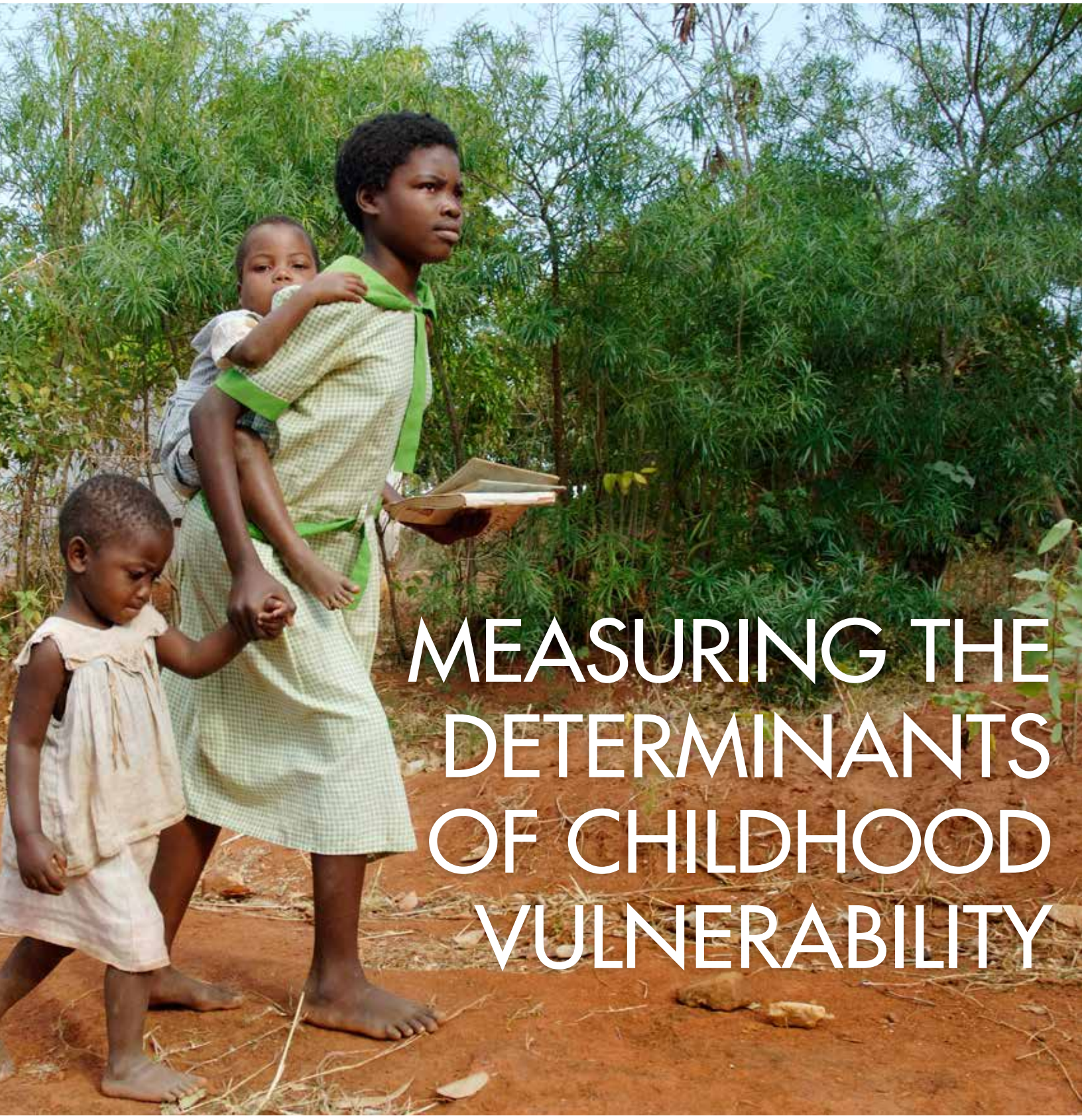

# MEASURING THE DETERMINANTS OF CHILDHOOD VULNERABILITY

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March 2014

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SYNTHESIS REPORT

# MEASURING THE DETERMINANTS OF CHILDHOOD VULNERABILITY

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# CONTENTS

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The report was edited by Natalie Leston and designed by Era Porth.

The authors have taken all reasonable precautions to verify the information contained in this report. For any survey data updates subsequent to this report, please visit **<www.data.unicef.org>** and **<www.measuredhs.com>**.

# EXECUTIVE SUMMARY

## BACKGROUND

Existing definitions of child vulnerability within the context of HIV and AIDS have been shaped by indicators developed for monitoring the Declaration of Commitment on HIV and AIDS (2001) and for the UNAIDS Monitoring and Evaluation Reference Group's working definition of a 'vulnerable child' (UNICEF and UNAIDS 2005). Recent evidence, however, indicates that global indicators used to identify the most vulnerable children in the context of HIV do not consistently identify children with poor outcomes (Akwara et al. 2010). It is therefore necessary to reconsider the usefulness of these indicators and undertake analysis to identify key variables that are more consistently associated with child vulnerability.

## OBJECTIVES

The objective of this study was to identify key determinants of vulnerability among children – including those affected by HIV and AIDS – that can contribute to developing an improved global measure of vulnerable children in the context of HIV and AIDS. Such determinants can be used for: 1) monitoring global coverage of social protection, care and support services to these children and to assess progress and identify gaps in the HIV response; 2) informing resource estimates of social protection, care and support programmes; and 3) providing evidence to inform the targeting of programmes for external support to households with vulnerable children, including children affected by HIV and AIDS. This study builds on Akwara et al.'s 2010 work by expanding the analysis to include pooled and country-specific multivariate models, and by examining a refined set of child- and adolescent-level outcomes, including measures not previously studied.

## METHODS

Data were derived from household surveys collected through the Multiple Indicator Cluster Survey (MICS), the Demographic and Health Survey (DHS) and the AIDS Indicator Survey (AIS). The most recent available household survey data sets at the time of the analysis (2005–2008) from 11 countries – Cambodia, Central African Republic, Haiti, Malawi, Rwanda, Sierra Leone, Swaziland, Uganda, United Republic of Tanzania, Zambia and Zimbabwe – were pooled and analysed using multivariate logistic regression.

The data sets were selected to represent countries with different HIV prevalence rates and geographic areas, and contain the key analytical and outcome variables of interest for the study. Selected outcome measures reflect age-specific vulnerabilities across a child's developmental life cycle (see table on pg, 3).

Analytical variables in the model include: sex of the child; age of the child; household wealth status; presence of an adult member in the household who has been sick for three or more months in the

past year; highest education level of any adult in the household; sex of household head; household dependency ratio; orphanhood status; child's living arrangements; and community characteristics (urban/rural).

Multiple logistic regression models were fitted to assess the strength of the associations between each of the outcomes and the analytical variables. Odds ratios with standard errors and p-values were calculated. Estimates were generated accounting for the multi-stage survey designs. Country variables were included in all models as fixed effects, in order to control for country-specific unobserved effects. Assessments of statistical significance were made at 0.05 level.

## RESULTS

Household wealth, a child's living arrangements, and household adult education emerged as the most powerful and consistent factors associated with key health and social outcomes of child vulnerability. Orphanhood status and the presence of a chronically ill adult in the household are also significant for some outcomes. Orphanhood is significant for schooling, child labour, birth registration and DPT3 vaccine, while adult chronic illness is significant for school attendance, DPT3, child labour and stunting. Existing data indicate, however, that while orphanhood continues to be a useful proxy for HIV affectedness, particularly in high prevalence settings, adult chronic illness in the household is not. In the 11 countries surveyed, the percentage of chronically ill adults who were also HIV-positive was relatively small (<15 per cent in most countries, with the exception of Swaziland and Zimbabwe). The results presented here are consistent with the earlier 2010 Akwara et al. analysis, and suggest that a core set of indicators that include markers of vulnerability traditionally associated with HIV (i.e., orphaning) in addition to broader dimensions of vulnerability (including household wealth status) can be better used to identify the most vulnerable children and adolescents.

## STUDY LIMITATIONS

The analysis presented here is limited by several factors. The outcomes selected for this analysis are confined to those available in the MICS, DHS and AIS data sets. Household data sets by design do not capture the entire population of orphans; rather, only orphans who live in households are represented. Importantly, some of the most vulnerable children include orphans living in streets or outside of families and households, and are not represented in the data. Furthermore, children who have lost one or both parents due to AIDS-related illnesses are more likely to be HIV-positive, and the HIV status of these children can affect their physical health and cognitive development. Biomarkers on the HIV status of children, however, were only available for one country included in the analysis (Swaziland 2006–2007). Due to the lack of data availability, the HIV status of children could not be accounted for in the analysis, and this may be a severe limitation. It is also not easy to assess the timing of events such as orphanhood or HIV affectedness and their effect on child outcomes. Another limitation is that the asset index used to capture household wealth may be biased towards urban areas, which may appear to be wealthier or better off than rural areas. Despite these limitations, the high-quality population-based data provide insights into the associations between indicators of vulnerability (including vulnerability due to HIV) and health and social well-being outcomes.

Selected outcome measures across a child's developmental life cycle

| Children (0–4 years) | Children (5–17 years) | Female adolescents (15–17 years) |
|---|---|---|
| Received the final dose of Diphtheria, Pertussis and Tetanus immunization (DPT3) | School attendance (7–17) | Early sexual debut |
| Fever treatment | Child labour (5–14) | Early marriage |
| Slept under insecticide-treated nets (ITNs) | | |
| Stunting | | |
| Birth registration | | |

## DISCUSSION AND RECOMMENDATIONS

Child vulnerability is an issue that cuts across development programming and planning, including in the sectors of HIV and AIDS, health, child protection and social protection. Based on the results of the pooled analysis, the key indicators of vulnerability for children and adolescents can be consistently identified as household wealth, a child's household living arrangements, and the education level of adults in the household. Orphanhood is also significant for some developmental outcomes and continues to be a useful proxy of HIV affectedness, particularly in high HIV prevalence settings. In Eastern and Southern Africa, for example, it is estimated that nearly 40 per cent of all children who have lost one or both parents have been orphaned due to AIDS.[1]

This set of analytical variables can be used to identify vulnerable children both for determining a global denominator and for programme planning purposes.

It is therefore proposed to redefine a vulnerable child that allows for contextualization and programme flexibility. The refocused 'child vulnerability' definition that emerged out of this analysis uses a combination of the following four variables: children who (1) live in a household ranked in the bottom two wealth quintiles; (2) are not living with either parent; (3) have lost one or both parents; and (4) are living in a household with adults with no education. Using these variables, we formulated three groups of children with various vulnerability characteristics, with household wealth status being the main variable combined across all three groups.

One group of vulnerable children is characterized by consisting of children who are orphans (lost one or both parents) and live in a household ranked in the bottom two wealth quintiles. This is recommended as the narrower definition, which relates closely to child vulnerability in the context of HIV and AIDS. HIV is one of the main drivers of parental death, and poor households are least resilient to the economic impacts of increased morbidity and mortality. For HIV and AIDS global programme monitoring purposes, we recommend focusing on this aspect of vulnerability.

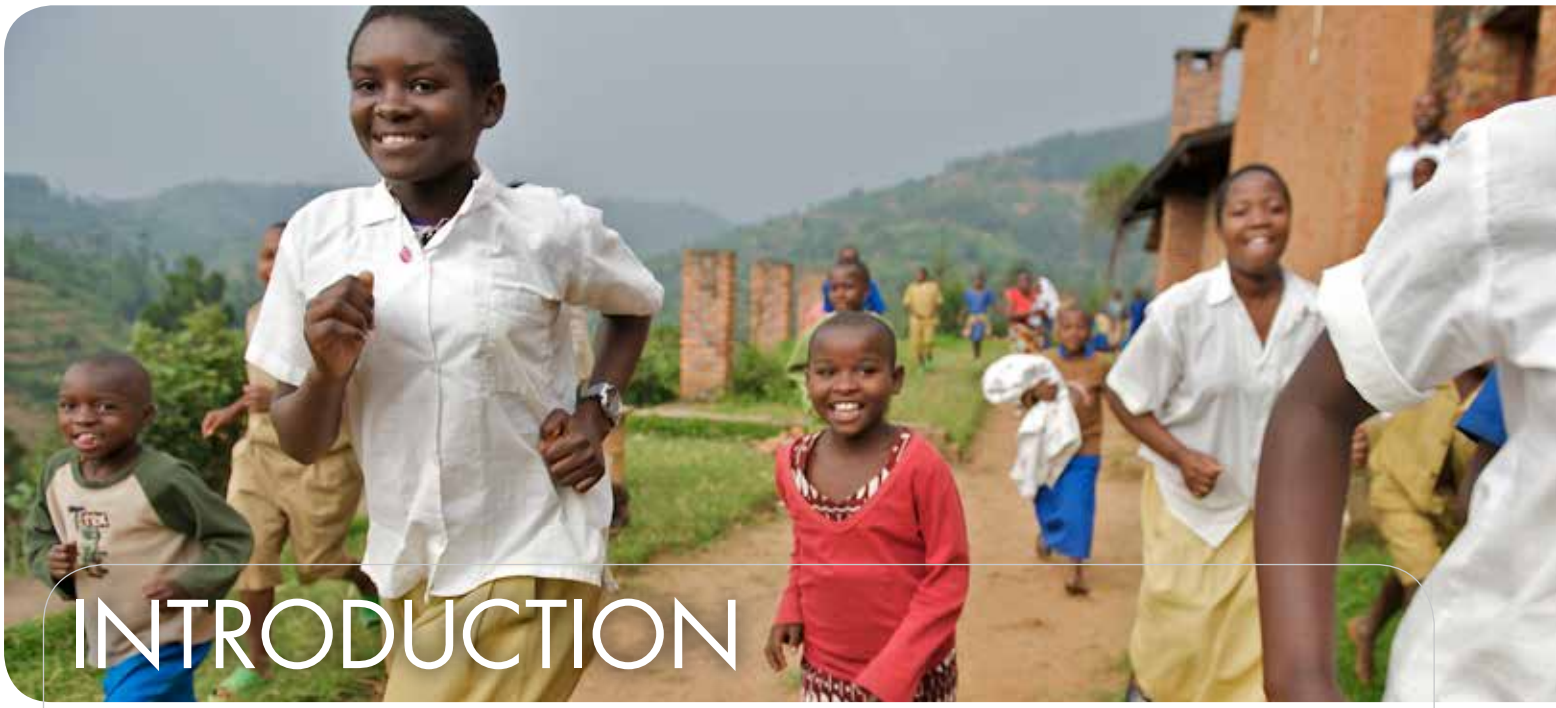
For overall child vulnerability, we recommend a broader definition that is HIV-sensitive (in that it is inclusive of HIV-affected children) but is also inclusive of other equally vulnerable children who are not directly affected by HIV at present. The broader definition takes into account orphanhood and the other two variables, in addition to household wealth status. That is, vulnerable children are those who: live in a household ranked in the bottom two wealth quintiles and who are: (1) not living with either parent; or (2) have lost one or both parents; or (3) living in a household with adults with no education. This wider definition will be useful for broader developmental responses in health, child and social protection and education programmes.

This analysis was carried out for the purposes of global definitions and can be a useful guiding framework for countries. However, it should not supersede country specific analysis used for program targeting or measurement.

The recommended definition of child vulnerability differs in several ways from the 2005 UNICEF and UNAIDS global definition in that it now excludes variables associated with chronic illness among adults in the household, as these variables do not have strong associations with developmental outcomes for children. Instead, the definition now focuses on household wealth status, orphanhood status, a child's living arrangements and the education level of adults in a household. To varying degrees, these indicators are significantly associated with key health and social outcomes among children across selected countries and HIV epidemic contexts, and are readily collected in household surveys with high temporal frequency, which is crucial for global monitoring.

Monitoring these indicators over time will help to ensure that progress continues to be made in reaching the most vulnerable children worldwide and responding to their needs. The results of the analysis has been used as a basis for estimating resources needed for protection, care and support of children affected by HIV and AIDS. Follow-up steps need to be taken to ensure that measurement and monitoring of these indicators can be achieved through household surveys.

1 UNICEF analysis of UNAIDS 2012 HIV and AIDS unpublished estimates.



# INTRODUCTION

Despite significant achievements in the global AIDS response throughout the past decade – declining new infections, decreased AIDS-related mortality, and the increased scale-up and availability of antiretroviral therapy – HIV and AIDS continue to have adverse impacts on the lives of children and families worldwide (UNAIDS 2012).

As of 2012, an estimated 17.8 million children had lost one or both parents to AIDS globally,[2] and millions more have been affected by living in households and communities severely impacted by the epidemic.

At the family and household level, commonly reported impacts on children affected by HIV and AIDS include the loss of parental care and protection, decreased access to schooling and health care, increased child labour, increased risk of abuse and exploitation, psychosocial distress, stigma and discrimination, and impoverishment (Nyberg et al. 2012).

Within this context, identifying and monitoring a core set of global indicators of child vulnerability has been essential for monitoring progress in service coverage, assessing global resource needs and ensuring that resources are reaching the most vulnerable children. Existing definitions of child vulnerability within the context of HIV and AIDS have largely been shaped by indicators developed for monitoring the Declaration of Commitment on HIV and AIDS adopted by the United Nations General Assembly Special Session (UNGASS) on HIV and AIDS in 2001, in addition to the UNAIDS Monitoring and Evaluation Reference Group's (MERG) working definition of a 'vulnerable child' (UNICEF and UNAIDS 2005).

The indicators set out by UNGASS to measure children affected by HIV and AIDS and incorporated in major survey programmes such as MICS and DHS since 2005 included: the ratio of school attendance between orphans and non-orphans aged 10–14, and the percentage of orphaned and vulnerable children under 18 whose households received free, basic external support in caring for the child. The first indicator was developed on the assumption that AIDS would lead to increased orphans who would be less likely than non-orphans to attend school. The external support indicator was intended to measure progress in meeting the care and support needs of children affected by HIV and AIDS. This indicator, however, will be revised because of a lack

2 UNAIDS 2012 HIV and AIDS estimates.

of clarity and agreement on how to define a vulnerable child, and also due to the need to narrow the components of external support that must be measured.

According to the definition initially recommended by the UNAIDS Monitoring and Evaluation Reference Group (UNICEF and UNAIDS 2005), a child made vulnerable by HIV and AIDS is one below the age of 18 and one who:

- Has lost one or both parents; or
- Has a chronically ill parent (regardless of whether the parent lives in the same household as the child); or
- Lives in a household where in the past 12 months at least one adult died and was sick for 3 of the 12 months before he/she died; or
- Lives in a household where at least one adult was seriously ill for at least 3 months in the past 12 months; or
- Lives outside of family care (i.e., lives in an institution or on the streets).

In response to the need to understand the utility and relevance of the above definitions of vulnerability, UNICEF supported multivariate analyses of survey-based data from DHS and MICS in 2008–2009 (Akwara et al. 2010) to explore whether these markers of child vulnerability are useful in differentiating outcomes for children across different developmental stages. There were three main outcomes: wasting[3] among children aged 0 to 4, school attendance among children aged 10 to 14, and early sexual debut among adolescents aged 15 to 17. The analysis explored three questions:

- Are orphans more likely to have worse outcomes than non-orphans?
- Are children living in households with chronically ill or HIV-positive adults more likely to have worse outcomes than children not living with such adults?
- Aside from orphaning and adult illness in the household, what other factors are associated with poor outcomes for children?

The results showed that being an orphan or residing with a chronically ill or HIV-infected adult did not consistently identify children with the worst education, health or protection outcomes. Other factors such as the wealth status of the household (as measured by asset index quintiles), the relationship of the child to the caregiver and the education level of adults in the household, particularly the female caretaker, had stronger associations with children's well-being. Of all of the markers of child vulnerability analysed, only household wealth consistently showed power to differentiate across age-disaggregated outcomes.

These findings raised the question of whether the current definition of vulnerability really captures the full proportion of vulnerable children affected by AIDS.

Since then, there have been developments on two important fronts:

- Questions that were used to identify 'vulnerable' children affected by AIDS, according to the definitions above, were removed from the standard questionnaires of the Multiple Indicator Cluster Survey (MICS) and Demographic and Health Survey (DHS), on the grounds that the data did not adequately capture vulnerability and that the questions were too difficult to ask and were ambiguous.
- There has been a shift away from more narrowly focused programmes for orphans and vulnerable children to more comprehensive nationally owned social protection, care and support programmes, which reach vulnerable children affected by AIDS as well as other equally needy children, including those in the poorest households. This requires a more comprehensive analysis of vulnerability, but also one that still captures the HIV-affected children who are most in need.

3 Wasting among young children is defined as those aged 0–59 months who are below minus two standard deviations from the median weight for height of the National Center for Health Statistics (NCHS)/World Health Organization (WHO) reference population (WHO Multicentre Growth Study Reference Group, 2006).

# STUDY OBJECTIVES

This study builds on Akwara et al.'s 2010 work, aiming to identify key predictors of selected poor developmental outcomes for children, including those affected by HIV and AIDS. It differs from the original analysis in that it includes both pooled and country-specific analyses, and examines a broader set of child- and adolescent-level outcomes.[4] Furthermore, in the 2010 study, the categories of guardianship and orphanhood status were combined into one variable, whereas in the current study orphanhood and living arrangements are analysed independently, so that both the independent and combined effects can be quantified.

From an aid effectiveness and equity perspective, it is important to ensure that global and national resources for children affected by AIDS are reaching those in greatest need. Consistent monitoring is needed at the global and national levels to assess the extent to which the most vulnerable children are being reached with a range of health, education, child and social protection interventions. The objective of this study is to identify key predictors of selected poor developmental outcomes for the majority of children – including those affected by AIDS – in order to develop a global measure of the most vulnerable children affected by HIV and AIDS that can be used to:

- Monitor global coverage of social protection, care and support services to children affected by HIV and to assess progress and identify gaps in the HIV response;
- Provide evidence to inform programme planning and implementation for external support to households with vulnerable children, including children affected by HIV; and
- Generate a global denominator for resource estimates of social protection, care and support programmes.

4 This synthesis report highlights the findings of the pooled multivariate regression analysis. Country-specific analyses will be presented separately in country reports (forthcoming).

# METHODS

## DATA SOURCES

Data used in this analysis come from 11 household surveys collected under MICS, DHS and the AIDS Indicator Survey (AIS) (see Table 1 below). The data sets were selected to represent countries with varying HIV prevalence levels and geographic areas, as well as to contain the key analytical and outcome variables of interest for this study. The most recent surveys available at the time the analysis was undertaken were chosen. Surveys were carried out between 2005 and 2008.

### MICS

UNICEF assists countries in the collection and analysis of data to fill data gaps in monitoring the status of women and children through its international household survey initiative, the MICS. More than 200 MICS have been conducted in more than 100 countries since the mid-1990s. MICS data are utilized to produce local estimates on a wide range of health, education, child protection, water and sanitation, and HIV and AIDS indicators that are internationally comparable.

**TABLE 1:** Survey data sets included in the analysis

| Data source | Country | Survey year | HIV prevalence (adults 15–49 years), 2012* |
|---|---|---|---|
| DHS | Cambodia | 2005 | 0.8 |
| MICS | Central African Republic | 2006 | 4.2 |
| DHS | Haiti | 2005/06 | 2.1 |
| MICS | Malawi | 2006 | 10.8 |
| DHS | Rwanda | 2005 | 2.9 |
| MICS | Sierra Leone | 2005 | 1.5 |
| DHS | Swaziland | 2006/07 | 26.5 |
| DHS | Uganda | 2006 | 7.2 |
| DHS | United Republic of Tanzania | 2007/08 | 5.1 |
| DHS | Zambia | 2007 | 12.7 |
| DHS | Zimbabwe | 2005/06 | 14.7 |

Source: Joint United Nations Programme on HIV/AIDS (2012) HIV and AIDS estimates.

### DHS/AIS

The USAID-supported DHS programme collects a wide range of data on women, men and children in developing countries in the areas of population, health and nutrition. The household surveys are nationally and regionally representative. Modules on HIV and AIDS knowledge and awareness are included in most surveys, and HIV testing has been included in more than 50 surveys to date. Similar to DHS, AIS is a nationally representative household survey; however, AIS specifically allows measurement of indicators for monitoring national HIV/AIDS programmes.

## VARIABLES IN THE ANALYSIS

### Outcome variables

Several indicators for young and older children aged 0–17 are used in this analysis to reflect social or health outcomes associated with vulnerability that go beyond the previous UNAIDS definition of a vulnerable child (UNICEF and UNAIDS 2005). Table 2 below delineates the key outcomes used in this analysis for children under 5, 5–14-year-olds, 7–17-year-olds and 15–17-year-olds. These measures were selected because they reflect key outcomes along a child's developmental life cycle, taking into account data availability. All outcome measures utilized in the analysis are dichotomous (indicating either the presence or absence of a given outcome). A value of zero was assigned for children who did not exhibit the outcome in question, and a value of one was assigned to children who did exhibit the outcome.

#### *Child-level outcomes*

Children under the age of 5 are of particular importance because poor health outcomes at early ages can hinder children's growth and development for a lifetime. DPT is the combined diphtheria,

**TABLE 2:** Outcome measures

| Children (0–4 years) | Definition |
|---|---|
| DPT3 (1–4) | Child between the ages of 12–59 months who received DPT3 (regardless of when he or she received it)[5] |
| Fever treatment (0–4) | Child who had a fever in the two weeks prior to the survey was treated at a health facility |
| Slept under insecticide-treated mosquito nets (ITNs) (0–4) | Child slept under an ITN the night before the survey |
| Stunting (0–4)[6] | Child's height for age is below two standard deviations from the mean of healthy children using the WHO Child Growth Standard reference population |
| Birth registration (0–4) | Child's birth is registered |
| **Children (5–17 years)** | |
| School attendance (7–17) | Child attended school in the past year |
| Child labour (5–14) | Child has done any kind of work for someone who is not a member of the household in the past week |
| **Female adolescents (15–17 years)** | |
| Early sexual debut (15–17) | Sexual debut occurred before age 15 |
| Early marriage (15–17) | Marriage or union occurred before age 18 |

5 DPT3 vaccination was identified by 1) the date of DPT3 on the immunization card; or 2) DPT3 marked on card with no date; or 3) mother's report on card with the actual card; or 4) mother's report of vaccination with no card.

6 For Cambodia, Rwanda, Swaziland, Uganda, Zambia and Zimbabwe, there were high percentages of missing values. In Uganda, only in one of three households selected for the survey were children's (<5 years) height and weight measurements taken. In Cambodia and Rwanda, children's height and weight measurements were only taken in one of two households selected for the survey. Swaziland, Zambia and Zimbabwe have a high percentage of missing values, because for a large percentage of children, data linking them to households were missing, and thus these data could not be included in this analysis.

pertussis and tetanus vaccine. The third dose, DPT3, though not a health outcome, is an indicator of routine immunization completion. Fever treatment reflects whether a child who had a fever in the two weeks prior to the survey was treated at a health facility or by a health provider. Whether a child slept under an insecticide-treated net (ITN) the night before reflects a reduced risk of illness; ITNs have been shown to reduce the number of deaths among young children by 20 per cent and are an important component of malaria prevention (Lengeler 2009). A child's growth is considered to be stunted if his or her height for age is below two standard deviations from the mean of healthy children using the WHO Child Growth Standard reference population (WHO Multicentre Growth Reference Study Group 2006). Finally, the indicator of birth registration, though not a health outcome, can remove barriers to basic health and education services. A child who is registered at birth is counted and has rights to services.

### *Child- and adolescent-level outcomes*

Millennium Development Goal (MDG) 2 is to achieve universal primary education. School attendance in the past year among 7–17-year-olds is a mechanism associated with poverty reduction, gender equality and lower mortality rates (UNICEF 2005). Child labour reflects both a cause and consequence of social inequities reinforced by discrimination, and may reinforce intergenerational poverty cycles. This indicator reflects whether a child has done any kind of work for someone who is not a member of the household in the past week.

Early sexual debut among 15–17-year-olds puts female adolescents at risk for teen pregnancy and sexually transmitted infections. Child marriage is a violation of human rights, and compromises the development of girls. It can lead to early pregnancy and social isolation, and poor future health outcomes. Like early sexual debut, child marriage is also linked to not attending school, and to higher maternal and child mortality rates (UNICEF 2009).

### Explanatory variables

A set of analytical variables is used in the regression analyses. These analytical or background variables include age, sex, wealth quintile ranking of the household, child's living arrangements, presence of an adult member in the household who has been sick for three or more months in the past year, education level of any adult in the household, household dependency ratio, and orphanhood status. The analytical variables are defined in Table 3 (pg. 11).

**TABLE 3:** Definitions of analytical variables

| Variable name | Variable definition |
|---|---|
| **Child variables** | |
| Age | Age of child |
| Sex | Male |
| | Female (reference) |
| **Household-level variables** | |
| Household wealth quintiles | |
| Wealth Quintile 1 (reference) | Household is in the lowest wealth quintile. |
| Wealth Quintile 2 | Household is in the second lowest wealth quintile. |
| Wealth Quintile 3 | Household is in the middle wealth quintile. |
| Wealth Quintile 4 | Household is in the second highest wealth quintile. |
| Wealth Quintile 5 | Household is in the highest wealth quintile. |
| Household dependency ratio | |
| Low household dependency ratio <1 (reference) | Household dependency ratio is less than one.[7] |
| High household dependency ratio or no household member aged 15–64 | Household dependency ratio is greater than one or there are no adults of working age in the household. |
| Household health | |
| No adult sick (reference) | No adults in the household have been sick for 3 or more months in the past 12 months. |
| Adult sick in household | An adult in the household was sick for 3 or more months in the past 12 months. |
| Sex of household head | |
| Male-headed household (reference) | Household is headed by a male |
| Female-headed household | Household is headed by a female |
| Household education | |
| At least one adult in household had primary or higher-level education (reference) | At least one adult (18 years and older) in the household has received some education. |
| No education among all adults in household | None of the adults (18 years and older) living in the household has received any education. |
| **Orphaning variable** | |
| Both parents alive (reference) | Both parents are alive. |
| Single orphan | One parent is dead and one parent is alive. |
| Double orphan | Both parents are dead. |
| **Living arrangements variable** | |
| Lives with one or both parents (reference) | The child lives with one or both parents. |
| Lives with other relatives or with no relatives | The child lives with other relatives or no relatives. |
| **Community variable** | |
| Rural | Relative to urban (reference). |

7 The household dependency ratio is the ratio of adults over age 64 and children under age 15 to adults age 15–64.

## STATISTICAL METHODS

Descriptive statistics indicate the unadjusted averages for each outcome and analytical variables, by country. The descriptive summaries were generated using the survey commands svy in Stata 12 (StataCorp 2011), which account for the multi-stage survey designs.

Data were pooled for 11 countries and were analysed using bivariate and multivariate methods. The number of countries with available data varied by outcome measure. The inclusion of countries in the pooled analysis was determined by whether a given outcome variable was measured in the country's survey for this analysis. For example, whether a child slept under an ITN was not measured in Haiti's 2005–2006 DHS, and therefore Haiti could not be included in the pooled analysis for this outcome measure. Table 4 below indicates which country surveys were included in the pooled analysis, by outcome variable.

In the bivariate analysis, key measures of vulnerability for children were compared by key background characteristics (i.e., analytical variables) described in Table 3 (pg. 11). Assessments of statistically significant differences (at the $p<0.05$ level) were made using chi-squared tests (results not included here). Multivariate analysis using logistic regression containing nine sets of analytical variables was undertaken to provide controls that allow for the quantification of the strength of associations between analytical and outcome variables, while controlling for other characteristics.

The regression results are presented as odds ratios (OR) with standard errors and p-values. Country variables were included in all models as fixed effects, in order to control for country-specific unobserved effects. Standard errors are clustered at the primary sampling unit level in order to account for the multi-stage survey designs. Assessments of statistical significance were made at 0.05 level.

The analyses presented herein are based on an analytical sample. Children for whom data were missing for any of the independent

**TABLE 4:** Countries included in pooled analysis, by outcome variable

| Countries/Survey | Central African Republic, MICS | Haiti, DHS | Cambodia, DHS | Malawi, MICS | Rwanda, DHS | Sierra Leone, MICS | Swaziland, DHS | United Republic of Tanzania, AIS | Uganda, DHS | Zambia, DHS | Zimbabwe, DHS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Children age 0–4 | | | | | | | | | | | |
| Birth registration | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Received DPT3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ |
| Stunting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ |
| Fever treatment | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Slept under ITN | ✓ | × | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Children age 5–14 | | | | | | | | | | | |
| Child labour | ✓ | × | × | ✓ | × | ✓ | × | × | × | × | × |
| Children age 7–17 | | | | | | | | | | | |
| Ever attended school in the past year | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Children age 15–17 | | | | | | | | | | | |
| Sex before age 15 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Married or in union before age 18 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

✓ = Outcome was included in the pooled analysis
× = Not included in pooled analysis, as outcome data were not collected in the respective surveys

or dependent variables were not included in the models.

## LIMITATIONS OF THE ANALYSIS

Although both MICS and DHS are widely considered to be reliable and high-quality sources of population and health information, they also have limitations. One major limitation is that the surveys do not include any children who live outside households and therefore do not provide representative estimates for all orphans, but only orphans living in households. Some of the most vulnerable children are those living outside the family environment, which will not be captured in these surveys. This is an important distinction when considering targeting of new programmes.

Moreover, HIV status was not available in all of the surveys selected for this report, and where it was, the sample size was not always large enough for the purposes of this study. There is a strong likelihood that some children who have lost one or both parents, due to AIDS-related illnesses, are HIV-positive themselves. The HIV status of these children can affect their physical health and cognitive development. Biomarkers on the HIV status of children, however, were only available for one country included in the analysis (Swaziland 2006–2007). Due to the lack of data the HIV status of children could not be accounted for, and this may be a severe limitation.

Another limitation is the use of the wealth index to classify the relative wealth of the survey populations. The wealth indices are survey-specific, relative indicators of overall asset ownership, which serves as a proxy for wealth or poverty. However, the index is often biased towards urban areas (which may appear to be wealthier or better off than rural areas) and may not correlate precisely with poverty as measured from consumption or expenditures. Despite these limitations, the assets index has been proven to be a highly useful proxy of wealth (Filmer and Scott 2012).

In addition, though they were selected for comparability and represent a range of measures throughout a child's life course, the outcomes and variables used for this analysis are confined to those available in the DHS, MICS and AIS data sets.

Furthermore, the role of social norms and socio-economic determinants of child outcomes, including those that shape gender roles, local understandings of childhood, and discrimination based on gender, ethnicity and religion, cannot be measured in a survey instrument such as the MICS, DHS or AIS. These may have important influences on both the outcomes and determinants of vulnerability.

Finally, while household survey data provide rich and extensive data on households, the survey data used are cross-sectional for each country. It is not known, for example, the age at which a child was orphaned, or the previous household living conditions of the orphan. Orphanhood status and living arrangements may have changed before – or after – the

critical period of the outcomes analysed in this study. It is not known whether the orphan status preceded the malnutrition, or occurred afterward. The duration of the current living arrangement is not known, nor is the timing of the acquisition of assets of the household. And though the directly measured indicator was not used for this analysis, HIV status itself cannot be situated in the life history of children or their parents, or in household members, as there is no way to know when the virus was contracted among those who are HIV-positive. Therefore, assumptions are made, and the results presented here can only inform us of the associations between these outcomes and selected determinants, regardless of timing of events.

Despite these limitations, the high-quality population-based data provide insights into the associations between indicators of vulnerability (including vulnerability due to HIV) and health and social well-being outcomes.[8]

8 Countries are encouraged to carry out their own analysis with more context specific data.

# RESULTS

This section includes descriptive statistics on the prevalence of orphanhood and adult chronic illness in the household, adult HIV prevalence, and data on the child outcomes analysed for the country surveys included in the analysis.

Figure 1 (pg. 15) presents the countries where orphaning has been measured for children aged 0–17 for the latest available survey for each country. The percent of children orphaned ranges from 8.8 per cent in Cambodia to more than 23.9 per cent in Zimbabwe. Rwanda, Swaziland and Zimbabwe all have orphan prevalence rates that exceed 20 per cent.

In terms of chronic illness, the percent of children aged 0–17 who live in a household where at least one adult has been chronically ill in the past 12 months (as measured in the latest available survey) ranges from 3.6 per cent in Zambia to 13.7 per cent in Sierra Leone, and in 9 of 11 countries it is less than 10 per cent (see Figure 2, pg 15).

Table 5 (pg. 16) presents adult HIV prevalence in addition to the most recent data on the outcome variables by country. Adult HIV prevalence ranges from 0.8 per cent in Cambodia to 26.5 per cent in Swaziland. Birth registration is high in Haiti (81.1 per cent), Rwanda (82.4 per cent) and Zimbabwe (73.9 per cent); moderate in the Central African Republic (49.2 per cent), Sierra Leone (47.8 per cent) and Cambodia (66.4 per cent); and low in Swaziland (29.8 per cent), the United Republic of Tanzania (21.8 per cent), Uganda (21 per cent) and Zambia (14 per cent). DPT3 uptake is moderate to high in most countries (62–92 per cent); however, in Haiti (47.9 per cent) and especially the Central African Republic, DTP3 (33.5 per cent) uptake is still low. Across all countries for which data are available, there continue to be substantial proportions of children aged 0–4 who are stunted. The prevalence of stunting ranges from 23.8 per cent in Haiti to 46 per cent in Malawi. The per cent of children who had a fever in the two weeks prior to the survey who were taken to a health facility is low in Zimbabwe (24.5 per cent), Cambodia (25.2 per cent) and Rwanda (26.3 per cent). The per cent of children who received fever treatment was highest in Zambia (62.4 per cent) and Uganda (68.9 per cent). Children (0–4 years) were most likely to have slept under an ITN the night previous to the survey in Zambia (28.5 per cent) and the United Republic of Tanzania (33.6 per cent), while only 2.9 per cent of children in Zimbabwe and 0.6 per cent of children in Swaziland slept under ITNs.

Data on child labour were not available for most countries. However, nearly 50 per cent of children aged 5–14 years in the Central African Republic and Sierra Leone, and more than 25 per cent of children in Malawi had done some form of work for someone who was not a member of their household in the week

prior to the survey. The percent of children aged 7–17 years who attended school in the past year ranges from 70 per cent to 88 per cent in most countries, with the exception of Central African Republic (59.8 per cent). The per cent of female adolescent aged 15–17 years who had sex before age 15 was lowest in Cambodia (0.5 per cent) and highest in Sierra Leone (28.2 per cent). The per cent of female adolescents aged 15–17 years who were married or in union by age 18 exceeds 10 per cent in four countries – Zimbabwe (11.3 per cent), Malawi (14.5 per cent), Sierra Leone (23.1 per cent) and the Central African Republic (44.5 per cent).

**FIGURE 1** **Per cent of children aged 0–17 who have lost one or both parents as measured at latest available survey, AIS, DHS or MICS 2005–2008.**

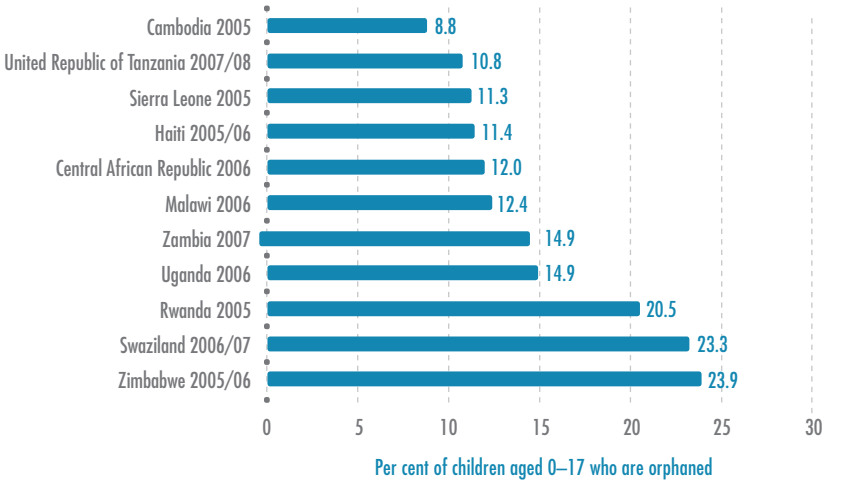
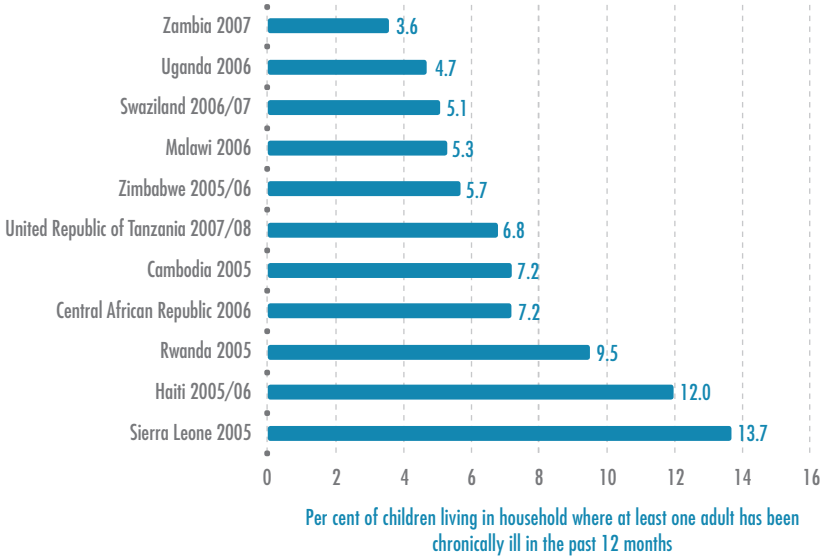



**FIGURE 2** **Per cent of children aged 0–17 who live in a household where at least one adult has been chronically ill in the past 12 months as measured at latest available survey, AIS, DHS or MICS 2004–2007.[9]**




## DESCRIPTIVE RESULTS

The distributions of variables for each outcome in the pooled analysis are presented in Table 6 (pg. 17). Samples are broadly divided into four age bands: under 5 years; 5–14 years; 7–17 years; and 15–17 years. In a number of countries for which HIV testing was included in the survey from a sub-sample of households, a variable was created to indicate the presence of at least one HIV-positive adult in the household. This variable, however, was not included in the multivariate regression, because this measurement is not available for all countries. With regard to orphan status, Table 6 presents the distribution by three categories (both parents alive; one parent alive; both parents dead). Given the small percentage of children falling into the category of having both parents deceased, single and double orphanhood were combined into one category for the multivariate analysis.

For children under 5 years of age, about 50 per cent had their births registered. Among children who had fever in the two weeks prior to the survey, less than 50 per cent were treated at a health facility.

9 Data presented in Figure 2 were taken from published AIS, DHS and MICS reports (2004–2007) for all countries, except Cambodia. For Cambodia, these data were not included in the published country report, and were therefore calculated by the UNICEF study team.

## TABLE 5: Adult HIV prevalence and percentages of children exhibiting given outcomes by country, AIS, DHS, MICS, 2005–2008

| Country | Central African Republic, MICS, 2006 | Malawi, MICS 2006 | Sierra Leone, MICS, 2005 | Haiti, DHS 2005/06 | Rwanda, DHS 2005 | Swaziland, DHS 2006/07 | United Republic of Tanzania, AIS 2007/08 | Uganda, DHS 2006 | Zambia, DHS 2007 | Zimbabwe, DHS 2005/06 | Cambodia, DHS 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult HIV prevalence (adults aged 15–49) 2012* | 4.2 | 10.8 | 1.5 | 2.1 | 2.9 | 26.5 | 5.1 | 7.2 | 12.7 | 12.7 | 0.8 |
| Per cent of children aged 0–4 years whose birth is registered | 49.2 | n.d. | 47.8 | 81.1 | 82.4 | 29.8 | 21.8 | 21.0 | 14.0 | 12.7 | 66.4 |
| Number of observations | 9,585 | n.d. | 5,245 | 6,000 | 8,123 | 3,219 | 7,488 | 8,398 | 6,341 | 12.7 | 7,793 |
| Per cent of children under age 5 who received DPT3 | 33.5 | 86.4 | n.d. | 47.9 | 87.0 | 91.7 | n.d. | 63.9 | 79.7 | 12.7 | 78.3 |
| Number of observations | 1,844 | 5,080 | n.d. | 1,135 | 1,626 | 531 | n.d. | 1,590 | 1,272 | 12.7 | 1,517 |
| Per cent of children aged 0–4 years who is stunted | 28.3 | 46.0 | 40.1 | 23.8 | 45.0 | 28.9 | n.d. | 38.1 | 45.4 | 12.7 | 37.3 |
| Number of observations | 5,873 | 20,404 | 4,135 | 2,841 | 3,859 | 2,940 | n.d. | 2,687 | 5,602 | 12.7 | 3,587 |
| Percent of children aged 0–4 years taken to health facility following fever | 33.0 | 43.0 | 48.9 | 40.0 | 26.3 | 58.0 | 59.9 | 68.9 | 62.4 | 12.7 | 25.2 |
| Number of observations | 1,964 | 7,914 | 1,782 | 1,502 | 1,884 | 2,553 | 1,141 | 2,670 | 951 | 12.7 | 2,573 |
| Per cent of children aged 0–4 years who slept under an ITN the previous night | 46.5 | 25.7 | 48.3 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | 12.7 | 4.2 |
| Number of observations | 9,585 | 22,994 | 5,245 | n.d. | 7,534 | 3,268 | 7,514 | 8,402 | 6,247 | 5,751 | 7,178 |
| Per cent of children aged 5–14 years who has done any kind of work for someone who is not a member of the household in the past week | 46.5 | 25.7 | 48.3 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| Number of observations | 15,362 | 40,326 | 12,776 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| Per cent of children aged 7–17 years who attended school in the past year | 59.8 | 85.1 | 70.7 | 84.7 | 76.4 | 88.4 | 79.5 | 87.2 | 82.1 | 86.0 | 80.0 |
| Number of observations | 12,931 | 36,914 | 11,469 | 13,604 | 13,090 | 6,562 | 13,059 | 14,227 | 10,439 | 12,416 | 21,585 |
| Per cent of females aged 15–17 years who had sex before age 15 | 25.8 | n.d. | 28.2 | 14.3 | 5.3 | 7.8 | 11.2 | 11.6 | 13.2 | 4.0 | 0.5 |
| Number of observations | 1,155 | n.d. | 568 | 1,606 | 1,464 | 788 | 2,567 | 1,128 | 941 | 1,143 | 2,299 |
| Per cent of females aged 15–17 years who were married or in union by age 18 | 44.5 | 14.5 | 23.1 | 9.0 | 0.5 | 0.4 | 5.6 | 8.9 | 8.8 | 11.3 | 3.8 |
| Number of observations | 1,125 | 2,621 | 564 | 1,608 | 1,464 | 1,274 | 2,567 | 1,129 | 942 | 1,144 | 2,300 |

Source: Joint United Nations Programme on HIV/AIDS (2012) HIV and AIDS estimates; DHS/AIS/MICS surveys 2005–2008.

## TABLE 6: Descriptive statistics of outcome and analytical variables for pooled data from 11 countries in the study

| Outcome variables | | Birth registration Age <5 | Received DPT3 Age 1–4 | Stunting Age <5 | Fever treatment Age <5 | Slept under ITN Age <5 | Child labour Age 5–14 | Ever attended school in the past year Age 7–17 | Sex before age 15 Age 15–17 | | Married or in union before age 18 Age 15–17 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Male | Female | Male | Female |
| Per cent | | 51.1 | 70.7 | 42.8 | 44.0 | 16.4 | 20.0 | 80.1 | 12.9 | 10.1 | 0.01 | 10.7 |
| **Analytical variables (in per cent)** | | | | | | | | | | | | |
| **Child characteristics** | | | | | | | | | | | | |
| Sex | Male | 49.9 | 49.9 | 49.6 | 49.6 | 49.8 | 49.4 | 50.0 | N/A | N/A | N/A | N/A |
| Age | 12-23 months | | 27.3 | | | | | | | | | |
| | 24-35 months | | 26.3 | | | | | | | | | |
| | 36-47 months | | 24.9 | | | | | | | | | |
| | 48-59 months | | 21.6 | | | | | | | | | |
| | <1 | 21.2 | | 21.5 | 22.5 | 21.4 | | | | | | |
| | 1 | 20.0 | | 21.2 | 25.9 | 20.4 | | | | | | |
| | 2 | 19.9 | | 20.1 | 21.8 | 20.4 | | | | | | |
| | 3 | 19.9 | | 19.9 | 17.2 | 19.8 | | | | | | |
| | 4 | 19.1 | | 16.7 | 12.6 | 18.0 | | | | | | |
| | 5-9 | | | | | | 55.1 | | | | | |
| | 7-9 | | | | | | | 30.8 | | | | |
| | 10-14 | | | | | | 44.9 | 48.4 | | | | |
| | 15-17 | | | | | | | 20.8 | | | | |
| | 15 | | | | | | | | | 35.9 | | 35.9 |
| | 16 | | | | | | | | | 34.6 | | 34.6 |
| | 17 | | | | | | | | | 29.5 | | 29.4 |
| **Household characteristics** | | | | | | | | | | | | |
| Wealth | Lowest quintile | 24.1 | 23.7 | 22.9 | 24.7 | 23.4 | 21.0 | 21.0 | | 17.1 | | 17.1 |
| | Second quintile | 21.9 | 21.8 | 22.1 | 22.2 | 21.7 | 20.3 | 19.8 | | 17.4 | | 17.4 |
| | Third quintile | 20.3 | 20.4 | 21.1 | 21.1 | 20.5 | 19.9 | 20.1 | | 18.9 | | 18.9 |
| | Fourth quintile | 18.8 | 18.7 | 18.9 | 18.8 | 18.9 | 19.9 | 20.0 | | 22.0 | | 22.0 |
| | Highest quintile | 15.0 | 15.4 | 15.0 | 13.2 | 15.5 | 18.9 | 19.1 | | 24.5 | | 24.5 |
| Adult sick in household for three+ months in past year | Adult sick in household | 6.3 | 6.1 | 5.8 | 7.7 | 5.5 | 7.0 | 7.0 | | 6.5 | | 6.5 |
| HIV-positive adult in household* | At least one adult HIV-positive | 19.3 (n=25239) | 20.3 (n=14019) | 21.1 (n=19036) | 15.6 (n=4935) | 21.2 (n=22844) | N/A | 19.4 (n=48190) | | 17.5 (n=6188) | | 17.5 (n=6192) |
| Sex of household head | Female | 23.2 | 21.5 | 22.5 | 20.9 | 20.8 | 24.4 | 29.5 | | 30.9 | | 30.9 |
| Highest education level of any adult in household | No adult age 18 and over had education | 13.9 | 13.2 | 12.2 | 13..4 | 12.1 | 22.4 | 15.5 | | 11.8 | | 11.8 |
| | Highest education is primary level+ | 86.1 | 86.8 | 87.8 | 86.6 | 87.9 | 77.6 | 84.5 | | 88.2 | | 88.2 |
| Household dependency ratio | Dependency ratio greater than 1 or No adult age 15–64 in household | 56.2 | 56.5 | 53.3 | 52.9 | 54.7 | 67.1 | 56.0 | | 25.1 | | 25.1 |
| *Number of adults over age 64 and children under age 15 to adults age 15–64 | Dependency ratio less than 1 | 43.8 | 43.5 | 46.7 | 47.1 | 45.3 | 32.9 | 44.0 | | 74.9 | | 74.9 |
| Orphan status | Both biological parents alive | 95.6 | 96.2 | 95.8 | 96.6 | 95.7 | 85.1 | 79.4 | | 74.1 | | 74.2 |
| | Only one parent alive | 4.0 | 3.6 | 3.8 | 3.2 | 3.9 | 11.9 | 16.2 | | 19.8 | | 19.8 |
| | Both biological parents dead | 0.4 | 0.2 | <0.1 | 0.2 | 0.4 | 3.0 | 4.4 | | 6.0 | | 6.0 |
| Living arrangement | Lives with one or both parents | 92.3 | 95.1 | 93.8 | 96.2 | 93.3 | 78.4 | 75.3 | | 65.8 | | 65.9 |
| | Lives with other relatives or with no relatives | 7.7 | 4.9 | 6.2 | 3.8 | 6.7 | 21.6 | 24.7 | | 34.2 | | 34.1 |
| **Community characteristics** | | | | | | | | | | | | |
| Place of residence | Urban | 27.2 | 24.4 | 23.9 | 21.7 | 22.1 | 27.2 | 25.1 | | 28.8 | | 28.8 |
| **Number of observations** | | **67,579** | **58,828** | **59,410** | **23,322** | **84,761** | **66,559** | **166,296** | | **16,213** | | **16,186** |

Note: For the variable 'HIV-positive adult in household', the denominators are different because HIV testing was undertaken on a sub-sample of respondents, and are shown in parentheses below the percentages.

Less than 20 per cent of children under age 5 had slept under an ITN the night before the survey.

Among children aged 5–14, one out of five had worked for someone outside the household in the past week, and among school-aged children 7–17 years old, the majority (80 per cent) had attended school in the past year.

About 13 per cent of adolescent boys and 10 per cent of adolescent girls (aged 15–17) had first sex before age 15. In terms of early marriage, more than 10 per cent of girls and less than 1 per cent of boys had married or were in union before the age of 18.

## LOGISTIC REGRESSION RESULTS

Logistic regression models were run for each outcome and by country, and also pooled for all of the countries. Only pooled results are presented in this report. Individual country results will be presented in a separate complementary report. The associations between the main outcomes and the key analytical variables are described in Table 7 (pg. 19).

### Determinants of birth registration

Among children under 5, those living in a household with no educated adults were about 30 per cent less likely to be registered. The likelihood of birth registration increases with household wealth quintile. Children living in the wealthiest households were more than three times more likely to have been registered than children living in the poorest households. Children under 5 were 10 per cent less likely to be registered if they had lost one or both parents, and 30 per cent less likely to be registered if they lived with anyone other than their parents compared with children living with one or both parents.

### Determinants of DPT3

The odds of having received DPT3 vaccine increase with each household wealth quintile. Children living in the wealthiest households are 70 per cent more likely to have received the vaccination as compared with children living in the poorest households. The odds of having received the DPT3 vaccine among children who lived in households with uneducated adults were 30 per cent lower compared with the odds among children who lived in households where at least one adult had any education, and 10 per cent lower among children who lived in households with a chronically ill adult as compared with children living in households with no chronically ill adult.

Children under 5 experienced 30 per cent lower odds of having their DPT3 vaccine if they were living with other relatives or non-relatives, compared with those living with any parent. Orphans experienced 20 per cent lower odds than non-orphans of having received the DPT3 vaccine.

### Determinants of stunting

Household wealth is a significant predictor of stunting. The odds of stunting among children living in the wealthiest households are 50 per cent lower compared with children in households ranked in the lowest wealth quintile. Boys (age 0–4) have 20 per cent greater odds of being stunted as compared with girls (age 0–4). Children who lived in households with a chronically ill adult were 10 per cent more likely to be stunted as compared with children living in households with no chronically ill adult. Orphans are no more likely to be stunted as compared with non-orphans.

### Determinants of fever treatment

Children who lived in households where no adult in the household was educated were 20 per cent less likely to have been taken for fever treatment. The association of wealth quintile and fever treatment did not vary significantly, except among the top two wealth quintiles. Children living in households in the fourth economic quintile had 40 per cent greater odds and children in the highest quintile had 60 per cent greater odds of being taken for fever treatment, as compared with children in the poorest households.

### Determinants of sleeping under ITNs

Children who lived in households where no adult was educated were about 20 per cent less likely to have slept under an ITN compared with children who lived in households where at least one adult had some education. Children living with anyone other than their parents were about 30 per cent less likely to be sleeping under an ITN than those living with one or both parents. The likelihood of sleeping under an ITN increases with household wealth quintile. Children living in the wealthiest households experienced nearly three times greater odds of sleeping under at ITN than children in the poorest households.

## TABLE 7: Multivariate logistic regression odds ratios for pooled data, by outcome

| Outcome variables | | Birth registered | Received DPT3 Age 1–4 | Stunting Age <5 | Fever treatment Age <5 | Slept under ITN Age <5 | Child labour Age 5–14 | Ever attended school in the past year Age 7–17 | Sex before age 15 Age 15–17 | Married or in union before age 18 Age 15–17 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Analytical variables** | | | | | | | | | | |
| **Child characteristics** | | | | | | | | | | |
| Sex | Male | 1.0 (0.02) | 0.9 (0.03) | 1.2*** (0.02) | 1.0 (0.04) | 1.0 (0.02) | 0.9*** (0.02) | 1.2*** (0.02) | | |
| Age | 24–35 months (ref=12–23 months) | | 1.0 (0.04) | | | | | | | |
| | 36–47 months | | 0.9** (0.04) | | | | | | | |
| | 48–59 months | | 0.9*** (0.03) | | | | | | | |
| | Age 1 (ref=<1) | 1.7*** (0.05) | | 3.3*** (0.09) | 0.9 (0.04) | 0.9* (0.03) | | | | |
| | Age 2 | 1.9*** (0.06) | | 3.0*** (0.09) | 0.9 (0.06) | 0.8*** (0.02) | | | | |
| | Age 3 | 2.0*** (0.06) | | 3.0*** (0.09) | 0.8*** (0.03) | 0.8*** (0.02) | | | | |
| | Age 4 | 2.1*** (0.07) | | 2.5*** (0.08) | 0.7*** (0.04) | 0.7*** (0.02) | | | | |
| | Age 10–14 (ref= Age 5–9) | | | | | | 1.7*** (0.04) | | | |
| | Age 10–14 (ref= Age 7–9) | | | | | | | 1.8*** (0.03) | | |
| | Age 15–17 | | | | | | | 0.5*** (0.01) | | |
| | Age 16 (ref= Age 15) | | | | | | | | 0.9* (0.06) | 2.3*** (0.20) |
| | Age 17 | | | | | | | | 0.8** (0.06) | 6.0*** (0.50) |
| **Household characteristics** | | | | | | | | | | |
| Wealth | Second quintile (ref=lowest quintile) | 1.3*** (0.05) | 1.1** (0.04) | 0.9** (0.03) | 0.9 (0.05) | 1.3*** (0.06) | 1.1* (0.06) | 1.4*** (0.04) | 1.1 (0.09) | 0.8* (0.08) |
| | Third quintile | 1.5*** (0.06) | 1.3*** (0.05) | 0.9*** (0.02) | 1.1 (0.05) | 1.5*** (0.08) | 1.2** (0.06) | 1.8*** (0.05) | 1.0 (0.09) | 0.6*** (0.06) |
| | Fourth quintile | 2.1*** (0.10) | 1.5*** (0.07) | 0.8*** (0.02) | 1.4*** (0.09) | 1.7*** (0.09) | 1.0 (0.06) | 2.5*** (0.08) | 0.8* (0.08) | 0.4*** (0.04) |
| | Highest quintile | 3.2*** (0.20) | 1.7*** (0.15) | 0.5*** (0.02) | 1.6*** (0.10) | 2.8*** (0.16) | 0.7*** (0.05) | 0.9*** (0.15) | 0.6*** (0.06) | 0.1*** (0.02) |
| At least one adult sick in household for three+ months in past year | Adult sick in household | 1.0 (0.05) | 0.9* (0.05) | 1.1* (0.05) | 0.9 (0.60) | 0.9 (0.06) | 1.1* (0.07) | 0.9* (0.03) | 1.2 (0.13) | 1.0 (0.13) |
| Sex of household head | Female | 1.0 (0.03) | 1.1 (0.04) | 0.9** (0.02) | 1.1 (0.05) | 0.8*** (0.03) | 1.1 (0.04) | 1.3*** (0.03) | 0.9+ (0.06) | 0.5*** (0.04) |
| Education level of any adult in household | No adult age 18 and over had education (ref=At least one adult in household had primary-level education) | 0.7*** (0.03) | 0.7*** (0.03) | 1.2*** (0.04) | 0.8*** (0.04) | 0.8** (0.05) | 0.8*** (0.04) | 0.4*** (0.01) | 1.1 (0.09) | 1.0 (0.10) |
| Household dependency ratio | Dependency ratio greater than 1 (ref= <1 or no adult age 15–64 in household) | 1.0 (0.02) | 0.9** (0.05) | 1.1*** (0.02) | 0.8*** (0.03) | 0.9*** (0.02) | 0.9 (0.03) | 1.0+ (0.02) | 1.0 (0.06) | 0.7*** (0.05) |
| Orphan status | Only one parent alive or both parents dead (ref= not orphan) | 0.9* (0.05) | 0.8** (0.05) | 1.0 (0.05) | 0.9 (0.08) | 0.9 (0.06) | 1.2*** (0.05) | 0.9*** (0.02) | 1.1 (0.07) | 0.8*** (0.06) |
| Living arrangement | Lives with anyone other than parents (i.e., other relatives or non-relatives) (ref= lives with parents) | 0.7*** (0.03) | 0.7*** (0.03) | 1.06 (0.04) | 0.9 (0.07) | 0.7*** (0.04) | 0.9* (0.03) | 0.7*** (0.01) | 1.8*** (0.11) | 7.2*** (0.53) |
| **Community characteristics** | | | | | | | | | | |
| Place of residence | Urban | 1.3*** (0.06) | 1.1 (0.06) | 0.9** (0.03) | 1.3*** (0.10) | 1.3*** (0.07 | 0.9* (0.06) | 1.0 (0.03) | 1.1 (0.08) | 1.3** (0.11) |
| **Number of observations** | | **67,579** | **58,828** | **59,410** | **23,322** | **84,761** | **66,559** | **166,296** | **16,213** | **16,186** |

Exponentiated coefficients; and standard errors in parentheses; + p < 0.10; * p < 0.05; ** p < 0.01; ***p < 0.001.
Fixed effects for surveys were included in all models; standard errors clustered at survey cluster level to account for multi-stage survey design.

### Determinants of child labour

Males were slightly less likely to work than females and older children were more likely to have worked than younger children. Children (ages 5–14) were about 20 per cent less likely to work if they lived in a household where no adults in the household were educated. But, if an adult in the household was sick for three or more months of the past year, children had 10 per cent greater odds of working compared with a child living in a house with no sick adult. Children in the wealthiest households were less likely to be working compared with children living in the poorest households, while children in the second and third economic quintiles were more likely to be working than children in the poorest quintile.

Orphans are 20 per cent likely to work outside the home compared with non-orphans. Children living with those other than their parents are slightly less likely to work than those living with one or both parents.

### Determinants of school attendance

If no adults in the household are educated, children are about 60 per cent less likely to attend school compared with counterparts living in households where at least one adult has some education. The odds for males attending school are about 20 per cent higher than the odds for females. Those 7–17-year-olds living in a household where an adult was sick for more than three months in the past year were 10 per cent less likely to have attended school in the past year, compared with children who lived in households where an adult was not sick. The wealthier the household, the greater the odds that the child attended school in the past year. The odds of attending school were nearly four times greater for those living in the wealthiest households as compared with those in the poorest households.

Orphans were 10 per cent less likely to have attended school compared with children whose parents are alive. Children living with anyone besides their parents experience 30 per cent lower odds of having attended school compared with children living with one or both parents.

### Determinants of early sexual debut

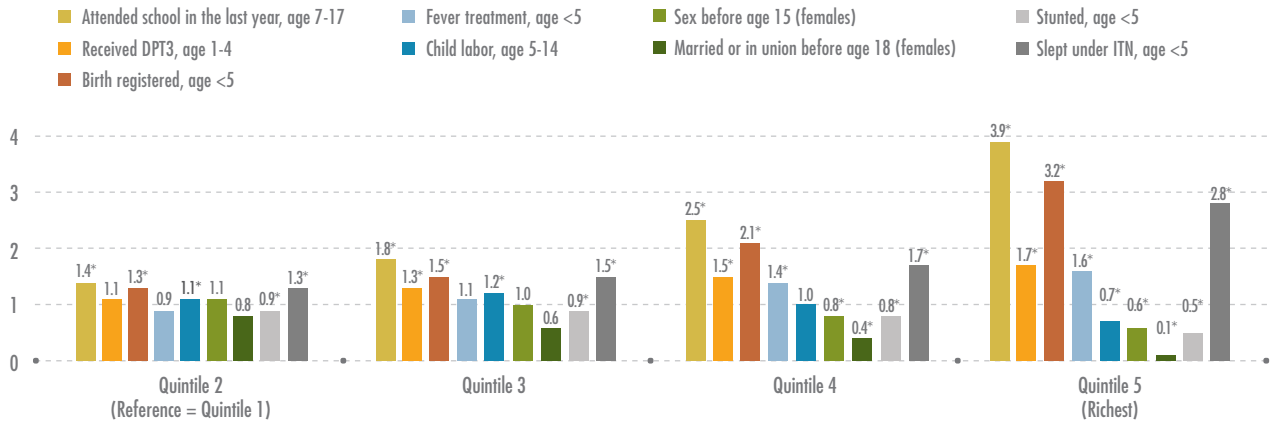
Female adolescents living in the wealthiest households were 40 per cent less likely to have experienced sexual debut before age 15 compared with the female adolescents in the poorest households. Female adolescents living with other relatives or no relatives had almost double the odds of experiencing sex before age 15 compared with adolescents who lived with one or both parents.

### Determinants of early marriage

Across all quintiles, the odds of early marriage among female adolescents were significantly lower compared with the poorest group. Those living in the wealthiest households were 90 per cent less likely to be married before age 18 than those living in poorest households.

The odds of early marriage were more than seven times greater for adolescents living with other relatives or no relatives compared with those living with one or both parents. On the other hand, orphans were less likely to marry early compared with non-orphans.

**FIGURE 3** Odds ratios on effects of wealth ranking on selected young and older children (0–17 years) outcomes (reference: lowest wealth quintile)

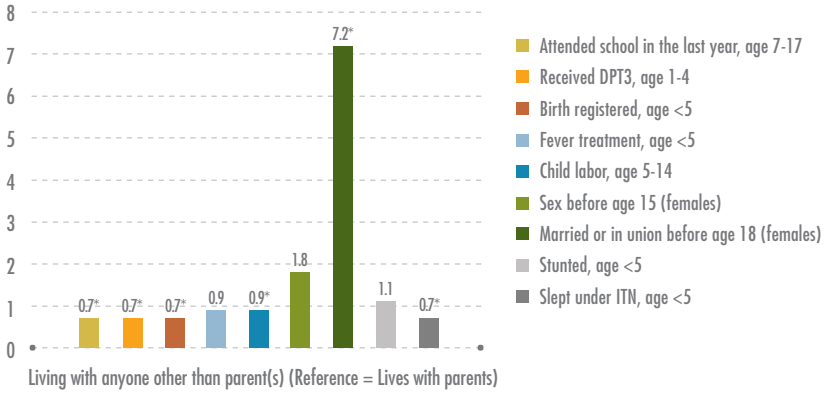



* Indicates statistical significance at p<0.05.

## SUMMARY BY BACKGROUND CHARACTERISTICS

These results indicate that household wealth, a child's living arrangements and household adult education are the most powerful and consistent factors associated with key outcomes of child vulnerability. Orphanhood and adult chronic illness are also significant for some outcomes. The graphs illustrate the odds for each background characteristic by outcome.

**FIGURE 4** Odds ratios on effects of a child's living arrangements on selected young and older children (0–17 years) outcomes (reference: lives with parents)




* Indicates statistical significance at p<0.05.

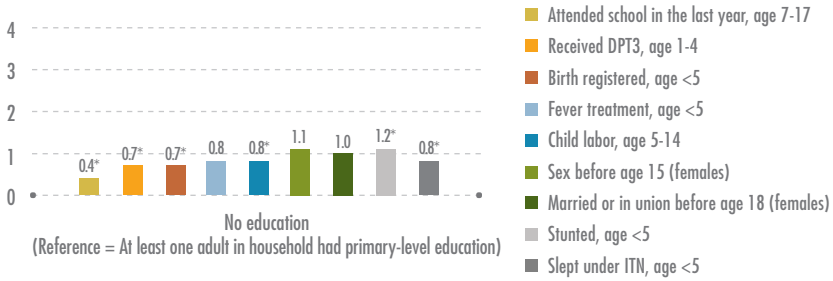
### Wealth

Household asset index ranking (relative for each country) is significantly associated with greater odds of attending school, birth registration, DPT3 and sleeping under an ITN. Household wealth is significantly associated with fever treatment for children among the top two wealth quintiles. Children living in the wealthiest households are significantly less likely to be engaged in child labour as compared with children in the poorest households. Only in the fourth and fifth quintiles are female adolescents significantly less likely to engage in early sex when compared with female adolescents in the poorest households. The odds of marrying before age 18 drops with each increase in wealth ranking compared with the poorest households. (see Figure 3)

### Living arrangements

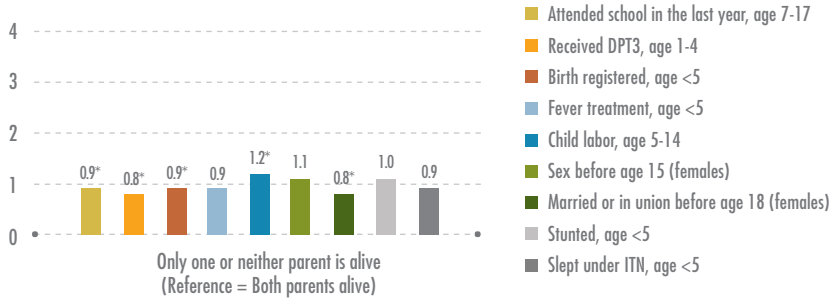
Children living with anyone other than parents have significantly lower odds of school attendance, child labour, birth registration, DPT3 and sleeping under at ITN. The odds of early sexual debut and early marriage are significantly greater for female adolescents living with those other than their parents as compared with those living with one or both parents. (see Figure 4)

**FIGURE 5** Odds ratios for effects of lack of adult education in the household on selected young and older children (0–17 years) outcomes (reference: at least one adult in the household had primary-level education)



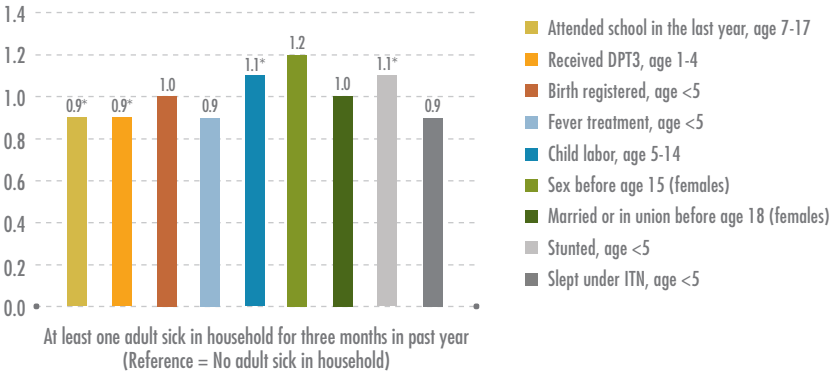

* Indicates statistical significance at p<0.05.

**FIGURE 6** Odds ratios on effects of orphanhood status on selected young and older children (0–17 years) outcomes (reference: both parents alive)




* Indicates statistical significance at p<0.05.

**FIGURE 7** Odds ratios on effects of living in a household with at least one sick adult for three months in past year on selected young and older children (0–17 years) outcomes (reference: no adult sick in household)




* Indicates statistical significance at p<0.05.

## Education of adults

Lack of education of adults in the household is significantly associated with lower odds of attending school, child labour, birth registration, fever treatment, sleeping under ITNs, and having received DPT3 as well as greater odds of stunting. There was no significant association between the lack of education amongst adults in the household and early marriage or early sex among female adolescents. (see Figure 5)

## Orphanhood status

Orphans are less likely to attend school and more likely to be engaged in child labour compared with non-orphans. Orphans are also less likely to have their births registered and to have received DPT3 vaccine. Orphans have no different odds of early sexual debut compared with non-orphans, and orphans are less likely to be married or in union before age 18 compared with non-orphans. (see Figure 6)

## Adult chronic illness

Living with an adult who had been sick for three or more months in the past year is significantly associated with lower odds of school attendance and DPT3 and higher odds of child labour and stunting. (see Figure 7)

# DISCUSSION AND RECOMMENDATIONS

The results of this study further validate the results of the Akwara et al. (2010) study by using a new set of country data, as well as additional social and health outcomes for children, including pooling data sets with fixed country effects, separating orphanhood status from living arrangements and clustering the standard errors of model estimates to account for the survey designs. These results indicate that household wealth, a child's living arrangements and household adult education are the most powerful and consistent factors associated with key outcomes of child vulnerability. In addition, both orphanhood status and the presence of a chronically ill adult are significant for some outcomes. Orphanhood is significant for school attendance, child labour, birth registration and DPT3 vaccine, and living with a chronically ill adult in the household is significant for DPT3, stunting, child labour and school attendance.

Of the five criteria identified by the UNAIDS Monitoring & Evaluation Reference Group (2005), orphanhood status and whether an adult in the household was sick for 3 of the past 12 months were included in this analysis. Neither is a consistent determinant of vulnerability, while both matter for some developmental outcomes.

Existing evidence, however, indicates that orphanhood continues to be a useful proxy for HIV- affectedness, particularly in high-prevalence settings. In Eastern and Southern Africa, for example, it is estimated that that nearly 40 per cent of all children who have lost one or both parents have been orphaned due to AIDS,[10] and HIV prevalence rates nine years earlier were found to be the biggest predictors of subsequent double orphan rates in sub-Saharan Africa (Belsey and Sherr 2011).

In addition, a recent systematic review and meta-analysis examining the association between orphan status and HIV risk in 10 studies (across 12 countries) found that orphaned youth (aged 24 years and younger) were nearly two times more likely to be HIV-positive and also exhibited higher levels of sexual risk behaviour than their non-orphaned peers (Operario et al. 2011).

Conversely, evidence linking the presence of a chronically ill adult in the household with HIV-affectedness is limited and will vary considerably by context. For the household survey data sets included in the current analysis (seven of which included data on the HIV status of adults), the percentage of chronically ill adults who were also HIV-positive was relatively small (<15 per cent in most countries), with the exception of Zimbabwe and Swaziland (results not shown). This suggests that adult chronic illness is not a useful proxy for AIDS-affectedness.

10 UNICEF analysis of UNAIDS 2012 HIV and AIDS unpublished estimates.

Child vulnerability is an issue that cuts across development programming and planning, including in the sectors of HIV and AIDS, health, child protection and social protection.

Plausible scenarios could explain the lack of consistent associations among orphanhood status and health outcomes. Firstly, it is well known that MICS and DHS represent the household population, and by definition only orphans who live in regular households would be included in the survey. Orphans who live in institutional or non-household settings will not be represented in these results. Furthermore, many programmes focused on HIV and AIDS and orphans and vulnerable children were not specifically targeting children living in the poorest households, and in many cases financial support may have followed orphans, including in wealthier households, and may have benefited more than orphans in poor households if they could not access the resources as effectively. Orphanhood appears to affect economic activity of the household (child labour and school attendance), which could explain why these outcomes are significantly associated with orphanhood status.

Child vulnerability is an issue that cuts across development programming and planning, including in the sectors of HIV and AIDS, health, child protection and social protection. Based on the results of the analysis, it is therefore proposed to redefine a vulnerable child that allows for contextualization and program flexibility. The refocused 'child vulnerability' definition that emerged out of this analysis uses a combination of the following four variables: children who (1) live in a household ranked in the bottom two wealth quintiles; (2) are not living with either parent; (3) have lost one or both parents; and (4) are living in a household with adults with no education. Using these variables, we formulated three groups of children with various vulnerability characteristics, with household wealth status being the main variable combined across all three groups.

One group of vulnerable children is characterized by consisting of children who are orphans (lost one or both parents) and live in a household ranked in the bottom two wealth quintiles. This is recommended as the narrower definition, which relates closely to child vulnerability in the context of HIV and AIDS. HIV is one of the main drivers of parental death, and poor households are least resilient to the economic impacts of increased morbidity and mortality. For HIV and AIDS global programme monitoring purposes, we recommend focusing on this aspect of vulnerability.

For overall child vulnerability, we recommend a broader definition that is HIV-sensitive (in that it is inclusive of HIV affected children), but is also inclusive of other equally vulnerable children who are not presently directly HIV-affected. The broader definition takes into account orphanhood and the other two variables, combined with household wealth status. That is, vulnerable children are those who: live in a household ranked in the bottom two wealth quintiles and who are: (1) not living with either parent; or (2) have lost one or both parents; or (3) living in a household with adults with no education. This wider definition

will be useful for broader developmental responses in health, child and social protection and education programmes.

The recommended definition of child vulnerability differs in several ways from the 2005 UNAIDS global definition in that it now excludes variables associated with chronic illness among adults in the household, as these variables do not have strong associations with developmental outcomes for children. Instead, the definition now focuses on the following four variables: household wealth status, orphanhood status, a child's living arrangements and the education level of adults in a household. To varying degrees, these indicators are significantly associated with key health and social outcomes among children across selected countries and HIV epidemic contexts, and are readily collected in household surveys and censuses with high temporal frequency, which is crucial for global monitoring.

Using these four variables, estimates of the number of children who fall into each of the defined measures of vulnerability, in addition to those who fall into the combinations of these measures, were calculated for each country. Table 8 below includes both estimated percentages and numbers of vulnerable children across the various categories to illustrate the range and magnitude of child vulnerability in the 11 select countries. This type of data can help inform resource estimation and programme planning.

This analysis was carried out for the purposes of global definitions and can be a useful guiding framework for countries; however, it should not supersede country specific analysis used for program

**TABLE 8:** Estimated number of children 0–17 years by various vulnerability characteristics in selected countries

| Countries | HIV prevalence, adults 15–49, % (2012) | Population Aged 0–17, 2012** (thousands) | Children who have lost one or both parents*** (% and number in thousands) | | Children not living with either parent*** (% and number in thousands) | | Children living in a household with adults with no education*** (% and number in thousands) | | Children living in a household ranked in the bottom two wealth quintiles*** (% and number in thousands) | | Group 1 Children not living with either parent and living in a household ranked in the bottom two wealth quintiles*** (% and number in thousands) | | Group 2 Children who lost one or both parents and living in a household ranked in the bottom two wealth quintiles*** (% and number in thousands) | | Group 3 Children who are living in a household with adults with no education & living in a household ranked in the bottom two wealth quintiles*** (% and number in thousands) | | Children who are in Group 1 or 2 or 3*** (% and number in thousands) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % | Number |
| Cambodia | 0.8 | 5,611 | 9.0 | 503 | 8.0 | 444 | 8.0 | 449 | 44.0 | 2,459 | 3.0 | 155 | 4.0 | 244 | 6.0 | 333 | 11.0 | 600 |
| Sierra Leone | 1.5 | 2,791 | 12.0 | 327 | 21.0 | 574 | 52.0 | 1,459 | 40.0 | 1,121 | 7.0 | 187 | 4.0 | 125 | 29.0 | 807 | 31.0 | 870 |
| Haiti | 2.1 | 4,232 | 12.0 | 493 | 20.0 | 855 | 20.0 | 857 | 43.0 | 1,833 | 7.0 | 282 | 4.0 | 192 | 15.0 | 644 | 21.0 | 880 |
| Rwanda | 2.9 | 5,482 | 21.0 | 1,180 | 15.0 | 788 | 15.0 | 827 | 41.0 | 2,221 | 4.0 | 244 | 9.0 | 520 | 8.0 | 442 | 16.0 | 870 |
| Central African Republic | 4.2 | 2,056 | 12.0 | 248 | 16.0 | 331 | 16.0 | 337 | 39.0 | 806 | 5.0 | 112 | 4.0 | 89 | 11.0 | 222 | 13.0 | 278 |
| **High-prevalence countries (5% and above)** | | | | | | | | | | | | | | | | | | |
| United Republic of Tanzania | 5.1 | 23,086 | 11.0 | 2,579 | 17.0 | 3,966 | 11.0 | 2,470 | 41.0 | 9,499 | 6.0 | 1,364 | 5.0 | 1,136 | 7.0 | 1,729 | 14.0 | 3,170 |
| Swaziland | 26.5 | 556 | 24.3 | 135 | 34.0 | 187 | 6.0 | 31 | 44.0 | 245 | 16.0 | 87 | 12.0 | 66 | 4.0 | 23 | 22.0 | 123 |
| Uganda | 7.2 | 18,955 | 15.0 | 2,883 | 20.0 | 3,832 | 9.0 | 1,693 | 40.0 | 7,694 | 7.0 | 1,281 | 6.0 | 1,209 | 6.0 | 1,128 | 13.0 | 2,521 |
| Malawi | 10.8 | 7,925 | 13.0 | 995 | 18.0 | 1,431 | 14.0 | 1,112 | 41.0 | 3,248 | 7.0 | 553 | 5.0 | 407 | 9.0 | 689 | 15.0 | 1,182 |
| Zambia | 12.7 | 7,076 | 15.0 | 1,054 | 19.0 | 1,344 | 6.0 | 403 | 43.0 | 3,005 | 7.0 | 478 | 5.0 | 344 | 4.0 | 311 | 11.0 | 812 |
| Zimbabwe | 14.7 | 6,374 | 25.0 | 1,586 | 29.0 | 1,804 | 4.0 | 254 | 45.0 | 2,850 | 12.0 | 798 | 11.0 | 729 | 3.0 | 183 | 18.0 | 1,132 |

** Source: United Nations Department of Economic and Social Affairs Population Division, the 2012 revision of the 2010 estimates (released in June 2013).
*** The numbers presented in these columns were calculated in three steps: 1) percentage estimates of children age 0–17 in each indicator category were calculated from DHS and MICS in the survey years presented in Table 1, using sample weights provided in the survey datasets; 2) the total estimated number of children age 0–17 was listed from the United Nations 2011 World Population Prospects (cited above); and 3) the survey percentages were multiplied by the population estimates to estimate the total number of children falling into each category.

targeting or measurement.

For example, the percentage of children who lost one or both parents and are living in a household ranked in the bottom two quintiles (a proxy for HIV and AIDS-affectedness) ranges from 4 per cent in the Central African Republic, Haiti, Rwanda and Sierra Leone to 12 per cent in Swaziland, while the estimated number of vulnerable children in this category ranges from 66,000 in Swaziland to 1,209,000 in Uganda. When all three categories of child vulnerability are combined, the percentages and number of vulnerable children across all countries is far greater. In Sierra Leone, for example, it is estimated that nearly one third of all children (870,000) are vulnerable. In the United Republic of Tanzania, while the percentage of vulnerable children may not be as large as that of other countries (14 per cent), the estimated number of vulnerable children (3,170,000) is considerable. This emphasizes the importance of country-specific analysis and programme planning that accounts for and monitors both the proportion and actual numbers of vulnerable children.

Monitoring these indicators over time will help to ensure that progress continues to be made in reaching the most vulnerable children worldwide and responding to their needs. The results of the analysis has been used as a basis for estimating resources needed for protection, care and support of children affected by HIV and AIDS. Follow-up steps need to be taken to ensure that measurement and monitoring of these indicators can be achieved through household surveys.

# CONCLUSION

Ensuring that global and national resources for children affected by AIDS are reaching those in greatest need is essential for an effective children and AIDS response. Within this context, identifying and monitoring a core set of global indicators of child vulnerability has been critical for assessing the extent to which the most vulnerable children are being reached with a range of interventions.

The current analysis proposes a new definition of child vulnerability within the context of HIV and AIDS as well as more broadly. It underscores the importance of a multivalent approach, which includes household wealth status as a key determinant of child vulnerability. A child's living arrangements, household adult education and orphanhood status are also, to varying degrees, key predicators of child vulnerability and, in conjunction with household wealth status, can help programme planners and policymakers identify the most vulnerable children given national and sub-national contexts. At the global and national level, knowing who the most vulnerable children are (their actual numbers as well as proportion of all children) will enable the development of resource estimates for social protection, care, and support programmes for all vulnerable, including children affected by HIV and AIDS as well as the more effective targeting of limited resources to children and families in greatest need.

# REFERENCES


Akwara, Priscilla A., et al., "Who is the Vulnerable Child: Using survey data to identify children at risk in the era of HIV and AIDS," AIDS Care, vol. 22, no. 9, 2010, pp. 1066–1085.

Belsey Mark A., and Lorraine Sherr, "The Definition of True Orphan Prevalence: Trends, contexts, and implications for policies and programmes," *Vulnerable Children and Youth Studies*, vol. 6, no. 3, 2011, pp. 185–200.

Filmer, Deon, and Kinnon Scott, "Assessing Asset Indices," *Demography*, vol. 49, no. 1, 2011, pp. 359–392.

Joint United Nations Programme on HIV/AIDS, *UNAIDS Report on the Global AIDS Epidemic*, UNAIDS, Geneva, 2012.

Lengeler, Christian, "Insecticide-Treated Bed Nets and Curtains for Preventing Malaria (Review)," John Wiley & Sons, 2009.

Nyberg, Beverly J., et al., "Saving Lives for a Lifetime: Supporting orphans and vulnerable youth impacted by HIV/AIDS," *Journal of Acquired Immune Deficiency Syndromes*, vol. 60, no. 3, 2012, pp. S127–S135.

Operario, Don, et al., "HIV Infection and Sexual Behaviour among Youth Who Have Experienced Orphanhood: Systematic review and meta-analysis," *Journal of the International AIDS Society*, vol. 14, no. 25, 2011.

Rutstein, Shea O., and Kiersten Johnson, "The DHS Wealth Index," DHS *Comparative Reports*, no. 6, ORC Macro, Calverton, Maryland, 2004.

StataCorp, Stata Statistical Software: Release 12, StataCorp, College Station, Texas, 2011.

United Nations Children's Fund, *The State of the World's Children*, UNICEF, New York, 2005.

United Nations Children's Fund, *The State of the World's Children*, UNICEF, New York, 2009.

United Nations Children's Fund and Joint United Nations Programme on HIV/AIDS, Guide to *Monitoring and Evaluation of the National Response for Children Orphaned and Made Vulnerable by HIV/AIDS*, UNICEF, New York, 2005.

United Nations Department of Economic and Social Affairs Population Division, "World Population Prospects: The 2010 revision," CD-ROM edition, United Nations, New York, 2011.

United Nations General Assembly, Declaration of commitment on HIV/AIDS, United Nations, New York, 2001.

World Health Organization Multicentre Growth Reference Study Group, "WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age – Methods and development," WHO, Geneva, 2006.

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