0.6,0.89]	280.67 [266.4,294.94]
Tanzania	2015-16	21.64 [19.38,23.9]	37.77 [36.96,38.58]	18.11 [17.62,18.59]	0.94 [0.81,1.06]	180.24 [168.48,192.01]
Uganda	2011	20.75 [18.54,22.97]	34.59 [33.83,35.34]	16.6 [16.15,17.05]	0.53 [0.36,0.7]	159.19 [149.88,168.5]
Zambia	2013-14	21.31 [19.92,22.7]	39.73 [39.24,40.22]	19.84 [19.51,20.16]	5.12 [4.55,5.69]	261.22 [245.73,276.71]

Appendix Table 5 Childhood outcomes for children under age 5

Country	Year	Stunted	Wasted	Anemic	No Care-seeking sought for ARI	No birth registration or birth certificate
Armenia	2010	19.3 [16.7,22.2]	4.0 [2.9,5.6]		43.2 [27.1,60.9]	0.4 [0.2,1.0]
Benin	2011-12	44.6 [43.2,46.1]	16.0 [14.9,17.2]	58.3 [56.2,60.5]	68.6 [60.3,76.0]	19.8 [18.3,21.4]
Burkina Faso	2010	34.6 [33.2,36.1]	15.5 [14.2,16.8]	87.8 [86.7,88.8]	44.5 [37.5,51.8]	23.1 [21.4,24.9]
Burundi	2010	57.7 [55.7,59.7]	5.8 [4.9,6.9]	44.5 [42.3,46.8]	45.4 [42.1,48.7]	24.8 [22.7,27.1]
Cambodia	2014	32.4 [30.6,34.3]	9.6 [8.6,10.8]	55.5 [53.4,57.6]	31.4 [25.2,38.3]	26.7 [24.7,28.8]
Chad	2015	39.9 [38.5,41.4]	13.0 [12.1,14.0]		74.4 [70.1,78.2]	88.0 [86.7,89.1]
Colombia	2010	13.2 [12.5,13.9]	0.9 [0.7,1.1]		35.5 [31.9,39.4]	
Congo Democratic Republic	2013-14	42.7 [40.9,44.5]	7.9 [7.0,8.9]	59.8 [57.5,62.1]	58.0 [51.8,64.0]	75.4 [72.5,78.1]
Côte d'Ivoire	2011-12	29.8 [27.7,31.9]	7.5 [6.4,8.9]	74.8 [72.9,76.7]	63.0 [54.4,70.8]	13.0 [11.7,14.4]
Ethiopia	2011	44.5 [42.7,46.2]	9.7 [8.7,10.7]	44.2 [42.1,46.4]	72.9 [67.5,77.6]	
Ghana	2014	18.8 [17.0,20.6]	4.7 [3.5,6.1]	65.7 [62.9,68.5]	47.3 [37.2,57.6]	29.5 [26.8,32.4]
Guinea	2012	31.2 [29.1,33.3]	9.6 [8.4,10.9]	76.6 [74.5,78.6]	62.1 [56.0,67.9]	42.1 [38.4,45.9]
Haiti	2012	21.9 [20.0,23.8]	5.1 [4.4,5.9]	65.0 [63.0,66.9]	61.6 [57.4,65.7]	20.2 [18.5,22.1]
Kenya	2014	26.1 [25.1,27.0]	4.1 [3.6,4.5]		34.5 [31.5,37.7]	33.1 [31.9,34.4]
Liberia	2013	31.7 [29.4,34.1]	6.0 [5.0,7.3]		47.7 [41.2,54.4]	75.4 [72.8,77.8]
Madagascar	2008-09	50.2 [48.0,52.3]		50.3 [48.4,52.3]	57.9 [51.2,64.4]	20.3 [18.7,22.0]
Malawi	2015-16	37.1 [35.6,38.7]	2.7 [2.3,3.3]	62.6 [60.7,64.5]	22.9 [19.1,27.3]	32.8 [31.5,34.1]
Mali	2012	38.3 [36.2,40.4]	12.6 [11.1,14.3]	81.6 [79.9,83.2]	73.3 [64.1,80.8]	15.7 [13.8,17.8]
Moldova	2005	10.2 [8.7,12.0]	5.0 [3.8,6.6]	32.1 [29.2,35.1]	40.3 [30.6,50.8]	7.7 [6.2,9.4]
Mozambique	2011	42.6 [41.0,44.2]	5.9 [5.3,6.6]	68.7 [66.6,70.7]	50.4 [41.4,59.4]	52.1 [50.1,54.2]
Myanmar	2015-16	29.2 [27.3,31.1]	7.0 [6.1,8.1]	57.8 [55.7,59.8]	42.0 [34.0,50.3]	18.7 [16.2,21.5]
Nepal	2011	40.5 [37.8,43.3]	10.9 [9.4,12.6]	46.2 [42.9,49.6]	50.8 [42.7,59.0]	57.7 [54.9,60.6]
Nigeria	2013	36.8 [35.7,38.0]	18.0 [17.1,18.9]		65.8 [61.0,70.4]	69.2 [67.5,70.9]
Rwanda	2014-15	37.9 [36.1,39.6]	2.2 [1.8,2.7]	36.5 [34.7,38.4]	46.5 [41.8,51.2]	44.0 [42.1,45.9]
Senegal	2015	20.5 [19.0,22.1]	7.8 [7.0,8.8]	66.3 [64.2,68.3]	52.2 [44.4,59.8]	31.7 [28.7,35.0]
Sierra Leone	2013	38.0 [36.0,40.0]	9.3 [8.2,10.6]	79.9 [78.4,81.4]	27.9 [22.1,34.5]	23.3 [20.8,26.0]
Tanzania	2015-16	34.4 [33.0,35.9]	4.5 [4.0,5.0]	57.7 [56.1,59.4]	44.0 [37.5,50.8]	73.6 [71.9,75.3]
Togo	2013-14	27.5 [25.7,29.4]	6.5 [5.7,7.5]	70.1 [68.0,72.1]	51.4 [43.5,59.2]	
Uganda	2011	33.4 [30.9,35.9]	4.7 [3.8,5.9]	49.3 [46.0,52.6]	21.2 [17.8,24.9]	70.1 [67.6,72.5]
Zambia	2013-14	40.1 [38.9,41.3]	6.0 [5.5,6.6]		30.4 [25.3,36.1]	88.7 [87.4,89.9]

Appendix Table 6 Percentage of children age 5-14 not attending school

Country	Year	% [C.I.]
Armenia	2010	10.2 [8.9,11.6]
Benin	2011-12	29.0 [27.6,30.4]
Burkina Faso	2010	58.1 [56.6,59.5]
Burundi	2010	39.1 [37.9,40.4]
Côte d'Ivoire	2011-12	36.5 [34.5,38.6]
Congo Democratic Republic	2013-14	23.4 [22.2,24.6]
Colombia	2010	5.1 [4.8,5.4]
Ethiopia	2011	46.0 [43.7,48.3]
Ghana	2014	19.5 [16.3,23.1]
Guinea	2012	50.3 [47.5,53.2]
Haiti	2012	7.5 [6.5,8.7]
Kenya	2014	5.6 [5.1,6.1]
Cambodia	2014	15.7 [14.7,16.8]
Liberia	2013	22.0 [20.1,24.1]
Moldova	2005	6.3 [5.5,7.2]
Madagascar	2008-09	26.7 [25.4,28.0]
Mali	2012	54.0 [51.5,56.4]
Malawi	2015-16	8.7 [8.1,9.3]
Myanmar	2015-16	14.1 [12.5,15.8]
Mozambique	2011	32.9 [31.2,34.7]
Nigeria	2013	32.0 [29.9,34.2]
Nepal	2011	8.8 [6.8,11.4]
Rwanda	2014-15	16.6 [15.7,17.5]
Sierra Leone	2013	32.9 [31.0,34.8]
Senegal	2015	47.5 [44.3,50.8]
Togo	2013-14	14.3 [12.6,16.2]
Chad	2015	51.7 [49.8,53.7]
Tanzania	2015-16	27.8 [26.2,29.5]
Uganda	2011	14.0 [12.9,15.1]
Zambia	2013-14	28.8 [27.9,29.8]

Appendix Table 7 Childhood outcomes for girls age 15-17

Country	Year	Pregnant or have a child	Had sex before age 15	Underweight	Anemic
Armenia	2010	0.4 [0.1,2.7]			
Benin	2011-12	8.3 [7.0,10.0]	12.9 [11.3,14.6]	14.1 [12.2,16.2]	43.2 [38.5,48.0]
Burkina Faso	2010	8.6 [7.3,10.2]	7.4 [6.1,8.9]	28.1 [25.1,31.3]	45.5 [42.1,49.1]
Burundi	2010	2.2 [1.4,3.4]	3.4 [2.5,4.7]	28.6 [24.9,32.7]	15.8 [12.8,19.2]
Cambodia	2014	4.0 [3.0,5.2]	0.7 [0.4,1.3]	31.0 [27.6,34.6]	48.1 [44.8,51.4]
Chad	2015	21.4 [19.3,23.6]	14.8 [13.0,16.7]	28.9 [25.7,32.2]	
Colombia	2010	11.2 [10.1,12.3]	13.5 [12.4,14.7]	15.8 [14.6,17.2]	
Congo Democratic Republic	2013-14	15.4 [13.4,17.6]	19.2 [16.7,21.9]	24.6 [21.2,28.5]	39.4 [35.3,43.7]
Côte d'Ivoire	2011-12	15.1 [12.4,18.2]	20.2 [16.7,24.3]	19.2 [15.4,23.7]	51.3 [46.1,56.6]
Ethiopia	2011	4.4 [3.2,6.1]	5.0 [3.7,6.7]	42.0 [38.9,45.2]	12.2 [10.2,14.7]
Ghana	2014	6.6 [4.8,9.0]	13.5 [11.1,16.3]	17.4 [13.6,21.9]	53.6 [48.3,58.9]
Guinea	2012	21.0 [18.0,24.3]	20.8 [17.8,24.1]	22.9 [19.6,26.6]	44.0 [39.3,48.8]
Haiti	2012	6.5 [5.3,7.8]	13.5 [11.8,15.4]	27.7 [24.8,30.8]	55.3 [52.2,58.3]
Kenya	2014	8.2 [7.1,9.4]	10.5 [9.3,11.8]	21.3 [19.0,23.8]	
Liberia	2013	16.3 [14.1,18.9]	24.6 [21.6,27.8]	19.3 [15.0,24.5]	
Madagascar	2008-09	17.9 [16.0,20.1]	15.9 [14.1,18.0]	29.6 [26.7,32.8]	33.4 [30.0,37.1]
Malawi	2015-16	13.6 [12.1,15.2]	14.4 [12.9,16.1]	16.7 [13.8,20.0]	33.8 [30.3,37.4]
Mali	2012	23.4 [20.0,27.1]	18.0 [15.1,21.2]	20.4 [16.9,24.5]	47.8 [43.1,52.5]
Moldova	2005	2.1 [1.2,3.5]	1.0 [0.5,2.2]	18.4 [15.8,21.3]	25.8 [22.8,29.0]
Mozambique	2011	22.0 [19.6,24.5]	22.0 [19.8,24.3]	17.7 [15.2,20.4]	55.3 [52.3,58.3]
Myanmar	2015-16	1.5 [0.9,2.6]	0.6 [0.3,1.4]	29.2 [25.8,32.9]	48.7 [44.8,52.6]
Nepal	2011	5.5 [4.3,7.0]	3.2 [2.2,4.6]	28.0 [23.7,32.8]	38.4 [34.2,42.8]
Nigeria	2013	12.5 [11.0,14.1]	15.0 [13.4,16.8]	27.7 [26.0,29.5]	
Rwanda	2014-15	2.2 [1.6,3.2]	7.6 [6.3,9.0]	14.4 [12.0,17.0]	18.6 [16.1,21.5]
Senegal	2015	8.0 [6.5,9.8]	5.2 [3.9,6.8]		
Sierra Leone	2013	12.7 [11.1,14.4]	18.3 [16.2,20.6]	19.0 [15.7,22.9]	49.5 [45.5,53.5]
Tanzania	2015-16	12.4 [10.3,14.8]	13.3 [11.5,15.3]	22.1 [19.7,24.7]	46.1 [43.1,49.2]
Togo	2013-14	6.7 [5.1,8.7]	12.1 [10.0,14.5]	15.1 [12.2,18.5]	53.3 [48.7,57.8]
Uganda	2011	8.4 [6.8,10.5]	11.0 [9.1,13.4]	16.8 [13.0,21.5]	17.8 [13.7,22.7]
Zambia	2013-14	14.1 [12.5,16.0]	12.3 [10.6,14.2]	20.2 [18.1,22.5]	

Appendix Table 8 Pooled odds ratios and 95% confidence intervals from the meta-analysis of the outcomes for children under age 5

	Stunted		Wasted		Anemic		No care-seeking sought for ARI		No birth registration or birth certificate	
Child level variables										
Child's sex										
Female (Ref.)	1		1		1		1		1	
Male	1.23***	[1.2,1.26]	1.20***	[1.14,1.27]	1.08***	[1.05,1.12]	.99	[.91,1.08]	.96*	[.92,.99]
Orphanhood status										
Both parents alive (Ref.)	1		1		1		1		1	
Mother alive, father dead	1.12*	[1.03,1.23]	.79*	[.64,.98]	.89	[.78,1]	1.07	[.76,1.5]	1.23***	[1.12,1.35]
Father alive, mother dead	1.29**	[1.09,1.53]	.97	[.72,1.3]	.99	[.8,1.22]	.		1.57***	[1.33,1.86]
Both parents dead	.83	[.57,1.23]	.96	[.53,1.74]	.55*	[.33,.91]	.		2.35***	[1.6,3.45]
Living arrangements										
Living with both parents (Ref.)	1		1		1		1		1	
Living with mother, not father	1.07***	[1.04,1.11]	1.09**	[1.02,1.17]	1.07**	[1.02,1.12]	1.03	[.91,1.16]	1.27***	[1.22,1.33]
Living with father, not mother	1.17**	[1.05,1.29]	.76*	[.6,.97]	.87	[.76,1]	.		1.08	[.98,1.19]
Living with relative, no parent	1.22***	[1.15,1.3]	.68***	[.59,.79]	.8***	[.74,.86]	.		1.32***	[1.24,1.41]
Does not live with relatives	1.17	[.96,1.43]	.80	[.57,1.12]	.94	[.74,1.2]	.		1.62***	[1.36,1.93]
Household risk factors										
Number of educated women										
None (Ref.)	1		1		1		1		1	
1	.94**	[.9,.98]	.86***	[.79,.94]	.96	[.92,1.01]	.82**	[.71,.94]	.76***	[.73,.8]
2	.91**	[.85,.96]	.81***	[.72,.9]	.93	[.86,1.01]	.86	[.69,1.08]	.78***	[.72,.84]
3+	.86**	[.79,.94]	.83*	[.7,.97]	.94	[.82,1.07]	.71*	[.52,.97]	.81***	[.72,.91]
Crowding	1.05***	[1.04,1.06]	1.03***	[1.02,1.05]	1.02***	[1.01,1.04]	1.03*	[1.01,1.06]	1.06***	[1.05,1.08]
Youth dependency	1.06***	[1.04,1.08]	.98	[.95,1.01]	.99	[.97,1.01]	1.12***	[1.06,1.19]	1	[.98,1.02]
Community level variables										
Percentage of educated women	.97***	[.96,.97]	.98***	[.97,.98]	.97***	[.97,.98]	.98***	[.97,.99]	.94***	[.93,.95]
Nighttime lights	.97***	[.96,.98]	1.01*	[1,1.03]	1	[.99,1.01]	.95**	[.91,.98]	.99	[.98,1]
Travel time to major city	1***	[1,1]	1	[1,1]	1**	[1,1]	1	[1,1]	1***	[1,1]

Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 9 **Pooled odds ratios and 95% confidence intervals from the meta-analysis of no schooling for children age 5-14**

	No schooling	
Child level variables		
Child's sex		
Female (Ref.)	1	
Male	.96***	[.93,.98]
Orphanhood status		
Both parents alive (Ref.)	1	
Mother alive, father dead	1.02	[.98,1.07]
Father alive, mother dead	1.07*	[1,1.15]
Both parents dead	1.38***	[1.22,1.55]
Living arrangements		
Living with both parents (Ref.)	1	
Living with mother, not father	1.12***	[1.09,1.16]
Living with father, not mother	.96	[.92,1.01]
Living with relative, no parent	1.19***	[1.15,1.23]
Does not live with relatives	1.93***	[1.8,2.08]
Household risk factors		
Number of educated women		
None (Ref.)	1	
1	.68***	[.66,.7]
2	.63***	[.6,.67]
3+	.64***	[.59,.7]
Crowding	1.09***	[1.08,1.1]
Youth dependency	1.00	[.99,1.02]
Community level variables		
Percentage of educated women	.90***	[.9,.91]
Nighttime lights	1.02***	[1.01,1.03]
Travel time to major city	1***	[1,1]

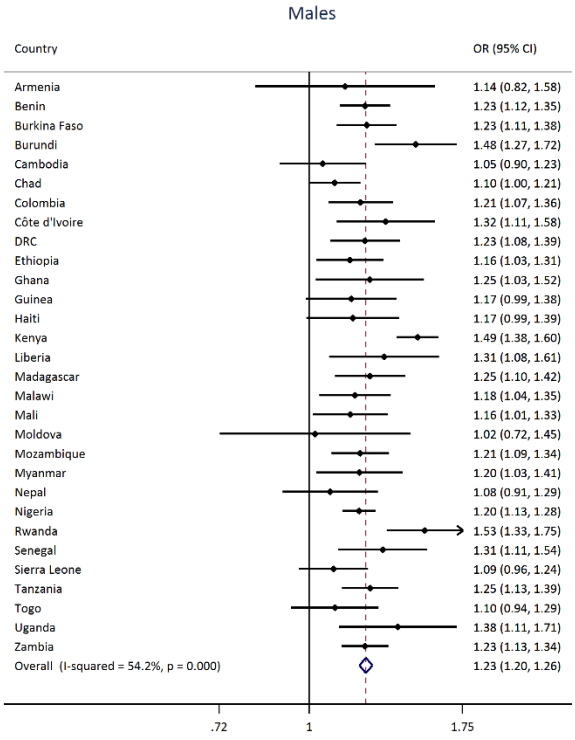
Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 10 Pooled odds ratios and 95% confidence intervals from the meta-analysis of the outcomes for girls age 15-17

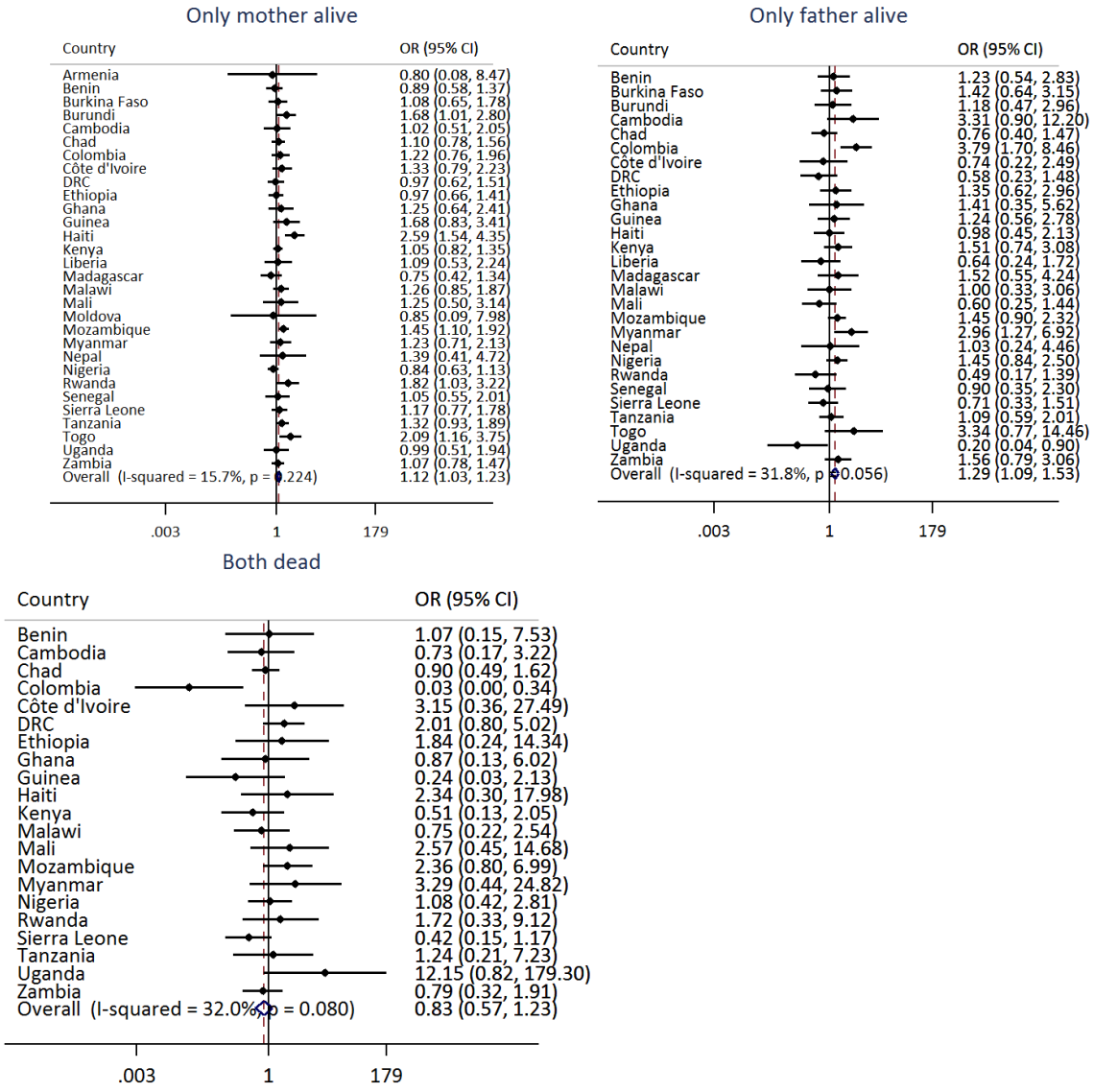
	Pregnant or have a child		Had sex before age 15		Underweight		Anemic	
Child level variables								
Orphanhood status								
Both parents alive (Ref.)	1		1		1		1	
Mother alive, father dead	1.34***	[1.18,1.52]	1.13	[.98,1.3]	.96	[.87,1.06]	1.01	[.89,1.14]
Father alive, mother dead	1.02	[.83,1.26]	1.25*	[1.03,1.52]	.94	[.78,1.14]	.88	[.71,1.08]
Both parents dead	1.50**	[1.12,2]	1.36*	[1.06,1.75]	.87	[.66,1.16]	1.11	[.84,1.46]
Living arrangements								
Living with both parents (Ref.)	1		1		1		1	
Living with mother, not father	1.94***	[1.69,2.22]	1.51***	[1.31,1.74]	.99	[.91,1.08]	1.11	[.99,1.24]
Living with father, not mother	.98	[.78,1.23]	1.23	[.99,1.53]	.89	[.76,1.04]	1.07	[.88,1.3]
Living with relative, no parent	5.87***	[5.28,6.52]	3.44***	[3.08,3.84]	.80***	[.73,.87]	1.10	[.99,1.23]
Does not live with relatives	1.59***	[1.27,1.99]	2.18***	[1.84,2.58]	.56***	[.47,.66]	1.09	[.92,1.3]
Household risk factors								
Number of educated women								
None (Ref.)	1		1		1		1	
1	.36***	[.32,.4]	.52***	[.46,.58]	1.07	[.98,1.17]	.99	[.89,1.1]
2	.30***	[.25,.35]	.46***	[.39,.54]	1.08	[.95,1.23]	1.00	[.86,1.17]
3+	.29***	[.22,.37]	.44***	[.35,.55]	.94	[.79,1.12]	1.19	[.96,1.48]
Crowding	1.07***	[1.04,1.1]	1.05***	[1.02,1.08]	1.06***	[1.03,1.08]	1.02	[1,1.05]
Youth dependency	1.37***	[1.28,1.47]	1.09	[.99,1.19]	.95	[.89,1.01]	1.02	[.94,1.1]
Community level variables								
Percentage of educated women	.97***	[.97,.98]	.97***	[.96,.98]	.98***	[.97,.98]	1.00	[.99,1]
Nighttime lights	.94**	[.91,.98]	.89*	[.8,.98]	.99	[.97,1]	.98	[.96,1.01]
Travel time to major city	1	[1,1]	1***	[1,1]	1	[1,1]	1	[1,1]

Note: * p<0.05, ** p<0.01, *** p<0.001

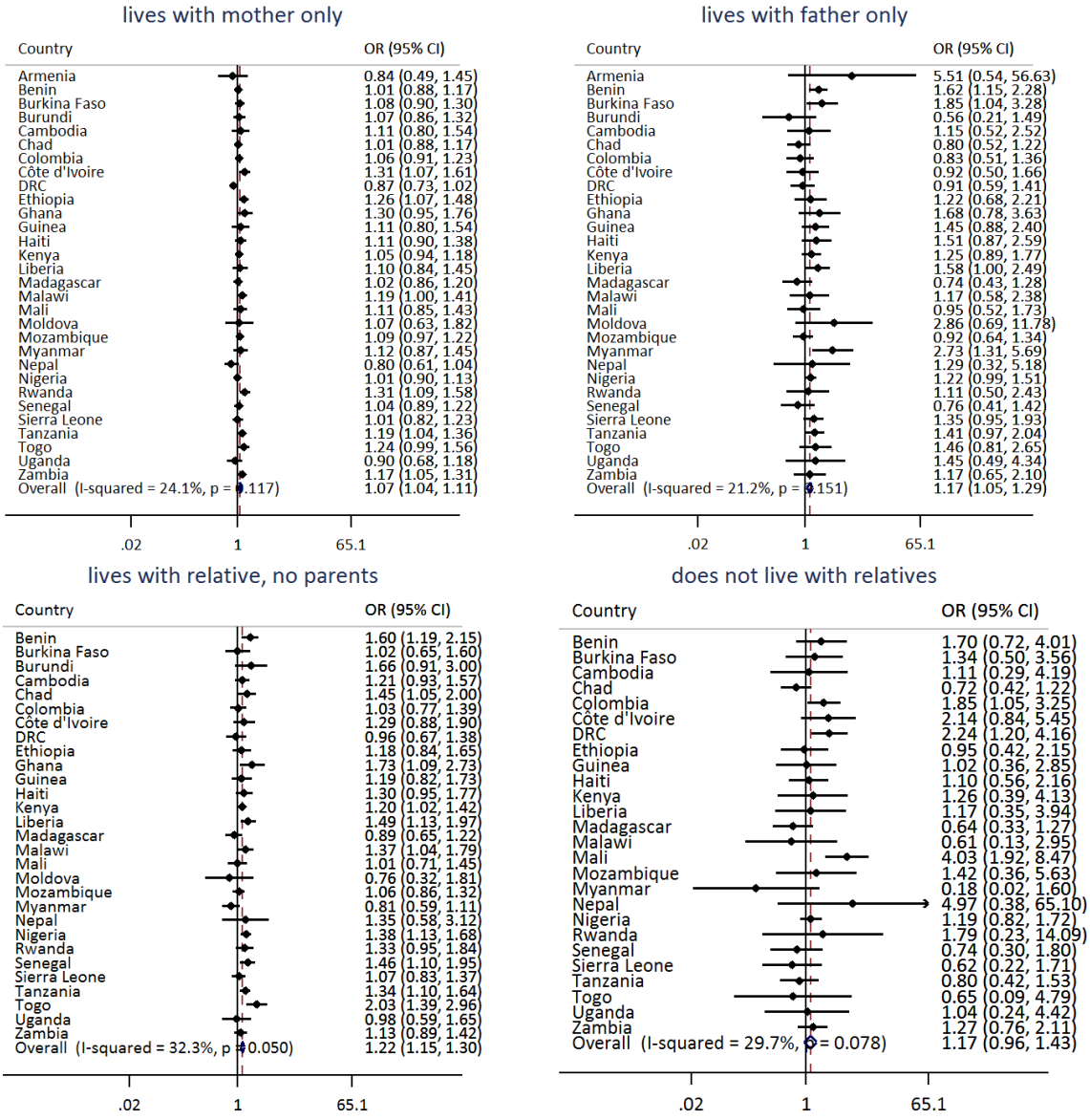
Appendix Figure 1 **Adjusted odds of being stunted, among children under age 5, for males vs. females (reference)**



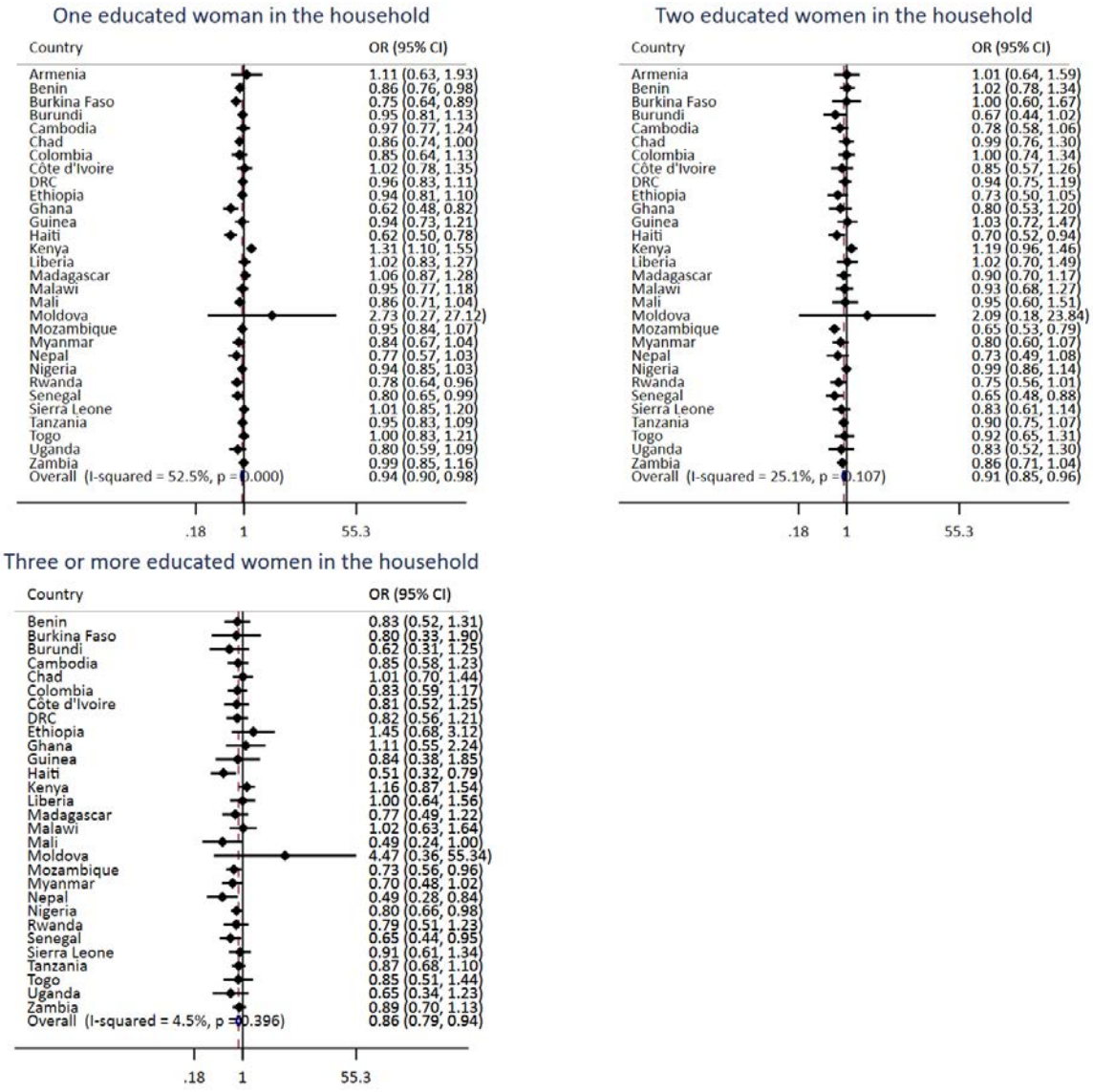
Appendix Figure 2 **Adjusted odds of being stunted, among children under age 5, for three types of orphans vs. non-orphans (reference)**



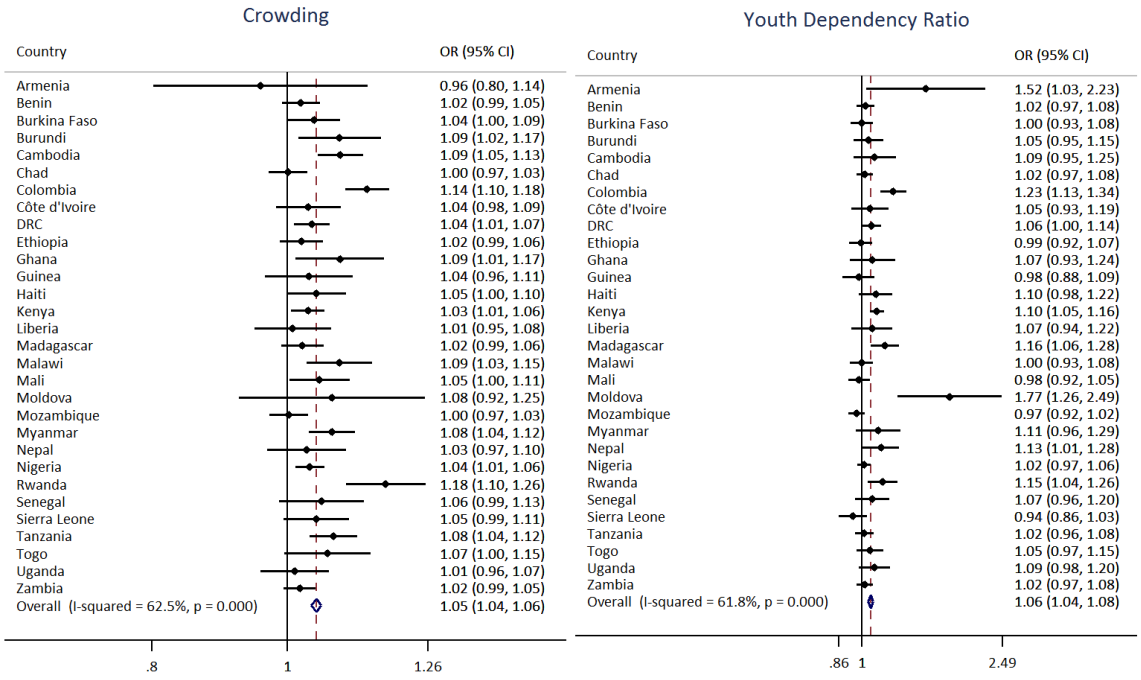
Appendix Figure 3 **Adjusted odds of being stunted, among children under age 5, for four types of living arrangements vs. living with both parents (reference)**



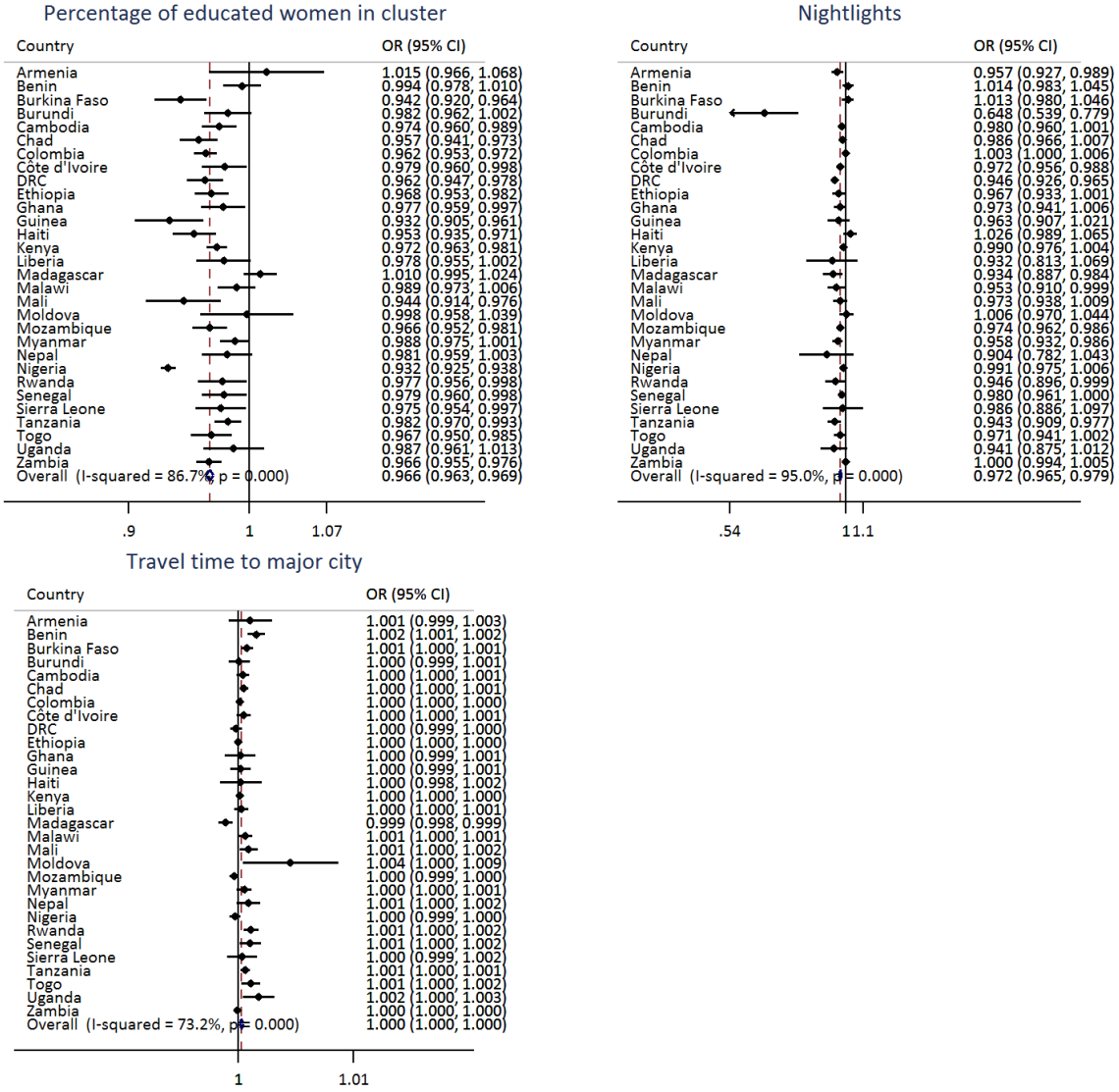
Appendix Figure 4 **Adjusted odds of being stunted, among children under age 5, for the number of educated women in the household vs. no educated women (reference)**



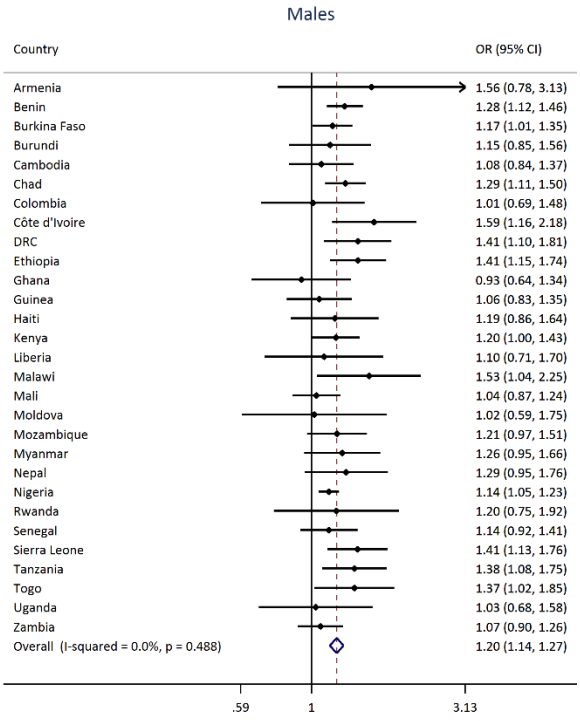
Appendix Figure 5 **Adjusted odds of being stunted, among children under age 5, for the household crowding index and the youth dependency ratio**



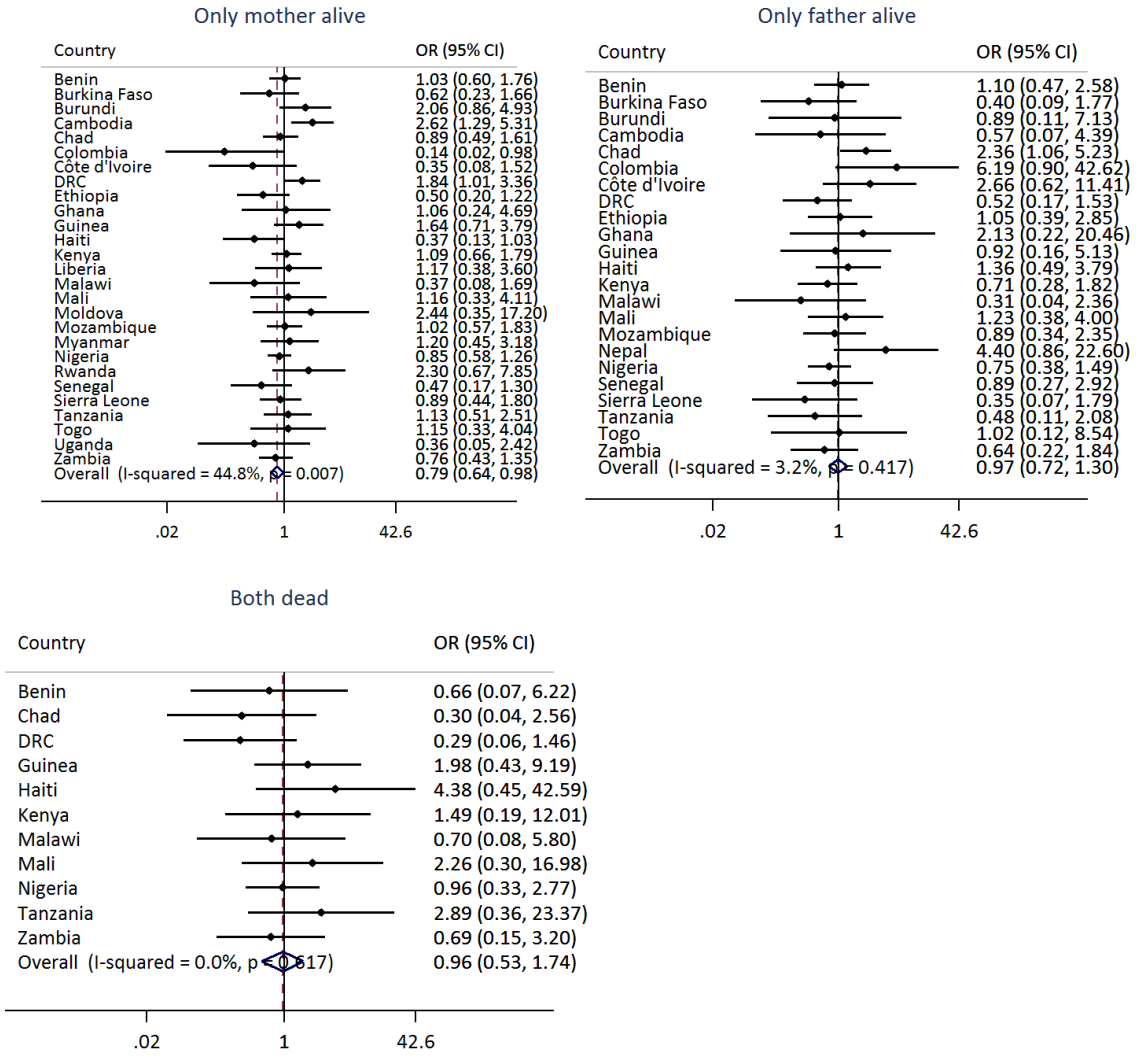
Appendix Figure 6 **Adjusted odds of being stunted, among children under age 5, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



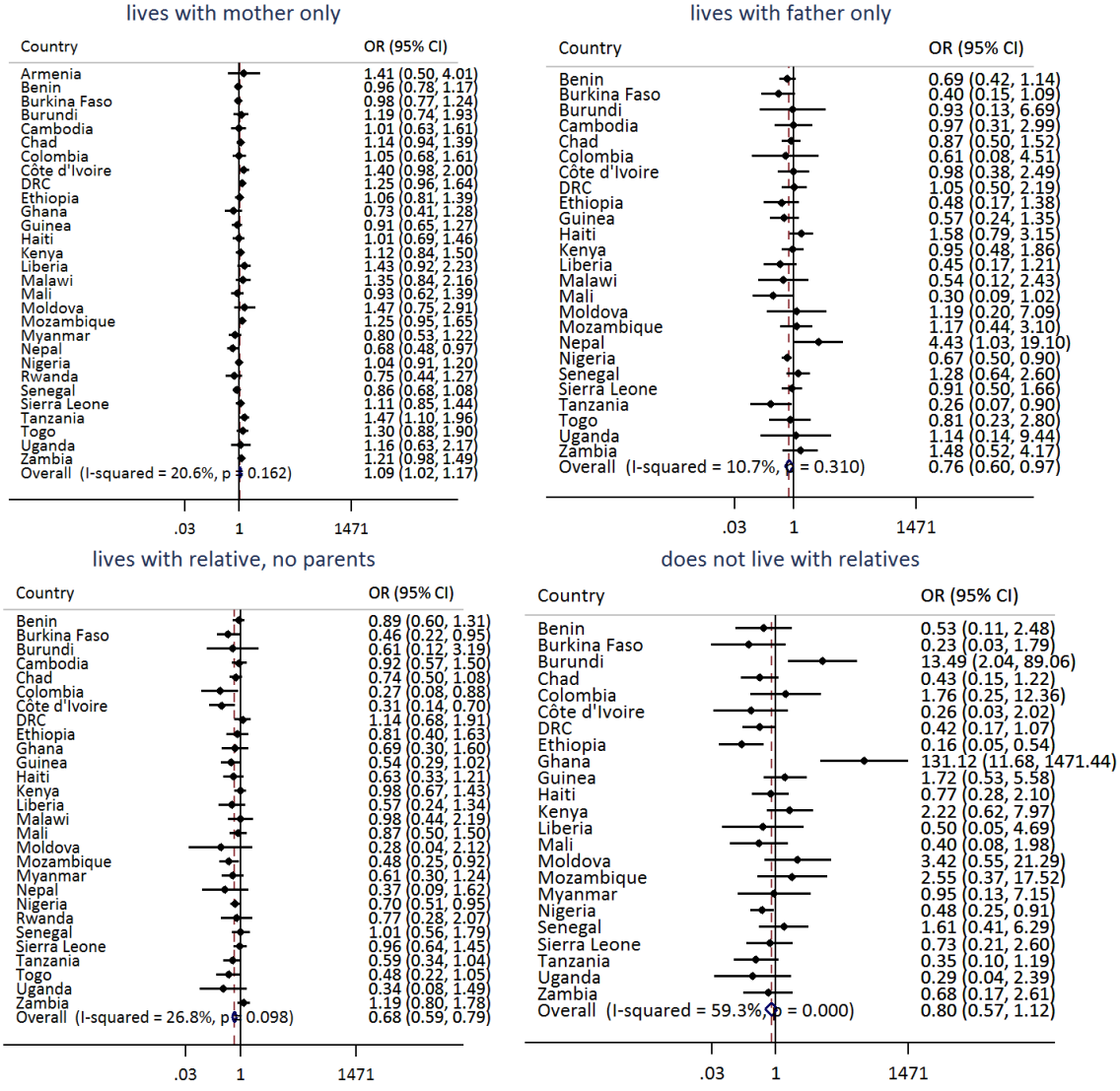
Appendix Figure 7 **Adjusted odds of being wasted, among children under age 5, for males vs. females (reference)**



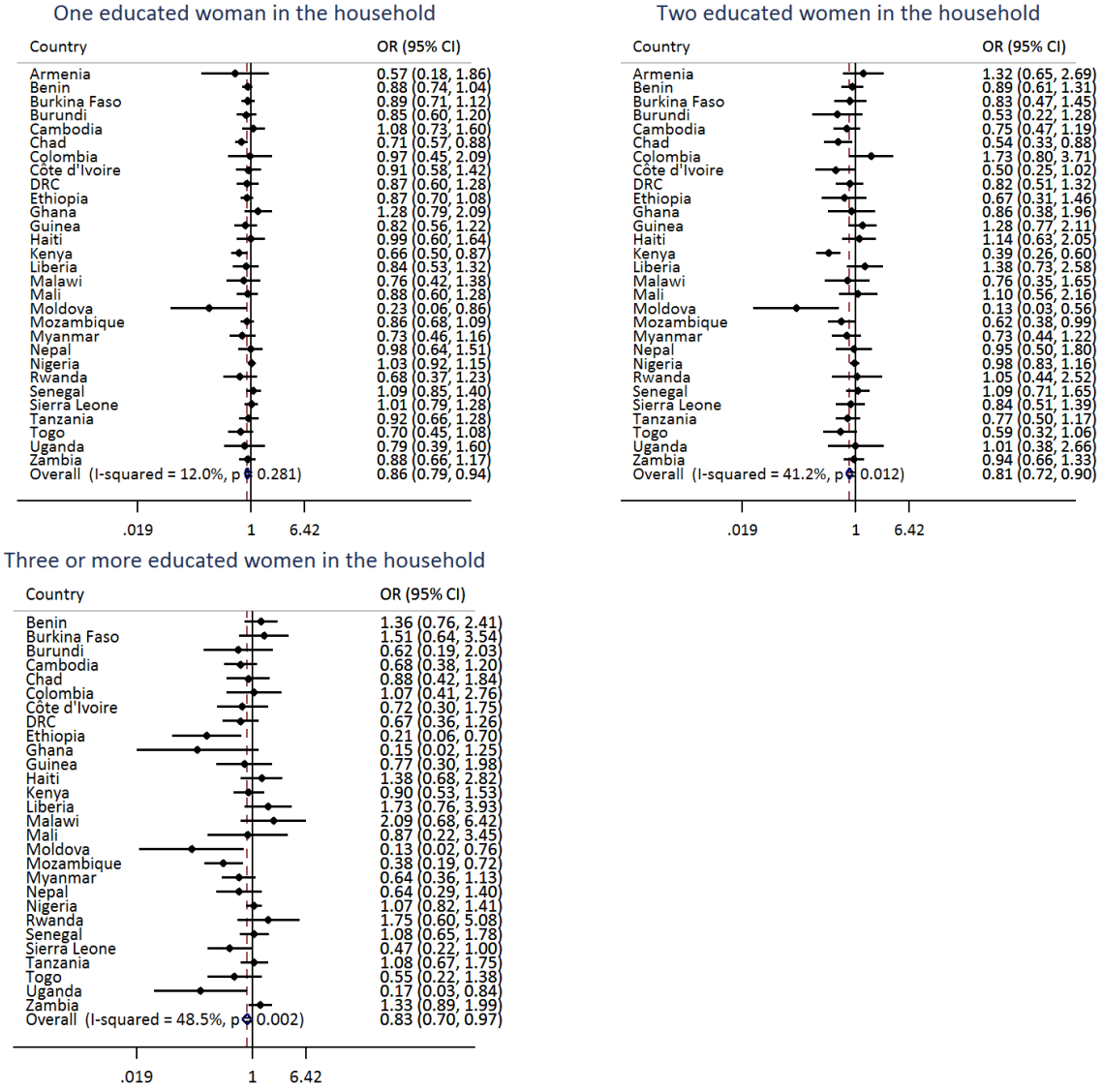
Appendix Figure 8 **Adjusted odds of being wasted, among children under age 5, for three types of orphans vs. non-orphans (reference)**



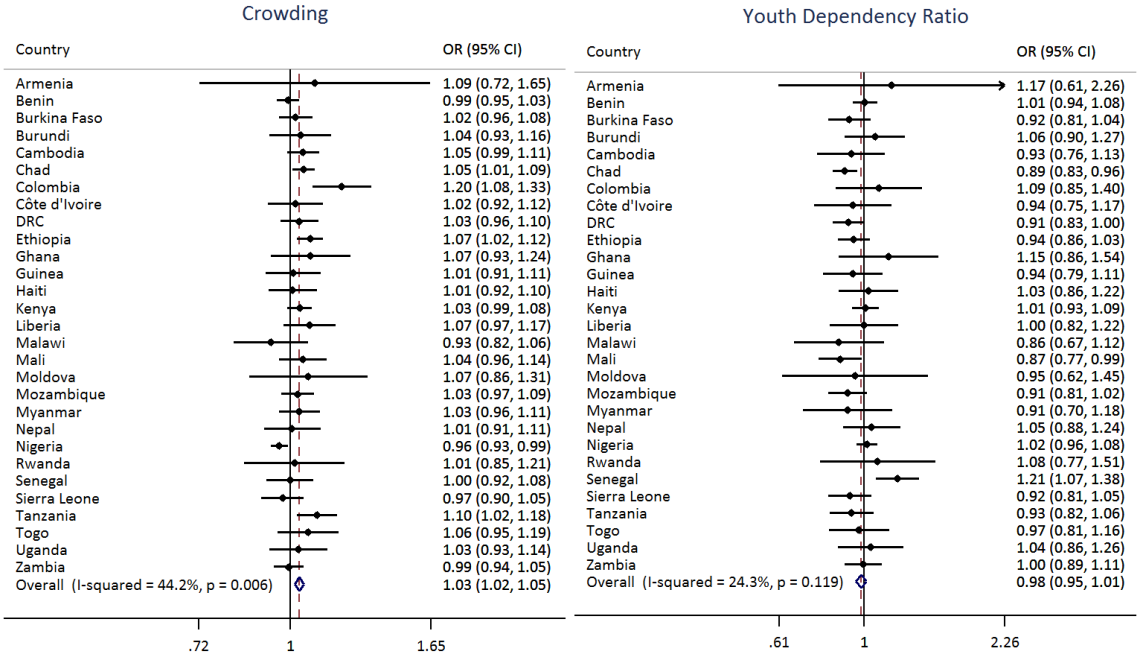
Appendix Figure 9 **Adjusted odds of being wasted, among children under age 5, for four types of living arrangements vs. living with both parents (reference)**



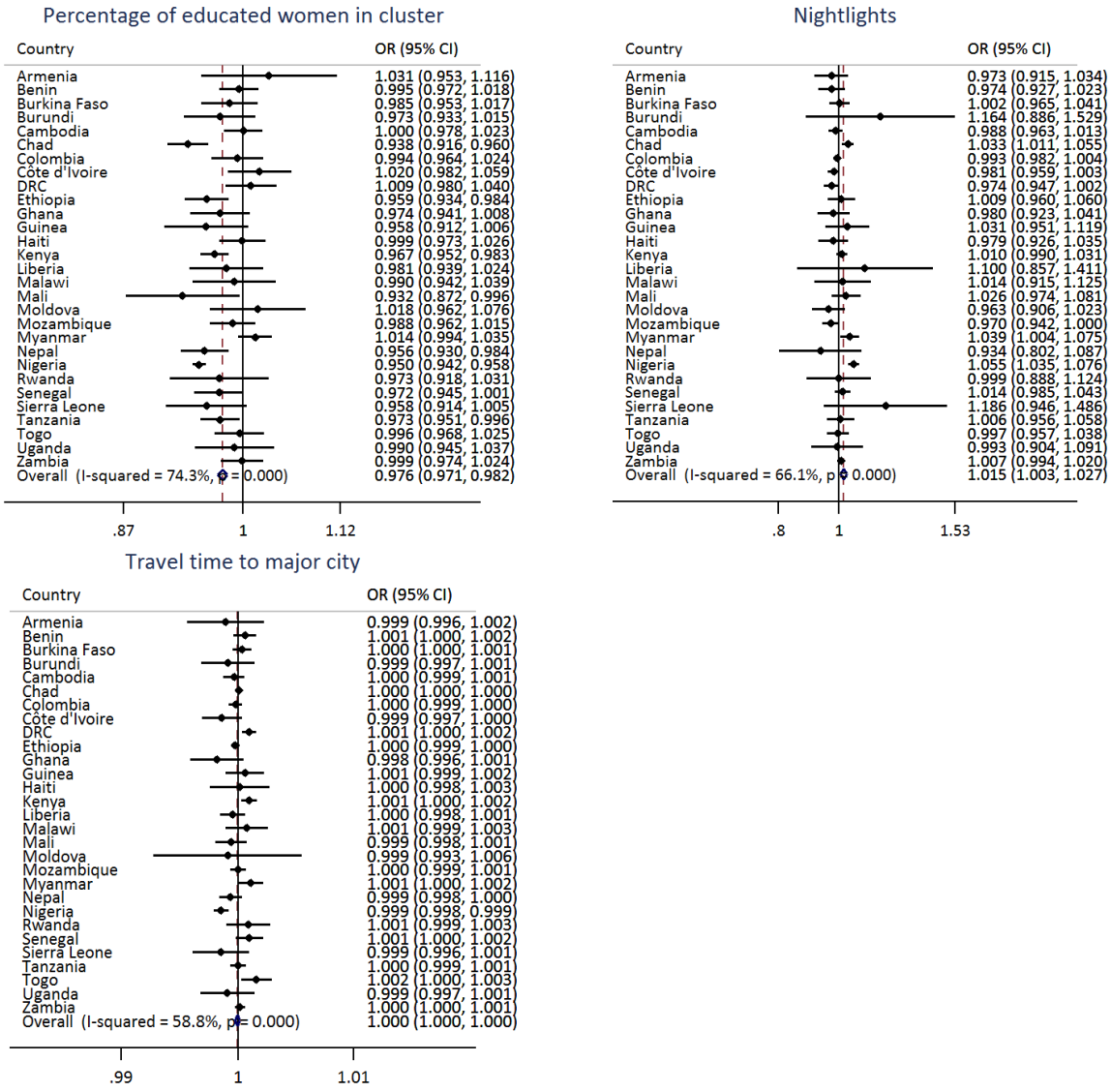
Appendix Figure 10 **Adjusted odds of being wasted, among children under age 5, for the number of educated women in the household vs. no educated women (reference)**



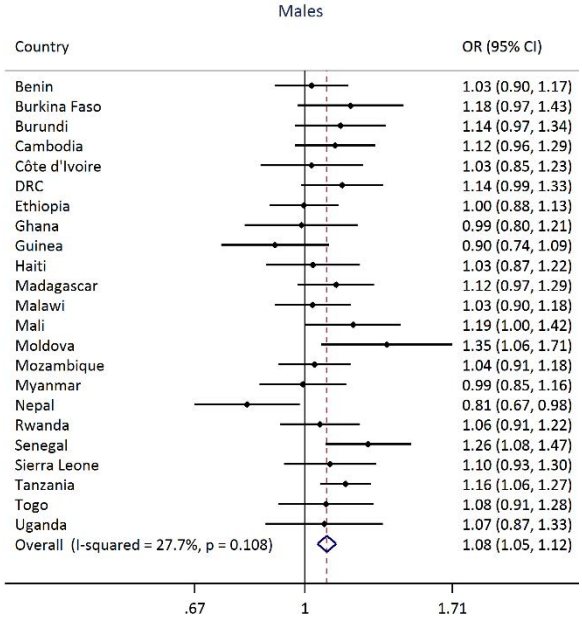
Appendix Figure 11 **Adjusted odds of being wasted, among children under age 5, for the household crowding index and the youth dependency ratio**



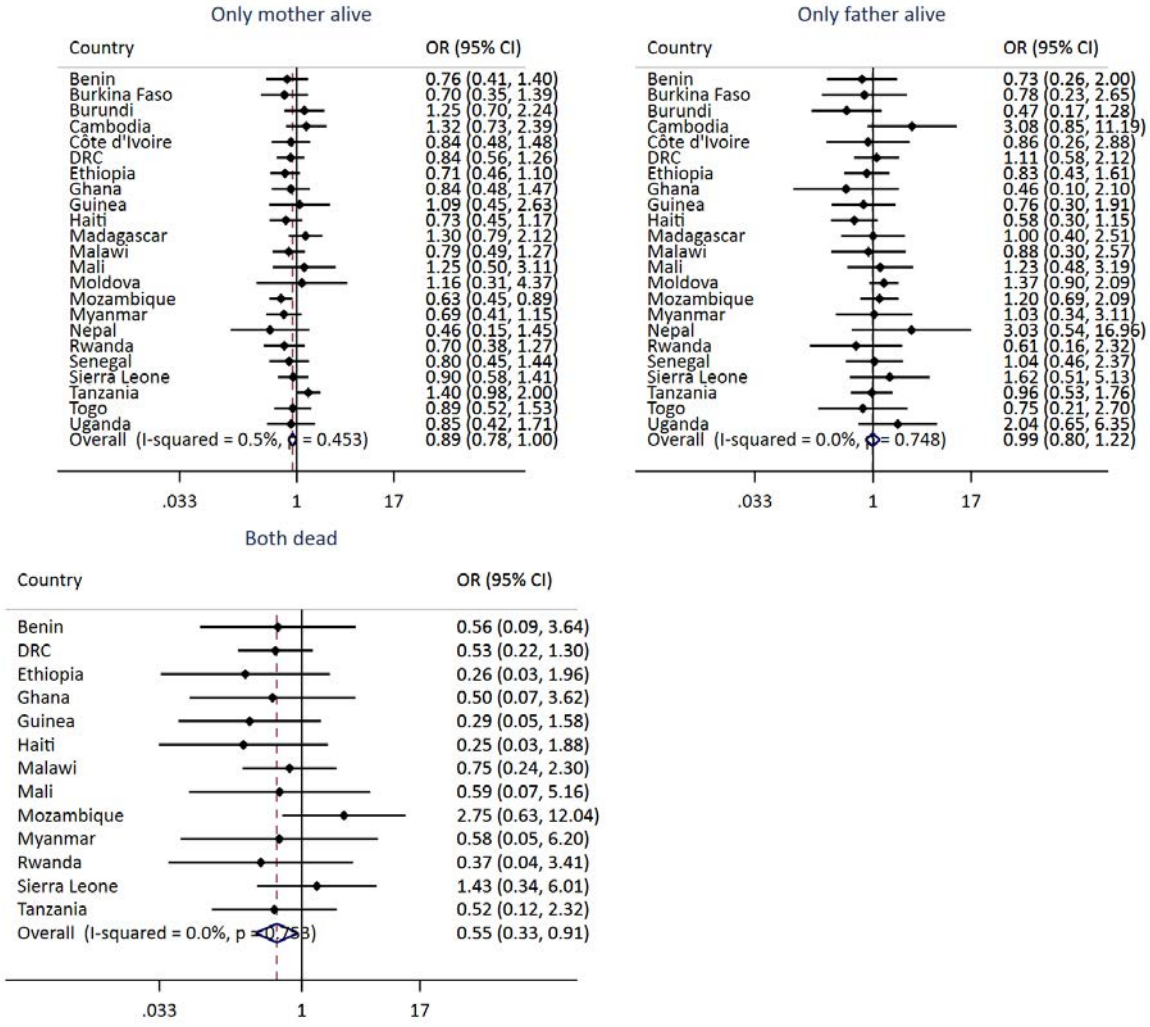
Appendix Figure 12 **Adjusted odds of being wasted, among children under age 5, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



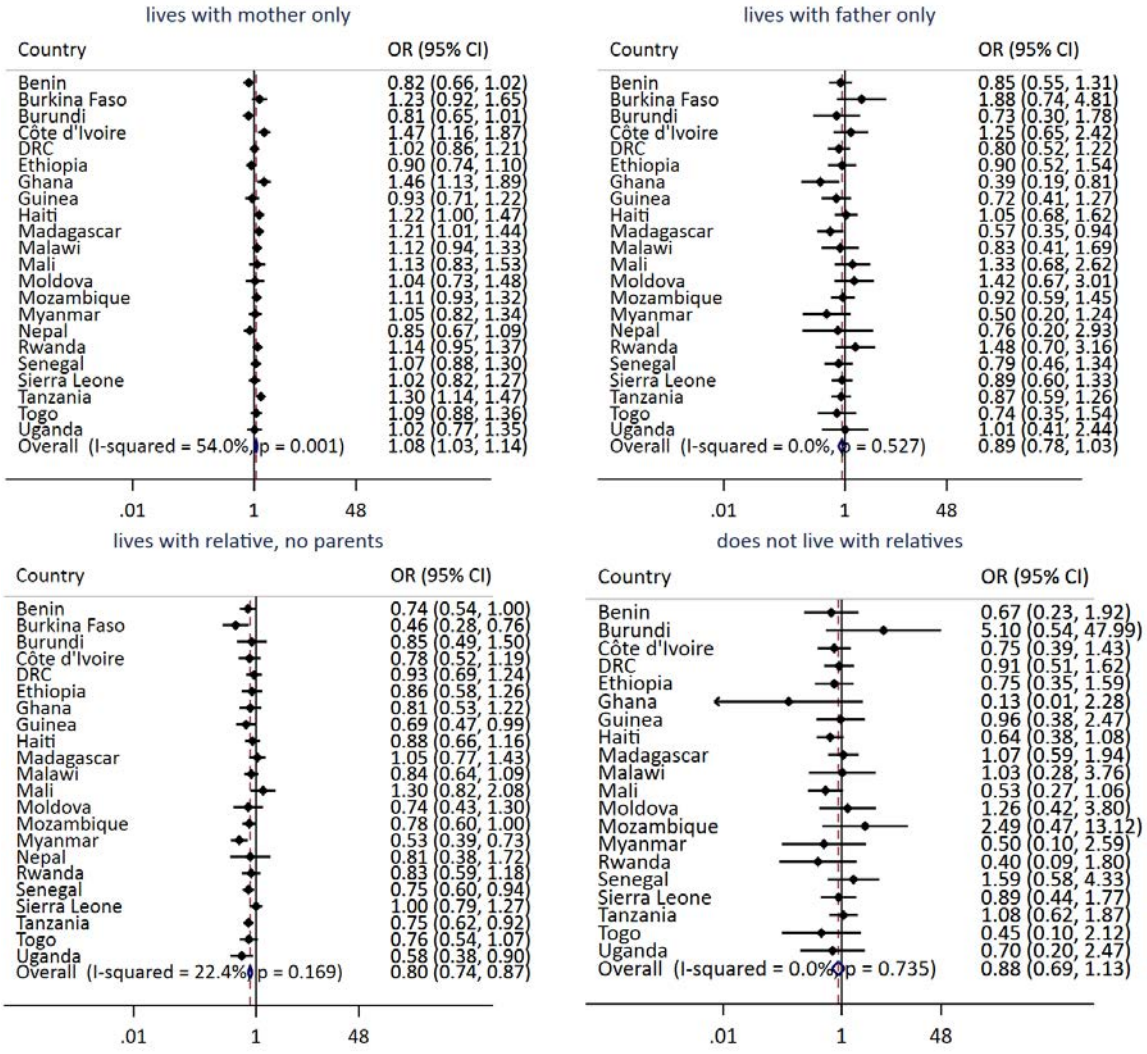
Appendix Figure 13 **Adjusted odds of anemia, among children under age 5, for males vs. females (reference)**



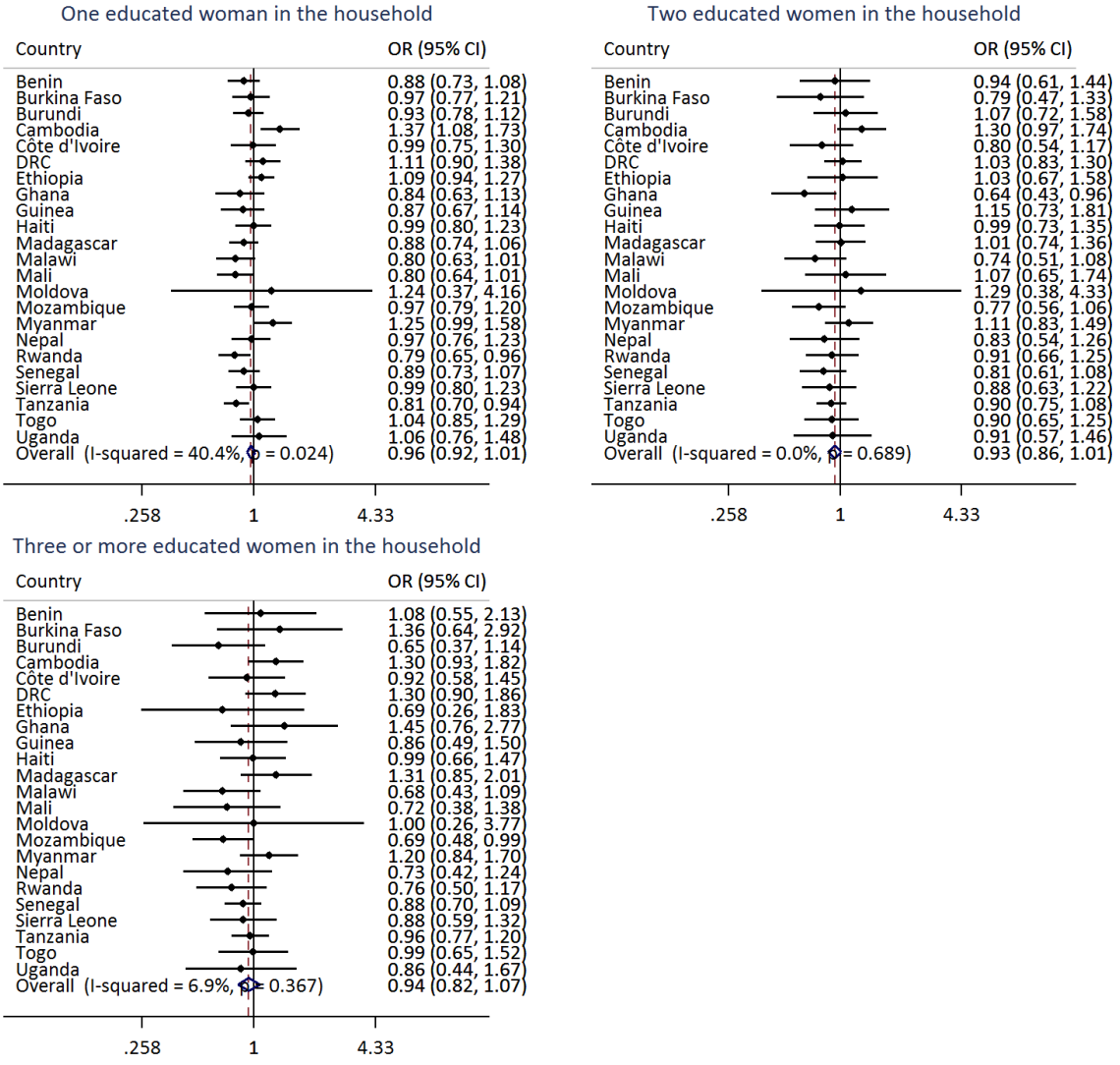
Appendix Figure 14 **Adjusted odds of anemia, among children under age 5, for three types of orphans vs. non-orphans (reference)**



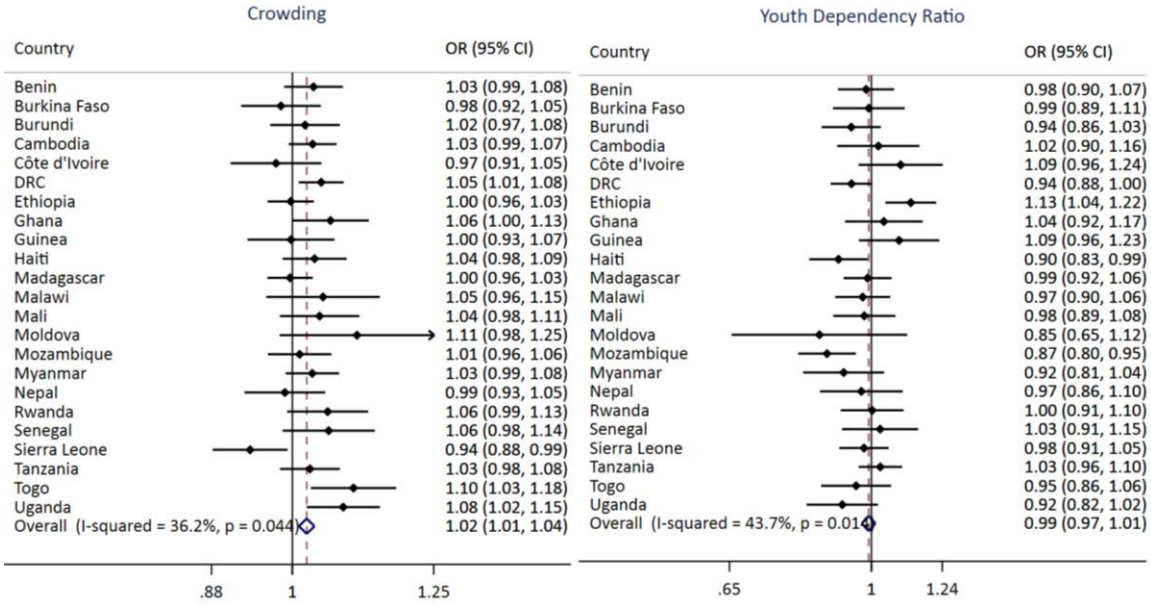
Appendix Figure 15 **Adjusted odds of anemia, among children under age 5, for four types of living arrangements vs. living with both parents**



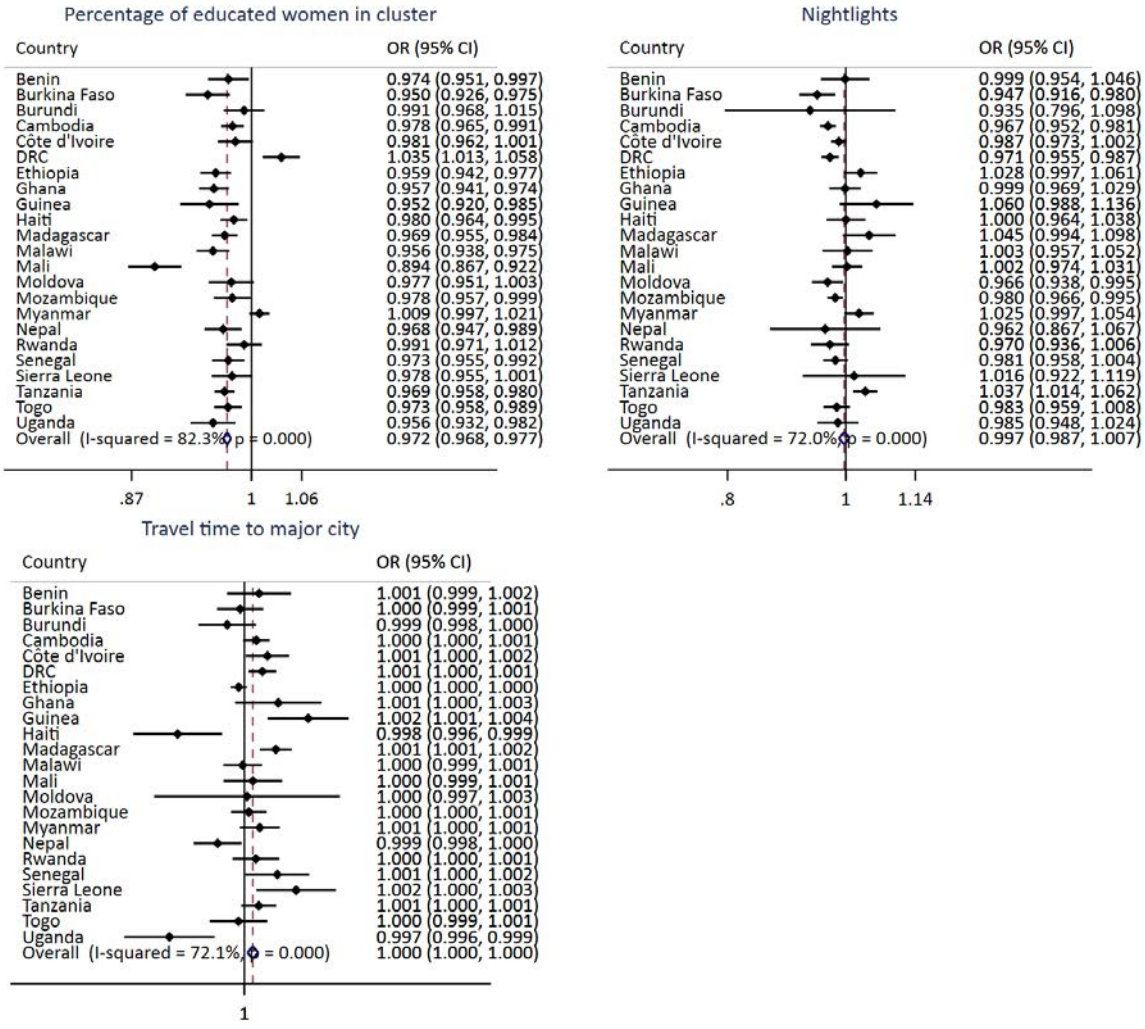
Appendix Figure 16 **Adjusted odds of anemia, among children under age 5, for the number of educated women in the household vs. no educated women (reference)**



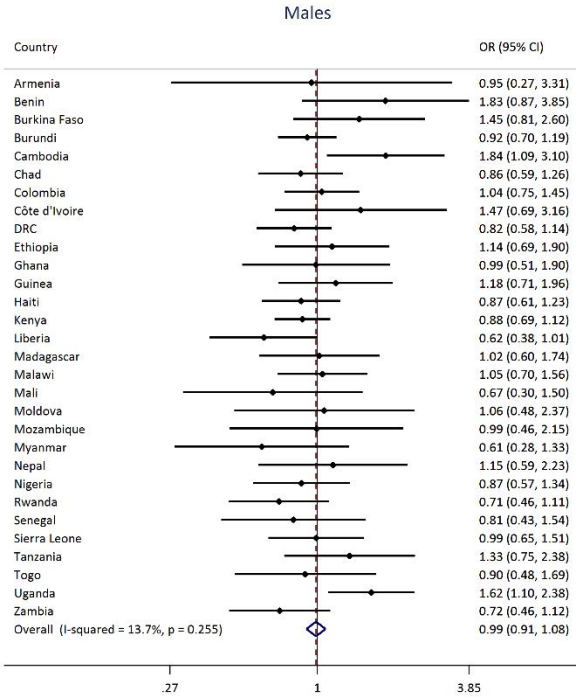
Appendix Figure 17 **Adjusted odds of anemia, among children under age 5, for the household crowding index and the youth dependency ratio**



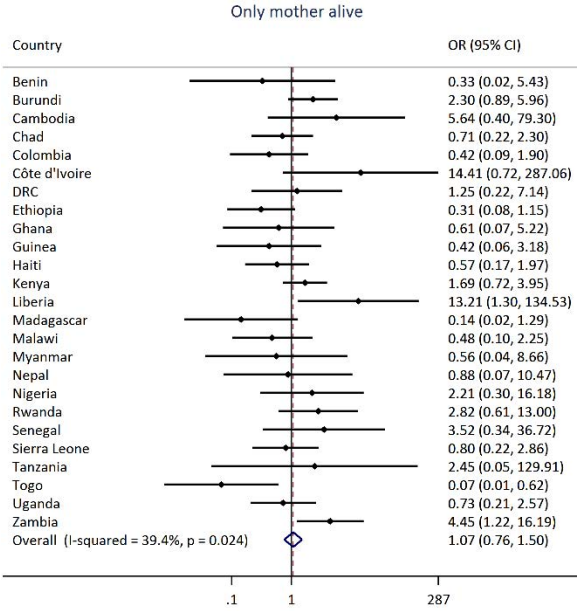
Appendix Figure 18 **Adjusted odds of anemia, among children under age 5, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



Appendix Figure 19 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for males vs. females (reference)**

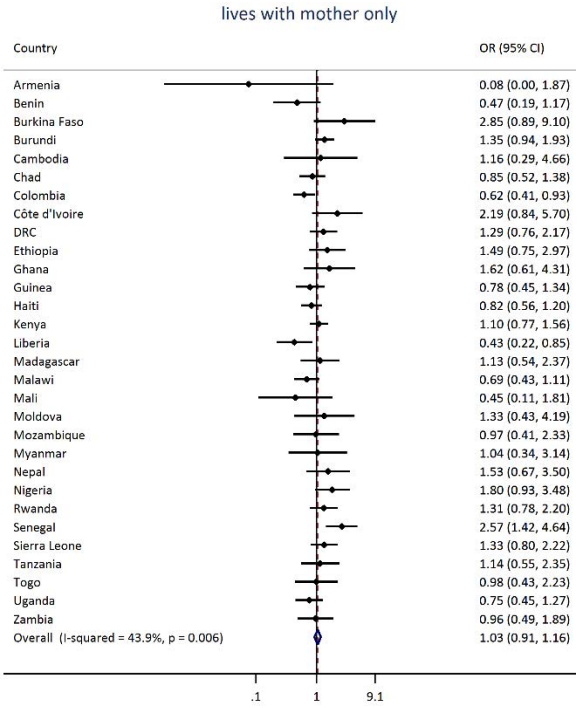


Appendix Figure 20 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for only mother alive vs. non-orphans (reference).**



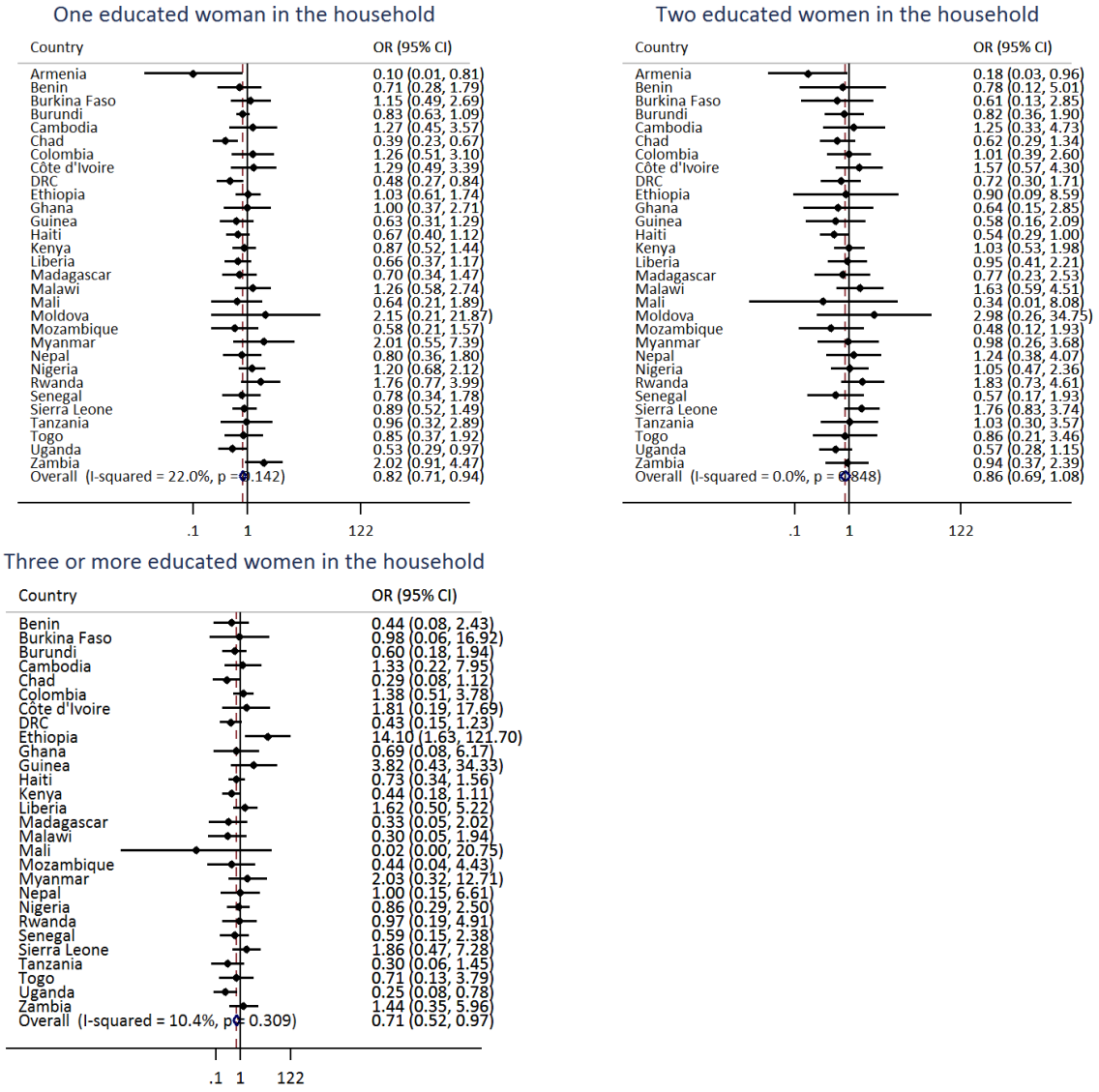
Note: Other orphan status categories did not have enough observations to produce estimates.

Appendix Figure 21 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for living with mother only vs. living with both parents (reference).**

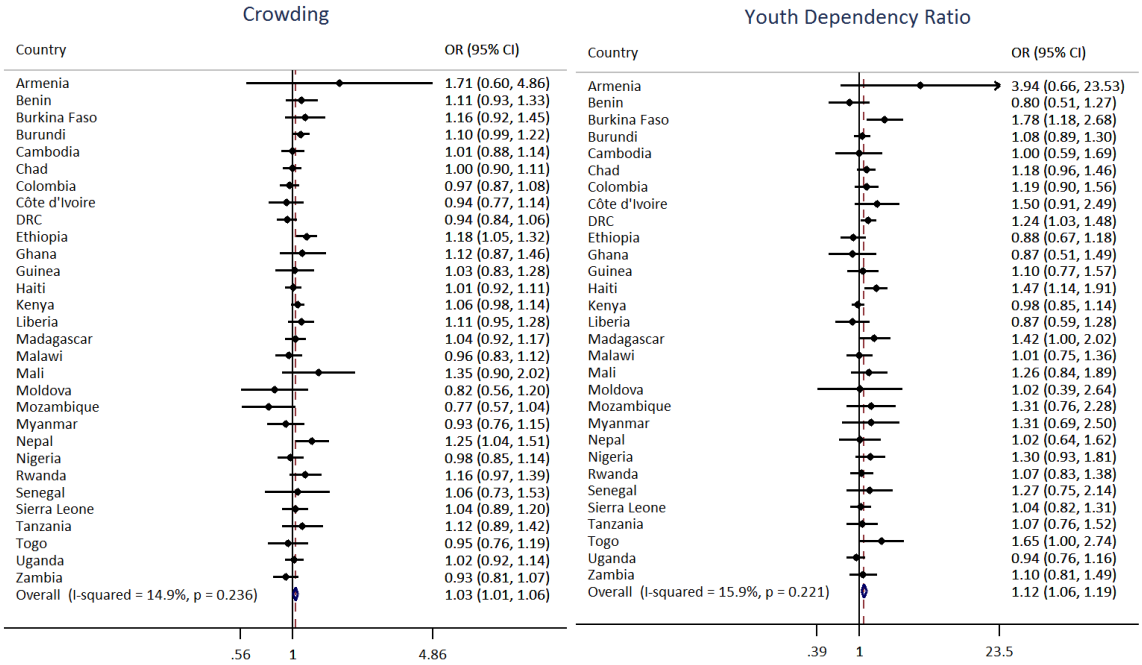


Note: Other living arrangement categories did not have enough observations to produce estimates.

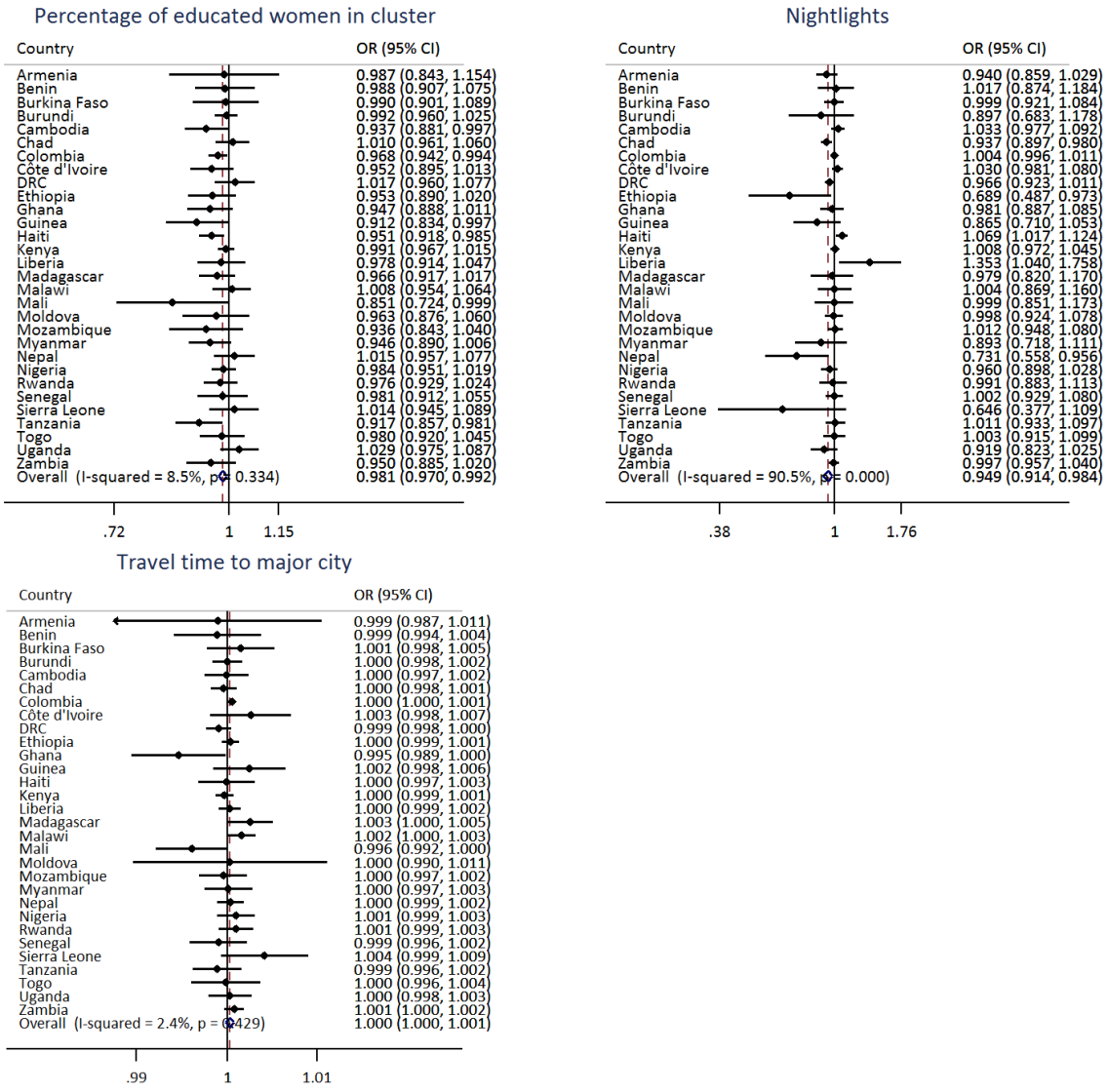
Appendix Figure 22 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for the number of educated women in the household vs. no educated women (reference)**



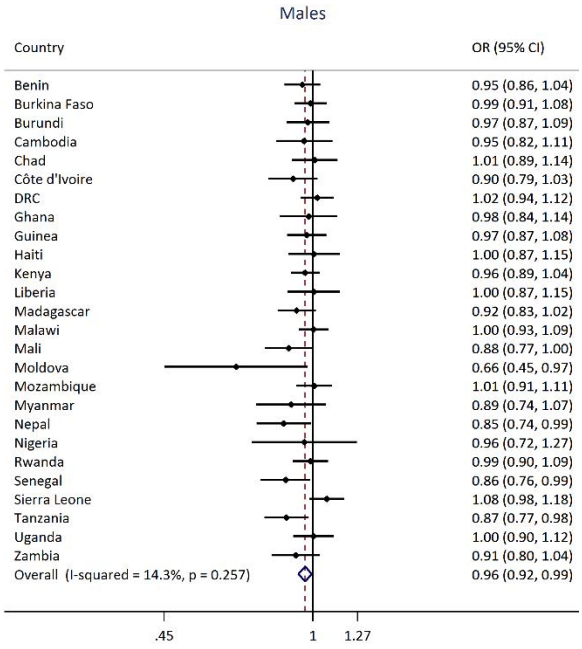
Appendix Figure 23 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for the household crowding index and the youth dependency ratio**



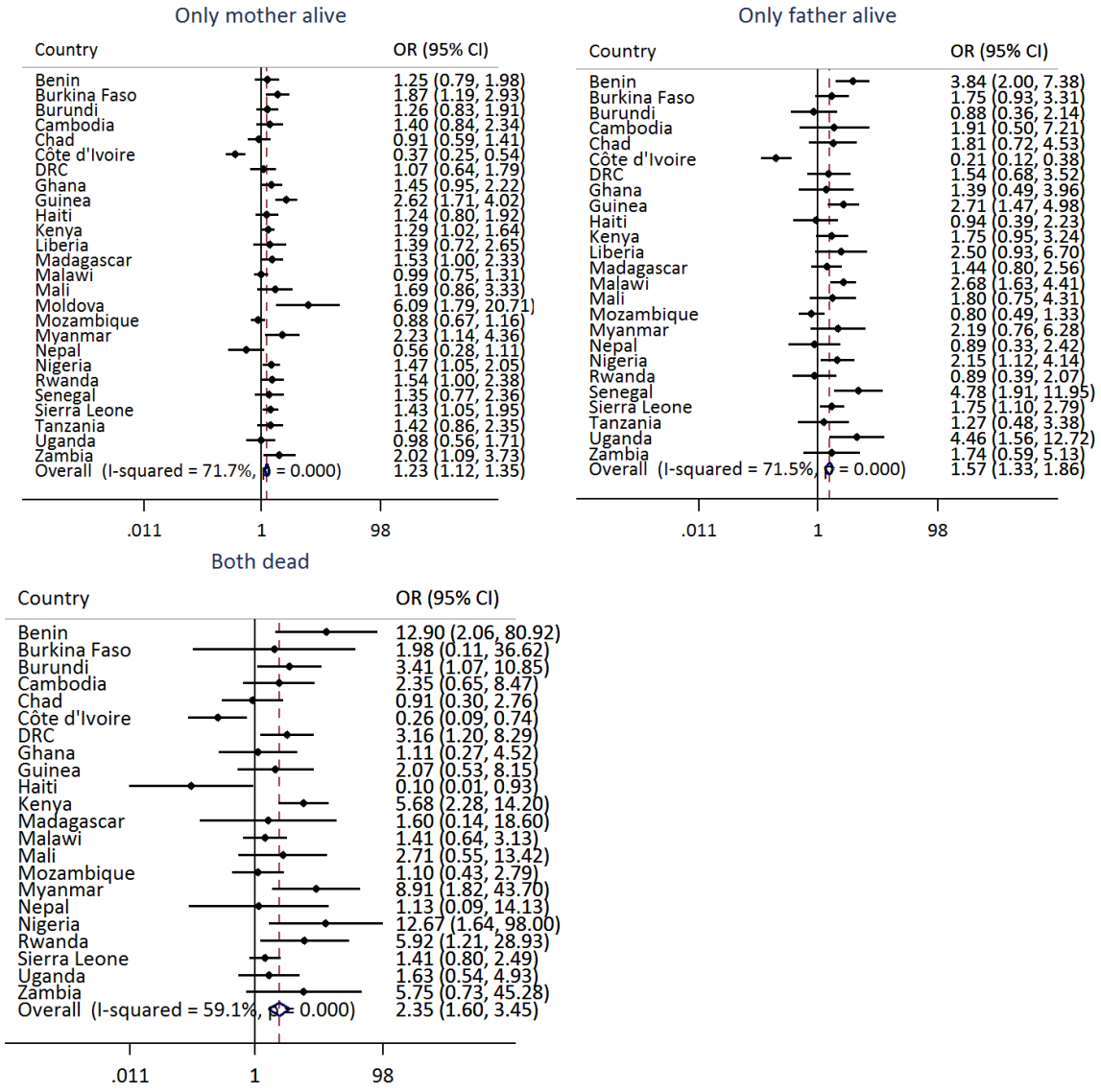
Appendix Figure 24 **Adjusted odds of receiving no treatment for ARI, among children under age 5 with ARI symptoms, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



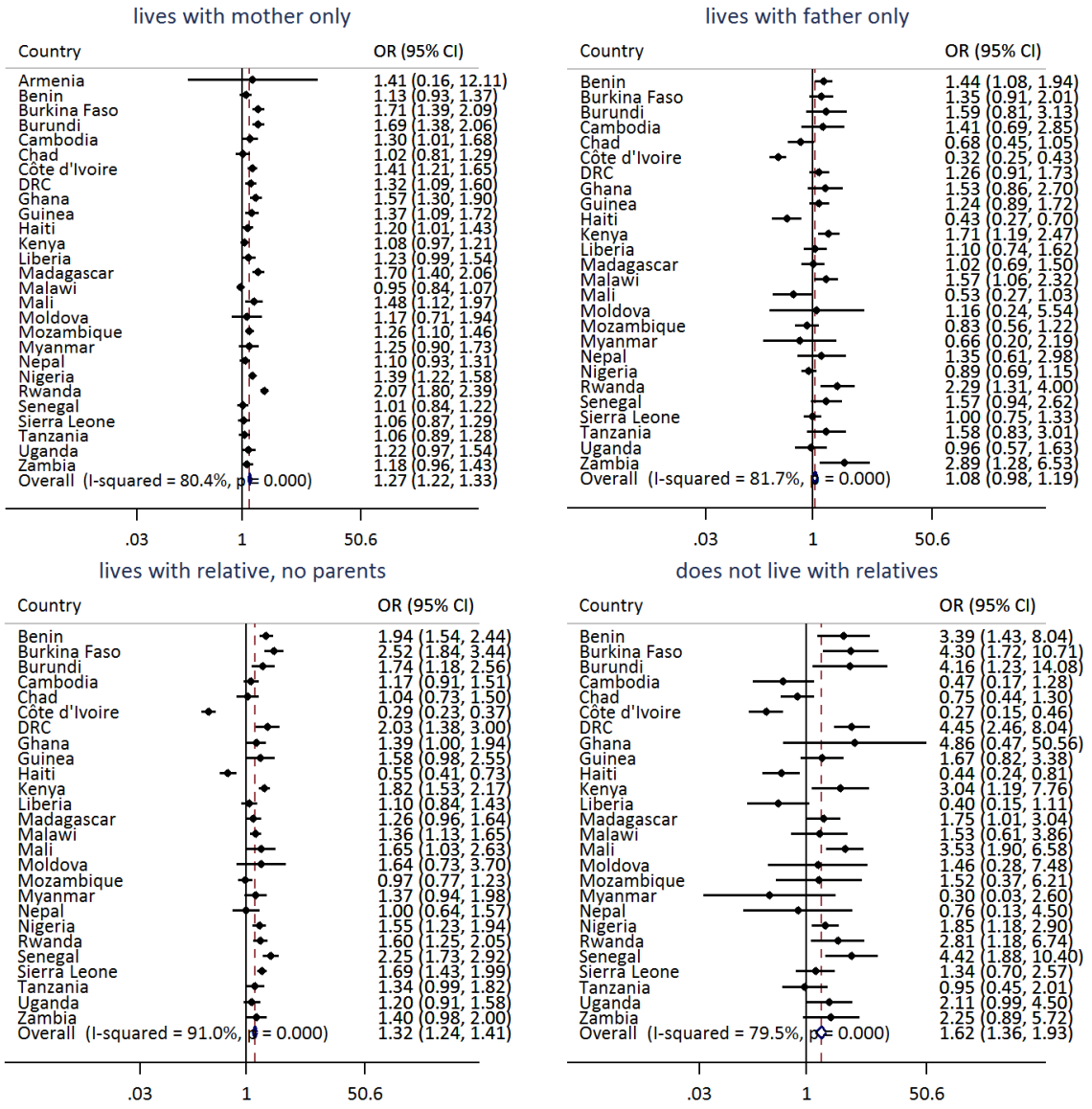
Appendix Figure 25 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for males vs. females (reference)**



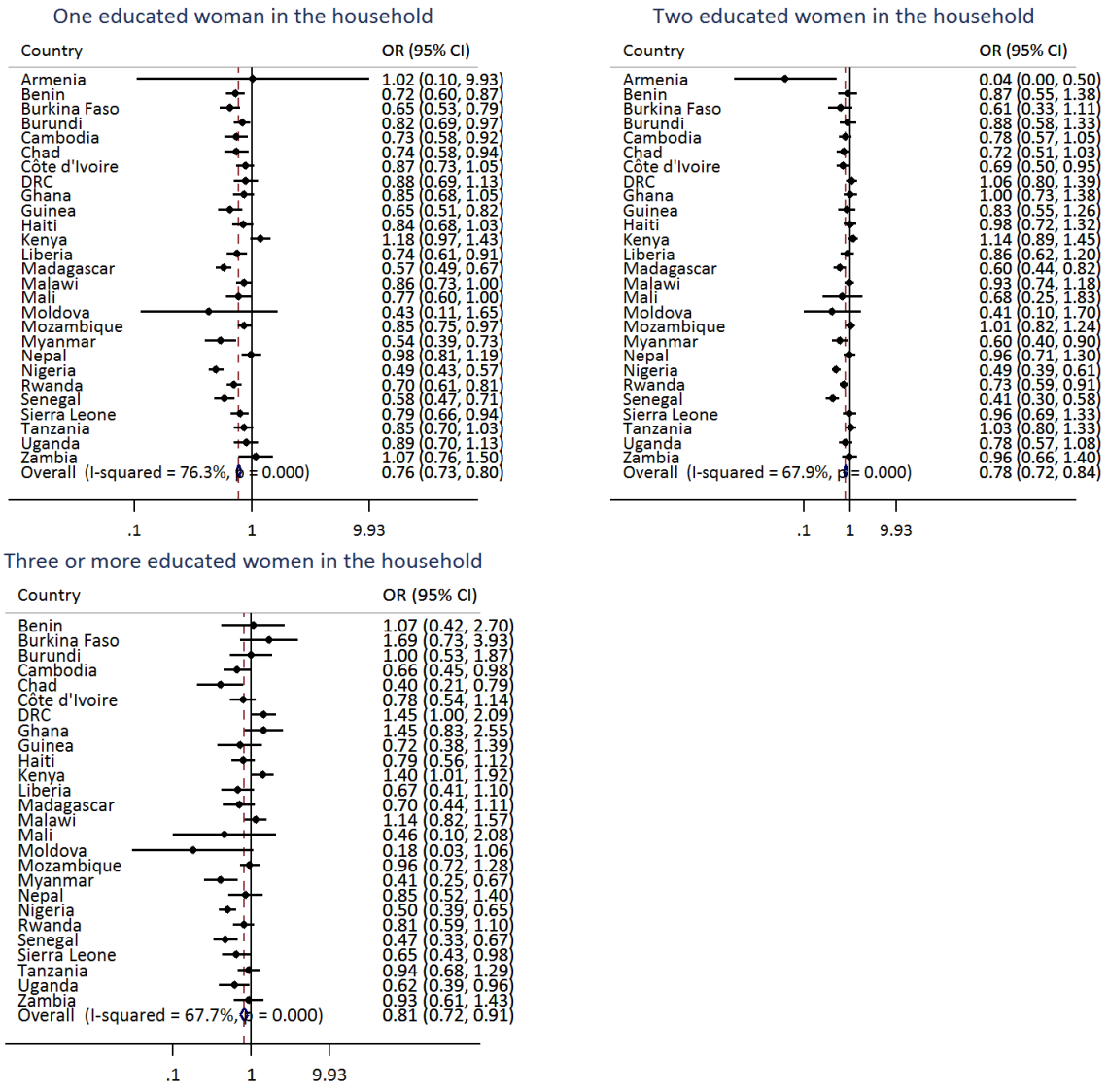
Appendix Figure 26 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for three types of orphans vs. non-orphans (reference)**



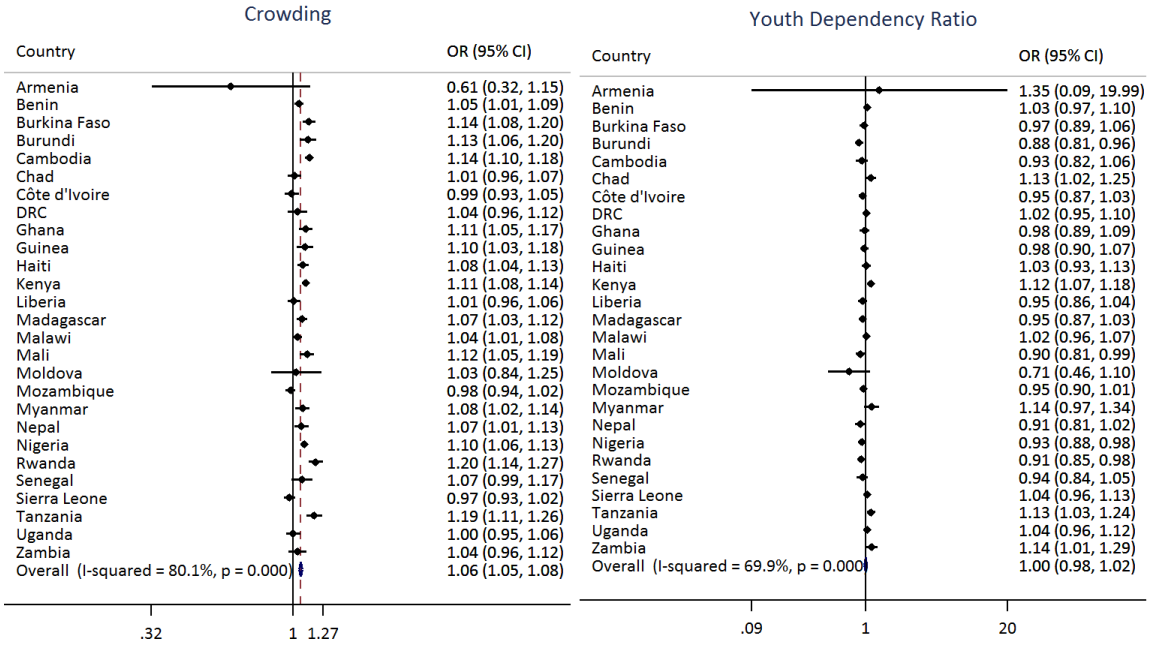
Appendix Figure 27 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for four types of living arrangements vs. living with both parents (reference)**



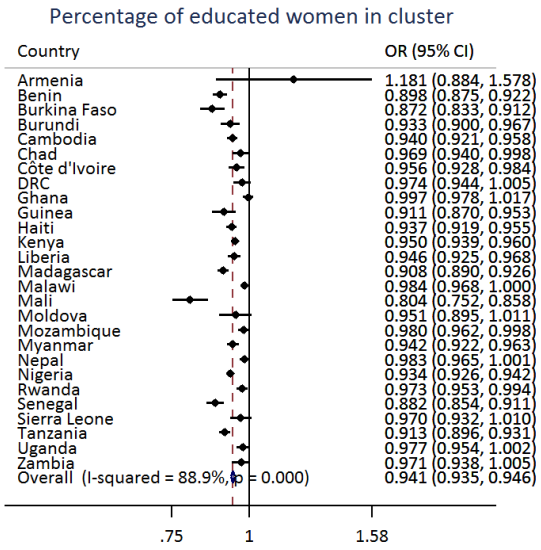
Appendix Figure 28 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for the number of educated women in the household vs. no educated women (reference)**

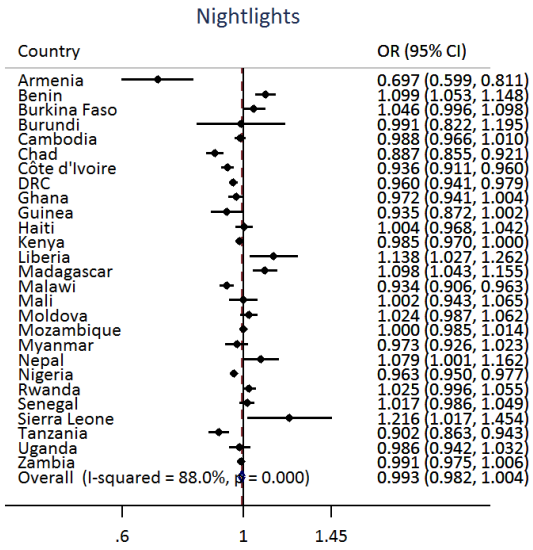


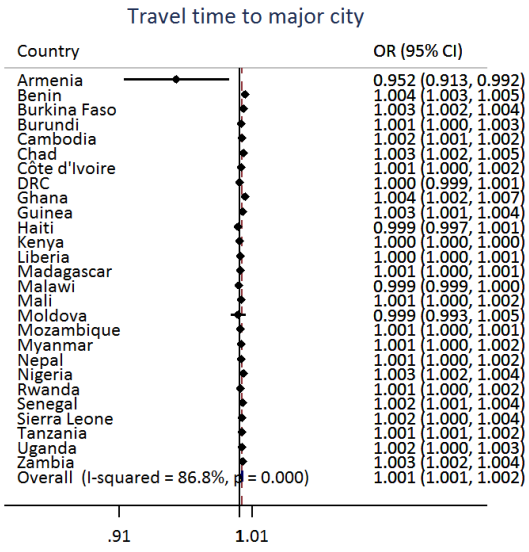
Appendix Figure 29 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for the household crowding index and the youth dependency ratio**



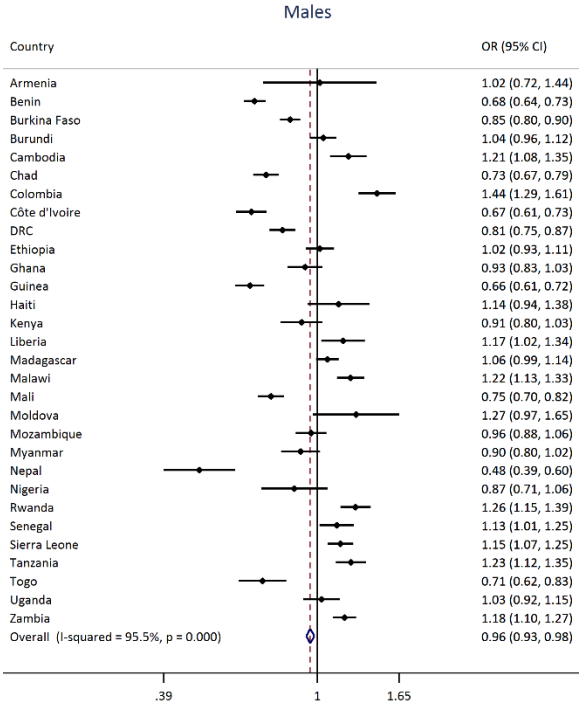
Appendix Figure 30 **Adjusted odds of not having a birth certificate or birth registration, among children under age 5, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



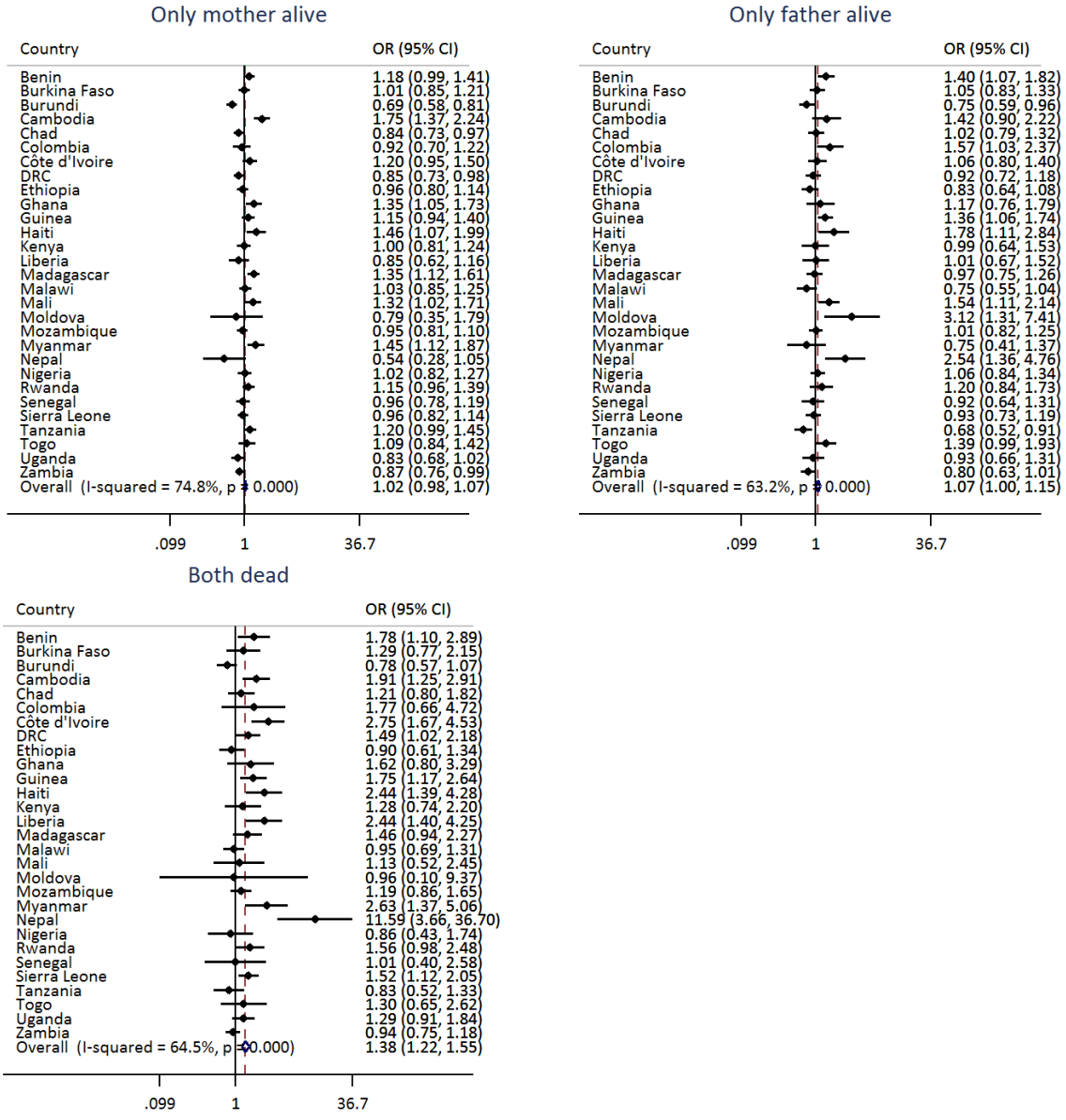




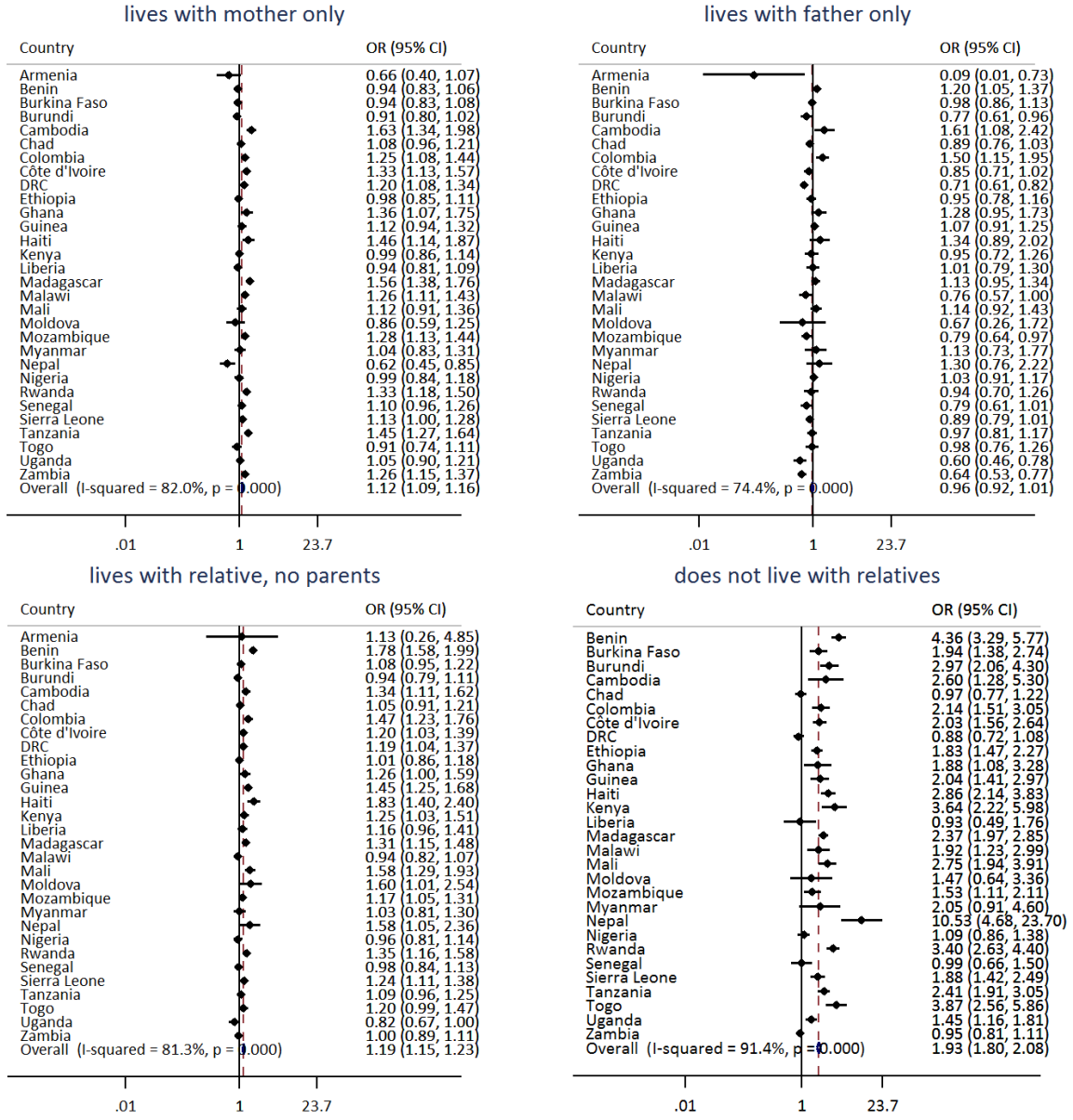
Appendix Figure 31 **Adjusted odds of not attending school, among children age 5-14, for males vs. females (reference)**



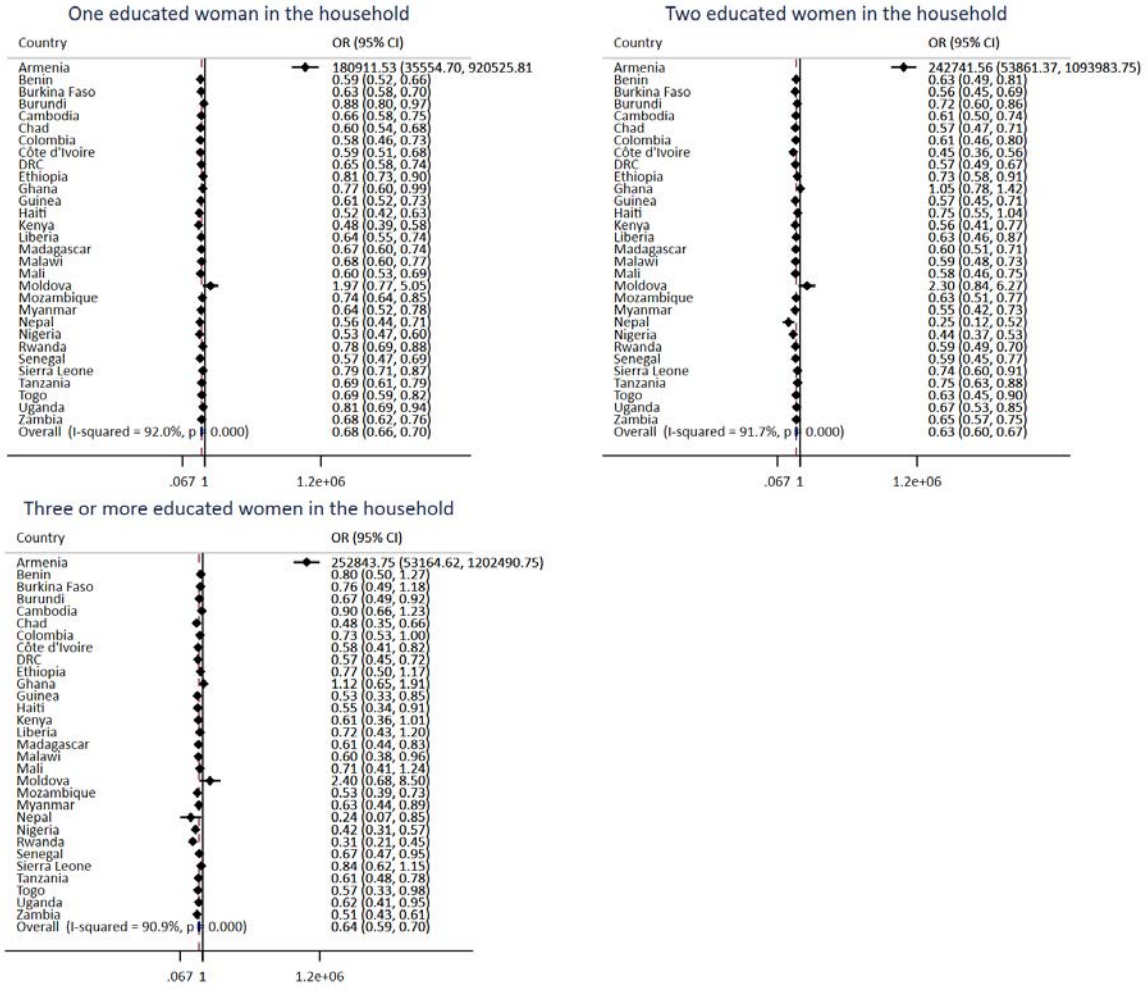
Appendix Figure 32 **Adjusted odds of not attending school, among children age 5-14, for three types of orphans vs. non-orphans (reference)**



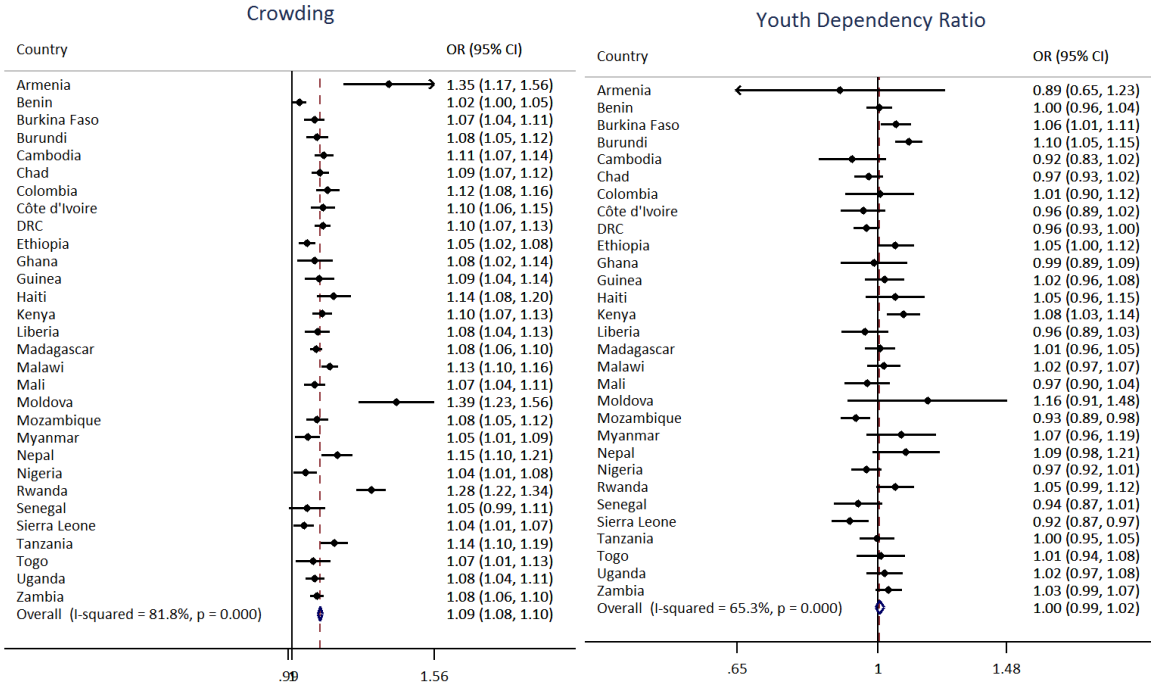
Appendix Figure 33 **Adjusted odds of not attending school, among children age 5-14, for four types of living arrangements vs. living with both parents (reference)**



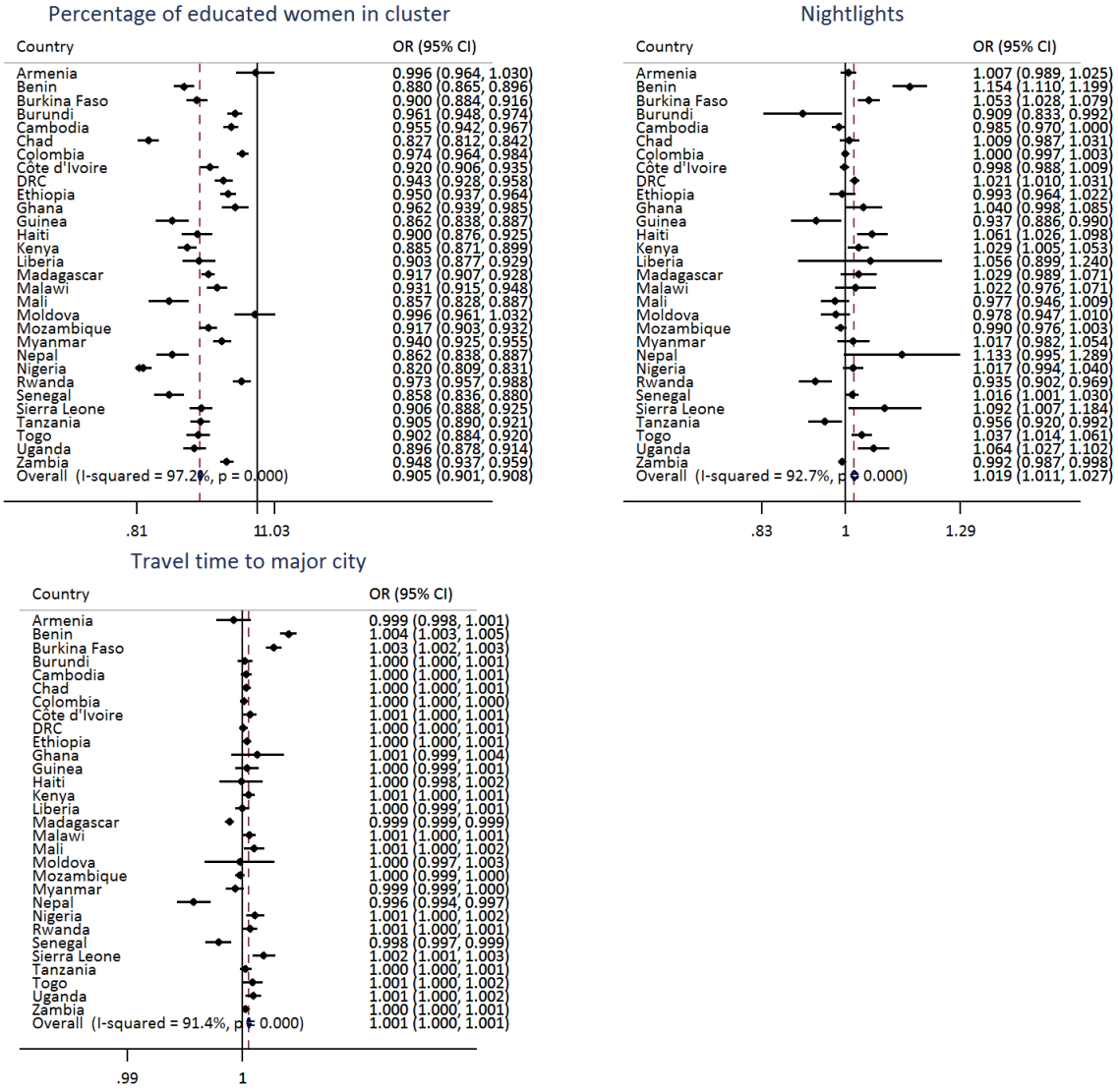
Appendix Figure 34 **Adjusted odds of not attending school, among children age 5-14, for the number of educated women in the household vs. no educated women (reference)**



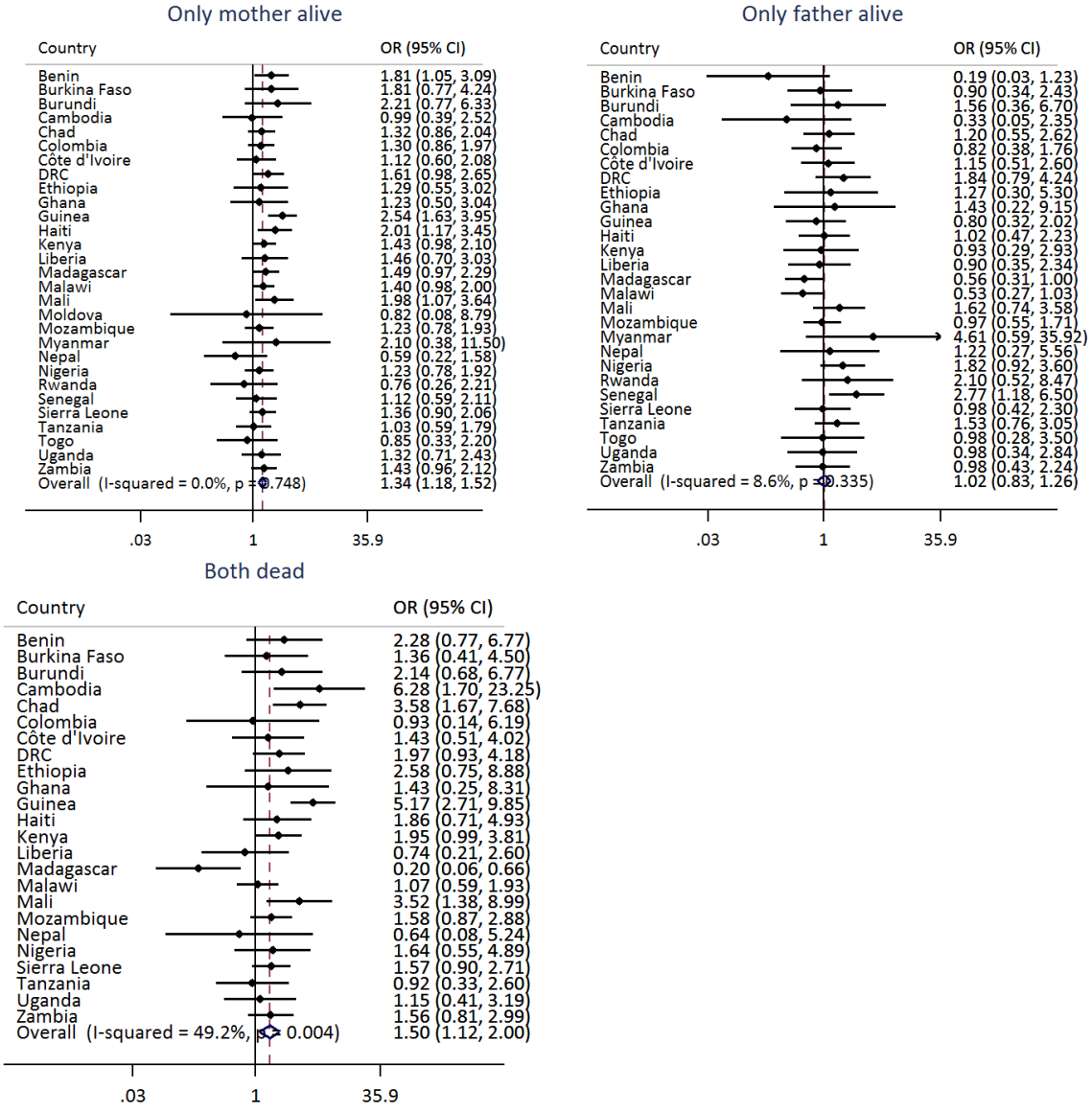
Appendix Figure 35 **Adjusted odds of not attending school, among children age 5-14, for the household crowding index and the youth dependency ratio**



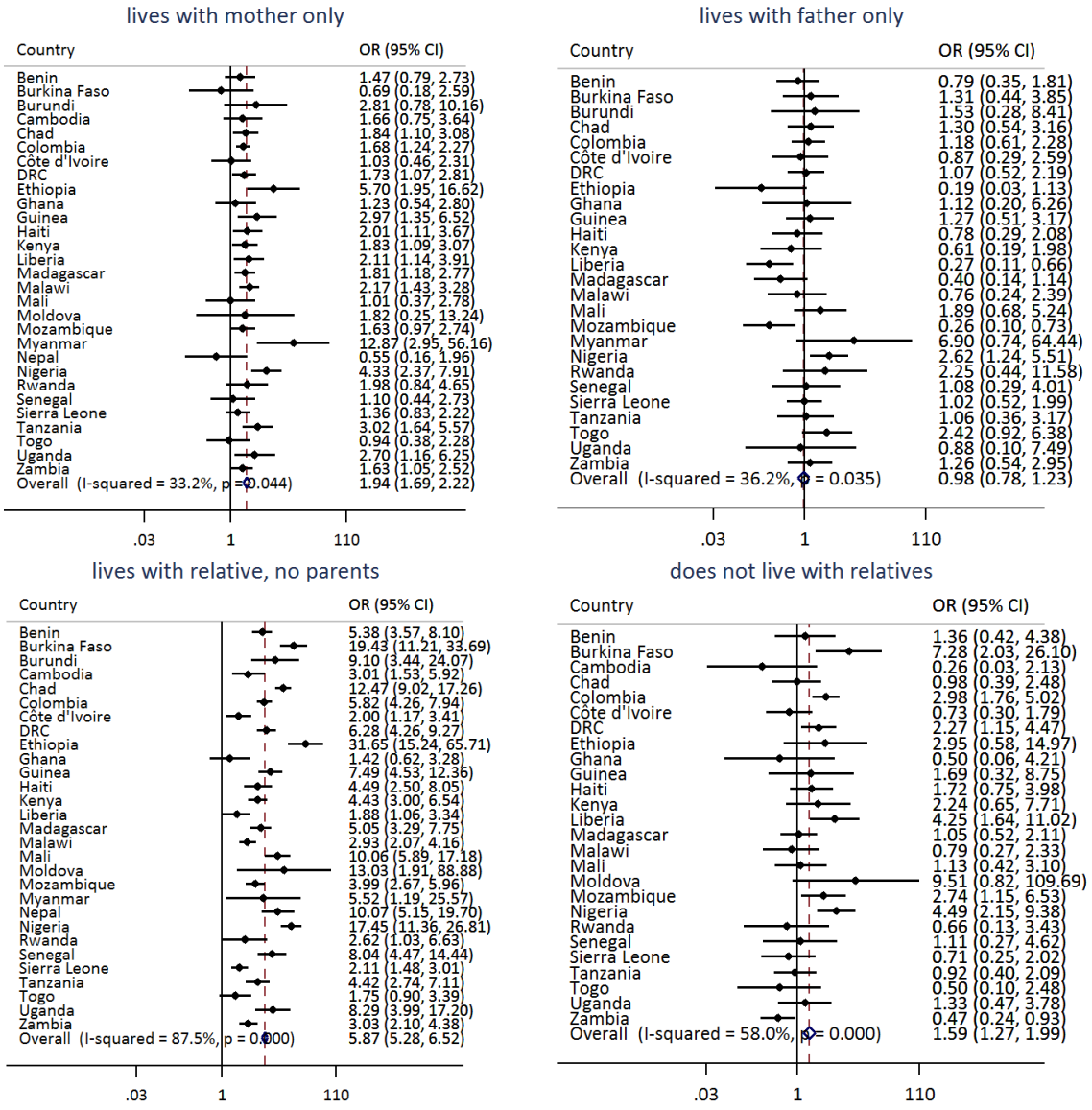
Appendix Figure 36 **Adjusted odds of not attending school, among children age 5-14, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



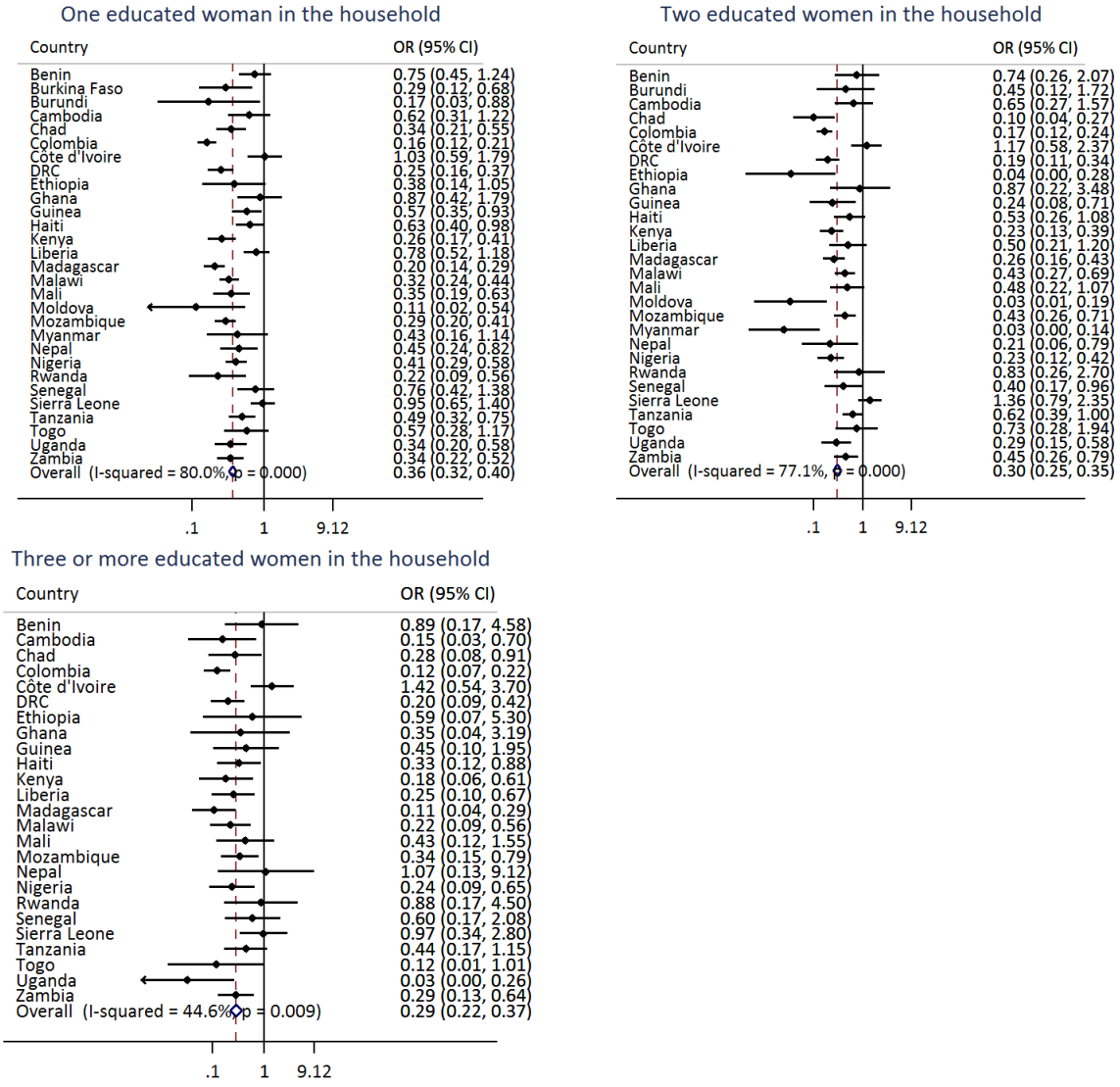
Appendix Figure 37 **Adjusted odds of adolescent fertility, among girls age 15-17, for three types of orphans vs. non-orphans (reference)**



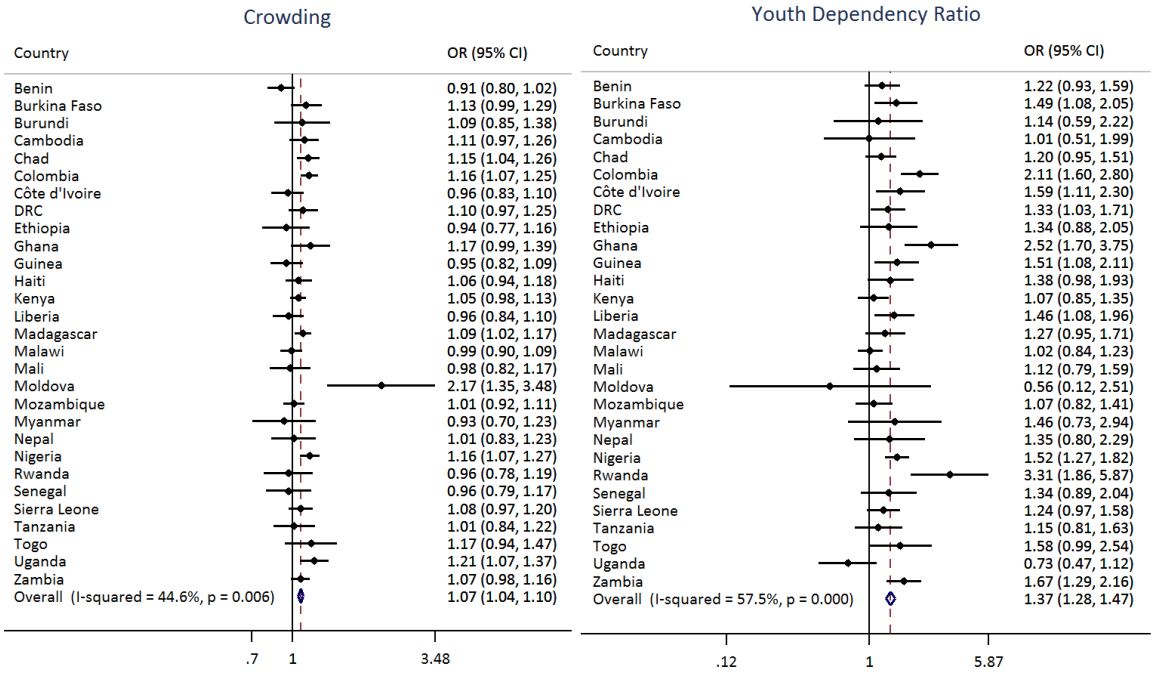
Appendix Figure 38 **Adjusted odds of adolescent fertility, among girls age 15-17, for four types of living arrangements vs. living with both parents (reference)**



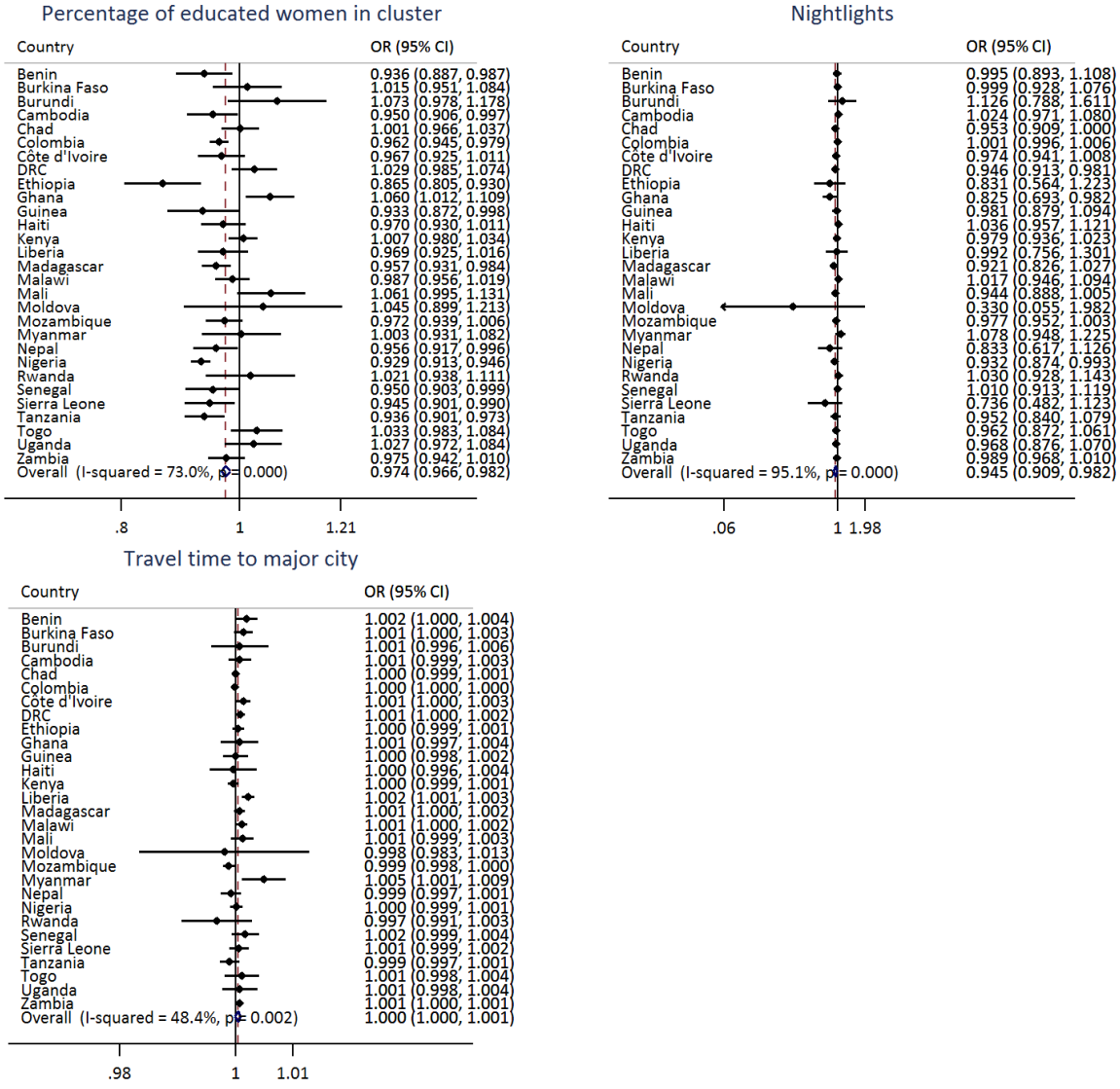
Appendix Figure 39 **Adjusted odds of adolescent fertility, among girls age 15-17, for the number of educated women in the household vs. no educated women (reference)**



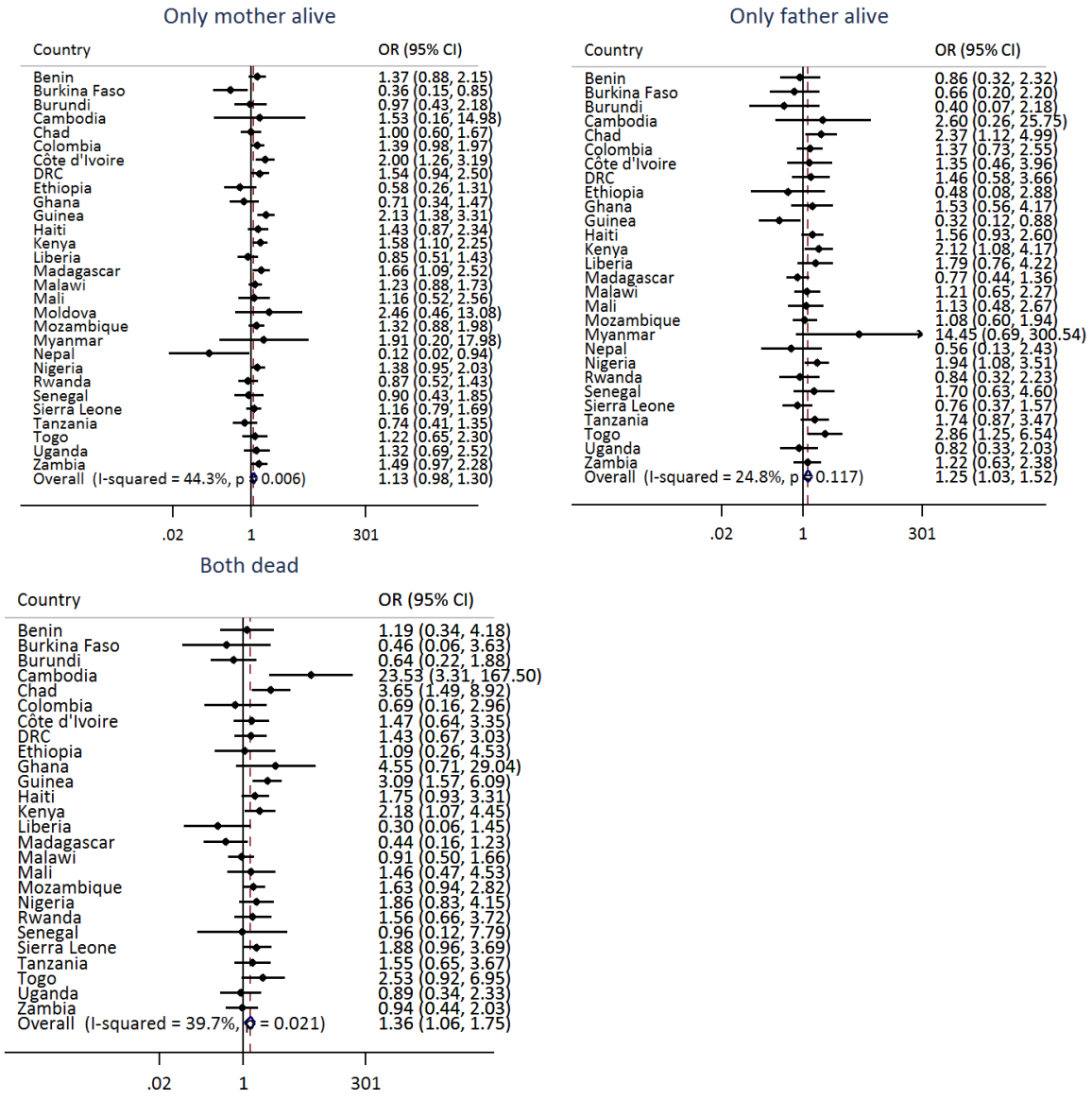
Appendix Figure 40 **Adjusted odds of adolescent fertility, among girls age 15-17, for the household crowding index and the youth dependency ratio**



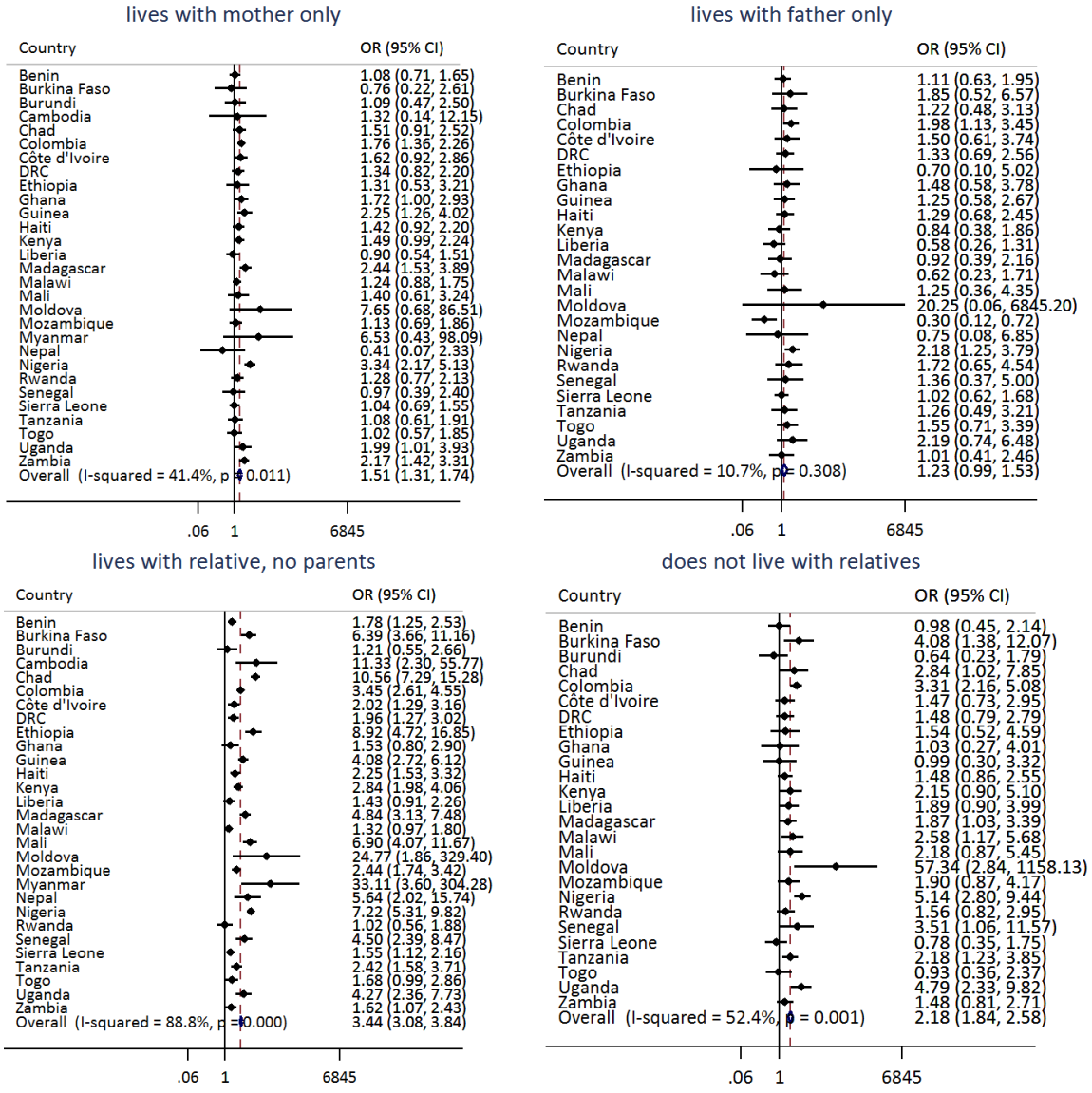
Appendix Figure 41 **Adjusted odds of adolescent fertility, among girls age 15-17, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



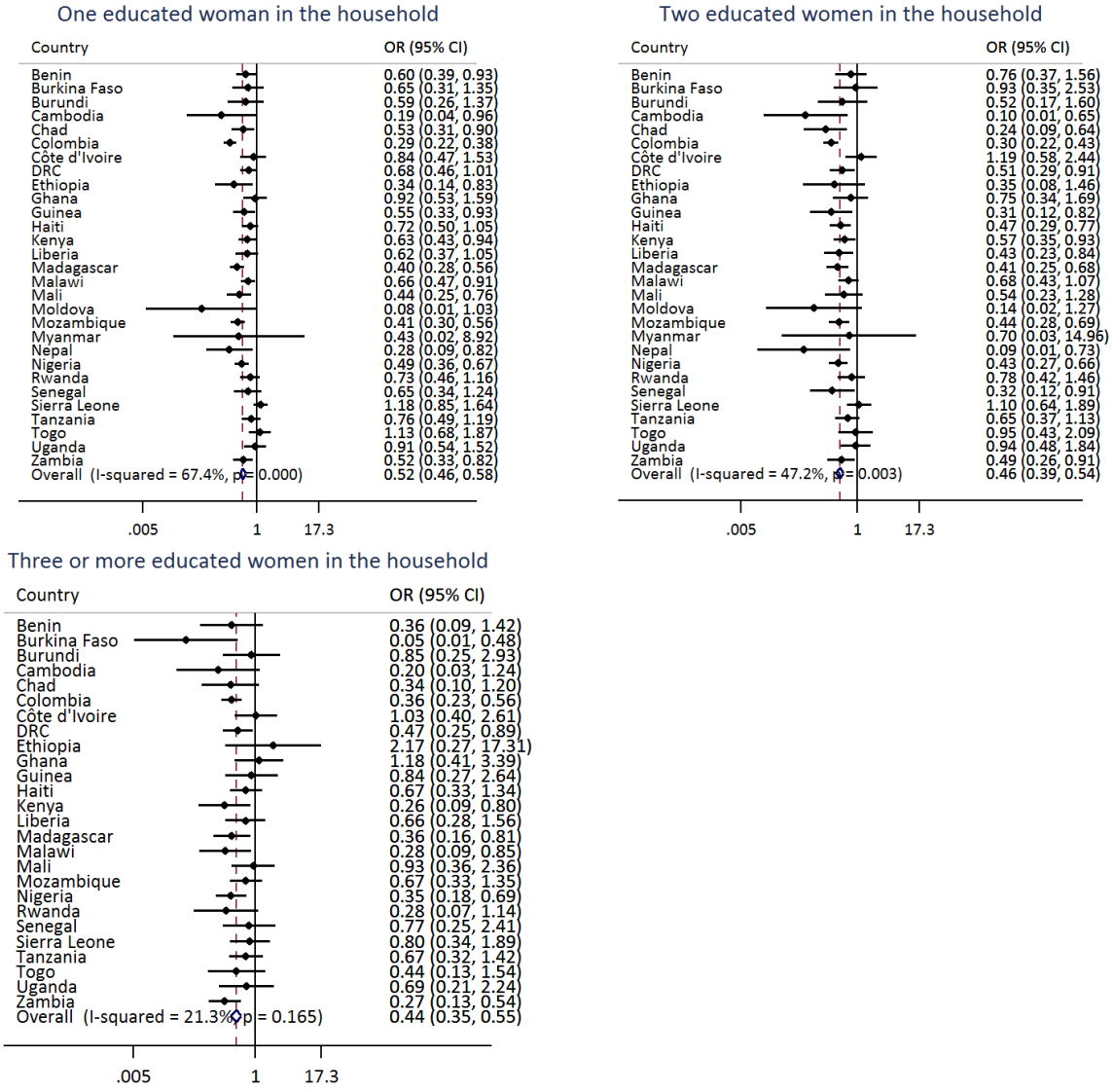
Appendix Figure 42 **Adjusted odds of sex before age 15, among girls age 15-17, for three types of orphans vs. non-orphans (reference)**



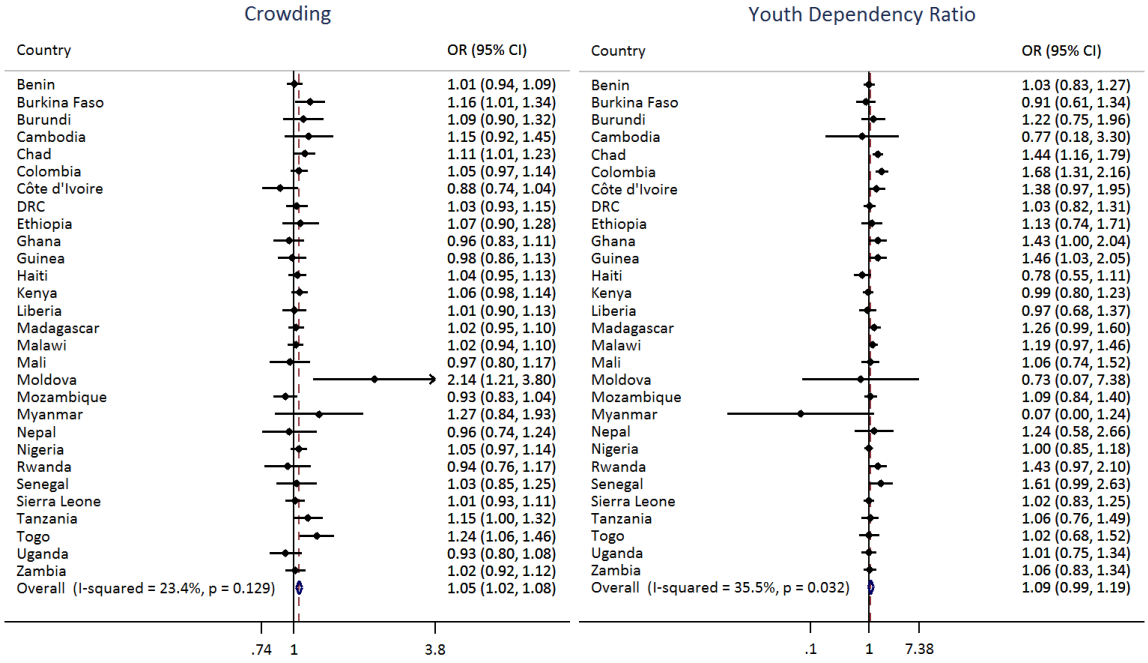
Appendix Figure 43 **Adjusted odds of sex before age 15, among girls age 15-17, for four types of living arrangements vs. living with both parents (reference)**



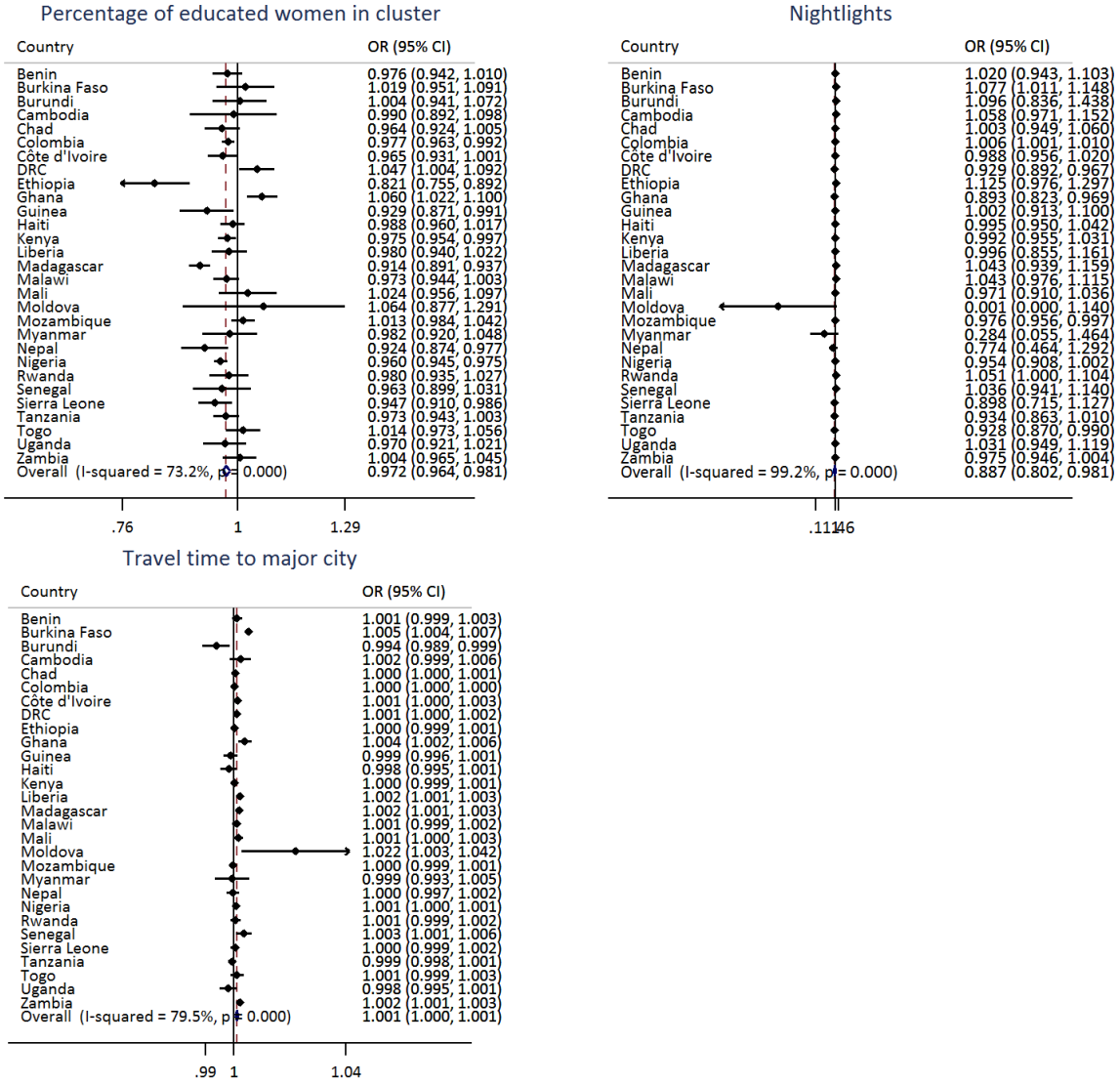
Appendix Figure 44 **Adjusted odds of sex before age 15, among girls age 15-17, for the number of educated women in the household vs. no educated women (reference)**



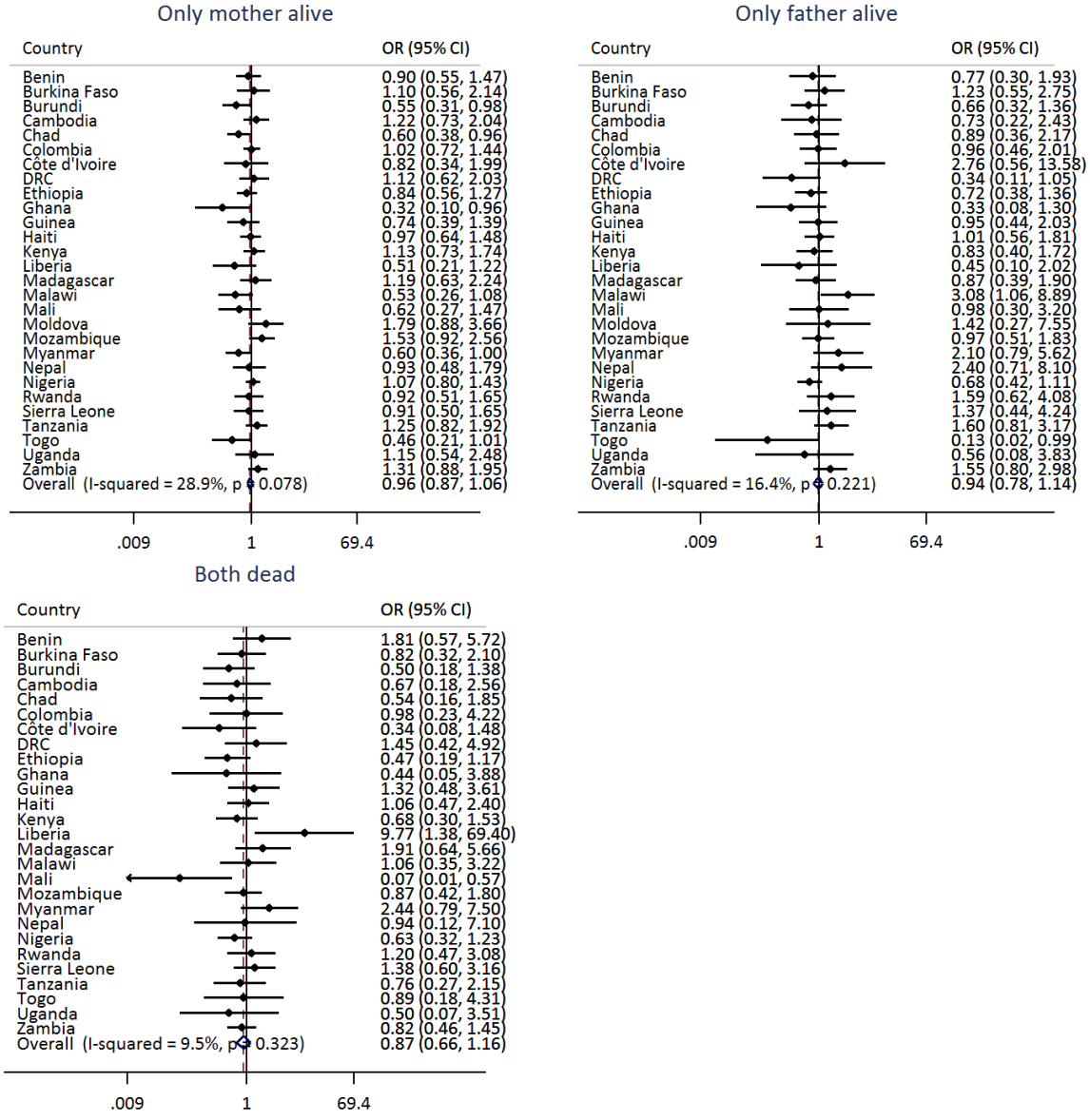
Appendix Figure 45 **Adjusted odds of sex before age 15, among girls age 15-17, for the household crowding index and the youth dependency ratio**



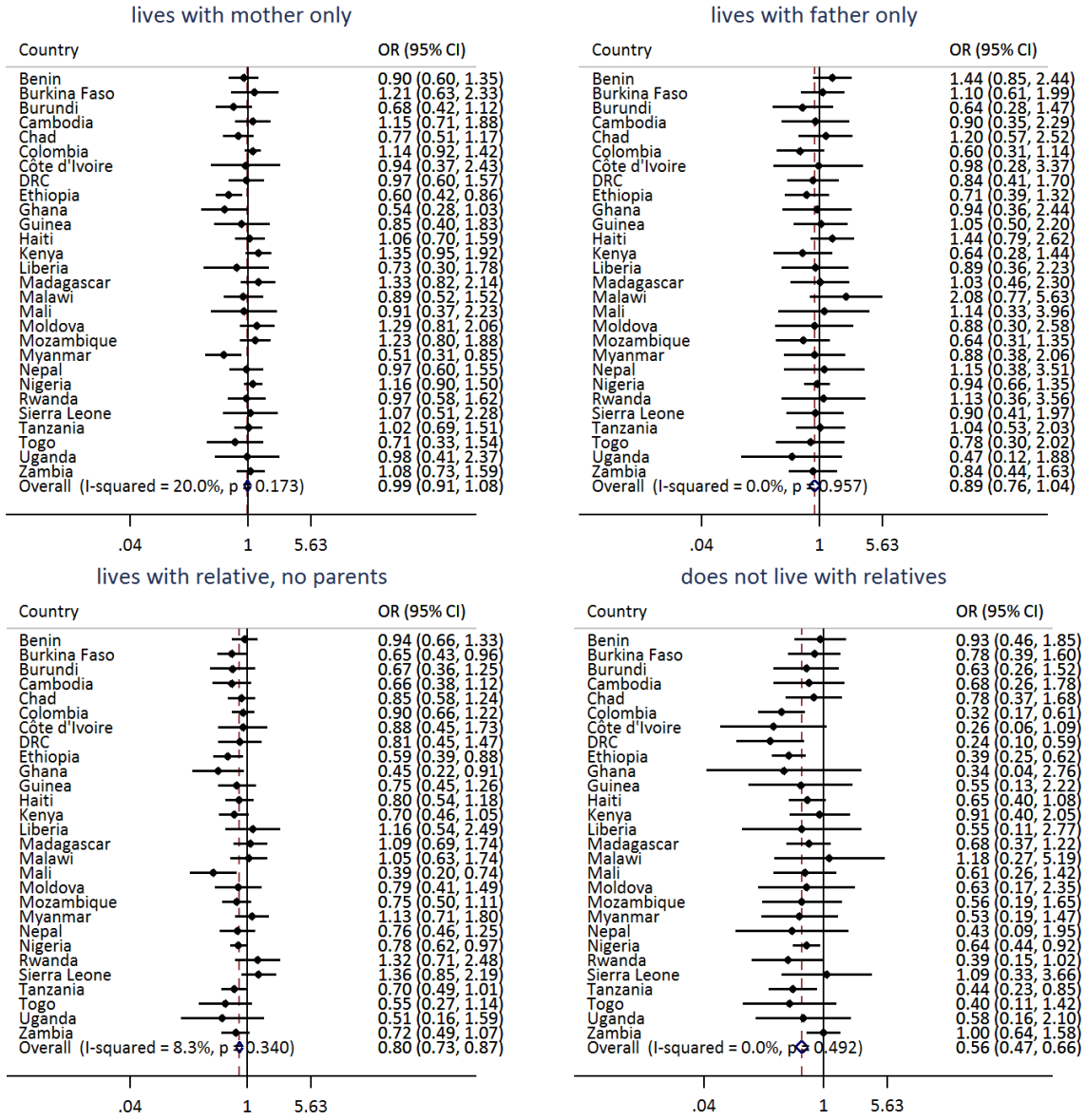
Appendix Figure 46 **Adjusted odds of sex before age 15, among girls age 15-17, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



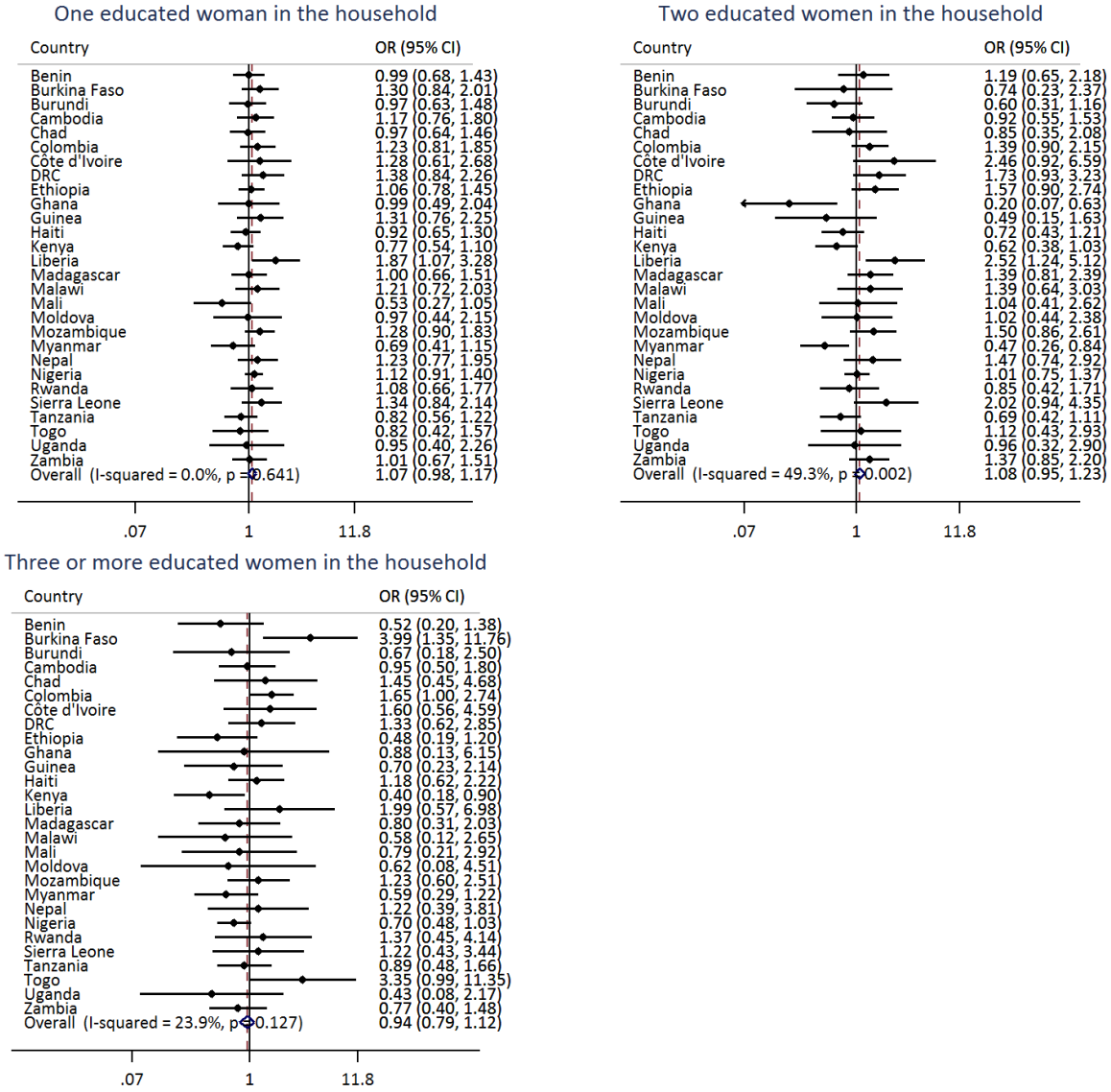
Appendix Figure 47 **Adjusted odds of being underweight, among girls age 15-17, for three types of orphans vs. non-orphans (reference)**



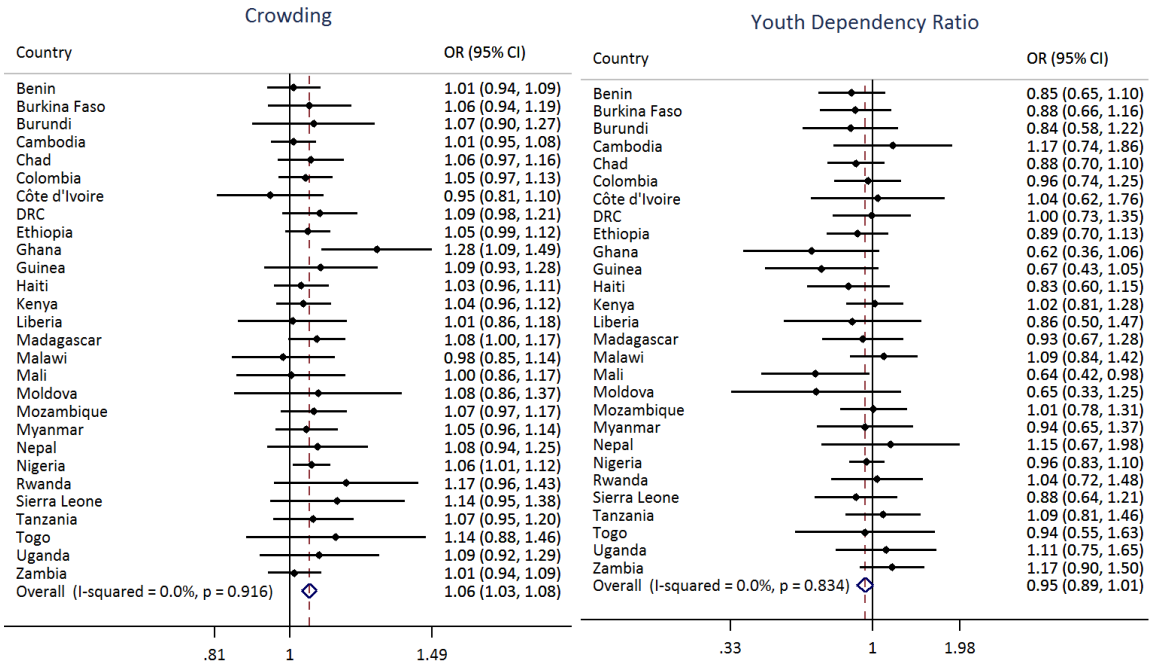
Appendix Figure 48 **Adjusted odds of being underweight, among girls age 15-17, for four types of living arrangements vs. living with both parents (reference)**



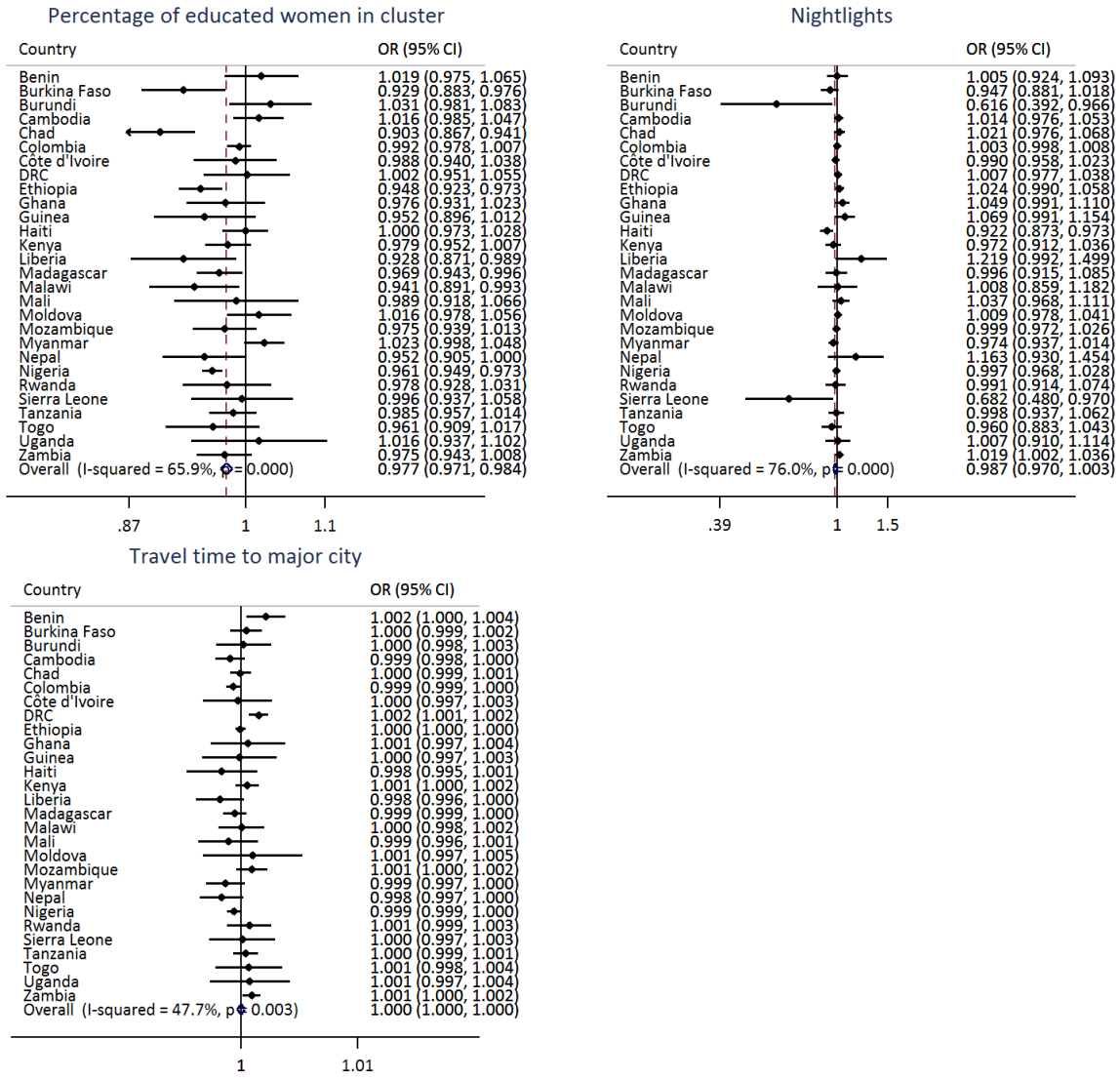
Appendix Figure 49 **Adjusted odds of being underweight, among girls age 15-17, for the number of educated women in the household vs. no educated women (reference)**



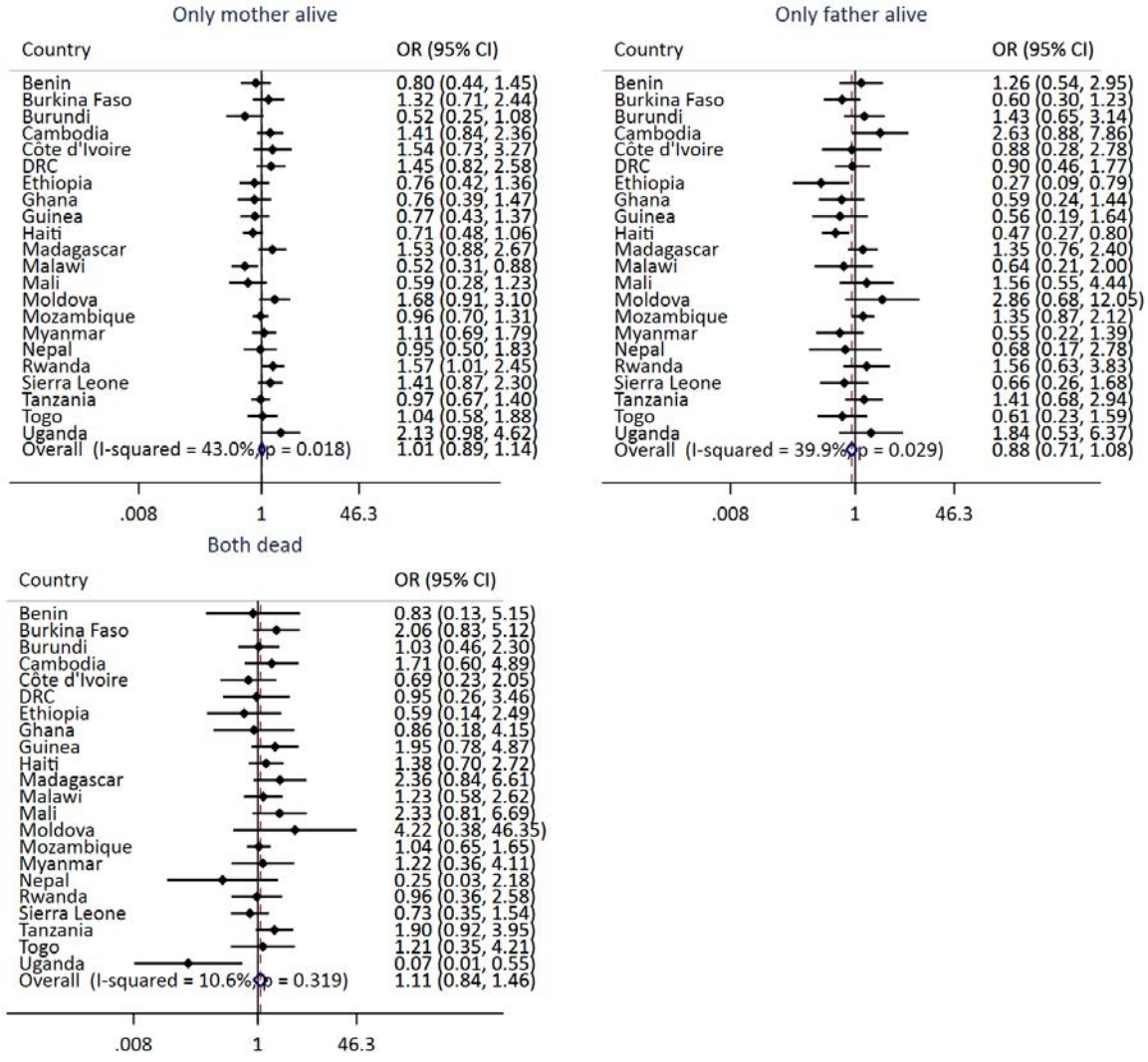
Appendix Figure 50 **Adjusted odds of being underweight, among girls age 15-17, for the household crowding index and the youth dependency ratio**



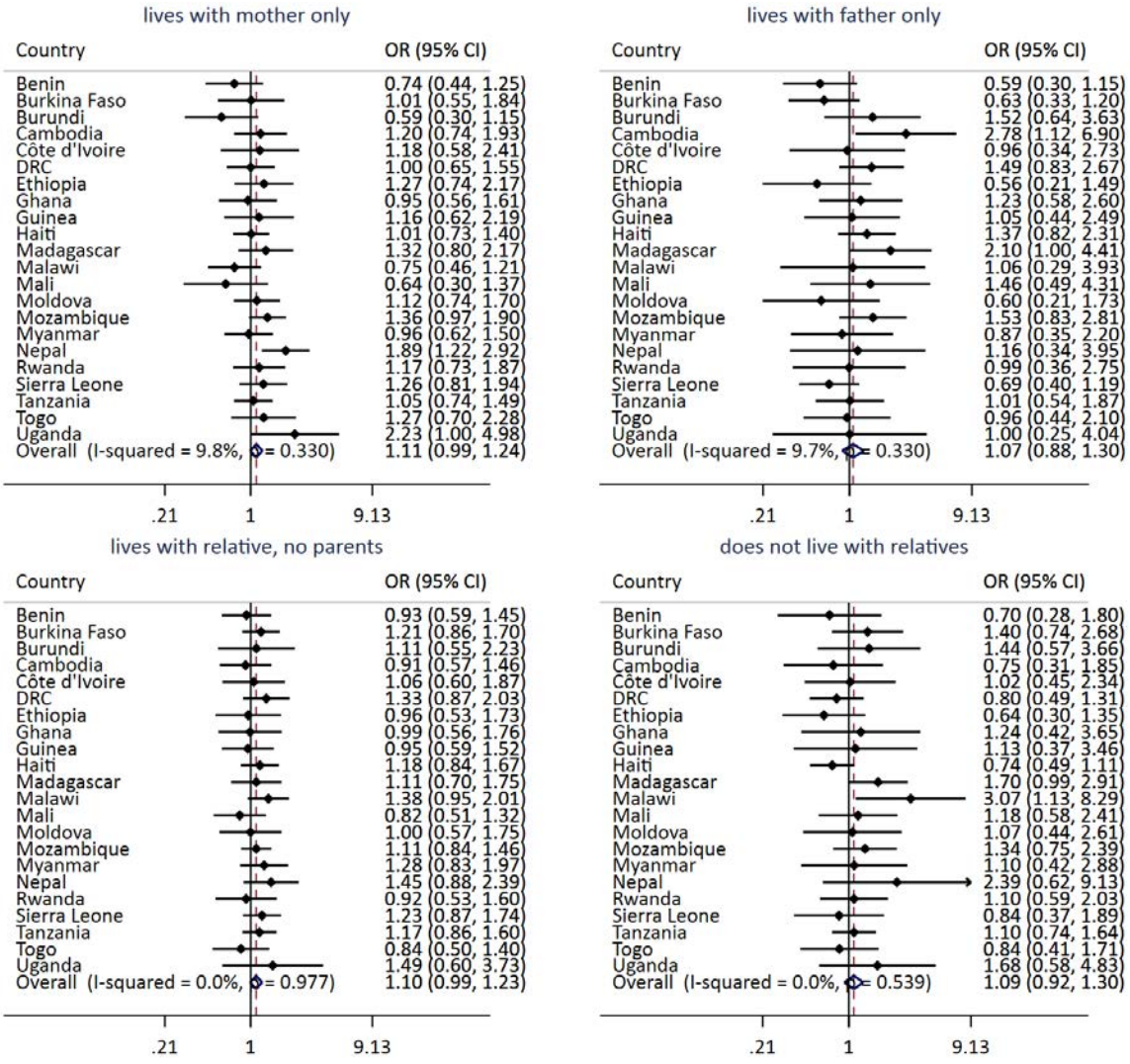
Appendix Figure 51 **Adjusted odds of being underweight, among girls age 15-17, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**



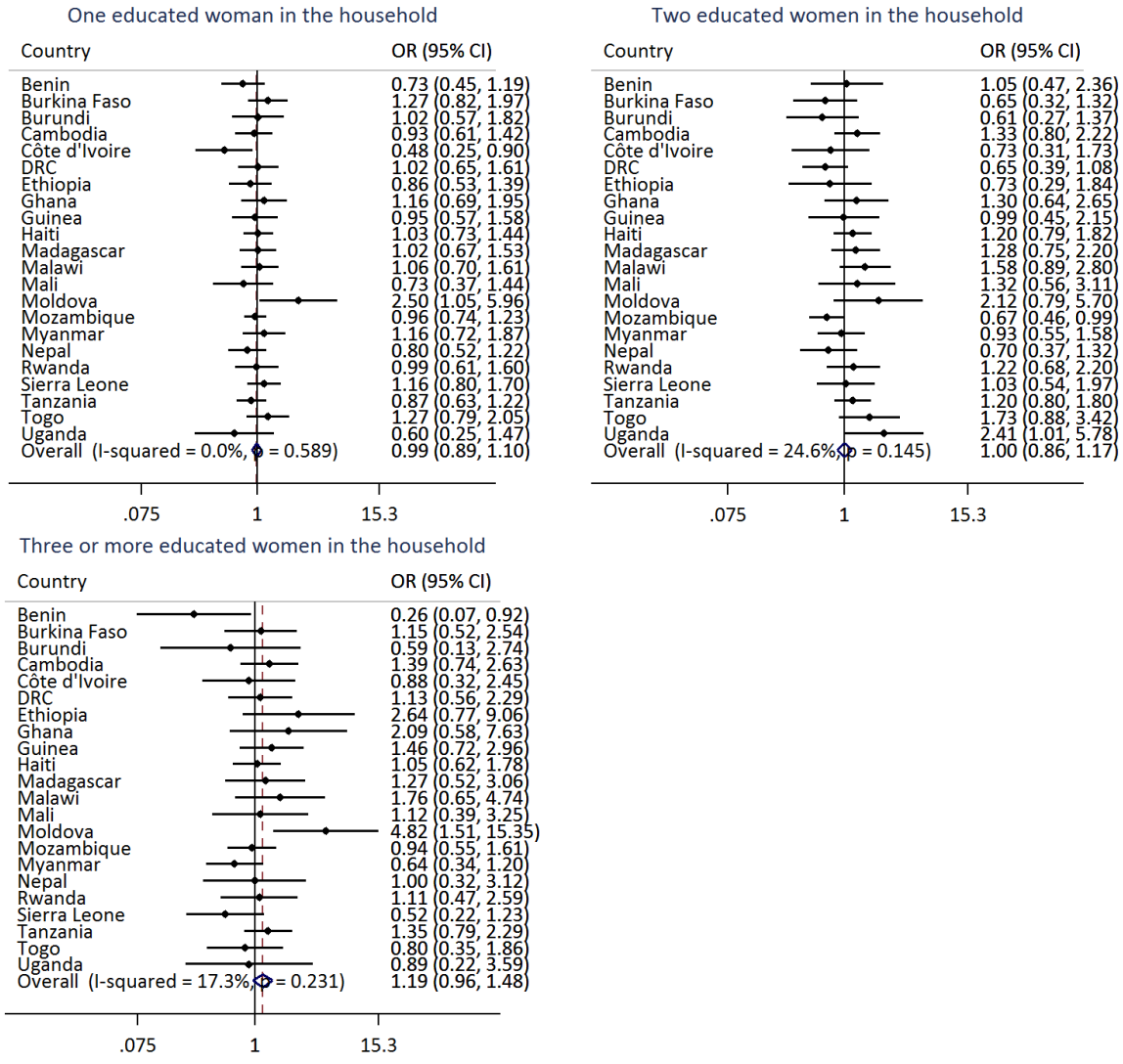
Appendix Figure 52 **Adjusted odds of anemia, among girls age 15-17, for three types of orphans vs. non-orphans (reference)**



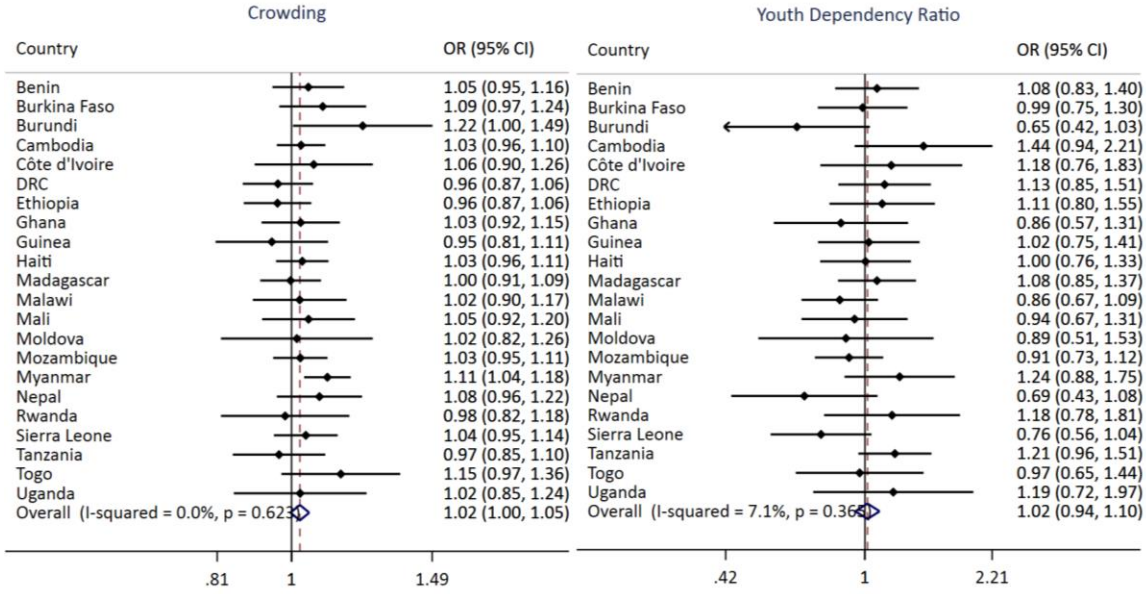
Appendix Figure 53 **Adjusted odds of anemia, among girls age 15-17, for four types of living arrangements vs. living with both parents (reference)**



Appendix Figure 54 **Adjusted odds of anemia, among girls age 15-17, for the number of educated women in the household vs. no educated women (reference)**



Appendix Figure 55 **Adjusted odds of anemia, among girls age 15-17, for the household crowding index and the youth dependency ratio**



Appendix Figure 56 **Adjusted odds of anemia, among girls age 15-17, for the percentage of educated women in a cluster, nighttime lights, and travel time to a major city**