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2005 No. 24

August 2005

DEMOGRAPHIC AND HEALTH RESEARCH

The *DHS Working Papers* series is an unreviewed and unedited prepublication series of papers reporting on research in progress based on Demographic and Health Surveys (DHS) data. Funding for this research was provided by the United States Agency for International Development (USAID) through the MEASURE DHS project (# GPO-C-00-03-00002-00). The views expressed are those of the authors and do not necessarily reflect the views of the United States Agency for International Development, the United States Government, or the organizations with which the authors are affiliated.

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Education and Nutritional Status of Orphans and Children of HIV-Infected Parents in Kenya

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August 2005

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ABSTRACT

We examine how school attendance and nutritional status differ between orphaned and fostered children, and between children of HIV-infected parents and non-HIV-infected parents in Kenya. Our analysis is based on information on 2,756 children age 0-4 years and 4,172 children age 6-14 years included in the male subsample of the 2003 Kenya Demographic and Health Survey (DHS). The 2003 Kenya DHS is one of the first population-based, nationally representative surveys to link individual HIV test results for both males (age 15-54 years) and females (age 15-49 years) in one-half of the sample households with the full set of behavioral, social, and demographic indicators included in the survey. Data are analyzed using both descriptive and multivariate logistic regression methods. The results indicate that orphaned and fostered children (age 6-14 years) are significantly less likely to be attending school than nonorphaned, non-fostered children of HIV-negative parents. We find no clear pattern of relationship between orphanhood and nutritional status of children, although fostered children are somewhat more likely to be stunted, underweight, and wasted than children of HIV-negative parents. Children of HIV-infected parents are significantly less likely to be attending school, more likely to be underweight and wasted, and less likely to receive treatment for ARI and diarrhea than children of non-HIV-infected parents. We also find that children of non-HIV-infected single mothers (with no spouse) are generally more disadvantaged in nutrition, health care, and schooling than children who live with both non-HIV-infected parents. There is no relationship between parent HIV status and either stunting or immunization coverage.

KEY WORDS: orphaned, fostered, vulnerable, children, education, nutrition, health care, HIV, AIDS, DHS, Kenya

HUMAN SUBJECTS INFORMED CONSENT

Analysis presented in this paper is based on an analysis of existing survey data with all identifier information removed. Informed consent was obtained from all respondents in the survey before asking questions and separately before obtaining blood samples for HIV testing. HIV test results were linked anonymously to the information in the questionnaires.

ACKNOWLEDGEMENTS

The authors thank Eric Roth, Benny Kottiri, and Laurie Liskin for comments on an earlier draft. The authors also thank Noureddine Abderrahim for computer programming and Shane Khan for research assistance. An earlier version of this paper was presented at the 2005 Population Association of American Annual Meeting in Philadelphia, March 31 to April 2, 2005.

INTRODUCTION

HIV/AIDS and associated infections are reversing some of the hard-won development gains in many countries and leaving populations more vulnerable to poverty, malnutrition, and ill health. The adverse effects of the AIDS epidemic are felt most severely in some of the world's poorest countries in sub-Saharan Africa. One of the consequences has been an upsurge in the number of orphaned children (UNICEF 2003; UNAIDS, UNICEF, and USAID 2004). In sub-Saharan Africa, every eighth child is an orphan, i.e., has lost one or both parents. In countries like Botswana, Zimbabwe, and Lesotho that are hardest hit by HIV/AIDS, up to one in every five children are orphaned. More than four-fifths of all children orphaned by HIV/AIDS worldwide live in sub-Saharan Africa, and the orphan crisis is projected to worsen in the coming years. If it were not for HIV/AIDS, the number of orphans in sub-Saharan countries would be decreasing (UNAIDS, UNICEF, and USAID 2004).

Millions more children are fostered and made vulnerable by the epidemic in various ways. Children of HIV-positive parents suffer from the trauma of sickness and eventual death of a parent and associated hardships. The burden of caring for a sick parent often falls on children; many are forced to drop out of school and take on adult roles (Case et al. 2004; UNICEF 2003). Parental HIV-related illness and death often lead to decreased household resources due to treatment costs and job loss, which may affect health care and the nutritional status of children. Death of even one parent could result in changes in living arrangements, displacement, and lack of availability of resources for schooling, health care, and food for children. In sub-Saharan Africa, a mother's death is more likely to result in changes in living arrangements for children, whereas a father's death is more likely to reduce resource availability. Care providers for orphans tend to be elderly persons, who are generally less likely to know about and to be capable of providing proper health care and schooling. Parental HIV seropositive status also affects the psychosocial adjustment of children. Stigma associated with HIV/AIDS contributes further to the vulnerability of these children. Orphaned and fostered children are more likely to be discriminated against in schooling and health care, and are more prone to neglect and abuse (UNICEF 2003).

Improvements in child morbidity and mortality rates achieved during the last several decades have been reversed in many countries in recent years due to HIV/AIDS. The epidemic influences child survival both directly through mother-to-child transmission and indirectly through diverting resources and attention away from children to the care and treatment of a sick parent. In several sub-Saharan African countries, infant and child mortality rates have already risen substantially and are expected to increase further in the coming years (Newell et al. 2004; UNAIDS, UNICEF, and USAID 2004; Foster 1998; Nicoll et al. 1994). Several studies have linked maternal HIV seropositive status to increased risk of infant and child mortality (Nakiyingi et al. 2003; Crampin et al. 2003). Another study of the association between adult HIV prevalence and changes in the under-5 mortality rate in 25 countries with DHS surveys noted that the magnitude of increase in the under-5 mortality rate was most noticeable in countries with high HIV prevalence (Adetunji 2000).

Orphans tend to be at increased risk of being HIV-positive than nonorphans. HIV-infection transmitted at birth or in early childhood may lead to growth faltering and may contribute to greater morbidity and mortality. A prospective study of 184 HIV-infected and 1,403 uninfected children of infected mothers followed from birth to 10 years of age in eight European countries found that there were no significant differences in the height and weight of infected and uninfected children at birth, but infected children grew more slowly than the uninfected children. By age 10, infected children were on average 7.5 cm shorter and 7 kg lighter than uninfected children (Newell et al. 2003). Another prospective cohort study of growth progression in HIV-

infected and non-HIV-infected children in Kinshasa, Democratic Republic of Congo, arrived at similar conclusions (Bailey et al. 1999). However, a third prospective cohort study comparing HIV-positive and HIV-negative children born to HIV-positive mothers and HIV-negative children born to HIV-negative mothers in Nairobi, Kenya did not find any significant differences in feeding practices and growth of children in the three cohorts (Sherry et al. 2000).

A number of recent studies have shown that orphans are more vulnerable than nonorphans with respect to schooling. A recent study on orphanhood and children's school enrollment in 10 sub-Saharan African countries concluded that orphans are less likely to be enrolled in schools than nonorphans with whom they live (Case et al. 2004). This study also found that orphans who lived with distant relatives and unrelated caregivers had lower school enrollment than those who lived with a close relative. A descriptive study of 40 nationally representative household surveys in sub-Saharan Africa observed that orphans were considerably less likely to attend school than nonorphans, and double orphans were most likely to be disadvantaged in schooling (Monasch and Boerma 2004). Another study of cross-sectional survey data from five sub-Saharan African countries found that orphaned children were less likely to be attending the appropriate grade level for their age (Bicego et al. 2003). This study also noted that double orphans were particularly disadvantaged, and loss of a mother was more detrimental for schooling than loss of a father. The disadvantage was more pronounced for primary education than secondary education.

However, not all studies have found adverse effects of orphanhood on health and education of children. Contrary to the findings of the Case et al. (2004), Monasch and Boerma (2004), and Bicego et al. (2003) studies discussed above, Ainsworth and Filmer (2002) find considerable variation in the effect of orphahood on school attendance, including higher school attendance rates among orphans than nonorphans in some countries. Another study in rural Zimbabwe found no difference between orphans and nonorphans in primary school completion rate, although maternal orphans but not paternal or double orphans were less likely to complete primary school education than nonorphans (Nyamukapa and Gregson 2005).

A recent cross-sectional study in urban Uganda found no differences between orphans and nonorphans in reported treatment-seeking behavior and in measured anthropometric parameters (Sarker et al. 2005). A 3-year prospective study in southwestern Uganda also failed to find any significant difference in mortality between orphans and nonorphans, even though orphans and their surviving parents were considerably more likely to be HIV-infected than nonorphans and their parents (Kamali et al. 1996). The same study also noted only a small and statistically insignificant difference between orphans and nonorphans in the school attendance rate.

A study in rural western Kenya compared several health and nutritional indicators for orphaned and nonorphaned children under age 6 and concluded that orphaned children are at no greater risk of poor health than nonorphaned children (Lindblade et al. 2003). This study found no difference between orphans and nonorphans for a number of key health indicators, including fever, malaria, history of illness, anemia, and stunting, but orphans were somewhat more likely to be wasted than nonorphans. Panpanich et al. (1999) failed to find any significant differences in health conditions of village orphans and nonorphans in rural Malawi. This study also looked at children in an orphanage and found that younger children in the orphanage were more likely and older children living in the orphanage were less likely to be undernourished than orphans and nonorphans living in the village. The Crampin et al. (2003) and Ryder et al. (1994) studies, which noted a higher mortality risk among children born to HIV seropositive mothers, also failed to find any significant differences in nutritional status and morbidity of orphans and nonorphans.

In sum, there is evidence in the literature of adverse effects of orphanhood on schooling, but the evidence of effects of orphanhood on health and nutritional status of children is weak and inconclusive.

While many studies have focused on orphans, little is known about the health and nutritional status of fostered children and children living with HIV-infected parents. A study of fostered children in rural Mali concluded that fostering *per se* has little impact on children's nutritional status (as measured by their weight-for-age Z-scores), but the context of fostering matters (Castle 1995). In this study, children who were fostered due to poverty or other unfavorable circumstances had poorer nutritional status than other fostered children. A study in Sierra Leone found that fostered children were underrepresented in hospital admissions and that younger fostered children were more likely to be undernourished, but not the older ones (Bledsoe et al. 1988).

In this study, we analyze data from the most recent Demographic and Health Survey in Kenya to study if orphaned and fostered children and children of HIV-infected parents are more disadvantaged in nutrition and education than children of non-HIV-infected parents. We also examine if children of HIV-infected parents are less likely to receive health care than children of non-HIV-infected parents.

DATA AND METHODS

Data for this study come from the 2003 Kenya Demographic and Health Survey (KDHS). The 2003 KDHS is one of the first population-based, nationally-representative surveys to link individual HIV test results with the full set of behavioral, social, and demographic indicators included in the survey. The survey collected information from 9,865 households in 400 sample enumeration areas selected from a list of enumeration areas in the master sample based on the 1999 national population census. The sample was designed to represent each of the eight provinces in Kenya. The survey collected detailed information on marriage, fertility, family planning, sexual activity, nutritional status of women and young children, maternal and child health, and awareness and behavior regarding HIV/AIDS and STDs.

One-half of the sample households were randomly selected to include interviews with men. In these households, a total of 4,303 women age 15-49 and 4,183 men age 15-54 were identified as eligible for individual interviews and for HIV testing. Of the eligible women and men, individual questionnaires were completed for 94 percent of women and for 86 percent of men, and HIV tests were conducted for 76 percent of women and 70 percent of men. A few drops of capillary blood were collected on filter paper from a finger prick from respondents who voluntarily consented to the blood draw. The blood spots were subsequently dried and transported to a medical laboratory where they were tested for HIV. The HIV test results for individual males and females were anonymously linked to their information in the individual and household questionnaires. The analysis presented in this study is based on 2,756 children age 0-4 years and 4,172 children age 6-14 years included in the male subsample.

The English questionnaires were translated into 12 local languages, and the survey was implemented in the local language of the respondents. The data collection took place from April to September 2003. Seventeen teams of nine members each were involved in data collection. Parallel teams of mobile VCT counselors provided counseling and testing for the respondents and others in the community who wanted to know their HIV status, based on separate tests. Details of the sampling design and survey implementation are provided in the basic survey report (Central Bureau of Statistics, Ministry of Health, Kenya, and ORC Macro 2004).

The survey collected information on orphaned and fostered children under age 15 in the household schedule. For each child under age 15, the household respondent was asked: “Is (NAME)’s natural mother alive?” If alive, the household respondent was further asked: “Does (NAME)’s natural mother live in this household?” Similar information was collected about each child’s natural father. Information from these questions and from the HIV status of the mother and father (actually the mother’s current spouse if eligible for HIV testing) was used to group children into the following six categories:

1. Orphaned children: one or both biological parents of the child are dead
2. Fostered children: both biological parents are alive, but the child is not living with either
3. Children of HIV-positive parents: both biological parents are alive and the mother is HIV-positive or the mother’s current husband/partner is HIV-positive (we do not have information on the HIV status of biological fathers living separately)
4. Children of HIV-negative parents: both the mother and her current husband/partner are HIV-negative
5. Children of HIV-negative mothers who have no spouse
6. Children whose parents’ HIV status is unknown

The six categories are mutually exclusive, i.e., a child can fall in one and only one category. Orphaned children were defined first, based on the survival status of their biological parents. Among the remaining children, fostered children are those who are not living with either biological parent. Non-orphaned and non-fostered children were then categorized in the remaining four categories based on the HIV status of the mother and her current husband or partner. This six category variable is the primary predictor variable in our analysis. Children of HIV-negative parents are used as the comparison group in all analyses. Children in households that were not selected for HIV testing are excluded from the analysis.

Data are analyzed using both descriptive and multivariate logistic regression methods. First, we compare the six groups of children age 0-4 years on measures of nutritional status[1]—stunting, underweight, and wasting. Next, we compare the six groups of children age 6-14 years on school attendance rates. Finally, we compare children of HIV-infected parents with children of non-HIV-infected parents on indicators of full immunization[2] coverage and treatment-seeking behavior for acute respiratory infection (ARI)[3] and diarrhea. The analysis of immunization coverage is limited to children age 1-4 years.[4] The analysis of treatment-seeking for ARI and diarrhea is limited to children age 0-4 years who were sick with diarrhea or symptoms of ARI in the two weeks preceding the survey interview.

In these analyses, we control for a number of characteristics of the child, the parent(s), and the household. In analyses that include orphaned and fostered children, there are no controls for parent characteristics. Control variables included in the analysis are: child's age, sex, birth order, preceding birth interval, succeeding birth interval, size at birth, wanted status of child, breastfeeding status, mother's age at childbirth, mother's education, mother's work status, occupation of mother's current or former spouse, mother's exposure to mass media, mother's marital status, mother's body mass index (BMI), ethnicity, religion, mother's participation in household decisionmaking, mother's experience of physical mistreatment, alcohol or illegal drug consumption by mother's spouse, mother's or spouse's experience of high-risk sexual behavior, whether the mother or her spouse were tested for HIV prior to the survey, sex of household head, family type, household wealth index, urban/rural residence, and region. It is necessary to control for these characteristics because they tend to be associated with the likelihood of being orphaned or fostered, as well as with parent HIV status, and may potentially confound the effects of child parentage on the outcome variables. For definitions of these variables, see Table 1.

We use household weights when analyzing all children, including orphaned and fostered children. In analyses that are limited to children of interviewed mothers (i.e., not including orphaned and fostered children) and in analyses that involve parent characteristics, we use women's weights. Results of the multivariate analyses are presented as odds ratios (OR) with significance levels.

[1] A child is defined as stunted if its height-for-age is more than two standard deviations below the median of an international reference population recommended by the World Health Organization. Underweight (based on weight-for-age) and wasted (based on weight-for-height) are similarly defined (Dibley et al. 1987a; 1987b).

[2] A child is defined as fully immunized if he or she received a BCG vaccination, three doses of DPT vaccine, three doses of polio vaccine (excluding polio 0: polio vaccine given at time of birth), and a measles vaccination.

[3] ARI is defined as coughing accompanied by short, rapid breathing.

[4] Children under 12 months of age are excluded because, according to health guidelines, children should be fully immunized by the time they complete their first year of life.

RESULTS

Background

HIV prevalence and its correlates

The Kenya Demographic and Health Survey finds that 7 percent of adults in Kenya are HIV positive. HIV prevalence among women age 15-49 is nearly 9 percent, while for men age 15-54 it is under 5 percent. The female to male ratio of 1.9 is higher than ratios found in other studies in Africa. Young women in Kenya are particularly vulnerable to HIV infection compared with young men. HIV prevalence is higher among urban, more educated, and working adults. Household wealth status is also positively associated with HIV prevalence in both women and men. Muslim adults have a much lower prevalence of HIV than those from other religions. Among the ethnic groups, the Luo community stands out as having the highest prevalence. By geographic region, Nyanza has the highest prevalence, followed by Nairobi. The number of sex partners and the number of higher-risk partners are also associated with higher HIV prevalence. Adults who reported having a sexually transmitted infection (STI) or STI symptoms in the past 12 months have much higher rates of HIV infection than other adults. Circumcised men have a much lower prevalence of HIV than uncircumcised men.

Living arrangements of children

Overall, 9 percent of children under age 15 years have lost their fathers, 4 percent have lost their mothers, and 2 percent have lost both of their biological parents. Altogether, 11 percent of children under age 15 are orphaned (i.e., they have lost one or both biological parents). Fifty-eight percent of children live with both parents, 20 percent live with their mothers only, 2 percent live with their fathers only, and 7 percent live with neither parent (i.e., they are fostered). The proportion of orphaned children in Kenya has increased from 9 percent in 1998 to 11 percent in 2003.

Sample Distribution

Table 1 shows the sample distributions of children age 0-4 years and 6-14 years by orphanhood, fosterhood, parent HIV status, and selected child, parent, and household characteristics. Among children age 0-4 years, 5 percent are orphaned, 3 percent are fostered, 7 percent have an HIV-positive parent (the mother, her current spouse, or both are HIV positive), another 7 percent have an HIV-negative mother who is a single parent, and 39 percent have both parents HIV-negative. For the remaining 38 percent, parent HIV status is unknown. The proportions orphaned and fostered are much higher among children age 6-14 years than among children age 0-4 years. Higher proportions of orphaned and fostered among older children mainly reflect longer exposure to becoming an orphan or to being fostered. Seventeen percent of children age 6-14 years are orphaned and another 9 percent are fostered. The proportion of children who have an HIV-positive parent is somewhat lower for children age 6-14 years (4 percent) than for children age 0-4 years (7 percent), which reflects increasing HIV-related mortality in the adult population. Twenty-nine percent of children age 6-14 have both parents HIV-negative and for another 36 percent the HIV status of one or both parents is unknown.

Table 1 Percent distribution of children age 0-4 years and 6-14 years by child parentage and selected child, parent, and household characteristics, Kenya 2003

Characteristic	Children age 0-4 years	Children age 6-14 years
Child Parentage		
Orphaned children	4.8	17.3
Fostered children	3.4	9.4
Children of HIV+ parents	6.9	4.3
Children of HIV- mothers who have no spouse	7.3	3.8
Children whose parents' HIV status is unknown	38.0	36.3
Children of HIV- parents	39.4	28.9
Child Characteristics		
Age of child (years)		
0	21.6	-
1	19.3	-
2	18.5	-
3	21.8	-
4	18.8	-
6	-	13.1
7	-	11.9
8	-	10.8
9	-	10.4
10	-	12.3
11	-	9.7
12	-	10.9
13	-	11.3
14	-	9.7
Sex of child		
Male	49.5	50.2
Female	50.6	49.8
Birth order		
1	24.0	23.2
2-3	35.9	36.5
4-5	21.0	22.0
6+	19.1	18.3
Preceding birth interval		
First birth	24.1	23.4
< 24 months	15.7	19.1
24-35 months	27.7	28.4
36+ months	32.6	29.0
Succeeding birth interval		
Last birth	69.9	14.8
< 24 months	9.5	18.8
24-35 months	15.1	30.9
36+ months	5.5	35.6
Size at birth[1]		
Larger than average/very large	23.8	-
Average	60.1	-
Smaller than average/very small	16.2	-
Wanted status of last child		
Wanted then	56.7	-
Wanted later	24.6	-
Not wanted	18.6	-

Continued..

Table 1—*Continued*

Characteristic	Children age 0-4 years	Children age 6-14 years
Breastfeeding duration[2]		
< 12 months	32.1	-
12-23 months	45.8	-
24+ months	22.1	-
Parent Characteristics		
Mother's age at childbirth (years)		
<20	17.1	18.5
20-24	30.8	34.0
25-29	23.6	25.1
30-34	17.5	14.9
35+	11.0	7.4
Mother's education		
No education	15.2	21.2
Incomplete primary	36.5	33.8
Complete primary	26.6	24.0
Secondary+	21.6	21.0
Mother's work status in past 12 months		
Employed for cash	44.9	52.5
Employed but not for cash	20.1	20.4
Not employed	35.0	27.1
Occupation of mother's current or former spouse[3]		
White collar	21.1	22.5
Agriculture	35.4	37.2
Other	38.1	38.5
Never married	5.4	1.8
Mother's regular exposure to mass media[4]		
2+ sources	23.4	23.1
< 2 sources/no information	76.6	76.9
Mother's marital status		
In union	89.5	92.9
Separated/divorced/widowed	5.1	5.4
Never married	5.4	1.8
Mother's BMI[5]		
<18.5	13.0	10.1
18.5-24.9	68.5	61.4
25+	18.5	28.5
Ethnicity		
Kalenjin	12.5	11.9
Kamba	12.8	12.4
Kikuyu	18.0	20.8
Luhya	15.1	13.6
Luo	11.5	10.4
Other[6]	30.1	30.8
Religion		
Roman Catholic	23.4	23.2
Protestant/other Christian	64.6	65.1
Muslim	8.6	8.8
Other/missing	3.3	2.9
Mother's participation in household decisionmaking[7]		
No decision	24.1	16.1
1-2 decisions	39.4	37.8
3-4 decisions	36.5	46.1

Continued…

Table 1—*Continued*

Characteristic	Children age 0-4 years	Children age 6-14 years
Mother's experience of physical mistreatment[8]		
Never	35.9	36.0
More than 12 months ago	16.1	18.6
Once in past 12 months	10.4	6.6
Two or more times in past 12 months	17.5	18.1
No information	20.2	20.7
Alcohol/illegal drug consumption by mother's current or former spouse		
Never	52.9	47.3
Occasionally	19.3	21.2
Often	7.9	11.0
No information	19.9	20.6
Mother's or current spouse's experience of higher risk sex in past 12 months[9]		
Either or both parents	8.8	7.0
Neither	81.9	85.2
No information	9.3	7.8
Mother or current spouse tested for HIV		
Never (neither parent)	67.7	74.3
Ever (either or both parents)	23.3	18.6
No information	9.0	7.2
Household Characteristics		
Sex of household head		
Male	73.8	64.3
Female	26.2	35.7
Family type[10]		
Nuclear	61.1	58.2
Non-nuclear	39.0	41.8
Wealth index (quintile)[11]		
Lowest	23.8	22.5
Second	21.8	22.3
Middle	19.1	19.9
Fourth	18.1	21.2
Highest	17.3	14.0
Residence		
Urban	17.8	14.8
Rural	82.2	85.2

Continued..

Table 1—*Continued*

Characteristic	Children age 0-4 years	Children age 6-14 years
Region		
Nairobi	5.6	4.1
Central	11.1	13.3
Coast	7.8	7.6
Eastern	16.3	17.0
Nyanza	15.6	16.6
Rift Valley	27.9	25.4
Western	13.0	12.6
North Eastern	2.9	3.5
Number of children[12]	2,756	4,172

[1]Where available, size at birth uses actual birth weight. Children <2500 g are categorized as smaller than average or very small; 2500-2999 g as average; and 3000+ g as larger than average or very large. If the birth weight is not available, the size at birth is based on the mother's report.
[2]Breastfeeding duration includes current breastfeeding. A child under age 12 months who was currently breastfeeding is categorized is having a duration of <12 months, and so on. Sixteen children who were never breastfed or had inconsistent or missing information on breastfeeding duration are excluded.
[3]Occupation of mother's current or former spouse is based on mother's report. 'White collar' includes professional/technical/managerial, clerical, and sales and service; 'Other' includes skilled manual, unskilled manual, and domestic service.
[4]Media sources include newspaper, television, and radio. Regular exposure to a media source is defined as exposure at least once a week.
[5]The body mass index (BMI) is defined as a woman's weight in kilograms divided by the square of her height in meters (kg/m^2).
[6]Other category includes Embu, Kisii, Maasai, Meru, Mijikenda/Swahili, Somali, Taita/Taveta, Turkana, Kuria, and others.
[7]Mother's participation in decisionmaking includes decisions made by herself only, jointly with her husband, or jointly with someone else. Four household decisions are considered here: own health care, large household purchases, daily household purchases, and visits to family and relatives.
[8]Physical mistreatment includes pushing, shaking, throwing something at, slapping, arm twisting, punching with fist or something else, kicking, dragging, attempt to strangle or burn, threaten with knife, gun, or other weapon, attack with a knife, gun, or other weapon, physically forced to have sexual intercourse when the woman did not want, forced to perform other sexual acts that the woman did not want.
[9]Higher risk sex is defined as sex with a nonmarital, noncohabiting partner.
[10]A nuclear household includes any combination of household head, spouse, cospouse, children, and fostered or adopted children.
[11]The wealth index measures a household's relative economic status based largely on household ownership of durable assets. For details on the methodology of calculating the index, see Rutstein and Johnson (2004).
[12]The number of children varies slightly for individual characteristics depending on the number of missing cases. For parent characteristics and for child characteristics derived from individual questionnaires, orphans and fostered children are excluded.

Children are about evenly distributed by child's age and sex. About one in four children are first order births and two-fifths are of birth order four or higher. For about three-fifths of children in both age groups, the preceding birth interval was over 24 months. The proportion of children that are reported as a last birth is much greater among children age 0-4 years (70 percent) than among children age 6-14 years (15 percent), reflecting the longer exposure period for older children to have a sibling born. Among children age 0-4 years, 16 percent were identified as smaller than average or very small at birth, and 19 percent were reported to be not wanted at the time of

conception. For more than two-thirds of children age 0-4 years, the breastfeeding duration was reported to be over 12 months.

Among children whose mothers were interviewed, mothers of more than one-half of children were illiterate or had less than primary education. Mothers of about one-half of children (45 percent for children age 0-4 and 53 percent for children age 6-14) were employed for cash in the past 12 months. Mothers of less than one-quarter of children were regularly exposed to two or more media sources. Mothers of younger children were somewhat less likely to participate in household decisionmaking and slightly more likely to have experienced physical mistreatment in the past 12 months. Among children age 0-4 years, 26 percent lived in a female-headed household, 61 percent in a nuclear family, and 82 percent in a rural area. The corresponding proportions for children age 6-14 years are 36, 58, and 85 percent, respectively.

Orphaned and fostered children are more likely to live in female-headed and non-nuclear households than children of HIV-negative parents (results in this paragraph not shown). Mothers of children of HIV-positive parents are less likely to be illiterate and undernourished (BMI<18.5), and more likely to be employed for cash, exposed to two or more media sources regularly, and participate in household decisionmaking than mothers of children of HIV-negative parents. Also, for children of HIV-positive parents, the current or former spouse of the mother is more likely to be a white-collar worker than for children of HIV-negative parents. The proportion of mothers reporting physical mistreatment since age 15 is about the same for children of HIV-positive and HIV-negative parents, but the proportion reporting physical mistreatment in the past 12 months is greater for children of HIV-negative parents (35 percent) than for children of HIV-positive parents (24 percent). Mothers are more likely to report alcohol or illegal drug consumption by their current or former spouse if they are HIV positive or their spouse is HIV positive. Children of HIV-positive parents are more likely to live in urban areas than children of HIV-negative parents. Also, children of HIV-positive parents are much more likely than children of HIV-negative parents to belong to the Luo ethnic group and to live in the Nyanza province.

Bivariate Results

Table 2 shows how indicators of child nutritional status—stunting, underweight, and wasting—vary by child parentage and other selected characteristics for children age 0-4 years. Overall, 32 percent of children are stunted, 21 percent are underweight, and 5 percent are wasted. As expected, prevalence of stunting is higher among fostered children (42 percent) than among children of HIV-negative parents (37 percent). But contrary to the expectation, stunting is less prevalent among orphaned children (22 percent) and children of HIV-positive parents (29 percent) than among children of HIV-negative parents. Children of HIV-negative mothers with no spouse are also less likely to be stunted than children of HIV-negative parents. As in the case of stunting, fostered children are more likely to be underweight (32 percent) than children of HIV-negative parents (23 percent), but the underweight prevalence is about the same in orphaned children, children of HIV-positive parents, and children of HIV-negative parents. The prevalence of wasting does not vary much by child parentage status, except it is somewhat higher among children of HIV-positive parents than among children of HIV-negative parents.

Due to the small number of orphans age 0-4 years in our sample, we are unable to examine how stunting, underweight, and wasting levels differ for paternal orphans (only father dead), maternal orphans (only mother dead), and double orphans (both parents dead).

Table 2 Prevalence of stunting, underweight, and wasting among children age 0-4 years, by child parentage and selected child, household, and parent characteristics, Kenya 2003

Characteristic	Stunting	Underweight	Wasting
Child Parentage			
Orphaned children	21.6	21.2	5.1
Fostered children	41.8	32.2	5.5
Children of HIV+ parents	29.2	22.4	5.9
Children of HIV- mothers who have no spouse	25.8	21.2	5.6
Children whose parents' HIV status is unknown	27.3	17.7	4.4
Children of HIV- parents	37.2	22.7	5.1
Child Characteristics			
Age of child (years)			
0	14.2	9.7	4.8
1	42.1	27.7	8.8
2	39.4	26.4	3.6
3	32.3	21.8	4.5
4	30.9	20.1	3.0
Sex of child			
Male	35.4	23.8	6.2
Female	27.9	18.3	3.7
Birth order			
1	25.7	17.9	5.4
2-3	30.4	19.6	4.7
4-5	36.5	22.9	4.5
6+	36.7	23.7	5.6
Preceding birth interval			
First birth	25.8	18.1	5.3
< 24 months	39.0	26.1	6.5
24-35 months	33.3	20.5	4.8
36+ months	31.3	20.1	4.1
Succeeding birth interval			
Last birth	29.9	19.3	5.5
< 24 months	34.9	22.2	4.2
24-35 months	36.3	22.6	3.4
36+ months	36.5	29.8	4.1
Size at birth[1]			
Larger than average/very large	26.4	12.1	3.9
Average	30.6	20.3	4.9
Smaller than average/very small	44.8	35.7	7.2
Wanted status of last child			
Wanted then	30.7	21.9	5.9
Wanted later	35.4	17.9	3.1
Not wanted	30.2	20.7	4.8
Breastfeeding duration[2]			
< 12 months	19.6	12.4	4.5
12-23 months	38.7	24.6	5.7
24+ months	34.1	23.6	3.9
Parent Characteristics			
Mother's age at childbirth (years)			
<20	34.1	23.0	5.8
20-24	31.5	20.4	5.4
25-29	31.5	21.8	4.6
30-34	29.1	20.0	4.3
35+	33.9	16.5	4.7

Continued…

Table 2—*Continued*

Characteristic	Stunting	Underweight	Wasting
Mother's education			
No education	38.7	32.8	13.6
Incomplete primary	36.1	23.8	4.9
Complete primary	30.5	17.2	1.3
Secondary+	21.1	11.3	3.8
Mother's work status in past 12 months			
Employed for cash	32.4	19.6	3.6
Employed but not for cash	35.0	24.5	5.9
Not employed	29.0	20.0	6.3
Occupation of mother's current or former spouse[3]			
White collar	25.4	13.7	3.2
Agriculture	36.4	28.0	7.1
Other	32.3	18.5	3.8
Never married	22.5	15.1	6.3
Mother's regular exposure to mass media[4]			
2+ sources	22.4	15.0	3.7
< 2 sources/no information	34.5	22.3	5.3
Mother's marital status			
In union	32.1	20.4	4.9
Separated/divorced/widowed	35.0	30.5	4.3
Never married	22.5	15.1	6.3
Mother's BMI[5]			
<18.5	43.4	38.1	12.7
18.5-24.9	32.9	20.7	4.0
25+	20.0	9.0	3.6
Ethnicity			
Kalenjin	36.6	27.8	5.6
Kamba	35.0	23.6	1.9
Kikuyu	27.3	15.7	3.0
Luhya	28.0	14.4	3.6
Luo	32.0	13.9	2.3
Other[6]	32.7	25.2	8.9
Religion			
Roman Catholic	34.5	21.5	2.8
Protestant/other Christian	29.7	18.9	4.1
Muslim	33.0	23.5	11.5
Other/missing	52.0	45.0	22.4
Mother's participation in household decisionmaking[7]			
No decision	32.1	23.5	8.2
1-2 decisions	33.5	22.3	4.1
3-4 decisions	29.8	17.2	3.8
Mother's experience of physical mistreatment[8]			
Never	26.1	16.2	4.1
More than 12 months ago	31.7	21.8	4.8
Once in past 12 months	39.5	21.2	7.0
Two more times in past 12 months	42.4	29.6	4.5
No information	28.1	19.5	6.0
Alcohol/illegal drug consumption by mother's current spouse			
Never	31.9	19.0	5.1
Occasionally	32.3	22.8	4.0
Often	39.8	29.6	3.7
No information	27.5	19.3	6.1

Continued…

Table 2—*Continued*

Characteristic	Stunting	Underweight	Wasting
Mother's or current spouse's experience of higher risk sex in past 12 months[9]			
Either or both parents	33.8	22.5	3.6
Neither	31.8	20.2	4.5
No information	29.0	23.3	10.6
Mother or current spouse tested for HIV			
Never (neither parent)	33.5	22.1	4.5
Ever (either or both parents)	25.9	16.4	5.1
No information	34.3	20.9	8.3
Household Characteristics			
Sex of household head			
Male	32.7	21.2	5.4
Female	28.5	20.6	3.8
Family type[10]			
Nuclear	33.7	22.0	4.9
Non-nuclear	28.3	19.4	5.1
Wealth index (quintile) [11]			
Lowest	41.5	30.6	9.4
Second	33.8	22.3	5.3
Middle	32.1	19.8	3.2
Fourth	25.4	18.4	2.8
Highest	20.0	9.1	2.4
Residence			
Urban	23.4	13.9	3.3
Rural	33.2	22.4	5.3
Region			
Nairobi	20.3	6.2	2.1
Central	26.2	14.6	3.4
Coast	36.7	25.0	5.5
Eastern	32.2	22.5	3.2
Nyanza	30.9	15.3	2.1
Rift Valley	34.0	26.4	7.5
Western	33.0	21.2	4.2
North Eastern	30.7	36.8	23.5
Total	31.6	21.0	5.0
Number of children[12]	2,464	2,464	2,464

Note: See Table 1 for list of footnotes.

Boys are more likely to be stunted, underweight, and wasted than girls. Undernutrition rates also vary strongly and expectedly with mother's education, media exposure, BMI, household wealth status, and urban/rural residence. Among other characteristics, children age one year, children of higher birth orders, children with a smaller than average or very small birth size, children of mothers whose current or former spouse worked in agriculture, children of separated/widowed/divorced mothers, children of Kalenjin mothers, children whose mothers experienced physical mistreatment, children in male-headed households, and children in nuclear families are more likely to be undernourished than other children.

Overall, the school attendance rate for children age 6-14 years is quite high (91 percent). Consistent with expectations, orphaned and fostered children and children of HIV-negative mothers who have no spouse are somewhat less likely to be attending school than children of HIV-negative parents (Table 3). However, contrary to the expectation, children of HIV-positive parents are somewhat more likely to be attending school than children of HIV-negative parents.

Also, contrary to expectations, double orphans are more likely to be attending school (95 percent) than paternal orphans (89 percent) or maternal orphans (80 percent). These differentials occur independent of household wealth status, urban/rural residence, and other factors (results not shown). Reasons for this unexpected finding are not clear.

Table 3 School attendance rate (%) among children age 6-14 years, by child parentage and selected child, parent, and household characteristics, Kenya 2003

Characteristic	Percentage attending school
Child Parentage	
Orphaned children	88.8
Fostered children	87.3
Children of HIV+ parents	95.5
Children of HIV- mothers who have no spouse	88.4
Children whose parents' HIV status is unknown	91.6
Children of HIV- parents	91.0
Child Characteristics	
Age of child (years)	
6	85.4
7	89.1
8	88.8
9	94.9
10	91.0
11	95.6
12	93.0
13	90.0
14	89.2
Sex of child	
Male	90.7
Female	90.4
Birth order	
1	93.4
2-3	92.8
4-5	89.1
6+	88.9
Preceding birth interval	
First birth	93.5
< 24 months	86.5
24-35 months	91.4
36+ months	92.9
Succeeding birth interval	
Last birth	97.1
< 24 months	86.9
24-35 months	92.0
36+ months	90.8
Parent Characteristics	
Mother's age at childbirth (years)	
<20	90.3
20-24	92.4
25-29	92.1
30-34	89.8
35+	90.1
Mother's education	
No education	68.1
Incomplete primary	96.1
Complete primary	98.2
Secondary+	99.3

Continued.

Table 3—*Continued*

Characteristic	Percentage attending school
Mother's work status in past 12 months	
Employed for cash	95.7
Employed but not for cash	93.6
Not employed	81.3
Occupation of mother's current or former spouse[3]	
White collar	94.8
Agriculture	85.4
Other	95.4
Never married	87.5
Mother's regular exposure to mass media[4]	
2+ sources	98.3
< 2 sources/no information	89.3
Mother's marital status	
In union	91.4
Separated/divorced/widowed	92.4
Never married	87.5
Mother's BMI[5]	
<18.5	75.8
18.5-24.9	91.6
25+	97.8
Ethnicity	
Kalenjin	91.3
Kamba	97.7
Kikuyu	98.8
Luhya	96.1
Luo	99.0
Other	79.1
Religion[6]	
Roman Catholic	92.4
Protestant/other Christian	95.8
Muslim	63.8
Other/missing	67.8
Mother's participation in household decisionmaking[7]	
No decision	83.0
1-2 decisions	91.7
3-4 decisions	94.1
Mother's experience of physical mistreatment[8]	
Never	90.2
More than 12 months ago	92.7
Once in past 12 months	95.5
Two or more times in past 12 months	89.2
No information	92.9
Alcohol/illegal drug consumption by mother's current spouse	
Never	89.6
Occasionally	94.4
Often	90.7
No information	92.9
Mother's or current spouse's experience of higher risk sex in past 12 months[9]	
Either or both parents	91.1
Neither	92.5
No information	79.8

Continued…

Table 3—*Continued*

Characteristic	Percentage attending school
Mother or current spouse tested for HIV	
Never (neither parent)	91.5
Ever (either or both parents)	95.5
No information	79.6
Household Characteristics	
Sex of household head	
Male	90.1
Female	91.5
Family type[10]	
Nuclear	90.5
Non-nuclear	90.6
Wealth index (quintile) [11]	
Lowest	75.8
Second	93.2
Middle	95.3
Fourth	95.4
Highest	96.0
Residence	
Urban	92.2
Rural	90.3
Region	
Nairobi	93.0
Central	97.1
Coast	83.4
Eastern	94.9
Nyanza	97.8
Rift Valley	85.9
Western	95.7
North Eastern	37.7
Total	90.6
Number of children[12]	4,165

Note: See Table 1 for list of footnotes.

As expected, the school attendance rate is strongly positively correlated with mother's education, work status, media exposure, BMI, degree of participation in household decisionmaking, and household wealth status. The school attendance rate is noticeably lower for Muslim children and for children in the North Eastern province. The rate does not vary much by other characteristics.

Table 4 shows that among children age 1-4 years, the likelihood of being fully immunized does not vary much by parent HIV status. Children of HIV-positive parents (64 percent) and children of HIV-negative parents (63 percent) are about equally likely to be fully immunized. Proportion fully immunized is strongly positively associated with mother's education and household wealth status. It is also positively associated with mother's work status, media exposure, BMI, mother's participation in household decisionmaking, and urban residence. Higher birth order, preceding birth interval of < 36 months, succeeding birth interval of <24 months, mother's older age at birth (35+ years), agricultural occupation of mother's current or former spouse, separated/widowed/ divorced status of mother, Luo ethnicity, Muslim religion, mother's experience of physical mistreatment, parents' experience of higher risk sex, nuclear family status, and residence in the North Eastern and Nyanza provinces is associated with lower likelihood of being fully immunized. Only 8 percent of children in the North Eastern province are fully immunized compared with 85 percent in the Central province.

Table 4 Immunization coverage among children age 1-4 years and treatment-seeking for ARI and diarrhea among children age 0-4 years who were sick with ARI or diarrhea in the past two weeks, by child parentage and selected child, parent, and household characteristics, Kenya 2003

Characteristic	Percentage fully immunized	Percentage received treatment for ARI	Percentage received treatment for diarrhea
Child Parentage			
Children of HIV+ parents	63.7	37.8	17.8
Children of HIV- mothers who have no spouse	63.5	41.5	15.0
Children whose parents' HIV status is unknown	61.4	56.3	33.6
Children of HIV- parents	63.2	53.7	26.9
Child Characteristics			
Age of child (years)			
0	-	62.0	26.7
1	61.4	51.6	32.3
2	60.8	48.6	20.3
3	60.7	38.3	29.8
4	68.0	64.1	21.8
Sex of child			
Male	63.2	54.1	24.5
Female	62.0	51.0	31.1
Birth order			
1	67.6	52.7	30.5
2-3	65.1	54.9	26.6
4-5	61.6	52.0	33.6
6+	52.5	49.5	19.1
Preceding birth interval			
First birth	67.6	52.7	30.5
< 24 months	58.8	52.9	23.4
24-35 months	56.2	50.4	30.4
36+ months	65.6	54.5	24.6
Succeeding birth interval			
Last birth	64.2	55.2	28.6
< 24 months	56.7	58.3	16.8
24-35 months	61.7	38.6	26.6
36+ months	61.5	43.4	23.6
Size at birth[1]			
Larger than average/very large	63.5	56.0	28.4
Average	62.7	51.0	25.8
Smaller than average/very small	61.4	52.6	30.6
Wanted status of last child			
Wanted then	62.7	52.8	30.6
Wanted later	60.2	51.4	28.1
Not wanted	65.6	53.5	17.6
Breastfeeding duration[2]			
< 12 months	62.9	62.3	26.3
12-23 months	62.2	48.0	26.3
24+ months	64.2	45.5	31.6
Parent Characteristics			
Mother's age at childbirth (years)			
<20	61.9	54.2	23.6
20-24	62.3	54.3	31.0
25-29	63.7	48.9	32.9
30-34	65.9	56.2	25.4
35+	56.7	48.3	17.2

Continued…

Table 4—*Continued*

Characteristic	Percentage fully immunized	Percentage received treatment for ARI	Percentage received treatment for diarrhea
Mother's education			
No education	32.3	48.3	26.1
Incomplete primary	58.7	51.6	27.1
Complete primary	71.7	56.0	25.7
Secondary+	78.2	53.9	33.2
Mother's work status in past 12 months			
Employed for cash	66.8	52.4	26.3
Employed but not for cash	63.4	50.3	27.2
Not employed	56.3	54.0	28.3
Occupation of mother's current or former spouse[3]			
White collar	69.6	65.8	32.1
Agriculture	54.1	49.1	23.9
Other	65.5	51.6	29.7
Never married	71.6	32.2	15.1
Mother's regular exposure to mass media[4]			
2+ sources	75.7	66.9	39.3
< 2 sources/no information	58.7	48.8	24.5
Mother's marital status			
In union	62.4	53.9	28.5
Separated/divorced/widowed	57.7	46.9	21.6
Never married	71.6	32.2	15.1
Mother's BMI[5]			
<18.5	52.1	50.0	43.2
18.5-24.9	61.6	49.3	23.5
25+	74.0	64.7	32.8
Ethnicity			
Kalenjin	76.7	53.7	18.1
Kamba	70.2	69.3	37.2
Kikuyu	76.8	53.0	23.5
Luhya	56.2	45.0	18.0
Luo	46.5	50.7	27.0
Other[6]	53.4	54.1	35.9
Religion			
Roman Catholic	64.3	54.9	29.4
Protestant/other Christian	64.9	51.6	25.6
Muslim	45.7	49.6	35.9
Other/missing	46.6	62.1	11.9
Mother's participation in household decisionmaking[7]			
No decision	54.8	43.4	33.2
1-2 decisions	60.7	54.9	25.6
3-4 decisions	69.2	57.7	24.0
Mother's experience of physical mistreatment[8]			
Never	67.7	49.2	33.0
More than 12 months ago	62.8	60.4	32.6
Once in past 12 months	54.4	47.0	22.4
Two or more times in past 12 months	52.7	57.2	24.8
No information	66.0	48.9	21.1

Continued…

Table 4—*Continued*

Characteristic	Percentage fully immunized	Percentage received treatment for ARI	Percentage received treatment for diarrhea
Alcohol/illegal drug consumption by mother's current spouse			
Never	60.4	51.9	31.3
Occasionally	65.6	60.0	30.1
Often	60.1	43.4	10.1
No information	66.4	49.9	21.4
Mother's or current spouse's experience of higher risk sex in past 12 months[9]			
Either or both parents	51.8	47.1	18.6
Neither	64.3	54.1	29.9
No information	56.3	43.9	16.8
Mother or current spouse tested for HIV			
Never (neither parent)	61.0	50.2	25.4
Ever (either or both parents)	69.5	59.0	24.4
No information	56.4	55.4	51.3
Household Characteristics			
Sex of household head			
Male	62.0	53.6	29.5
Female	64.4	48.5	20.9
Family type[10]			
Nuclear	60.1	52.4	27.5
Non-nuclear	67.3	52.9	27.3
Wealth index (quintile) [11]			
Lowest	48.3	50.3	25.7
Second	59.5	47.2	23.2
Middle	66.1	39.9	21.6
Fourth	70.1	60.5	31.4
Highest	73.7	70.6	41.1
Residence			
Urban	69.6	72.6	27.4
Rural	61.1	49.1	27.4
Region			
Nairobi	69.2	80.2	40.0
Central	84.7	55.4	40.7
Coast	68.5	63.9	42.4
Eastern	69.5	72.0	45.7
Nyanza	49.0	48.8	23.6
Rift Valley	61.6	51.6	19.5
Western	56.6	38.4	18.8
North Eastern	8.1	17.9	4.8
Total	62.6	52.6	27.4
Number of children[12]	1,869	445	396

Note: See Table 1 for list of footnotes.

Table 4 also shows treatment-seeking for children age 0-4 years who have ARI and diarrhea. Overall, children with ARI were more likely to receive medical advice or treatment (53 percent) than children with diarrhea (27 percent). Among children who were sick with ARI in the two weeks preceding the survey, children of HIV-positive parents were considerably less likely to have received medical advice or treatment for ARI (38 percent) than children of HIV-negative parents (54 percent). Children of HIV-negative mothers with no spouse were also less likely to have received ARI treatment (42 percent) than children of HIV-negative parents. A similar

pattern is observed for diarrhea treatment. Children of HIV-positive parents (18 percent) and children of HIV-negative mothers with no spouse (15 percent) were considerably less likely to have received medical advice or treatment when sick with diarrhea in the two weeks preceding the survey than children of HIV-negative parents (27 percent).

Mother's education, media exposure, and household wealth status are associated with a greater likelihood of receiving advice or treatment for ARI and diarrhea. Children in male-headed households are more likely to have received ARI and diarrhea treatment than children in female-headed households. Mother's participation in household decisionmaking and urban residence are associated with a greater likelihood of treatment-seeking for ARI, but not for diarrhea. Children in the North Eastern province are much less likely to have received treatment for ARI and diarrhea than children in other provinces.

Multivariate Results

Nutritional status

Fostered children tend to have higher prevalence of stunting (OR=1.37; n.s.), underweight (OR=1.96; p=0.031), and wasting (OR=1.64; n.s.) than children of HIV-negative parents (Table 5). However, the results on the relative nutritional status of orphaned children are mixed. Orphaned children are less likely to be stunted (OR=0.46; p=0.011), about equally likely to be underweight (OR=1.01; n.s.), and more likely to be wasted (OR=1.59; n.s.) than children of HIV-negative parents. A lack of association between orphanhood status and nutritional status may reflect the fact that for more than four-fifths of the orphaned children one of the parents was alive. A significantly lower prevalence of stunting among orphaned children is unexpected, however. Children of HIV-positive parents are significantly more likely to be underweight (OR=1.57; p=0.061) and significantly more likely to be wasted (OR=2.37; p=0.043) than children of HIV-negative parents. Children of HIV-negative mothers who have no spouse also tend to have higher prevalence of underweight (OR=1.37; n.s.) and wasting (OR=1.57; n.s.), but these effects are not statistically significant. Contrary to expectations, children of HIV-positive parents and children of HIV-negative mothers with no spouse tend to have lower prevalence of stunting than children of HIV-negative parents, but these effects are also not statistically significant.

When the analysis is limited to children of interviewed mothers by additionally controlling for several child and parent characteristics, children of HIV-positive parents remain significantly more likely to be underweight (OR=1.69; p=0.055) and wasted (OR=3.48; p=0.004) than children of HIV-negative parents (Table 6). These effects are much stronger than in the previous model. Children of HIV-negative mothers with no spouse also remain more likely to be underweight (OR=1.91; p=0.074) and more likely to be wasted (OR=1.51; n.s.) than children of HIV-negative parents. Again, children of HIV-positive parents and children of HIV-negative mothers with no spouse have lower prevalence of stunting than children of HIV-negative parents, but these effects are not statistically significant.

With parent HIV status and other factors controlled in Table 6, girls are significantly less likely to be stunted, underweight, and wasted than boys. Diarrhea in the past two weeks, mother's nutritional status, and household wealth status are also significantly associated with stunting, underweight, and wasting. Child's age, birth order, birth size, mother's age at childbirth, occupation of mother's current or former spouse, and mother's experience of physical violence are significantly associated with stunting and underweight, but not wasting. On the other hand, mother's regular exposure to two or more media sources is significantly associated with underweight and wasting, but not with stunting.

Table 5 Odds ratios for effects of child parentage and selected child and household characteristics on the risk of stunting, underweight, and wasting among children age 0-4 years, Kenya 2003

Characteristic	Stunting	Underweight	Wasting
Child parentage			
Orphaned children	0.46**	1.01	1.59
Fostered children	1.37	1.96**	1.64
Children of HIV+ parents	0.90	1.57*	2.37**
Children of HIV- mothers who have no spouse	0.78	1.37	1.57
Children whose parents' HIV status is unknown	0.70***	0.85	1.06
Children of HIV- parents†	1.00	1.00	1.00
Child characteristics			
Age of the child (years)			
0†	1.00	1.00	1.00
1	4.63****	3.75****	2.10**
2	4.06****	3.53****	0.74
3	3.09****	2.73****	0.90
4	2.70****	2.31****	0.65
Sex of child			
Male†	1.00	1.00	1.00
Female	0.70****	0.70***	0.57***
Household characteristics			
Sex of household head			
Male†	1.00	1.00	1.00
Female	1.01	0.99	0.71
Family type[10]			
Nuclear†	1.00	1.00	1.00
Non nuclear	0.84	0.82	1.17
Wealth index (quintile) [11]			
Lowest†	1.00	1.00	1.00
Second	0.74**	0.71**	0.72
Middle	0.64***	0.57***	0.40**
Fourth	0.48****	0.49****	0.30****
Highest	0.29****	0.20****	0.23**
Residence			
Urban†	1.00	1.00	1.00
Rural	0.81	0.71	0.86
Region			
Nairobi†	1.00	1.00	1.00
Central	0.89	1.41	1.20
Coast	1.16	2.22**	1.32
Eastern	0.96	2.05*	0.87
Nyanza	0.84	1.06	0.42
Rift Valley	0.97	2.32**	1.90
Western	0.80	1.55	0.92
North Eastern	0.65	3.09***	5.89***
Number of children[12]	2,349	2,349	2,349

Note: See Table 1 for list of footnotes.
†Reference category.
* p<.1, ** p<.05, *** p<.01, **** p<.001

Table 6 Odds ratios for effects of child parentage and selected child, parent, and household characteristics on the risk of stunting, underweight, and wasting among children age 0-4 years (excluding orphans and foster children), Kenya 2003

Characteristic	Stunting	Underweight	Wasting
Parent HIV status			
Children of HIV+ parents	0.79	1.69*	3.48***
Children of HIV- mothers who have no spouse	0.64	1.91*	1.51
Children whose parents' HIV status is unknown	0.63***	1.10	1.20
Children of HIV- parents†	1.00	1.00	1.00
Child characteristics			
Age of the child (years)			
0†	1.00	1.00	1.00
1	6.09****	5.02****	1.83
2	4.80****	4.45****	0.74
3	3.86****	3.65****	0.96
4	3.35****	3.21****	0.50
Sex of child			
Male†	1.00	1.00	1.00
Female	0.64****	0.65***	0.62**
Birth order			
1†	1.00	1.00	1.00
2-3	1.51**	1.31	0.87
4-5	2.41****	1.78*	0.76
6+	2.56***	2.05**	0.76
Size at birth[1]			
Larger than average/very large†	1.00	1.00	1.00
Average	1.23	1.75***	1.09
Smaller than average/very small	2.07****	3.41****	1.16
Wanted status of last child			
Wanted then†	1.00	1.00	1.00
Wanted later	1.32*	0.81	0.73
Not wanted	0.92	0.98	1.54
Breastfeeding duration[2]			
< 12 months†	1.00	1.00	1.00
12-23 months	0.92	0.89	1.10
24+ months	1.00	1.15	1.21
Had ARI in last 2 weeks			
No†	1.00	1.00	1.00
Yes	1.17	1.46**	1.28
Had diarrhea in last 2 weeks			
No†	1.00	1.00	1.00
Yes	1.38**	2.07****	2.30****
Parent characteristics			
Mother's age at childbirth			
<20†	1.00	1.00	1.00
20-24	0.68*	0.73	1.01
25-29	0.46***	0.58*	0.78
30-34	0.46***	0.60	1.02
35+	0.48**	0.32***	0.90
Mother's education			
No education†	1.00	1.00	1.00
Incomplete primary	1.04	1.07	0.85
Complete primary	0.97	0.81	0.25***
Secondary+	0.88	0.66	0.66
Mother's work status in past 12 months			
Employed for cash†	1.00	1.00	1.00
Employed but not for cash	0.91	1.19	1.04
Not employed	0.70**	0.75	0.68

Continued…

Table 6—*Continued*

Characteristic	Stunting	Underweight	Wasting
Occupation of mother's current or former spouse[3]			
White collar†	1.00	1.00	1.00
Agriculture	1.19	1.93***	1.75
Other	1.35*	1.45*	1.68
Never married	1.41	0.91	1.65
Mother's regular exposure to mass media[4]			
2+ sources†	1.00	1.00	1.00
< 2 sources/no information	1.07	0.69*	0.52**
Mother's BMI[5]			
<18.5†	1.00	1.00	1.00
18.5-24.9	0.80	0.60***	0.50**
25+	0.50***	0.30****	0.65
Ethnicity			
Kalenjin†	1.00	1.00	1.00
Kamba	1.83*	1.77	0.59
Kikuyu	1.31	0.92	0.67
Luhya	0.72	0.43**	0.91
Luo	1.07	0.65	0.99
Other[6]	0.97	1.06	1.68
Religion			
Roman Catholic†	1.00	1.00	1.00
Protestant/other Christian	0.73**	0.80	1.28
Muslim	1.13	0.67	3.12
Other/missing	1.80*	1.75	7.91****
Mother's participation in household decisionmaking[7]			
No decision †	1.00	1.00	1.00
1-2 decisions	1.38**	1.16	0.51**
3-4 decisions	1.11	0.80	0.61
Mother's experience of physical mistreatment[8]			
Never/no information†	1.00	1.00	1.00
More than 12 months ago	1.60***	1.76***	1.24
Once in past 12 months	1.65**	1.08	1.73
Two or more times in past 12 months	1.98****	1.62**	0.99
Alcohol/illegal drug consumption by mother's current or former spouse			
Never/no information†	1.00	1.00	1.00
Occasionally	0.78	1.08	1.00
Often	1.10	1.37	0.59
Mother's or current spouse's experience of higher risk sex in past 12 months[9]			
Either or both parents†	1.00	1.00	1.00
Neither	0.83	0.77	1.01
No information	0.76	0.77	1.73
Mother or current spouse tested for HIV			
Never (neither parent) †	1.00	1.00	1.00
Ever (either or both parents)	0.83	0.96	1.71*
No information	1.48*	0.99	1.96*
Household Characteristics			
Sex of household head			
Male†	1.00	1.00	1.00
Female	1.18	0.96	0.66
Family type[10]			
Nuclear†	1.00	1.00	1.00
Non-nuclear	1.06	1.03	1.11

Continued…

Table 6—*Continued*

Characteristic	Stunting	Underweight	Wasting
Wealth index (quintile)[11]			
Lowest†	1.00	1.00	1.00
Second	0.75*	0.79	0.81
Middle	0.67**	0.74	0.52
Fourth	0.58**	0.65*	0.33**
Highest	0.47***	0.41**	0.21**
Residence			
Urban†	1.00	1.00	1.00
Rural	0.92	0.59*	0.64
Region			
Nairobi†	1.00	1.00	1.00
Central	1.02	1.97	2.39
Coast	1.19	2.21	0.32
Eastern	0.76	1.63	1.01
Nyanza	0.73	1.21	0.45
Rift Valley	1.05	2.61*	1.47
Western	0.99	2.59*	0.87
North Eastern	0.67	4.29**	1.89
Number of children[12]	2,054	2,054	2,054

Note: See Table 1 for list of footnotes.
†Reference category
* p<.1, ** p<.05, *** p<.01, **** p<.001

School attendance

Model 1 in Table 7 shows that orphaned and fostered children are significantly less likely to be attending school than children of HIV-negative parents (OR=0.53; p=0.003 for orphaned children; OR=0.49; p=0.008 for fostered children). Children of HIV-positive parents (OR=0.82) and children of mothers with no spouse (OR=0.62) are also less likely to be attending school than children of HIV-negative parents, but these effects are not statistically significant. In Model 2, additionally controlling for several child and parent characteristics and limiting the analysis to nonorphaned and non-fostered children of interviewed mothers sharpens the effect of parent HIV status on school attendance considerably. With all child, parent, and household characteristics controlled in Model 2, children of HIV-positive parents are significantly less likely to be attending school than children of HIV-negative parents (OR=0.37; p=0.039). Children of HIV-negative mothers with no spouse also have a lower school attendance rate (OR=0.66) than children of HIV-negative parents, but this effect is not statistically significant.

Among the control variables, mother's education and household wealth status are strongly positively associated with the likelihood of attending school, as expected. Girls, children of unemployed mothers, children of undernourished mothers, and children of mothers whose current spouse consumes alcohol or illegal drugs often are significantly less likely to be attending school than other children. With other factors in the table controlled, urban residence is associated with a significantly lower school attendance rate than rural children. Child's age, birth order, mother's age at childbirth, religion, and ethnicity are also significantly associated with the school attendance rate.

Table 7 Odds ratios for effects of child parentage and selected child, parent, and household characteristics on the likelihood of school attendance among children age 6-14 years, Kenya 2003

Characteristic	Model 1	Model 2
Child Parentage		
Orphaned children	0.53***	n/a
Fostered children	0.49***	n/a
Children of HIV+ parents	0.82	0.37**
Children of HIV- mothers who have no spouse	0.62	0.66
Children whose parents' HIV status is unknown	1.03	1.50*
Children of HIV- parents†	1.00	1.00
Child Characteristics		
Age of the child (years)		
6-8†	1.00	1.00
9-11	2.22****	3.49****
12-14	1.45**	2.69****
Sex of child		
Male†	1.00	1.00
Female	0.83	0.62**
Birth order		
1†		1.00
2-3		0.86
4-5		0.47**
6+		0.41**
Parent Characteristics		
Mother's age at childbirth		
<20†		1.00
20-24		1.22
25-29		1.07
30-34		1.49
35+		4.21***
Mother's education		
No education†		1.00
Incomplete primary		3.68****
Complete primary		6.22****
Secondary+		10.93****
Mother's work status in past 12 months		
Employed for cash†		1.00
Employed but not for cash		0.78
Not employed		0.40****
Occupation of mother's current or former spouse[3]		
White collar†		1.00
Agriculture		0.69
Other		1.43
Never married		0.58
Mother's regular exposure to mass media[4]		
2+ sources†		1.00
< 2 sources/no information		1.14

Continued..

Table 7—*Continued*

Characteristic	Model 1	Model 2
Mother's BMI[5]		
<18.5[†]		1.00
18.5-24.9		1.55*
25+		2.60**
Ethnicity		
Kalenjin[†]		1.00
Kamba		3.43*
Kikuyu		1.84
Luhya		0.37
Luo		1.72
Other[6]		0.75
Religion		
Roman Catholic[†]		1.00
Protestant/other Christian		1.79**
Muslim		1.99*
Other/missing		0.79
Mother's participation in household decisionmaking[7]		
No decision [†]		1.00
1-2 decisions		0.95
3-4 decisions		0.88
Mother's experience of physical mistreatment[8]		
Never/no information[†]		1.00
More than 12 months ago		0.59*
Once in past 12 months		1.34
Two or more times in past 12 months		1.18
Alcohol/illegal drug consumption by mother's current or former spouse		
Never/no information[†]		1.00
Occasionally		0.80
Often		0.47**
Mother's or current spouse's experience of higher risk sex in past 12 months[9]		
Either or both parents[†]		1.00
Neither		1.02
No information/remaining		0.68
Mother or current spouse tested for HIV		
Never (neither parent) [†]		1.00
Ever (either or both parents)		0.69
No information		0.77
Household Characteristics		
Sex of household head		
Male[†]	1.00	1.00
Female	1.26	0.84
Family type[10]		
Nuclear[†]	1.00	1.00
Non-nuclear	0.97	1.03
Wealth index (quintile)[11]		
Lowest[†]	1.00	1.00
Second	2.81****	2.42****
Middle	4.13****	2.35***
Fourth	5.26****	4.75****
Highest	13.04****	4.54***

Continued..

Table 7—*Continued*

Characteristic	Model 1	Model 2
Residence		
Urban†	1.00	1.00
Rural	1.44	2.14**
Region		
Nairobi†	1.00	1.00
Central	5.31****	0.91
Coast	1.23	0.37
Eastern	4.51****	0.76
Nyanza	13.59****	4.63
Rift Valley	1.67	0.78
Western	5.61****	6.10**
North Eastern	0.24****	0.13**
Number of children[12]	4,024	2,693

Note: See Table 1 for list of footnotes.
†Reference category
* p<.1, ** p<.05, *** p<.01, **** p<.001

Immunization and treatment-seeking for ARI and diarrhea

Information on immunization coverage and treatment-seeking for ARI and diarrhea was collected only for the children (under age five years) of interviewed mothers. When estimating the effect of parent HIV status on the likelihood of being fully immunized, children under 12 months of age are excluded. Table 8 shows that, with other variables controlled, children of HIV-positive parents are about as likely to be fully immunized as children of HIV-negative parents (OR=0.99; n.s.). Children whose parents' HIV status is unknown are significantly less likely to be fully immunized than children of HIV-negative parents (OR=0.66; p=.011).

Table 8 Odds ratios for parent HIV status and selected child, parent, and household characteristics on the likelihood of being fully immunized (children age 1-4 years) and on the likelihood of receiving treatment when sick with ARI and diarrhea in the two weeks preceding the survey (children age 0-4 years), Kenya 2003

Characteristic	Fully immunized	Received treatment for	
		ARI	Diarrhea
Parent HIV status			
Children of HIV+ parents	0.99	0.44*	0.31*
Children of HIV- mothers who have no spouse	0.67	0.82	0.59
Children whose parents' HIV status is unknown	0.66**	0.96	1.48
Children of HIV- parents†	1.00	1.00	1.00
Child Characteristics			
Age of the child (years)[a]			
0†	na	1.00	1.00
1	1.00	1.94	2.41
2	1.12	1.60	0.67
3	1.01	0.90	0.56
4	1.53**	4.63**	0.31
Sex of child			
Male†	1.00	1.00	1.00
Female	0.98	0.91	2.48***
Birth order			
1†	1.00	1.00	1.00
2-3	1.15	1.05	0.48
4-5	1.24	0.96	0.80
6+	1.19	1.26	0.77
Size at birth[1]			
Larger than average/very large†	1.00	1.00	1.00
Average	0.90	1.03	0.67
Smaller than average/very small	1.05	1.39	0.60
Wanted status of last child			
Wanted then†	1.00	1.00	1.00
Wanted later	0.87	0.79	1.06
Not wanted	0.97	1.53	0.74
Breastfeeding duration[2]			
< 12 months†	1.00	1.00	1.00
12-23 months	1.07	0.31**	0.31
24+ months	0.98	0.31*	0.91
Parent Characteristics			
Mother's age at childbirth			
<20†	1.00	1.00	1.00
20-24	0.69*	0.68	2.20
25-29	0.76	0.57	1.71
30-34	0.83	0.65	0.99
35+	0.83	0.39	0.90
Mother's education			
No education†	1.00	1.00	1.00
Incomplete primary	2.33****	0.70	0.47
Complete primary	3.75****	0.54	0.15***
Secondary+	4.50****	0.46	0.75
Mother's work status in past 12 months			
Employed for cash†	1.00	1.00	1.00
Employed but not for cash	1.11	1.03	1.50
Not employed	0.87	1.09	0.62

Continued..

Table 8—*Continued*

Characteristic	Fully immunized	Received treatment for	
		ARI	Diarrhea
Occupation of mother's current or former spouse[3]			
White collar†	1.00	1.00	1.00
Agriculture	0.82	0.54*	0.95
Other	1.02	0.44**	1.43
Never married	1.54	0.34	0.77
Mother's regular exposure to mass media[4]			
2+ sources†	1.00	1.00	1.00
< 2 sources/no information	0.88	0.43**	0.34**
Mother's BMI[5]			
<18.5†	1.00	1.00	1.00
18.5-24.9	1.16	0.95	0.25**
25+	1.42	1.63	0.22**
Ethnicity			
Kalenjin†	1.00	1.00	1.00
Kamba	0.34***	1.01	0.25
Kikuyu	0.32****	0.32*	0.50
Luhya	0.26****	1.11	0.63
Luo	0.20****	0.65	3.06
Other[6]	0.38****	0.86	1.30
Religion			
Roman Catholic†	1.00	1.00	1.00
Protestant/other Christian	0.97	1.39	0.55
Muslim	1.34	1.51	4.41*
Other/missing	0.67	2.14	0.39
Mother's participation in household decisionmaking[7]			
No decision †	1.00	1.00	1.00
1-2 decisions	1.03	1.28	0.51
3-4 decisions	1.26	1.21	0.47
Mother's experience of physical mistreatment[8]			
Never/no information†	1.00	1.00	1.00
More than 12 months ago	0.83	1.82	1.43
Once in past 12 months	0.65*	0.89	0.72
Two or more times in past 12 months	0.66**	1.42	1.14
Alcohol/illegal drug consumption by mother's current or former spouse			
Never/no information†	1.00	1.00	1.00
Occasionally	1.17	1.55	1.19
Often	1.16	0.53	0.09**
Mother's or current spouse's experience of higher risk sex in past 12 months[9]			
Either or both parents†	1.00	1.00	1.00
Neither	2.13***	1.46	1.92
No information	1.97**	0.88	0.47
Mother or current spouse tested for HIV			
Never (neither parent) †	1.00	1.00	1.00
Ever (either or both parents)	1.07	1.54	0.80
No information	0.86	0.86	2.51

Continued..

Table 8—*Continued*

Characteristic	Fully immunized	Received treatment for	
		ARI	Diarrhea
Household Characteristics			
Sex of household head			
Male†	1.00	1.00	1.00
Female	1.10	0.99	0.67
Family type[10]			
Nuclear†	1.00	1.00	1.00
Non-nuclear	0.98	1.02	0.92
Wealth index (quintile)[11]			
Lowest†	1.00	1.00	1.00
Second	1.19	0.89	1.76
Middle	1.10	0.61	1.09
Fourth	1.34	1.44	1.99
Highest	1.71	0.87	2.75
Residence			
Urban†	1.00	1.00	1.00
Rural	0.95	0.66	2.94
Region			
Nairobi†	1.00	1.00	1.00
Central	2.77**	1.07	2.88
Coast	1.77	0.63	0.19*
Eastern	1.58	0.76	2.64
Nyanza	0.80	0.48	0.18*
Rift Valley	0.86	0.32	0.29
Western	1.18	0.16*	0.21
North Eastern	0.13****	0.03***	0.00****
Number of children[12]	1,695	437	367

Note: See Table 1 for list of footnotes.
†Reference category * p<.1, ** p<.05, *** p<.01, **** p<.001
[a]Reference category for the immunization model is age 1, because children age 0 are excluded from the analysis.
na = Not applicable

With parent HIV status and other factors controlled, children of more educated mothers, Kalenjin children, and children in the Central province are significantly more likely to be fully immunized than other children. On the other hand, children of mothers who experienced physical mistreatment, children whose mother or her current spouse engaged in higher risk sex in the past 12 months, and children living in the North Eastern province are significantly less likely to be fully immunized.

Among children who were sick with symptoms of an acute respiratory infection in the two weeks preceding the survey, children of HIV-positive parents were significantly less likely to have received medical advice or treatment for ARI than children of HIV-negative parents (OR=0.44; p=0.098). Similarly, among children who were sick with diarrhea in the two weeks preceding the survey, children of HIV-positive parents were significantly less likely to have received medical advice or treatment for diarrhea than children of HIV-negative parents (OR=0.31; p=0.099). Large *p*-values for these adjusted odds ratios partly reflect small numbers of ARI and diarrhea cases in our sample.

With other factors controlled, mother's media exposure is the only variable that is significantly associated with the likelihood of having received treatment for both ARI and diarrhea. Children of mothers regularly exposed to two or more media sources are significantly more likely to have received treatment for ARI and diarrhea than children of mothers not so exposed. Among other variables, girls are more likely to have received diarrhea treatment than boys, and a longer duration of breastfeeding is associated with a significantly lower likelihood of treatment-seeking for ARI. Contrary to expectations, children of undernourished mothers (BMI<18.5) are significantly more likely to have received diarrhea treatment. Again, children in the North Eastern province are much less likely to have received treatment for ARI and diarrhea. Contrary to expectations, the adjusted effects of mother's education and household wealth status on treatment-seeking for ARI and diarrhea are mostly not statistically significant.

DISCUSSION

Results of our analyses show that in Kenya orphaned and fostered children age 6-14 years are significantly less likely to be in school than children of HIV-negative parents. This finding is consistent with other recent research in sub-Saharan Africa (Case et al. 2004; Monasch and Boerma 2004; Bicego et al. 2003). We also find that children of HIV-positive parents are significantly less likely to be attending school than children of HIV-negative parents. This is a new finding, which suggests that children of HIV-infected parents (irrespective of the parents' knowledge of their HIV status) are more disadvantaged in schooling than children of non-HIV-infected parents. It is noteworthy that in the bivariate analysis the school attendance rate was higher for children of HIV-positive parents than for children of HIV-negative parents. A reversal in the association between bivariate and multivariate results occurs because the HIV-infected population in Kenya appears to be more socioeconomically advantaged than the uninfected population. This is contrary to the situation in many western countries, where HIV-infected population tends to be socioeconomically disadvantaged.

Our study finds no consistent relationship between orphanhood status and the nutritional status of children. Contrary to expectations, we find that orphaned children are significantly less likely to be stunted than nonorphaned children of HIV-negative parents, and orphaned children are about equally likely to be underweight and somewhat more likely to be wasted than nonorphaned children of HIV-negative parents. This lack of a clear relationship between orphanhood and nutritional status of children is in line with the findings of the Lindblade et al. (2003) study in western Kenya and other studies in sub-Saharan Africa (Sarker et al. 2005; Crampin et al. 2003; Panpanich et al. 1999; Ryder et al. 1994). The study finds that fostered children are more likely to be stunted, underweight, and wasted, but the effects are not statistically significant for stunting and wasting.

We find that children of HIV-infected parents are significantly more likely to be underweight and wasted than children of non-HIV-infected parents, but we do not find a relationship between parent HIV status and stunting. This may be because stunting, which is an indicator of chronic undernutrition, is largely determined early in life, possibly before the parents were infected with HIV. Wasting, on the other hand, indicates acute undernutrition, and underweight combines the effects of acute and chronic undernutrition. These two indicators are likely to be affected more by current HIV status.

We also find that children of HIV-positive parents are significantly less likely than children of HIV-negative parents to receive medical advice or treatment when they get sick with an acute respiratory infection or diarrhea, but we find no relationship between parent HIV status and the likelihood of being fully immunized. Again, as in the case of stunting, a lack of association between parent HIV status and immunization coverage may be because most children are fully immunized within the first year of life, possibly before their parents were infected with HIV or before the parents became symptomatic.

Consistent with expectations, our analyses show that children of non-HIV-infected single mothers (with no spouse) are more likely to be underweight and wasted, less likely to attend school, less likely to be fully immunized, and less likely to receive medical advice or treatment for ARI and diarrhea, although most of these effects were not statistically significant.

Due to the small number of orphans under age 5 years in the sample, we were unable to differentiate between the nutritional status of paternal orphans, maternal orphans, and double orphans. However, contrary to expectations, we find that double orphans are more likely to be

attending school than paternal or maternal orphans. We also find that boys are more disadvantaged in nutrition, but girls are more disadvantaged in schooling.

In sum, we find clear evidence that orphaned and fostered children are disadvantaged in schooling compared with children of non-HIV-infected parents in Kenya. We find no clear relationship between orphanhood and the nutritional status of children, but fostered children tend to be more undernourished than children of non-HIV-infected parents. Children of HIV-infected parents are more likely to be underweight and wasted, less likely to be attending school, and less likely to receive medical advice or treatment when sick with ARI or diarrhea than children of non-HIV-infected parents. We also find that children of non-HIV-infected single mothers are generally more disadvantaged in nutrition, health care, and schooling than children who live with both non-HIV-infected parents. However, we find no relationship between parent HIV status and stunting or the likelihood of being fully immunized.

Several measurement constraints must be kept in mind when considering the findings of this study. First, our estimated results may be affected by the survival bias. Our analysis of orphaned children is limited to children who survived the death of their parent(s). Orphans tend to be at an increased risk of contracting HIV than nonorphans, and are therefore more likely to die from it. Our analysis is also biased to the extent that fostered children and children of single-mothers are more likely to have died than children of non-HIV-infected parents. Children of HIV-infected mothers also tend to have higher mortality rates than children of uninfected mothers (Newell et al. 2004). Our estimated effects are underestimated to the extent that such survival bias occurs in our data.

Results of this study may also be biased due to nonresponse in the survey. Thirty percent of males and 24 percent of females eligible for HIV-testing in the survey were not tested, mainly due to refusal and absence from the house during repeated visits. There is evidence that nonresponder males in the Kenya survey are somewhat more likely to be HIV-infected than the responder males (Mishra et al. 2005). Although, the effect of such nonresponse on the overall HIV prevalence in the population tends to be small, children of HIV-positive parents are likely to be underrepresented in our sample. To the extent that this occurs, it may have contributed to an underestimation of the effects of parent HIV status.

Cross-sectional data used in our study do not allow an examination of transitional effects. For example, a parent's getting sick with HIV or some other serious illness may lead to job loss and considerable expenses for treatment and care, which may affect children's schooling, health care, and nutrition even before they become orphans. The nonorphaned groups in our analysis include such children in transition, which may have further diluted some of our estimated effects.

Persons who tested positive for HIV in the survey may not know that they are infected with HIV (either they were not previously tested or they were tested but did not obtain the results). It is likely that the relationship between HIV-positive parents and children's education and health would have been stronger if only those children whose parents knew that they were HIV positive could be identified and compared with children whose parents were not HIV positive.

Another limitation is that for orphaned and fostered children who have changed households, we only have information on the current household. While school enrollment, treatment-seeking for recent illness, and wasting are more likely to be associated with the characteristics of the current household, more chronic conditions such as stunting and immunization coverage (which mostly occurs in the first year of life when the child's biological mother and father are more likely to

have been alive and living with the child) are more likely to be associated with the characteristics of the previous household.

Finally, our analysis excludes street children and children living in institutions. Our estimated effects of orphanhood and parent HIV status are likely to be underestimated to the extent these excluded children are more likely to be orphans or have HIV-infected parents and more likely to be disadvantaged in schooling, nutrition, and health care. However, proportions of such children tend to be small. Recent pilot surveys of children in Blantyre, Malawi and Kingston, Jamaica that included household children, street children, and children in institutions, found that only 0.2 percent of children in Malawi and only 0.5 percent of children in Jamaica were street children or lived in institutions. Although, the non-household children were much more disadvantaged on a range of health and economic indicators, their inclusion in the sample made virtually no difference to the indicators derived from children in households (UNICEF and ORC Macro, 2005). Therefore, the exclusion of street children and children in institutions in our analysis is unlikely to alter the findings of this study.

Despite these limitations, the findings of this study reinforce the need to target child welfare programs to address the needs of children made vulnerable due to parent death, displacement, or parent HIV infection. There is already considerable attention given to the needs of orphaned children, but our findings indicate that fostered children are equally, if not more, disadvantaged in schooling and nutrition. Our findings that children of HIV-infected parents are disadvantaged in nutrition, schooling, and health care, irrespective of parents' knowledge of their HIV status, highlight the need to make voluntary counseling and testing (VCT) services more widely available, so that such children can be identified and their needs addressed. Children of single mothers also tend to be disadvantaged on all outcome measures and need attention. Programs also need to take into account differential vulnerabilities of children by other characteristics. For example, girls tend to be disadvantaged in schooling, but boys tend to be disadvantaged in nutrition. Our inability to examine nutritional differences between paternal orphans, maternal orphans, and double orphans, and the unexpected finding that double orphans are more likely to be attending school than single orphans call for further, more in-depth research on orphaned children.

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