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Who is the vulnerable child? Using survey data to identify children at risk in the era of HIV and AIDS

Priscilla Atwani Akwara[a]*, Behzad Noubary[b], Patricia Lim Ah Ken[b], Kiersten Johnson[c], Rachel Yates[b], William Winfrey[d], Upjeet Kaur Chandan[e], Doreen Mulenga[f], Jimmy Kolker[b] and Chewe Luo[b]

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Over the past decade, there has been increasing global attention to mitigating the impacts of the HIV/AIDS epidemic on children's lives. Within this context, developing and tracking global child vulnerability indicators in relation to HIV and AIDS has been critical in terms of assessing need and monitoring progress. Although orphanhood and adult household illness (co-residence with a chronically ill or HIV-positive adult) are frequently used as markers, or definitions, of vulnerability for children affected by HIV and AIDS, evidence supporting their effectiveness has been equivocal. Data from 60 nationally representative household surveys (36 countries) were analyzed using bivariate and multivariate methods to establish if these markers consistently identified children with worse outcomes and also to identify other factors associated with adverse outcomes for children. Outcome measures utilized were wasting among children aged 0–4 years, school attendance among children aged 10–14 years, and early sexual debut among adolescent boys and girls aged 15–17 years. Results indicate that orphanhood and co-residence with a chronically ill or HIV-positive adult are not universally robust measures of child vulnerability across national and epidemic contexts. For wasting, early sexual debut, and to a lesser extent, school attendance, in the majority of surveys analyzed, there were few significant differences between orphans and non-orphans or children living with chronically ill or HIV-positive adults and children not living with chronically ill or HIV-positive adults. Of other factors analyzed, children living in households where the household head or eldest female had a primary education or higher were significantly more likely to be attending school, better household health and sanitation was significantly associated with less wasting, and greater household wealth was significantly associated both with less wasting and better school attendance. Of all marker of child vulnerability analyzed, only household wealth consistently showed power to differentiate across age-disaggregated outcomes. Overall, the findings indicate the need for a multivalent approach to defining child vulnerability, one which incorporates household wealth as a key predictor of child vulnerability.

Keywords: orphans; vulnerable children; HIV/AIDS; global markers and indicators; definitions

Introduction

Globally, it is estimated that approximately 2.1 million children (under the age of 15) are living with HIV and AIDS, about 17.5 million children have lost one or both parents to AIDS (UNAIDS, 2009), and a great number are living with chronically ill caregivers (UNICEF, 2010). Although the impact of HIV/AIDS on children's outcomes is variable, for many children the impact of HIV and AIDS engenders specific vulnerabilities such as the loss of parental care, food insecurity, withdrawal from school, increased poverty, decreased access to healthcare, stigma, and increased risk of abuse and HIV infection (Foster, Levine & Williamson, 2005; Hunter & Williamson, 2004).

As a result, there has been increasing global attention and resources allocated to mitigating the impacts of the HIV/AIDS epidemic on children's lives. Within this context, developing and tracking a core set of global indicators of child vulnerability in relation to HIV and AIDS has been important for the international community and global policy makers to assess global need, monitor progress in identifying unmet need, target limited resources to reach those most in need, and measure progress in service coverage. How child vulnerability is defined thus is central, as the usefulness of these indicators depends upon accurately understanding if and how children are made vulnerable by HIV and AIDS. Global markers, or definitions, of child vulnerability are important for

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identifying children more likely to have poor outcomes, as well as for tracking the progress of vulnerable children relative to non-vulnerable children so resources can effectively be used to improve their situation. Identifying core global markers of children affected by AIDS does not, however, remove the need for identifying additional child vulnerability markers at country level for the effective targeting of resources and measuring of national progress within different settings.

Because of the diversity of the HIV/AIDS epidemic across national contexts as well as the multidimensional nature of child vulnerability itself, generating markers that are relevant globally has been problematic. Although orphanhood and chronic illness of an adult in the household are internationally agreed upon and commonly used proxies[1] of vulnerability for children affected by HIV and AIDS (cf. UNICEF, 2005), evidence supporting the effectiveness of these markers is limited and inconclusive.

Empirical evidence on the utility of orphanhood, in particular, has been equivocal (cf. Ainsworth & Filmer, 2002; Case, Paxson, & Ableidinger, 2004; Lindblade, Odhiambo, Rosen, & DeCock, 2003; Parikh et al., 2007). Similarly, a recent systematic review on the effect of orphanhood on child outcomes within the context of AIDS shows a mixed picture. While most controlled studies report some negative effects, in some contexts for certain outcomes there are no reported differences between orphans and non-orphans. The variation in research findings, however, also reflects a lack of consistency in how orphans are defined (Sherr et al., 2008). More recently, with the recognition that children are affected by HIV and AIDS before a parent dies, the illness of a co-resident adult household member has been adopted as a marker of child vulnerability, although its effectiveness has been inadequately studied (but see Gray et al., 2009). Moreover, there is a common perception that children living in households with an HIV-positive adult are necessarily vulnerable. Largely untested, there is a need to evaluate the validity of this claim empirically. Lastly, there is increasing evidence that many of the vulnerabilities faced by children affected by HIV/AIDS are poverty-related (Franco et al., 2009; JLICA, 2009), such that targeting children based upon HIV-specific criteria may be misguided.

Speaking to this gap in evidence and seeking to inform global policymakers and practitioners working at the intersection of children and HIV/AIDS, this paper critically examines the utility of orphanhood and adult household illness as global proxies of child vulnerability in the context of HIV and AIDS. In particular, this analysis contributes to better understanding of whether children living in households with HIV-positive adults are at greater risk of poor outcomes compared with children not living in households with HIV-positive adults. Using nationally representative household survey data from 36 low- and middle-income countries (60 surveys in total), the majority of which are in sub-Saharan Africa,[2] this paper explores three main questions:

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

To assess the effects of orphaning and adult illness on child health and well-being, this paper looks at three child outcomes at different developmental stages, namely wasting[3] among children aged 0–4, school attendance among children aged 10–14, and early sexual debut among adolescents aged 15–17.

Methods

Data source

This paper analyzes data collected by the Demographic and Health Surveys (DHS), and the Multiple Indicator Cluster Surveys (MICS), the two largest international survey programs collecting nationally representative data from countries in the developing world, as well as the AIDS Indicator Survey (AIS), which focuses on sexual activity and topics related to HIV/AIDS.[4] Both the DHS and MICS have developed data collection modules to measure the prevalence of orphans and vulnerable children (OVC) and assess the situation of these children.

In addition, for more than a decade, the DHS has collected information necessary for establishing the survival status of children's parents, and Round 3 of the MICS also collected this information. In the last several years, the DHS has begun collecting information necessary to establish child vulnerability based upon chronically ill adults in the household. Round 3 of the MICS also frequently collects this information. However, both the DHS and MICS only gather these data in countries with an HIV prevalence of 1% or more or an orphan prevalence of 8% or more. In terms of the HIV serostatus of adults, the AIS and DHS may collect this information on a voluntary basis.

This report concentrates on countries meeting four criteria:

1. The country has an orphan prevalence of 8% or more; or
2. The adult prevalence of HIV exceeds 1%; and
3. An AIS or DHS has been conducted since 1995 or a MICS Round 3 survey has been conducted; and
4. The datasets were available prior to 15 June 2008.

Definitions

Definitions of child vulnerability critically examined in this analysis are derived from the UNAIDS Monitoring and Evaluation Reference Group's definitions of orphans and other children made vulnerable by HIV/AIDS (see UNICEF, 2005, p. 17)

According to the UNAIDS definition, a child made vulnerable by HIV and AIDS is below the age of 18 and:

- 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 three of the 12 months before he/she died, or
- Lives in a household where at least one adult was seriously ill for at least three months in the past 12 months.
- Lives outside of family care (i.e., lives in an institution or on the streets).

Orphan

An orphan is defined inclusively as a child aged 0–17 who has lost one or both parents.[5]

Children who live in households with an adult who is chronically ill or HIV-positive

A child is defined as living in a household with a chronically ill adult if she/he lives in a household where at least one adult was seriously ill for at least three months in the past 12 months. A child is defined as living in a household with HIV if she/he lives in a household where all eligible adults in a household accepted testing for HIV and at least one of the adults was HIV-positive. Although the HIV status of adults in the household is not part of the UNAIDS definition, it was added as a marker of child vulnerability for the present analysis. Only nine surveys had information on both chronic illness and/or death among adults and the HIV status of adults in the household.[6]

Outcome indicators

To assess the effects of orphaning and adult illness on child health and well-being, this analysis concentrates on three outcome measures at different stages of childhood, namely wasting among children aged 0–4 (whether they are <2 standard deviations below the median of the new WHO Child Growth Standards), school attendance among children aged 10–14 (whether they have attended school in the past year), and early sexual debut among boys and girls aged 15–17 (defined as first sexual intercourse before the age of 15). Data for early sexual debut are disaggregated by sex because of gender differences in sexual behavior, the increased biological susceptibility of girls to HIV infection as well as differentials in HIV prevalence, particularly in sub-Saharan African where girls are more likely to be infected than boys (UNAIDS, 2008).

Outcome indicators were selected from a larger set of core indicators developed by the UNAIDS Monitoring and Evaluation Group (UNICEF, 2005). These indicators were selected because they reflect important child welfare outcomes and also speak to age-specific vulnerabilities children face within the context of the HIV/AIDS epidemic. All outcome variables are dichotomous. A value of zero was assigned for children who did not exhibit the outcome in question, and a value of one assigned to children who did exhibit the outcome.

Wasting was selected as an important indicator for young children as it can determine longer term health and developmental outcomes (cf. Victora et al., 2008). School attendance for children aged 10–14 was selected given the importance of education for positive outcomes in adulthood (Behrman, Alderman, & Hoddinott, 2004; Grantham-McGregor et al., 2007). In addition, school attendance by orphans (10–14 year olds) is both an UN General Assembly Special Session on HIV/AIDS (UNGASS) and Millennium Development Goal (MDG) indicator used to monitor the situation of orphans globally.

Early sexual debut like early marriage, is linked to various negative outcomes including not attending school, increased risk of HIV infection, maternal and infant mortality associated with young age at first birth, and poverty (Clark, 2004; Jain & Kurz, 2007; Jensen & Thornton, 2003; Nour, 2006). Although recent research has examined causes underlying early sexual debut among adolescents (Madise, Zulu, & Ciera, 2007), few empirical studies have explored whether orphans are at greater risk for early sexual

debut than non-orphans (but see Palermo & Peterman, 2008).

Statistical methods

Data were analyzed using bivariate and multivariate methods.

Bivariate analysis

Outcomes for children who are vulnerable were compared to outcomes for children who are not vulnerable (according to vulnerability definitions examined in this study). The three measures of vulnerability examined were: orphan status; having a chronically ill adult in the household; and having an HIV-positive adult in the household. Assessments of statistically significant differences (at the $p \leq 0.05$ level) were made using chi-squared tests. The question of whether orphans are more likely to have worse outcomes than non-orphans was analyzed using data from 36 countries. The question of whether children living in households with a chronically ill adult or HIV-positive adult are more likely to have worse outcomes than children who do not was analyzed using data from nine countries.

Multivariate analysis

Multivariate analysis was undertaken to control for confounding factors and to identify additional factors associated with poor child outcomes. Of the nine DHS or AIS surveys that collected information to establish if there is a chronically ill and/or HIV-positive adult in a household, all nine collected information on school attendance, six collected the anthropometry necessary for establishing wasting among children aged 0–4, and eight collected the information necessary for establishing early sexual debut. The interaction effect of the presence of both chronic illness and an HIV-positive adult in the household was assessed for their effect. For each outcome measure where data were available, a logistic regression was run. Logistic regressions are generally used to estimate partial correlations when an outcome variable is dichotomous (e.g., wasted/not wasted), and regression coefficients are easily interpreted as odds ratios. The regressions contain six types of variables: household, community, household health, orphanhood and living arrangements, demographic and household education variables. The six types of variables are described below in Table 1.

For the first two research questions, assessments of statistical significance were made at the 0.10 level and better. For the third research question, assessments were made at 0.05 level and better.[7]

Limitations of the analysis

For proper interpretation of the results, it is necessary to take into account specific limitations of the analysis. Firstly, household surveys do not gather data on children living outside of households, namely children on the streets or in institutions. This may bias some of the findings in terms of underestimating vulnerability. Although children living outside of households constitute a small percentage of vulnerable children, they are highly vulnerable. Moreover, the limited availability of data on adult health in the household as well as data on given outcome indicators limited the number of countries that could be included. Also, only one hyper-endemic country (Zimbabwe) was included in the multivariate analysis, precluding analysis of data by epidemic type. Lastly, the analysis did not examine the interaction effects of some variables, in particular the interaction of wealth and orphan status or wealth and education, the latter which is often highly correlated.

Country background

This section presents descriptive statistics on the prevalence of orphanhood as well as other measures of child vulnerability according to the UNAIDS definition, data on adult HIV prevalence, and aggregated data on the child outcomes analyzed for the country surveys included in the analysis.

Figure 1 presents the countries where orphaning has been measured for children aged 0–17 for the last available survey for each country. The percent of children orphaned ranges from a low of 4.5% in Jamaica to more than 28% in Lesotho. Lesotho, Rwanda, and Zimbabwe all have orphan prevalence rates that exceed 20%. In almost every country, the level of paternal orphan prevalence is about 2–2.5 times larger than the level of maternal orphan prevalence. In general as HIV prevalence increases, orphan prevalence also increases.

Figure 2 presents the percentage of children who are orphaned as well as children who have ill parents, ill adults in the household, or have experienced recent deaths in the household. Children impacted by illness in the household ranges from 2.7% in Thailand to 23.4% in Mali. When orphaning and household illness as definitions of vulnerability are combined, the percent of children considered vulnerable, according to the UNAIDS criteria of child vulnerability, is almost 30% in Rwanda, Sierra Leone, and Zimbabwe.

Table 2 presents adult HIV prevalence as well as the most recent data on the outcome variables by country. Children in Thailand (about 10%) were least

Table 1. Variable names and definitions used in multivariate regressions.

Variable name	Variable definition
HOUSEHOLD level variables	
Wealth quintile	
Lowest quintile (reference)	Household is in the lowest wealth quintile
Second quintile	Household is in the second lowest wealth quintile
Third quintile	Household is in the middle wealth quintile
Fourth quintile	Household is in the second highest wealth quintile
Highest quintile	Household is in the highest wealth quintile
Household head male (reference: household head female)	Head of household: female = 0, male = 1
High household dependency ratio	Household dependency ratio is greater than one
COMMUNITY level variables	
High community HIV prev	Community HIV prevalence is higher than national average
High wealth high	Community wealth quintile is higher than survey average
High community OVC prev	Community OVC prevalence is higher than survey average
Low community HIV stigma	Community HIV stigma level is less than survey average
Urban	Urban residence = 1, Rural residence = 0
HOUSEHOLD HEALTH variables	
Diarrhea in HH[a]	Child under five years in the household had diarrhoea in the past two weeks
Adult sick in HH	An adult in the HH has been ill for three of last 12 months
HIV positive adult in HH	At least one adult in the HH is HIV+
Adult: HIV*Sick	Interaction of HIV-positive adult with adult ill in HH
ORPHANING and GUARDIANSHIP variables	
Lives with both parents (reference)	
Neither parent dead, resides with mother only	Both parents are alive, lives with mother only
Father is dead resides with mother	Father is dead, lives with mother
Neither parent dead, resides with father only	Both parents are alive, lives with father only
Mother is dead, resides with father	Mother of child is dead, lives with father
Neither parent dead, resides in grandparent headed household	Both parents are alive, lives in household headed by a grandparent
Neither parent dead, resides with neither parent nor grandparent headed household	Both parents are alive, lives in household where neither parent lives nor a grandparent
Mother is dead, resides in grandparent headed household	Mother is dead, lives in household headed by a grandparent, but not with father
Mother is dead, resides with neither parent nor grandparent headed household	Mother is dead, lives in household where neither parent lives nor a grandparent
Father is dead, resides in grandparent headed household	Father is dead, lives in household headed by a grandparent, but not with mother
Father is dead, resides with neither parent nor grandparent headed household	Father is dead, lives in household headed by a grandparent
Both parents dead resides in grandparent headed household	Both parents are dead, lives in household headed by a grandparent
Both parents dead resides with neither parent nor grandparent headed household	Both parents are dead, does not live in household headed by a grandparent
DEMOGRAPHIC variables	
Boy	Relative to girls
Child age 0–2	Child is aged 2–4 = 1, aged 0–1 = 0
Child age 12–14	Child is aged 12–14 = 1, aged 10–11 = 0
Child age 17	Child is aged 17 = 1, aged 15–16 = 0
EDUCATION or HUMAN CAPITAL variables	
Oldest woman prim education	Oldest woman in household has primary education or higher
HH head prim education	Education level of head of household is primary or higher
Attend_school[b]	Youth attends school

[a]Used in "Wasting" regressions only.
[b]Used in sexual debut regressions only.

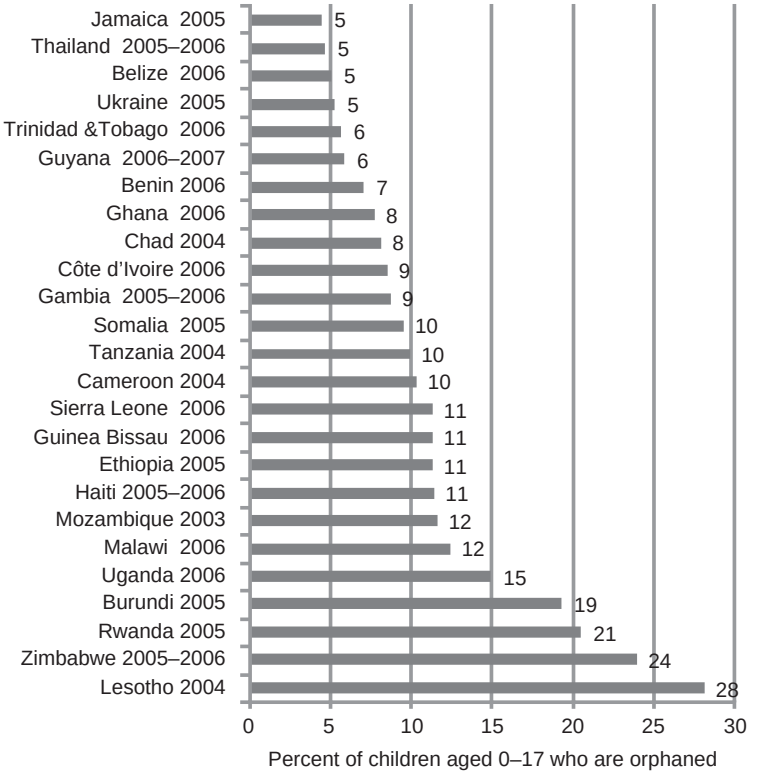

Figure 1. Percent of children aged 0–17 who have lost one or both parents as measured at latest available survey, AIS, DHS, or MICS 2004—2007.

likely to be wasted, while levels of child wasting were highest in Ethiopia at 41%. School attendance is lowest in Burkina Faso, Mali, and Chad (all less than 50%), while several countries, such as Gabon, Jamaica, Thailand, Trinidad and Tobago, and Ukraine, have school attendance rates that exceed 95%. In terms of sexual debut, in only three out of 17 countries (Ethiopia, Ghana, and Zimbabwe) did less than 10%

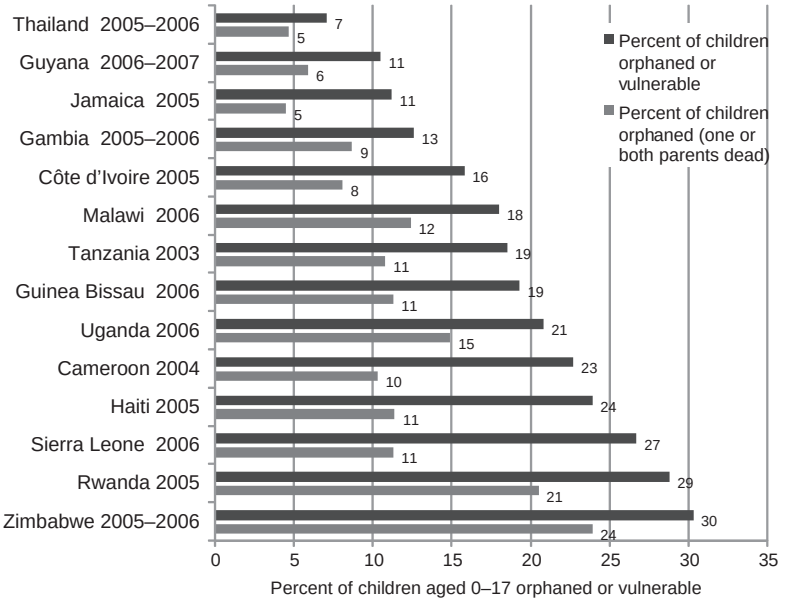

Figure 2. Percent of children aged 0–17 who are orphaned or have sick parents, ill adults in the household or have experienced a recent death in the household (as per the UNAIDS definition of child vulnerability), as measured at latest available AIS, DHS, and MICS 2003–2007.

Table 2. Adult HIV prevalence and percentages of children exhibiting given outcomes (wasting, school attendance, sexual debut) by most recent survey AIS, DHS, MISC 1994–2007.

Country	Year	Adult HIV prevalence	Percent of children wasted[a]	Number of observations	Percent of children 10 to 14 who attended school in the last year	Number of observations	Percent of boys who initiated sex before the age of 15	Number of observations	Percent of girls who initiated sex before the age of 15	Number of observations
Belize	2006	2.1	n.d.	n.d	93.6	988	n.d.	n.d	n.d.	n.d.
Benin	2006	1.2	18.5	12733	68.9	12141	11.9	610	12.2	1790
Burkina Faso	2003	1.9	n.d	n.d	31.6	8222	n.d.	n.d.	n.d.	n.d.
Burundi	2005	2.4	n.d.	n.d	72.5	6264	n.d.	n.d.	4.1	1490
Cameroon	2004	5.5	14.6	3531	85.2	6773	12.2	700	15.7	1446
CAR	1994–1995	4.6	n.d.	n.d	60.9	3441	n.d.	n.d.	n.d.	n.d.
Chad	2004	3.6	n.d.	n.d.	47.7	3967	10.5	250	15.0	829
Côte d'Ivoire	2006	4.2	20.5	8505	63.4	7209	14.7	471	20.8	604
Eritrea	2002	1.2	34.3	5289	77.1	6343	n.d.	n.d.	n.d.	n.d.
Ethiopia	2005	2.1	33.0	4547	56.9	10284	1.4	801	9.1	1899
Gabon	2000	5.3	n.d.	n.d.	95.6	4106	n.d.	n.d.	n.d.	n.d.
Gambia	2005–2006	0.9	20.6	6423	74.6	6276	n.d.	n.d.	3.8	1339
Ghana	2006	2.0	18.6	3244	86.4	3348	4.7	308	1.9	762
Guinea	2005	1.5	n.d.	n.d.	56.5	5602	n.d.	n.d.	n.d.	n.d.
Guinea Bissau	2006	1.9	22.6	5378	71.9	5444	n.d.	n.d.	23.9	1041
Guyana	2006–2007	2.5	14.0	2306	94.1	2586	n.d.	n.d.	n.d.	n.d.
Haiti	2005–2006	2.2	18.1	2808	87.3	6320	43.9	757	14.3	1611
Jamaica	2005	1.5	n.d.	n.d.	99.1	1769	n.d.	n.d.	n.d.	n.d.
Kenya	2003	7.0	15.6	4924	91.0	5304	n.d.	n.d.	n.d.	n.d.
Lesotho	2004	23.6	16.2	1587	91.3	5037	17.6	475	7.4	979
Malawi	2006	12.1	20.6	21768	89.8	18407	n.d.	n.d.	12.6	2884
Mali	2006	1.5	32.1	11344	46.3	10051	n.d.	n.d.	n.d.	n.d.
Mozambique	2003	11.5	19.7	8556	75.9	8025	34.3	423	28.1	1328
Namibia	2000	14	19.5	4023	90.3	4464	n.d.	n.d.	n.d.	n.d.
Nigeria	2003	3.2	24.3	4649	74.4	4415	n.d.	n.d.	n.d.	n.d.
Rwanda	2005	3.1	22.4	3819	86.2	6341	13.9	686	5.4	1584
Sierra Leone	2006	1.7	32.8	4507	74.9	5541	n.d.	n.d.	27.8	565
Somalia	2005	0.5	36.7	5737	58.1	4403	n.d.	n.d.	n.d.	n.d.
Tanzania	2004	6.5	16.4	7649	86.0	6409	14.6	377	11.6	1289
Thailand	2005–2006	1.5	9.5	9135	97.8	10969	n.d.	n.d.	n.d.	n.d.
Trinidad&Tobago	2006	1.5	n.d.	n.d.	98.4	1501	n.d.	n.d.	4.1	444
Uganda	2006	5.7	16.2	2546	92.8	6986	14.4	369	10.5	1129
Ukraine	2005	1.5	n.d.	n.d.	99.6	1148	n.d.	n.d.	n.d.	n.d.
Zambia	2001–2002	15.3	22.6	5635	77.5	5265	n.d.	n.d.	n.d.	n.d.
Zimbabwe	2005–2006	18.1	16.7	4756	90.3	6082	6.0	1147	4.3	1200

[a]Wasting is defined as children aged 0–59 months who are below minus two standard deviations from median weight for height of the NCHS/WHO reference population.
n.d. = no data

of boys aged 15–17 report sexual debut before the age of 15. In contrast, a large percentage of boys aged 15–17 in Mozambique and Haiti reported sexual debut before the age of 15 (34% and 44%, respectively). For girls aged 15–17 in 10 out of 23 countries, less than 10% of girls, reported early sexual debut. In Cote d'Ivoire, Guinea-Bissau, Mozambique, and Sierra Leone, more than 20% of girls reported early sexual debut.

Findings

The results of the bivariate and multivariate analyses are presented below according to each research question and by outcome indicator.

Are orphans more likely to have worse outcomes than non-orphans?

Wasting

In 23 out of 35 surveys analyzed, orphans were more likely to be wasted than non-orphans. However, only in five of the 35 surveys (Ethiopia 2000; Ghana 2006; Haiti 2000; Malawi 2004; and Zimbabwe 2006) was the difference statistically significant. In general, countries with high levels of wasting did not have large differences between orphans and non-orphans (see Figure 3).

Similarly, in the multivariate analysis, there was no significant association between orphanhood and wasting.

School attendance

In 47 out of 59 surveys analyzed, orphans were less likely to be attending school than non-orphans. In 38 of the 59 surveys, the difference was statistically significant. In addition, in countries with high levels of overall school attendance, both orphans and non-orphans attended school in large and at nearly the same percentages. At lower levels of school attendance, however, many countries showed large disparities between orphans and non-orphans (see Figure 4).

In multivariate analysis, although there is no clear pattern, a lack of guardianship by a parent or grandparent (whether parents are alive or deceased) is most frequently correlated with lower school attendance. In eight of nine regressions, if both parents are alive and the child is not living with neither parent nor in a grandparent-headed household, the child is significantly less likely to be attending school than if she/he were living with both parents. In seven of nine regressions, if both parents are dead and the child is not living in a grandparent headed household, the child is significantly less likely to be attending school than if she/he were living with both parents. In six of nine regressions, if the mother is dead and the child is not living with his/her father or in a grandparent-headed household, the child is significantly less likely to be attending school than if she/he were living with both parents. In six of nine regressions, if the father is dead and the child is not living with his mother or in a grandparent-headed household, the child is significantly less likely to be attending school than if she/he were living with both parents (see Table 3) .

Early sexual debut (boys)

In 13 out of 17 surveys analyzed, orphaned boys were more likely to have initiated sex before age 15 than non-orphaned boys; however, in none of the surveys was the difference statistically significant. Similarly, in the multivariate analysis, being an orphan was not significantly associated with timing of sexual debut among boys.

Early sexual debut (girls)

In 17 out of 23 surveys analyzed, orphaned girls were more likely to have initiated sex before age 15 than non-orphaned girls. However, in only seven out of the 23 surveys (Ethiopia 2005; Ghana 2006; Haiti 2005–2006; Malawi 2004; Mozambique 2003; Uganda 2004; and Zimbabwe 2005–2006) was the difference statistically significant. In seven out of eight multivariate analyses, orphaning was not significantly associated with early sexual debut (see Table 4).

Are children living in households with chronically ill or HIV-positive adults more likely to have worse outcomes than children not living with chronically ill or HIV-positive adults?

Wasting

Among seven surveys analyzed, only in Zimbabwe were children living in households with HIV-positive adults significantly more likely to be wasted. In eight out of 13 surveys analyzed, children living with chronically ill adults were more likely to be wasted; however, only in Guinea Bissau and Haiti were the differences statistically significant. In multivariate analysis for Cameroon and Zimbabwe, having an HIV-positive adult in the household increased the odds of childhood wasting, but in four other countries there was no significant association. Having a chronically ill adult in the household did not significantly increase the odds of childhood wasting in any survey analyzed (see Table 5).

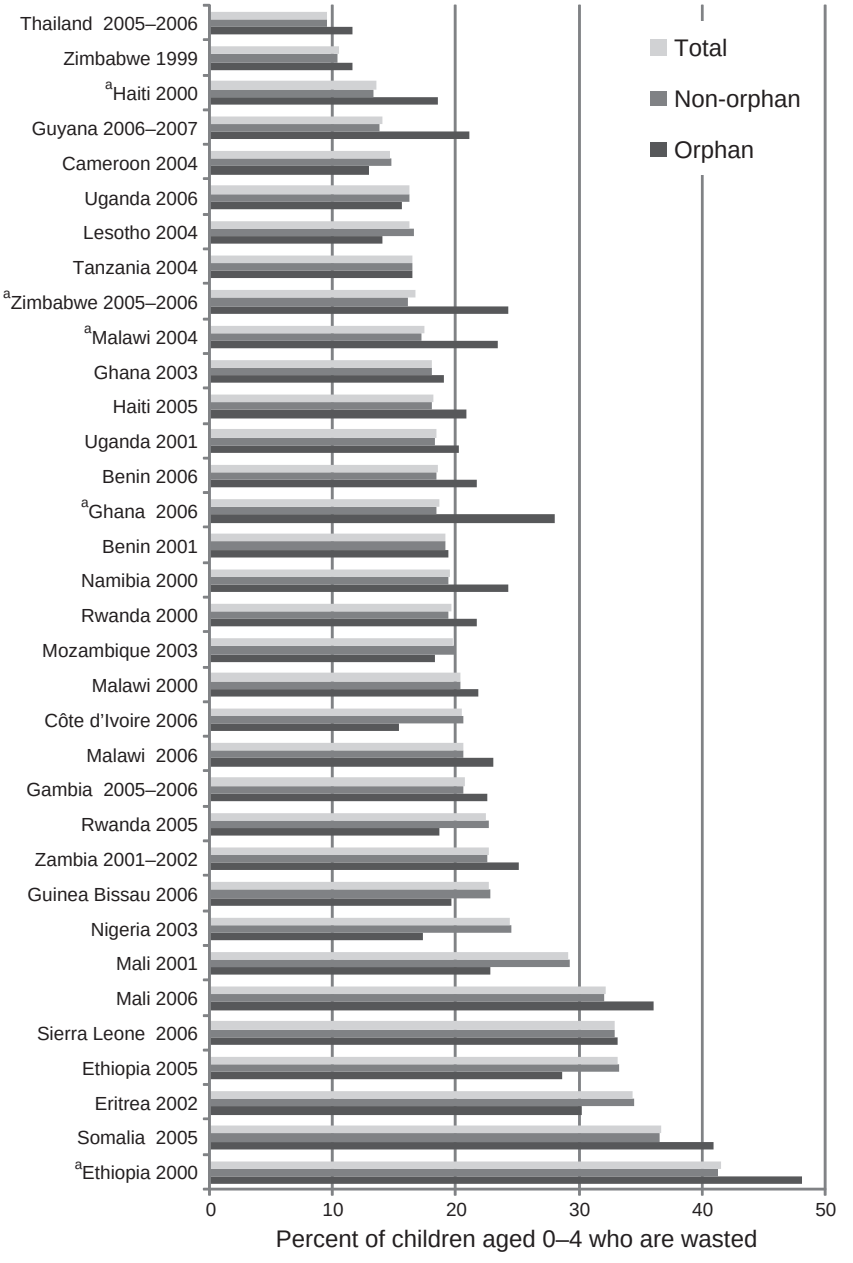

Figure 3. Children aged 0–59 months who are below minus two standard deviations from median weight for height of the NCHS/WHO reference population all children, orphans, and non-orphans, DHS or MICS 1999–2007.
[a]Orphans are more likely to be wasted and the difference between orphans and non-orphans is statistically significant at the 0.05 level.

School attendance

Bivariate analysis found no significant differences between children living in households with HIV-positive adults and children not living in households with HIV-positive adults. Only in three of 17 surveys (Sierra Leone 2006; Haiti 2005–2006; and Uganda 2006) was there a statistically significant difference between children living in households with chronically ill adults and those who did not live with chronically ill adults. However, in three out of nine multivariate analyses having an HIV-positive adult in the household was negatively and significantly associated with school attendance and in five out of nine multivariate analyses have a chronically ill adult in the household was negatively and significantly associated with school attendance (see Table 3).

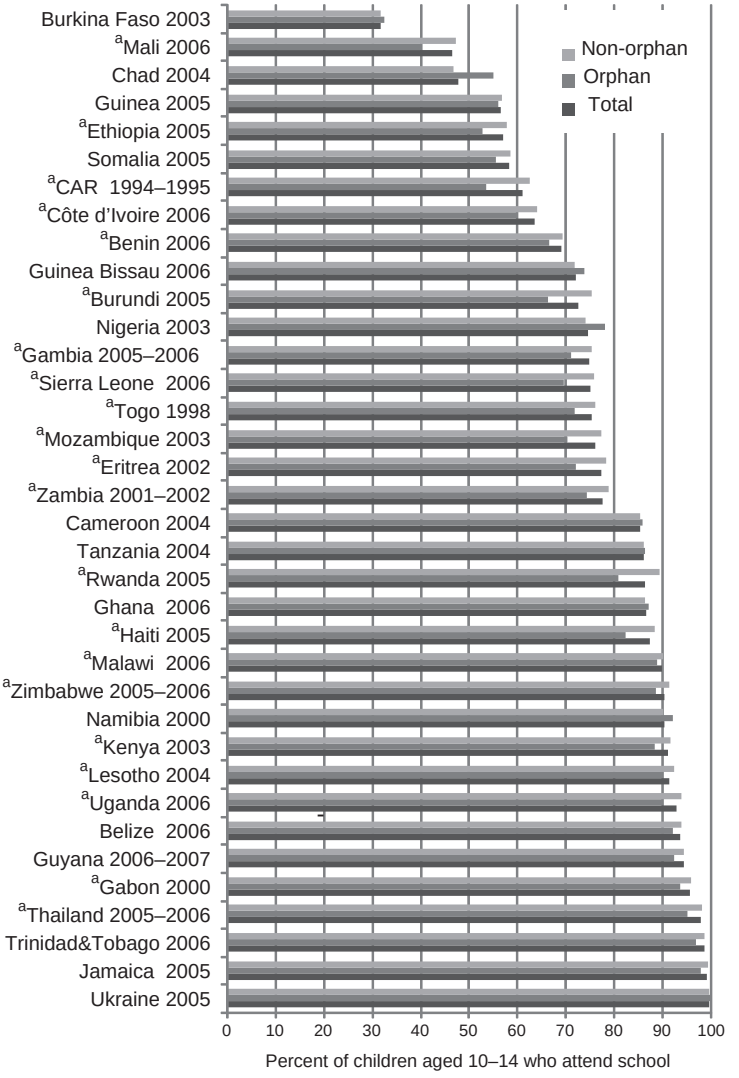

Figure 4. Percent of children aged 10–14 who attended school in the last year, latest survey AIS, DHS, and MICS 1994–2007. [a]Orphans are less likely to attend school and the difference between orphans and non-orphans is statistically significant at the 0.05 level.

Early sexual debut

Only in one out of eight countries (Uganda) was having an HIV-positive adult in the household significantly associated with early sexual debut for boys. In three out of eight countries (Côte d'Ivoire, Haiti, and Uganda), having an HIV-positive adult or a chronically ill adult in the household was significantly associated with early sexual debut for girls (see Table 4).

Aside from orphaning and illness in the household, what other factors are associated with poor outcomes for children?

In addition to assessing the impact of orphaning and co-residence with a chronically ill adult or HIV-positive adult on child outcomes, the multivariate analysis assessed additional variables that could impact each child outcome.

Wasting

In six out of six countries, children living in households with greater household wealth were significantly less likely to be wasted. In five out of six countries, better household health and sanitation, as measured by the incidence of diarrhea among young children, was significantly associated with less wasting (see Table 5).

School attendance

For eight out of nine countries, greater household wealth was significantly associated with better school

Table 3. Multivariate logistic regression odds ratios for school attendance.

	Cameroon DHS 2004 ($N=2771$)		Côte d'Ivoire AIS 2005 ($N=1271$)		Haiti DHS 2005–2006 ($N=3115$)		Malawi DHS 2004 ($N=2256$)		Mali DHS 2006 ($N=2849$)		Rwanda DHS 2005 ($N=3041$)		Tanzania AIS 2003 ($N=2528$)		Uganda AIS 2004 ($N=5701$)		Zimbabwe DHS 2005–2006 ($N=3652$)	
Variable name	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)
Household variables																		
HH wealth very low (reference)																		
Second quintile	0.982	1.00	0.473	0.87	0.000	1.87***	0.024	1.57**	0.229	1.16	0.092	1.36	0.469	1.14	0.010	1.44**	0.201	1.22
Third quintile	0.000	2.29***	0.417	0.83	0.000	2.38***	0.133	1.37	0.141	1.21	0.172	1.27	0.079	1.39	0.000	1.81***	0.018	1.48**
Fourth quintile	0.000	5.08***	0.018	1.97**	0.027	1.84**	0.008	1.81**	0.540	1.09	0.903	0.98	0.000	2.37***	0.000	2.53***	0.084	1.57
Highest quintile	0.000	5.16***	0.002	2.64**	0.002	2.96**	0.007	2.66**	0.000	6.37***	0.079	1.46	0.558	1.21	0.004	1.84**	0.001	5.37***
HH head male	0.077	0.65	0.277	0.80	0.572	0.92	0.107	0.73	0.557	0.90	0.042	0.71**	0.013	0.62**	0.142	0.78	0.013	0.68**
HH dependency ratio >1	0.761	1.05	0.161	1.23	0.927	0.99	0.086	0.72	0.268	1.12	0.083	0.81	0.013	0.69**	0.428	1.11	0.985	1.00
Community variables																		
Community wealth high	0.338	0.78	0.004	0.54**	0.001	2.06***	0.462	1.14	0.045	1.30**	0.155	1.22	0.164	1.31	0.000	1.87***	0.238	1.28
High community OVC prev	0.000	1.82***	0.598	1.08	0.384	0.90	0.022	1.40**	0.537	1.06	0.177	1.18	0.398	1.13	0.544	1.07	0.000	1.73***
Low community HIV stigma	0.915	1.02	0.037	1.39**	0.860	0.97	0.013	1.43**	0.000	1.79***	0.570	1.07	0.189	1.23	0.029	1.28**	0.223	0.86
Urban	0.530	1.14	0.026	1.50**	0.531	0.87	0.769	1.09	0.043	0.74**	0.377	0.84	0.730	1.09	0.567	1.18	0.194	1.61
High community HIV prev	0.013	0.72**	0.356	1.15	0.059	0.80	0.241	0.85	0.010	0.80**	0.297	1.13	0.386	1.15	0.032	0.78**	0.009	0.70**
Household illness																		
HIV positive adult in HH	0.355	0.73	0.352	1.27	0.591	0.83	0.975	1.01	0.033	2.15**	0.102	1.83	0.000	0.47***	0.014	0.63**	0.047	0.74**
Adult sick in HH	0.041	0.65**	0.124	1.57	0.007	0.65**	0.074	0.67*	0.365	1.10	0.496	0.88	0.402	1.23	0.684	1.06	0.008	0.58**
Interaction: HIV*adult illness	0.233	2.87	0.537	0.55	0.205	2.27	0.953	0.97	0.495	1.54	0.005	0.20**	0.152	0.45	0.377	0.75	0.011	2.88**
Guardianship																		
Lives with both parents (reference)																		
Neither parent dead, resides with mother only	0.409	1.29	0.420	0.82	0.208	0.78	0.081	0.62*	0.361	0.82	0.004	0.47**	0.001	0.44***	0.519	0.86	0.119	1.50
Father is dead resides with mother	0.069	1.90*	0.211	1.62	0.022	0.55**	0.008	0.47**	0.000	0.37***	0.001	0.47***	0.004	0.44**	0.027	0.61**	0.480	0.84
Neither parent dead, resides with father only	0.664	1.09	0.004	0.50**	0.004	0.49**			0.801	1.06	0.014	0.34**	0.990	1.00	0.484	1.20	0.835	1.08

Table 3 (*Continued*)

Variable name	Cameroon DHS 2004 ($N=2771$)		Côte d'Ivoire AIS 2005 ($N=1271$)		Haiti DHS 2005–2006 ($N=3115$)		Malawi DHS 2004 ($N=2256$)		Mali DHS 2006 ($N=2849$)		Rwanda DHS 2005 ($N=3041$)		Tanzania AIS 2003 ($N=2528$)		Uganda AIS 2004 ($N=5701$)		Zimbabwe DHS 2005–2006 ($N=3652$)	
	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)
Mother is dead, resides with father	0.539	1.26	0.895	1.13	0.514	1.58	0.001	0.12***	0.074	0.58*	0.004	0.40**	0.436	1.52	0.694	1.17	0.030	0.45**
Neither parent dead, resides in grandparent headed household	0.004	2.24**	0.920	1.04	0.871	1.04	0.300	0.79	0.102	0.76	0.793	1.10	0.019	0.56**	0.013	2.05**	0.776	1.07
Neither parent dead, resides with neither parent nor grandparent headed household	0.537	0.86	0.000	0.27***	0.000	0.21***	0.015	0.47**	0.000	0.23***	0.000	0.09***	0.000	0.19***	0.000	0.50***	0.001	0.44***
Mother is dead, resides in grandparent headed household			0.222	0.23	0.009	0.37**	0.196	2.40	0.766	0.85	0.036	0.40**	0.007	0.31**	0.618	0.81	0.289	0.66
Mother is dead, resides with neither parent nor grandparent headed household	0.170	0.45	0.911	1.08	0.000	0.22***	0.151	0.53	0.003	0.21**	0.000	0.07***	0.003	0.25**	0.064	0.51*	0.004	0.33**
Father is dead, resides in grandparent headed household	0.161	2.29	0.238	0.33	0.338	0.61	0.233	1.90	0.061	0.38*	0.181	0.58	0.538	0.74	0.378	1.53	0.760	0.92
Father is dead, resides with neither parent nor grandparent headed household	0.257	0.56	0.097	0.50*	0.262	0.60	0.049	0.40**	0.000	0.23***	0.000	0.05***	0.001	0.25***	0.291	0.72	0.000	0.35***
Both parents dead resides in grandparent headed household	0.795	1.23	0.409	0.36	0.060	0.29*	0.631	1.20	0.710	0.77	0.005	0.40**	0.540	1.72	0.354	0.73	0.702	0.90
Both parents dead resides with neither parent nor grandparent headed household	0.060	0.29*	0.107	0.32	0.000	0.21***	0.000	0.21***	0.446	0.64	0.000	0.14***	0.000	0.06***	0.016	0.49**	0.003	0.47**

Table 3 (*Continued*)

Variable name	Cameroon DHS 2004 ($N=2771$)		Côte d'Ivoire AIS 2005 ($N=1271$)		Haiti DHS 2005–2006 ($N=3115$)		Malawi DHS 2004 ($N=2256$)		Mali DHS 2006 ($N=2849$)		Rwanda DHS 2005 ($N=3041$)		Tanzania AIS 2003 ($N=2528$)		Uganda AIS 2004 ($N=5701$)		Zimbabwe DHS 2005–2006 ($N=3652$)	
	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)
Demographics																		
Boy (girl is reference)	0.000	2.21***	0.000	1.65***	0.951	0.99	0.055	0.77*	0.000	1.38***	0.002	0.70**	0.966	1.01	0.386	1.10	0.020	0.76**
Aged 12–14 (reference is 10–11)	0.042	0.77**	0.000	0.62***	0.020	1.32**	0.010	0.68**	0.074	0.86*	0.000	0.49***	0.000	0.61***	0.470	0.92	0.000	0.25***
Oldest women in HH has primary educ.	0.000	3.92***	0.007	1.56**	0.433	1.12	0.000	1.95***	0.003	1.53**	0.185	1.19	0.000	2.08***	0.000	1.76***	0.001	1.67***
HH head has primary educ.	0.000	3.49***	0.000	2.09***	0.000	2.61***	0.049	1.42**	0.000	2.17***	0.000	2.03***	0.296	1.18	0.000	1.66***	0.003	1.62**
Constant	0.622	1.17	0.231	0.70	0.000	3.75	0.000	8.03	0.005	0.52	0.000	17.12	0.000	9.86	0.000	4.32	0.000	12.28

Significance at *$p \leq 0.10$, **$p \leq 0.05$, ***$p \leq 0.001$.

attendance. In nine out of nine countries, children living in households where the head of household or the eldest female had a primary education or higher were significantly more likely to be attending school. Depending on the country, many of the other independent variables were also significant; however, none of them were as consistently statistically significant as household wealth or the education of adults in the household (see Table 3).

Sexual debut

In multivariate analysis, none of the independent variables were consistently associated with early sexual debut for either boys or girls across eight countries.

Discussion

Because of emerging evidence, global program managers and policy professionals are revisiting how child vulnerability is defined within the context of HIV and AIDS. A growing body of evidence, including this analysis, indicates that often used global markers to monitor child vulnerability in the context of HIV/AIDS, namely orphanhood and co-residence with a chronically ill or HIV-positive adult, do not apply universally as robust measures of child vulnerability across national and epidemic contexts.

In terms of wasting, early sexual debut, and to a lesser extent, school attendance, in the majority of surveys, there were few significant differences between orphans and non-orphans or children living with chronically ill or HIV-positive adults and children not living with chronically ill or HIV-positive adults. Importantly, besides household wealth, no other potential markers of vulnerability consistently showed association or power to differentiate across the age-disaggregated outcomes.

Therefore, in many countries, targeting resources to children based solely on orphan status or co-residence with a chronically ill or HIV-positive adult in the household is not the most effective way of identifying vulnerable children or targeting limited resources. This does not signify that these child vulnerability markers should be disregarded entirely. In some national contexts and for school attendance in particular, a child's orphanhood status or co-residence with a chronically ill or HIV-positive adult was in fact significant. However, as the current analysis suggests, given the consistent significance of household economic status for school attendance outcomes, the interplay of factors is not always clear. Indeed, related research on school attendance and

orphanhood (Ainsworth & Filmer, 2002; Campbell, Moroni, & Webb, 2008) suggests that household wealth may be the more important factor. By examining various categories of children affected by HIV/AIDS (not just orphans) as well as multiple outcomes (wasting and sexual debut in addition to school attendance), the findings of this study thus both expand and reinforce the significance of previous research – that household wealth is a strong predictor of child outcomes.

As a whole, the data speak to the need for a multivalent approach to defining child vulnerability, such as combining wealth indicators with dimensions of AIDS-related vulnerability. Given that one of the most widely documented impacts of the HIV/AIDS epidemic on children, families, and households across prevalence settings is reduced economic capacity and economic duress (Barnett & Whiteside, 2002; Franco et al., 2009; JLICA, 2009), a multivalent approach incorporating household economic status is particularly relevant. Indeed, one of the best measures for identifying vulnerable children with poor outcomes was the wealth index, a weighted average of various household assets and amenities, used by DHS and MICS. A multivalent approach may be more amenable to age disaggregation and also have the desired effect of avoiding the so-called "orphan exceptionalism" or targeting AIDS-affected children in isolation of other equally needy children. Such an approach, however, should be sensitive to the specific needs of AIDS-affected children who may experience stigma and discrimination, require psycho-social support, and if infected, access to treatment services.

At the global level, developing a multivalent index entails identifying core variables associated with child vulnerability that are comparable and relevant cross-nationally and can be used for realistic resource allocation, costing, planning, and trend analysis. At the same time, these core variables can be added to at a national level to further define childhood vulnerability in line with national plans. Importantly, vulnerability definitions used for global monitoring and those used for programming at country level need not be identical, but the latter should ideally be inclusive of the former (Campbell et al., 2008). Program implementers can incorporate more context-specific markers of child vulnerability to identify vulnerable children to be targeted through interventions (cf. Schenk et al., 2008).

Indeed, the variation in the data across countries and different outcome indicators speak to the importance of national context, the need to identify additional country-specific child vulnerability markers, as well the need to "know your epidemic" and tailor targeting strategies to particular contexts. For example, in some cases, differences between orphans and non-orphans were less distinct where national levels of child well-being outcomes were generally poor (i.e., high levels of wasting) and in other instances where national levels of child well-being were better (i.e., high levels of school attendance). In national contexts of high wasting, for example, nutrition interventions targeted specifically at orphaned children would exclude other vulnerable children at risk of poor outcomes. In such contexts all children, regardless of HIV/AIDS-related vulnerability, should be considered vulnerable to wasting. The usefulness of these HIV/AIDS-related indicators of child vulnerability thus should be evaluated on a country basis and in conjunction with other relevant research, rather than applied uniformly at a global level.

The data clearly highlight the importance of not only "knowing your epidemic" within each country, but also of "knowing your children" in each country: knowing who the vulnerable children are and their specific vulnerabilities and needs. To this end, taking a life cycle and gendered approach to identifying vulnerability is critical because children's vulnerabilities are often age and gender-specific. Young children, for example, are particularly susceptible to illness, malnutrition, and neglect which can have long-term negative impacts on their health and well-being (Dunn, 2005; Grantham-McGregor et al., 2007). Similarly, adolescent girls face particular vulnerabilities. In many parts of sub-Saharan Africa, for example, adolescent girls are three to five times more likely to be infected than boys of the same age (UNAIDS, 2008). Part of "knowing your epidemic" thus includes careful analysis of age and gender-specific risks within country-specific contexts.

It is thus recommended that additional secondary analysis of MICS, DHS, and other nationally representative household data sets be conducted to identify country-specific predictors of child vulnerability. It may also be useful to identify and compare predictors of child vulnerability in hyper-endemic countries ($>15\%$ prevalence) to other countries with generalized epidemics. Different epidemic contexts may indeed have different profiles of child vulnerability. Children in hyper-endemic contexts, for example, may also be more likely to be affected by the death or illness adults outside their immediate households (i.e., teachers, neighbors, etc.). Lastly, additional analysis examining the combined effect of wealth status and given AIDS sensitive characteristics, such as co-residence with a chronically ill or HIV-positive adult (on school attendance, for example) could

Table 4. Multivariate logistic regression odd ratios for sex before age 15: females.

Variable name	Cameroon DHS 2004 ($N=438$)		Côte d'Ivoire AIS 2005 ($N=227$)		Haiti DHS 2005–2006 ($N=689$)		Malawi DHS 2004 ($N=164$)		Rwanda DHS 2005 ($N=716$)		Tanzania AIS 2003 ($N=389$)		Uganda AIS 2004 ($N=802$)		Zimbabwe DHS 2005–2006 ($N=595$)	
	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)
Household variables																
Lowest wealth quintile (reference)																
Second quintile	0.196	2.96	0.850	1.12	0.427	1.59	0.259	5.73	0.268	0.50	0.124	0.32	0.005	0.24**	0.844	1.39
Third quintile	0.121	3.75	0.903	0.90	0.386	1.75	0.622	0.42	0.707	1.23	0.969	0.98	0.054	0.34*	0.454	3.12
Fourth quintile	0.115	4.71	0.489	0.46	0.090	3.31	0.106	11.37	0.690	1.24	0.997	0.00	0.819	0.91	0.938	0.87
Highest quintile	0.475	2.17	0.584	0.53	0.626	1.46	0.849	1.35	0.275	2.10	0.127	0.19	0.399	0.68	0.586	3.07
HH head male	0.943	0.96	0.043	0.31**	0.301	0.70	0.515	2.18	0.725	1.28	0.824	1.19	0.384	0.71	0.718	0.74
HH dependency ratio >1	0.813	1.10	0.634	1.28	0.127	1.72	0.707	0.73	0.693	0.83	0.730	0.82	0.016	1.97**	0.589	1.58
Community variables																
Community wealth high	0.200	0.39	0.418	1.95	0.378	1.54	0.611	1.58	0.808	0.90	0.493	0.61	0.632	1.18	0.870	1.21
High community OVC prev	0.003	3.40**	0.883	0.93	0.254	0.70	0.217	0.32	0.339	1.44	0.324	0.59	0.037	1.82**	0.438	0.49
Low community HIV stigma	0.104	2.03	0.414	0.68	0.041	2.00**	0.146	3.27	0.006	2.95**	0.872	0.91	0.863	0.95	0.843	1.18
Urban	0.770	1.19	0.795	0.82	0.022	0.38**	0.374	0.36	0.172	0.39	0.689	1.44	0.053	0.39*	0.634	0.47
High community HIV prev	0.654	0.83	0.123	2.18	0	0.29	0.806	0.78	0.699	0.86	0.151	2.29	0.056	1.91*	0.208	4.16
Household illness																
HIV-positive adult in HH	0.380	0.48	0.559	0.62	0.091	2.49*	0.582	1.77	0.611	1.67	0.503	0.44	0.084	2.03*	0.720	1.34
Adult sick in HH	0.928	0.96	0.079	4.50*	0.817	0.90	0.999	0.00	0.544	0.70	0.814	1.24	0.418	0.67	0.817	1.38
Interaction: HIV*adult illness	0.874	1.30	0.999	0.00	0.052	6.55*	1.000	0.13	0.999	0.00	0.139	17.30	0.880	0.86	0.998	0.00
Guardianship																
lives with both parents (reference)																
Neither parent dead, resides with mother only	0.222	2.47	0.899	0.90	0.425	0.67	0.312	5.50	0.698	1.38	0.613	1.59	0.021	3.62	1.000	1.06
Father is dead resides with mother	0.197	2.84	0.720	1.45	0.861	0.88	0.999	0.00	0.773	1.25	0.667	1.54	0.323	0.43		
Neither parent dead, resides with father only	0.132	3.00	0.495	0.54	0.233	0.13	0.999	0.00	0.774	1.44	0.999	0.00	0.072	2.81*	1.000	2.05
Mother is dead, resides with father	0.224	3.36	0.999	0.00	0.992	0.99	0.039	67.19**	0.998	0.00	0.475	2.54	0.001	15.21**		
Neither parent dead, resides in grandparent headed household	0.160	3.41	0.656	0.66	0.311	2.05	0.102	16.70	0.999	0.00	0.496	0.37	0.863	0.85	1.000	1.47
Neither parent dead, resides with neither parent nor grandparent headed household	0.926	0.94	0.941	1.05	0.168	1.88	0.131	8.98	0.335	0.30	0.260	2.60	0.078	2.28*		

Table 4 (*Continued*)

Variable name	Cameroon DHS 2004 ($N=438$)		Côte d'Ivoire AIS 2005 ($N=227$)		Haiti DHS 2005–2006 ($N=689$)		Malawi DHS 2004 ($N=164$)		Rwanda DHS 2005 ($N=716$)		Tanzania AIS 2003 ($N=389$)		Uganda AIS 2004 ($N=802$)		Zimbabwe DHS 2005–2006 ($N=595$)	
	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)	Signif	exp (Beta)
Mother is dead, resides in grandparent headed household	1.000	0.00	0.999	0.00	0.532	2.05*			0.999	0.00	0.259	6.03	0.025	8.98**	11.000	0.52
Mother is dead, resides with neither parent nor grandparent headed household	0.156	3.88	0.475	3.65	0.160	2.31	0.999	0.00	0.998	0.00	0.999	0.00	0.072	3.77*		
Father is dead, resides in grandparent headed household	0.999	0.00	1.000	0.00	1.000	0.00	0.999	0.00	0.032	9.26**	0.999	0.00	0.999	0.00		
Father is dead, resides with neither parent nor grandparent headed household	0.566	1.88	0.452	0.17	0.094	2.86*	0.999	0.00	0.939	0.93	0.999	0.00	0.002	5.34**	1.000	1.22
Both parents dead resides in grandparent headed household					0.117	9.18	0.999	0.00	0.999	0.00	0.999	0.00	0.640	1.78		
Both parents dead resides with neither parent nor grandparent headed household	0.565	0.41	1.000	0.00	0.999	0.00	0.650	2.31	0.336	0.38	0.999	0.00	0.286	0.22		
Demographics																
Aged 17 (reference is 15–16)	0.060	0.35	0.345	0.62	0.005	0.38**	0.637	0.60	0.925	0.96	0.020	0.25**	0.771	0.91	0.112	0.19
Currently attending school	0.179	0.57	0.972	1.02	0.010	0.40*	0.191	0.27	0.142	0.55	0.002	0.13**	0.171	0.65	0.057	0.19*
Oldest women in HH has primary educ.	0.799	1.15	0.459	0.62	0.526	1.25	0.576	1.62	0.301	1.58	0.887	0.92	0.574	0.82	0.240	5.11
HH head has primary educ.	0.597	1.38	0.423	0.64	0.511	0.79	0.920	1.10	0.027	0.38**	0.672	1.30	0.018	3.35**	0.767	0.62
Constant	0	0.02	0.784	0.81	0.014	0.19	0.032	0.01	0	0.04	0.215	0.29	0	0.02	0.994	0.00

Significance at *$p \leq 0.10$, ** $p \leq 0.05$, ***$p \leq 0.001$

Table 5. Multivariate logistic regression odds ratios for wasting.

	Cameroon DHS 2004 ($N=$ 2852)		Haiti DHS 2005–2006 ($N=2743$)		Malawi DHS 2004 ($N=1876$)		Mali DHS 2006 ($N=3103$)		Rwanda DHS 2005 ($N=3560$)		Zimbabwe DHS 2005–2006 ($N=2902$)	
Variable name	Signif	Exp (Beta)	Signif	Exp (Beta)	Signif	Exp (Beta)	Signif	Exp Beta)	Signif	Exp (Beta)	Signif	Exp (Beta)
Household variables												
Lowest wealth quintile (reference)												
Second quintile	0.486	1.10	0.889	1.02	0.157	0.77	0.107	0.83	0.165	0.84	0.079	0.79
Third quintile	0.050	0.71**	0.722	0.94	0.070	0.71	0.986	1.00	0.000	0.60***	0.019	0.71**
Fourth quintile	0.003	0.46**	0.000	0.44***	0.116	0.73	0.789	0.97	0.004	0.67**	0.007	0.55**
Highest quintile	0.000	0.19***	0.000	0.31***	0.000	0.28***	0.017	0.62**	0.000	0.27***	0.004	0.35**
HH head male	0.338	1.22	0.931	0.99	0.667	1.11	0.506	1.13	0.298	0.79	0.140	0.81
HH dependency ratio >1	0.010	1.37**	0.000	1.57***	0.845	1.03	0.528	1.06	0.209	1.13	0.654	1.05
Community variables												
Community wealth high	0.586	0.89	0.219	1.23	0.150	1.22	0.934	0.99	0.652	1.05	0.945	0.99
High community OVC prev	0.003	0.68**	0.641	0.95	0.500	0.91	0.414	1.07	0.672	1.04	0.714	1.04
Low community HIV stigma	0.563	0.90	0.031	1.33**	0.599	1.07	0.255	1.12	0.170	1.14	0.304	1.12
Urban	0.700	0.94	0.481	0.88	0.685	1.12	0.244	0.83	0.876	0.97	0.810	1.07
High community HIV prev	0.703	1.05	0.765	1.03	0.015	0.71**	0.911	0.99	0.693	0.96	0.022	1.32**
Household illness												
Child with diarrhea in the HH	0.017	1.33**	0.000	1.83***	0.034	1.35**	0.068	1.20	0.000	1.53**	0.048	1.30**
HIV positive adult in HH	0.014	1.73**	0.430	0.79	0.920	0.98	0.828	0.93	0.243	0.72	0.089	1.22*
Adult sick in HH	0.748	0.94	0.215	1.21	0.540	1.15	0.193	0.88	0.741	0.95	0.903	0.97
Interaction: HIV*adult illness	0.802	1.12	0.670	1.26	0.236	0.38	0.552	1.43	0.580	0.65	0.598	1.20
Guardianship												
lives with both parents (reference)												
Neither parent dead, resides with mother only	0.699	1.07	0.895	0.98	0.726	1.09	0.931	0.99	0.721	0.92	0.421	0.88
Father is dead resides with mother	0.751	0.88	0.472	1.29	0.805	1.12	0.131	1.61	0.279	0.68	0.692	1.11
Neither parent dead, resides with father only	0.767	0.89	0.107	1.64	0.913	1.13	0.007	0.31**	0.264	1.95	0.791	1.13
Mother is dead, resides with father	0.936	0.90	0.999	0.00			0.191	2.24	0.830	0.85	0.061	4.74*
Neither parent dead, resides in grandparent headed household	0.780	0.91	0.196	1.32	0.619	1.15	0.515	1.15	0.426	0.75	0.292	1.23
Neither parent dead, resides with neither parent nor grandparent headed household	0.179	0.34	0.017	2.21**	0.086	3.39*	0.259	0.60	0.607	1.43	0.067	1.93*
Mother is dead, resides in grandparent headed household	0.999	0.00	0.999	0.00	0.128	3.22	0.034	6.61**	0.459	0.41	0.196	1.82
Mother is dead, resides with neither parent nor grandparent headed household	0.046	5.83**	0.198	3.37	1.000	0.00	1.000	0.00	0.322	3.71	0.077	9.15*
Father is dead, resides in grandparent headed household	0.874	1.23	0.070	3.69*	0.943	1.07	0.999	0.00	0.999	0.00	0.186	1.60

Table 5 (*Continued*)

Variable name	Cameroon DHS 2004 ($N=$ 2852)		Haiti DHS 2005–2006 ($N=2743$)		Malawi DHS 2004 ($N=1876$)		Mali DHS 2006 ($N=3103$)		Rwanda DHS 2005 ($N=3560$)		Zimbabwe DHS 2005–2006 ($N=2902$)	
	Signif	Exp (Beta)	Signif	Exp (Beta)	Signif	Exp (Beta)	Signif	Exp Beta	Signif	Exp (Beta)	Signif	Exp (Beta)
Father is dead, resides with neither parent nor grandparent headed household	1.000	0.00	0.756	0.53			0.812	0.54	1.000	0.00	0.681	0.72
Both parents dead resides in grandparent headed household	0.999	0.00			0.002	5.24**	0.735	2.24	0.999	0.00	0.768	1.19
Both parents dead resides with neither parent nor grandparent headed household	0.999	0.00	0.999	0.00	0.167	6.16			0.685	1.53	0.077	3.77*
Demographics												
Child is a boy (girl is reference)	0.996	1.00	0.048	1.23**	0.717	1.05	0.763	1.02	0.231	1.11	0.378	1.09
Aged 2–4 (0–1 reference)	0.696	1.05	0.397	1.10	0.335	0.88	0.510	1.05	0.493	0.94	0.766	1.03
Oldest women in HH has primary educ.	0.000	0.56***	0.019	0.75**	0.808	0.97	0.838	1.03	0.025	0.80**	0.485	0.89
HH head has primary educ.	0.919	1.01	0.038	1.29**	0.309	0.84	0.021	0.78**	0.540	0.94	0.275	1.22
Constant	0.000	0.22	0.000	0.13	0.000	0.29	0.000	0.45	0.000	0.37	0.000	0.19

Significance at *$p \leq 0.10$, **$p \leq 0.05$, ***$p \leq 0.001$

yield important insights on child vulnerability within particular national contexts.

Concomitant with "knowing your children" in a way that reflects country-specific realities, there is also a need to arrive at an internationally comparable definition of vulnerability for tracking global progress and mobilizing mitigation resources. The current analysis as well as other research clearly point to the need for multivalent markers which incorporate household wealth as a key predictor of child vulnerability. Simultaneously, it is also imperative that we support the development of country-level vulnerability markers for children in response to different epidemic settings and country priorities. This will better enable the effective targeting of scarce resources to those most in need.

Notes

1. Because of the sensitivities and stigma associated with HIV and AIDS, it is not possible to accurately measure AIDS-specific orphanhood or chronic illness directly. Thus, since 2005 UNAIDS has facilitated a process of developing global measures of child vulnerability within the context of HIV and AIDS, and orphanhood and adult chronic illness in the household have become internationally accepted proxies for AIDS-affectedness.
2. West and Central Africa (15 countries), Eastern and Southern Africa (14 countries), Latin America and the Caribbean (five countries), as well as Thailand and Ukraine.
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 NCHS/WHO reference population (WHO, 2006).
4. The DHS and the MICS are typically implemented by a country once every 5 years. There have been five rounds of DHS and three rounds of MICS. For more information, see http://www.childinfo.org/mics.html and http://www.measuredhs.com, respectively.
5. There is a small amount of variability in how orphans are defined. In most countries the age range is 0–17. A few countries (e.g., Guinea and Mali) define orphans among children aged 0–14. Also, the age definition of orphans changed in 2004 to include children aged 15–17. Prior to that time orphans were defined as those children aged 0–14 (UNICEF/UNAIDS, 2004).
6. Cameroon 2004, Côte d'Ivoire 2005, Haiti 2005–2006, Malawi 2004–2005, Mali 2006, Rwanda 2005, Tanzania 2003–2004, Uganda 2004, and Zimbabwe 2005–2006.
7. For questions one and two, multivariate analysis was used to determine whether being an orphan (Question 1) or having an HIV positive or chronically ill adult in the household (Question 2) were significantly associated with the three outcome indicators. As the assumption of the paper is that orphanhood and co-residence with HIV positive or chronically adult are not good

predictors of negative outcomes for children, the more lenient 0.10 significance level was used in an attempt to identify evidence to the contrary. Given that the intent of the third research question is to identify other factors (i.e., household wealth) associated with poor outcomes for children, assessments of significance were made at the 0.05 level to strengthen the validity of the findings and to be in line with the conventional approach in most studies.

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