The Impact of Orphanhood on Luo Children

A dissertation presented to

the faculty of

the College of Arts and Sciences of Ohio University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy

Amy M. Zidron

November 2008

© Amy M. Zidron. All Rights Reserved.
This dissertation titled
The Impact of Orphanhood on Luo Children

by

AMY M. ZIDRON

has been approved for
the Department of Biological Sciences
and the College of Arts and Sciences by

Gillian H. Ice
Associate Professor of COM- Social Medicine

Benjamin M. Ogles
Dean, College of Arts and Sciences
ABSTRACT

ZIDRON, AMY M., Ph.D., November 2008, Biological Sciences

The Impact of Orphanhood on Luo Children (196 pp.)

Director of Dissertation: Gillian H. Ice

The HIV/AIDS pandemic is creating a generation of orphaned children in Africa. In addition to the loss of a parent(s), orphaned children may face many hardships during their childhood including a decline in health, nutrition, and psychological well-being.

The central goal of this dissertation is to investigate the impact of orphanhood on a group of Luo children. This goal is achieved by investigating four aspects of orphan life: nutritional status, physical health, mental health, and food intake and estimated energy expenditure. Four hundred eleven Luo children (9±1yr) were recruited from two districts in Nyanza Province, Kenya to participate in this research. Participants underwent an interview including the Beck’s Depression Inventory for Youth (BDI-Y), anthropometric measurements, testing for anemia, a clinical history and physical exam, and a 24-hour dietary recall. Energy expenditure was estimated using an Actical® activity monitor.

Variables were compared across groups using t-tests. All analyses were gender specific and the effect of length of orphanhood was also investigated. Few differences were found between orphaned and nonorphaned Luo children. No significant differences were found between anthropometric measurements, hemoglobin level, or health between orphans and nonorphans for either gender. Orphans had significantly higher BDI-Y raw scores than nonorphans (p<0.001). This was true for males (p<0.001) and females (p=0.005). Male orphans consumed significantly less fat (p=0.01) and protein (p=0.001)
than male nonorphans. No significant differences were found between the two groups of males for the other food intake or the energy expenditure variables, and similar results were found for the females groups. Length of orphanhood was not correlated with any of the variables. This was true for both males and females. Overall, the Luo orphans who participated in this dissertation research do not appear to be disadvantaged when compared to nonorphans.

Approved: _____________________________________________________________

Gillian H. Ice
Associate Professor of COM- Social Medicine
ACKNOWLEDGMENTS

I would like to thank my dissertation committee: my advisor, Gillian Ice, and committee members Audrone Biknevicius, Anne Loucks, Doug Mann, and Karen Montgomery-Reagan for their continual support and guidance during the completion of this dissertation.

Much appreciation goes to the Kenyan field team: Fred Awili, Monica Audi Liech, Doreen Awuor Otieno, Danish Odie Agai, Brenda Loice Omondi, Beryl Awuor Ogot, Antoney Odhimbo, Leticia Akoth Otieno, Jack Omondi Gao, Agness Atieno Aluodo, Nancy Mackreen Omondi, Kennedy Otieno Nyagwara, Fredrick Owuor Anyona, Florence Akinyi, Kevin Nam, Felix, Dickson, and Evans Ochieng, as well as the communities and people of Nyando District and Kisumu Rural. Thank you to the American field team for their help with data collection: Chelsea Crabtree, Elizabeth Gomes, Meghan Mehl, Kate Philippi, Denise Starkey, and Katie Zeoli. Much appreciation goes Jaja Yogo for all of his work with translations and organization while in Kenya.

I would also like to thank Dr. Jane Hamel-Lambert for her help and insight with the construction of the depression paper. Much appreciation goes to Elizabeth Gomes for the time that she spent designing the depression portion of this study and for reading various drafts of the paper. Thank you to Lindsey Barrick, Jen Drost, Kim Jackson, and Meghan Mehl for reading drafts of this dissertation.

Funding for this dissertation was provided by Ohio University College of Osteopathic Medicine (OUCOM)/Research Award, OUCOM/OU Challenge Award, OU
Graduate Student Senate Grant for Original Work, and the OUCOM D.O./Ph.D. program. Additional support was provided by the Centers for Osteopathic Research and Education, OUCOM Tropical Disease Institute, OUCOM Social Medicine Department, OUCOM Center of Excellence in Minority Medicine. The project infrastructure was additionally supported by the National Science Foundation (Grant No. 0515980, P.I. Gillian H. Ice). The project was conducted in collaboration with the Kenya Medical Research Institute.

I would like to thank my family for their support during this endeavor. I would also like to give a special thank you to Kim Jackson, Emily Kauffman, Mark Loudin, and Amanda McConnell Mack for their support and friendship during my time at OUCOM. A very special thank you to Christian Stork for reading drafts of my proposal and dissertation, listening to me talk and talk about orphans, having confidence in me, and for being awesome.
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>3</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>5</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>11</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>12</td>
</tr>
<tr>
<td>CHAPTER 1: THE HIV/AIDS PANDEMIC AND ORPHANED CHILDREN</td>
<td>13</td>
</tr>
<tr>
<td>Introduction</td>
<td>13</td>
</tr>
<tr>
<td>Specific Aims</td>
<td>19</td>
</tr>
<tr>
<td>Background</td>
<td>20</td>
</tr>
<tr>
<td>Nutritional Status</td>
<td>20</td>
</tr>
<tr>
<td>Health</td>
<td>21</td>
</tr>
<tr>
<td>Mental Health</td>
<td>22</td>
</tr>
<tr>
<td>Food Intake and Energy Expenditure</td>
<td>24</td>
</tr>
<tr>
<td>Overview of Methods</td>
<td>26</td>
</tr>
<tr>
<td>Significance</td>
<td>26</td>
</tr>
<tr>
<td>Literature cited</td>
<td>27</td>
</tr>
<tr>
<td>CHAPTER 2: DOES BEING AN ORPHAN DECREASE THE NUTRITIONAL STATUS OF LUO CHILDREN?</td>
<td>37</td>
</tr>
<tr>
<td>Abstract</td>
<td>37</td>
</tr>
<tr>
<td>Introduction</td>
<td>37</td>
</tr>
<tr>
<td>Methods</td>
<td>41</td>
</tr>
</tbody>
</table>
CHAPTER 4: ARE KENYAN LUO ORPHANS MORE DEPRESSED THAN NONORPHANS? ................................................................................................................................. 98

Abstract ......................................................................................................................................................... 98
Introduction ....................................................................................................................................................... 99
Methods ............................................................................................................................................................. 104
  Study Population .............................................................................................................................................. 104
  Sample ........................................................................................................................................................... 107
Inclusion/Exclusion Criteria ............................................................................................................................. 108
Data Collection Methods .................................................................................................................................... 109
Analysis ............................................................................................................................................................ 111
Results ......................................................................................................................................................... 112
Discussion ...................................................................................................................................................... 115
Acknowledgements ........................................................................................................................................ 121
Literature Cited .............................................................................................................................................. 122

CHAPTER 5: A COMPARISON OF FOOD INTAKE AND ENERGY EXPENDITURE AMONG LUO ORPHANS AND NONORPHANS ...................................................... 134

Abstract ....................................................................................................................................................... 134
Introduction ...................................................................................................................................................... 135
Methods ............................................................................................................................................................. 142
  Study Population .............................................................................................................................................. 142
  Sample ........................................................................................................................................................... 144
Inclusion/Exclusion Criteria ............................................................................................................................. 145
Data Collection Methods ................................................................. 146

Analysis ............................................................................................. 150

Results ............................................................................................... 150

Discussion ......................................................................................... 152

Acknowledgements ........................................................................... 160

Literature Cited ................................................................................ 160

CHAPTER 6: SYNTHESIS, LIMITATIONS, AND FUTURE DIRECTIONS .... 175

Synthesis ............................................................................................ 175

Limitations ........................................................................................ 181

Future Directions .............................................................................. 184

Literature Cited ................................................................................ 189

APPENDIX A: OPEN-ENDED QUESTIONNAIRES ............................... 194

APPENDIX B: FOOD INTAKE AND ENERGY EXPENDITURE CORRELATION TABLES .................................................................................. 195
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Sample characteristics, Mean(SD) or %</td>
<td>65</td>
</tr>
<tr>
<td>2.2</td>
<td>Anthropometric measures and hemoglobin level of males</td>
<td>66</td>
</tr>
<tr>
<td>2.3</td>
<td>Anthropometric measures and hemoglobin level of females</td>
<td>67</td>
</tr>
<tr>
<td>2.4</td>
<td>Z-scores for males and females</td>
<td>68</td>
</tr>
<tr>
<td>3.1</td>
<td>Sample characteristics, Mean(SD) or %</td>
<td>96</td>
</tr>
<tr>
<td>3.2</td>
<td>Comparison of health for males</td>
<td>97</td>
</tr>
<tr>
<td>3.3</td>
<td>Comparison of health for females</td>
<td>97</td>
</tr>
<tr>
<td>4.1</td>
<td>Sample characteristics, Mean(SD) or %</td>
<td>131</td>
</tr>
<tr>
<td>4.2</td>
<td>T-scores ranges and corresponding clinical severity</td>
<td>132</td>
</tr>
<tr>
<td>4.3</td>
<td>BDI-Y raw score by orphan status</td>
<td>132</td>
</tr>
<tr>
<td>4.4</td>
<td>Self-reported depression severity and orphan status</td>
<td>133</td>
</tr>
<tr>
<td>5.1</td>
<td>Sample characteristics, Mean(SD) or %</td>
<td>173</td>
</tr>
<tr>
<td>5.2</td>
<td>Comparison of food intake and energy expenditure for males</td>
<td>174</td>
</tr>
<tr>
<td>5.3</td>
<td>Comparison of food intake and energy expenditure for females</td>
<td>174</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 2.1. z-scores for males and females.........................................................69
CHAPTER 1: THE HIV/AIDS PANDEMIC AND ORPHANED CHILDREN

Introduction

The HIV/AIDS pandemic is creating a generation of orphaned children in Africa. Worldwide there is estimated to be 33 million people who are HIV positive; 67% of these individuals live in sub-Saharan Africa. In 2007, approximately 2.0 million people lost their lives to AIDS and approximately 3 million were newly infected with the disease around the world (UNAIDS, 2008). At the end of 2007, it was estimated that there were 2.7 million cases of pediatric HIV with 2 million of these cases being identified in sub-Saharan Africa (World Health Organization, 2008). AIDS is the leading cause of death in persons 15-59 years of age living in sub-Saharan Africa (UNICEF, 2006a). Therefore it is not surprising that the continent of Africa is home to 95% of the world’s children who have lost one or both parents to AIDS (Matshalaga & Powell, 2002; Human Rights Watch, 2001b).

Although the number of children orphaned by all causes has decreased over the past decade in Asia, Latin America, and the Caribbean, there has been a substantial increase in the number of orphans due to all causes in sub-Saharan Africa (UNICEF, 2006a). The number of children estimated to be orphaned due to all causes in sub-Saharan Africa is currently 48.3 million. Twelve million of these children are thought to be AIDS orphans (UNICEF, 2006a). It is estimated that by the year 2010, approximately 18 million African children under 18 years of age will be orphaned as a result of the HIV/AIDS pandemic (UNICEF, 2005). UNICEF (2006a) reported that the age distributions of orphans are consistent across Africa: 16% are 0-5 years of age, 36% are
6-11 years and 48% are 12-17 years of age. According to a report by UNAIDS (2006), the HIV/AIDS crisis has not peaked so the extent of the orphan crisis has yet to be fully realized. The number of AIDS orphans will continue to increase long after the crisis peaks so it is important to determine how best to aid these children to ensure that they are healthy and well-nourished.

Currently there are more paternal orphans than maternal orphans living in Africa (UNICEF, 2006a). UNICEF (2006a) reported that there is an increase in the number of women dying from of HIV/AIDS and children are losing their mothers at increasingly high rates. Furthermore, the number of children experiencing the death of both parents (“double orphans”) will only continue to increase because of the nature of disease transmission. It is estimated that by 2010 there will be 10 million double orphans living in sub-Saharan Africa (UNICEF, 2006a). These children are thought to suffer the most because they experience a total loss of parental care. Double orphans are commonly sent to live in homes where few other children live (often with elder relatives). Male orphans are likely to be sent to live with grandparents and females with “other relatives” (i.e. aunts and uncles) (UNICEF, 2006a).

In sub-Saharan Africa, the vast majority of orphans are cared for by their extended family, often by grandparents (UNICEF, 2003). A study in Malawi found that in many instances orphans prefer to live with their grandparents over other family members (Mann, 2002). It has also been documented that orphans are more likely to be invited to live in homes that are headed by females and these homes are often found to have the highest dependency ratio (UNICEF, 2006a; UNICEF, 2003). Negative impacts
of orphanhood may be buffered if children are allowed to remain with siblings and are invited to live with biological family members (UNICEF, 2006a). Unfortunately, many times the extended family cannot provide adequate care to these children (UNICEF, 2003). With parents continuing to fall prey to the HIV/AIDS crisis, more and more orphans are left under the care of grandparents who may not have the resources or the health to adequately care for their growing families. Many grandparents report that they do not have money and are unable to earn enough money to provide for children living in their homes (Foster, Makufa, Drew, Kambeu, & Saurombe, 1996). It is also possible that children living with older relatives are working to help bring food and income into the house. These children may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers. Another problem arising for children living with grandparents is the possible loss of their elderly caregiver and the psychological issues that may arise as a consequence of losing another caregiver (UNICEF, 2006a).

Few children are thought to live in households headed by other children. It is currently estimated that <1% of households containing orphans are headed by children under the age of 18 years (UNICEF, 2006a).

Orphaned children may face many hardships during their childhood and adolescence. The loss of one or both parents is only the beginning of the misfortunes that they may experience, as the death of a parent permeates into all aspects of a child’s life. Orphans are more likely to miss school due to increased responsibilities on the homestead. They may be asked to participate in caregiving for younger children or sick adults and may need to help with farming or other wage earning activities (UNICEF,
Orphaned children are often not enrolled at the appropriate grade level because of high numbers of school absences. Double orphans are at a higher risk for being behind in school than single orphans (Bicego, Rutstein, & Johnson, 2003). A trend exists for orphans to live in households with low food security, which can contribute to a decline in nutritional status and health. Orphans may also experience a decline in psychological well-being, which can manifest as anxiety and/or depression (UNICEF, 2006a; UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003).

Furthermore, orphans are reported to be stigmatized and discriminated against by community members if the cause of parent death is either unknown or is known to be the result of AIDS (UNICEF, 2006a; Brown & Sittitrai, 2005; UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). The stigma experienced by orphans can impact various aspects of their lives including education and ability to obtain healthcare (McNally, Hadingham, Archary, Moodley, & Coovadia, 2006). In addition to the stigma these children face, they may be subject to exploitation, abuse, violence, and isolation (UNICEF, 2003; Foster, 2002). Thus orphaned children may be at a heightened risk for contracting sexually transmitted infections, including HIV. According to Henry (2000), orphans perceive their greatest problems to be stigmatization and sexual vulnerability. It seems likely that children living in these types of unstable environments would be at a heightened risk for malnutrition, poor health, and depression.

Although the HIV/AIDS pandemic and the associated increase in orphans is not limited to Africa, it has not been as dramatic in other regions of the world. In the Asia-Pacific region less attention has been paid to the HIV/AIDS pandemic because it did not
occur until much later in this area of the world. Furthermore, the effects of the disease have not been as pervasive as those seen in sub-Saharan Africa (Brown & Sittitrai, 2005). The low prevalence of HIV/AIDS in the Asia-Pacific region means that the number of AIDS orphans in the region is much lower than that seen in Africa. Currently it is estimated that approximately 1.8 million children in the Asia-Pacific region under 15 years of age have lost a parent(s) to HIV/AIDS. Orphans living in this area face many of the same issues that orphans living in Africa may face, including loss of family support, loss of education, and stigmatization (Brown & Sittitrai, 2005).

In the Asia-Pacific region, the extended family is the most important source of support to orphaned children. One study reported that 10% of AIDS orphans are living with their grandparents (Knodel & Im-em, 2003). Caregiving grandparents in the Asia-Pacific region will often receive help from their surviving children (Knodel, Im-em, Saengtienchai, VanLandingham, & Kespichayawattana, 2002). As in Africa, the greatest burden in the Asia-Pacific region is among the poorest families (Brown & Sittitrai, 2005). The cost of education can be high and many children in poor families stop going to school because education becomes unaffordable (Brown & Sittitrai, 2005).

The stigma and discrimination experienced by families affected by HIV/AIDS can be very severe in the Asia-Pacific region. Families may suffer rejection from their community, employed persons may be fired from their jobs, and HIV/AIDS infected individuals may even be denied traditional burials (Busza, 1999). Orphans may be ostracized by their playmates at school and one study reported that young children may be refused at daycare centers if their families are known to be affected by HIV/AIDS.
(Brown & Sittitrai, 2005; Safman, 2002). Children, especially orphans, are extremely vulnerable to HIV infection in the Asia-Pacific region because child trafficking for sexual exploitation and child prostitution is a common practice (Brown & Sittitrai, 2005).

The United States has been extremely successful in the prevention and control of HIV/AIDS. The major difference between the impact of HIV/AIDS seen in the United States and the impact seen in Africa and the Asia-Pacific region is due to the vast numbers of resources available in this country. With the introduction of highly active antiretroviral therapy (HAART), people are living longer with HIV (Draimin & Reich, 2005). In 2003, it was reported that there were 100,000 maternal orphans living in the United States (Lee & Fleming, 2003). Orphaned children living in the United States can face many of the same life changing issues that occur as the result of losing a parent(s) in other parts of the world. The psychological impact of orphanhood in the United States has been well-studied (see Chapter 4) (Draimin & Reich, 2005). Similar to orphans living in the Africa and in the Asia-Pacific region, orphans living in the United States often live with grandmothers (Draimin & Reich, 2005).

In general, one would expect the long term effects of orphanhood to be negative. These children are at an increased risk for suffering from malnutrition, poor physical and mental health, as well as being at risk for stigmatization and exploitation. Orphans are at a high risk for contracting HIV themselves as a result of maternal transmission, prostitution, and sexual exploitation (UNICEF, 2006a, Brown & Sittitrai, 2005). Many AIDS orphans are forced to drop out of school for financial reasons. This hinders their opportunities for jobs and economic growth in the future (UNICEF, 2006a, Brown &
The effects of malnutrition and poor health are far reaching. In addition to potentially causing early death, they can also lead to low educational achievement and productivity because malnutrition can lead to delayed intellectual development (UNICEF, 2006a, Webb, 2005). It is important to identify the areas in which orphans and their communities are most in need of help in order to prevent the negative impacts of orphanhood from occurring.

Specific Aims

The central goal of this dissertation is to examine the impact of orphanhood on a group of Kenyan Luo children ages 7-11 years old. Much of the research investigating the impact of orphanhood on children is equivocal. By looking at four different aspects of orphan life in the same population of children as well as by investigating the lives of male and female orphans in middle childhood, this dissertation will add to the growing bank of orphan literature. The age group of 7-11 was chosen because many of the studies investigating the impact of orphanhood focus on investigating the health and nutritional status of children less than 5 years old. Little is known about the fate of orphaned children over 5 years. Males and females were examined separately. Therefore, it is be possible to see if orphanhood has a greater impact on Luo males or females. Length of orphanhood is also investigated. This research investigates four different aspects of life experienced by orphans in middle childhood: nutritional status, physical health, mental health, and food intake and energy expenditure.

The central goal of this dissertation is fulfilled by the following aims:

1. To examine the impact of orphanhood on nutritional status.
Hypothesis: Orphans will have lower anthropometric measures and a lower hemoglobin level than nonorphans.

2. To examine the impact of orphanhood on health.

Hypothesis: Orphans will have poorer health as demonstrated by a clinical history and physical exam than nonorphans.

3. To examine the impact of orphanhood on mental health.

Hypothesis: Orphans will be more likely to self-report depression than nonorphans.

4. To examine the impact of orphanhood on food intake and energy expenditure.

Hypothesis: Orphans will be more likely to have a lower food intake and a higher energy expenditure than nonorphans.

Background

Nutritional Status

Over the past decade the number of malnourished children living in Africa has increased (UNICEF, 2006b; World Bank, 2006). The HIV/AIDS crisis presents itself as a major challenge to overcoming the high prevalence of malnutrition in African populations. HIV/AIDS reinforces malnutrition by decreasing the ability of adults to be productive and bring food into the household as well as by routing money away from food and supplies for the household to medication for infected individuals (Kinabo, 2001; Ainsworth & Semali, 2000; Whyte & Kariuki, 1991). Malnutrition is widespread not only among AIDS orphans but also among children living in homes affected by HIV/AIDS. It has been suggested that younger orphans may suffer the most from
malnutrition and it has been noted that boy orphans are more susceptible to malnutrition than girls (Kenyan Ministry of Health, 2004).

Results from recent studies investigating the impact of orphanhood on child nutrition are equivocal. Children who are orphaned have been found to be at a heightened risk for malnutrition, including stunting (Lindblade, Odhiambo, Rosen, & DeCock, 2003; UNICEF, 2003; Ainsworth & Semali, 2000; UNICEF/UNAIDS, 1999). Studies in Kenya, Tanzania, and Zimbabwe also found orphans to be nutritionally disadvantaged (Watts et al., 2007; UNICEF, 2003; Bloss, Wainaina, & Bailey, 2004). Although orphans may be expected to have a decreased nutritional status when compared to their nonorphaned peers, not all studies have found results supporting this conclusion (Barrientos, 2006; Lindblade et al., 2003; Panpanich, Brabin, Gonani, & Graham, 1999).

Health

It has been suggested that a child born today in Africa will face more health risks throughout his life than a child born on any other continent (World Health Organization, 2006). The heightened risk of poor health may be the result of several factors, including the high HIV/AIDS prevalence on the continent as well as the high rates of poverty (World Health Organization, 2006). Several means exist through which orphanhood could impact child health. Although research findings differ regarding how orphanhood affects nutritional status (i.e. Barrientos, 2006; Lindblade et al., 2003; Ainsworth & Semali, 2000), rates of malnutrition in Africa are high regardless of orphan status (UNICEF, 2006b). Malnutrition increases the likelihood of infectious disease. Orphaned children who are living in households in which one or more persons are infected with
HIV/AIDS will be exposed and potentially infected with more diseases than children living in non-AIDS affected homes (McNally et al., 2006). Furthermore, it is possible that resources will be allocated to people living with AIDS in the homestead rather than the health and nutrition of other household members. Similarly, children living with grandparents may suffer from poor health because elderly people are more susceptible to infectious disease. Elderly caregivers may not have the resources for a physician and pharmacy visit.

Although it would seem that orphans would be more likely to have poor health when compared to nonorphans, the majority of studies investigating the impact of orphanhood on health have failed to find a correlation between orphan status and poor health. These studies have failed to find a relationship between the morbidity and/or mortality of children who have been impacted by AIDS and those who have not (Parikh et al., 2007; Crampin et al., 2003; Kamali, et al., 1996). It is possible that caregivers are able to provide adequate care for orphans. Results from several studies in Africa support the conclusion that the extended family is able to provide adequate care to orphans (Sarker, Neckerman, & Muller, 2005; Crampin et al., 2003; Ryder, Kamenga, Nkusu, Batter, & Heyward, 1994). Although many studies suggest that orphans are healthy and are receiving adequate care, several studies have found orphans to be in poor health when compared to nonorphans (Watts et al., 2007; Sarker et al., 2005).

**Mental Health**

In addition to the increase in research focusing on orphan health and nutrition, there is also a growing interest in the psychosocial effects of orphanhood on children
living in Africa (Cluver & Gardner, 2007; Atwine, Cantor-Grace, Bajunirwe, 2005). Research in this area is important because the death of a parent is a risk factor for the development of psychosocial issues in children (Bauman & German, 2005). Orphanhood could lead to an increase in depression and poor mental health in children through several means. Risk factors for poor mental health that have been identified for orphans living in both Africa and the United States include the type of relationship with the new caregiver and his family, movement from home, separation from siblings, poverty, an inability to attend school, and HIV/AIDS-related stigma. (Cluver & Gardner, 2007; Foster, Makufa, Drew, Mashumba, & Kambeu, 1997). Other risk factors for poor mental health in orphans include loss of peer interaction and increased responsibility on the homestead (Cluver & Gardner, 2007; Bauman & German, 2005).

Current research in Africa suggests that orphanhood has a negative impact on child mental health (Earls, Raviola, & Carlson, 2008; Andrews, Skinner, & Zuma, 2006; Bauman & German, 2005; Wild, 2001). Studies investigating child emotional problems in AIDS orphans report that orphans are more likely to suffer from poorer mental health, including post-traumatic stress, depression, and anxiety than nonorphans (Cluver, Gardner, & Operario, 2007; Cluver & Gardner, 2006; Atwine et al., 2005). It has also been reported that orphans are more likely to suffer from behavioral or conduct problems and report suicidal thoughts than nonorphans (Cluver et al., 2007; Cluver & Gardner, 2006). Similar to what is reported in the African literature, research in the United States has found orphaned children to be more likely to suffer from internalizing problems, such
as depression and anxiety (Pivnick & Villegas, 2000; Forehand et al., 1998; Forehand et al., 1997).

*Food Intake and Energy Expenditure*

HIV/AIDS is considered to be a major threat to food security in Africa (FAO, 2000a; FAO, 2000b; FAO, 2000c). Coping mechanisms that have been utilized by AIDS affected households in Africa include consumption of a diet consisting of nonpreferred foods, a decrease in portion size, skipping entire meals or not eating at all during the day, or borrowing money (Bukusuba, Kikafunda, & White, 2007; Oldewage-Theron, Dicks, & Napier, 2006). The addition of an orphan(s) to the home can cause a decrease in food security because of the increase in household dependents (Schroeder & Nichola, 2006; FAO, 2000a). Several studies have found relationships between poor orphan nutritional status and food insecurity (Rivers, Silvestre, & Mason, 2004; FAO, 2000b). The dietary diversity in both low socioeconomic status homes and those affected by HIV/AIDS has been found to be low (Bukusuba et al., 2007). Children living in food insecure homes may not have a balanced diet.

Despite the increasing prevalence of food insecurity in African households, current studies investigating the impact of orphanhood on orphan nutritional status are conflicting in both results and conclusions. Several studies suggest that living with a grandmother increases child survival and nutritional status (Sarker et al., 2005; Sear, Mace, & McGregor, 2000). Although female-headed households may be at a heightened risk for lower incomes and associated food security, one study found that child nutritional status was higher in female-headed homes (Kennedy & Peters, 1992). Orphaned children
living with grandparents and other extended family members may have adequate nutritional statuses, however, it is largely unknown if they are consuming balanced diets that contain adequate amounts of carbohydrates, protein, and fat.

Even though orphaned children may be a drain on already meager household resources, it has been suggested that the presence of children on the homestead can be advantageous to the caregiver. The child can work to increase household income and can care for other children. Children work in order to supplement family income or to pay school fees. Unfortunately, children who participate in labor may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers. Girl children are more likely to be pulled out of school in order to help with the care of an ill parent(s), with chores, and/or the care of younger brothers and sisters (Kenyan Ministry of Health, 2004; Human Rights Watch, 2001a; Human Rights Watch, 2001b). Therefore, it is possible that female orphans may be more impacted by orphanhood than male orphans.

Few studies exist that quantitatively measure orphan workload. One study found orphan workload to be higher than that of nonorphans (Foster et al., 1997). Similarly, a higher percentage of children living in homes where an HIV/AIDS-related death had occurred were working more and spending little time participating in personal activities (K’Oyugi & Muita, 2002). Results from a study in western Kenya suggest that caregivers are receiving help from their grandchildren (Ice, Zidron, & Juma, 2008). On the other hand, a study in South Africa did not find a difference in the amount of work performed by orphans and nonorphans (Parikh et al. 2007).
Overview of Methods

This project was conducted in Nyanza Province, Kenya from June-July 2007. Four hundred eleven children (age 9±1 yr) were recruited from 17 schools in Nyando District and Kisumu Rural, both of which are located within Nyanza Province. The headmaster at each school was contacted and asked to selected male and female children that could participate in the study. Approximately half of the children were orphans and half were nonorphans. Children between ages 7-11 years and residents of Nyando District or Kisumu Rural were included in the study. Since consent, assent, and other parts of the study were conducted in either Dholuo or Swahili, it was necessary that both the child and his guardian were fluent in either language. A child was excluded from the study if after the clinical history and physical exam he was thought to be potentially infected with HIV/AIDS. Four children were excluded from the study: two children were excluded because of questionable HIV status; one child was excluded because age was undeterminable; the last child was excluded for both factors, leaving 407 children in the analysis.

Participants underwent an interview that included the Beck’s Depression Inventory for Youth, anthropometric measurements, testing for anemia, a clinical history and a physical exam, and a 24-hour dietary recall. The energy expenditure of the participants was estimated using an Actical® activity monitor.

Significance

Much of the current research investigating the impact of the HIV/AIDS crisis on orphans has looked qualitatively at the African community and family structures as
opposed to looking specifically at different aspects of orphan life (Nyambedha, Wandibba, & Aagaard-Hansen, 2003; Henry, 2000; Kamali et al., 1996). Qualitative research is important because it helps to determine how best to allocate money (i.e. to healthcare or education) and which forms of assistance are needed to help prevent communities from falling further into poverty. Information obtained from the current research will allow for international organizations, including UNICEF and UNAIDS, to develop strategies and recommendations to help improve the lives of orphans and other vulnerable children (UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). By focusing on four specific areas of orphan life (nutritional status, physical health, mental health, and food intake and energy expenditure), this dissertation will shed light on disadvantages that orphaned children may endure, allowing for more directed interventions for orphaned children to be developed and implemented.

Literature cited


AIDS orphans in rural Uganda. Social Science & Medicine, 61, 555-64.


children in need through a community-based orphan visiting programme. *AIDS Care, 8*, 389-403.


Rivers, J., Silvestre, E., & Mason, J. (2004). *Nutritional and food security status of*


World Bank (2006). *Repositioning nutrition as central to development: A strategy for*

CHAPTER 2: DOES BEING AN ORPHAN DECREASE THE NUTRITIONAL STATUS OF LUO CHILDREN?

Abstract

The HIV/AIDS pandemic is creating a generation of orphaned children in Africa. The number of orphans will continue to increase long after the HIV/AIDS crisis has peaked, therefore it is important to determine how best to assist these children. Current studies investigating the impact of orphanhood have conflicting results and conclusions. Several studies report that orphans are at a disadvantage and are more likely to suffer from malnutrition, while other studies report no difference between the nutritional status of orphans and nonorphans. Four hundred eleven Luo children (age 9±1 yr) were recruited to participate in a study investigating the impact of orphanhood on nutritional status. Participants underwent an interview, anthropometric measurements, testing for anemia, a clinical history and a physical exam. Anthropometric variables and hemoglobin level were compared across groups using a t-test. The data presented here suggest that there is no significant difference between the nutritional status of orphaned and nonorphaned Luo children. This study supports research indicating there is little, if any, difference in nutritional indicators between orphans and nonorphans. Luo orphans may not be at higher risk for poor health than nonorphans. Therefore, interventions targeted at this age group should include both orphaned and nonorphaned children.

Introduction

The HIV/AIDS pandemic is creating a generation of orphaned children in Africa. The continent of Africa is home to 95% of the world’s children who have lost one or both
parents to AIDS (Matshalaga & Powell, 2002; Human Rights Watch, 2001b). It is estimated that by the year 2010, approximately 18 million African children under 18 years of age will be orphaned as a result of the pandemic (UNICEF, 2005). UNICEF (2006a) reported that the age distributions of orphans are consistent across Africa: 16% are 0-5 years of age, 36% are 6-11 years and 48% are 12-17 years of age. According to a report by UNAIDS (2006), the HIV/AIDS pandemic has not peaked so the extent of the orphan crisis has yet to be fully realized. The number of HIV/AIDS orphans will continue to increase long after the crisis peaks so it is important to determine how best to aid these children to ensure that they are healthy and well-nourished.

Orphaned children may face many hardships during their childhood and adolescence. The loss of one or both parents is only the beginning of the misfortunes that they may experience. The death of a parent permeates into all aspects of a child’s life. Orphans may experience a decline in health, nutrition, and psychological well-being (UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). Many orphans are reported to be stigmatized by their communities if the cause of parent death is either unknown or is the result of AIDS (UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). In addition to the stigma these children face, they may be subject to exploitation, abuse, violence, and isolation (UNICEF, 2003; Foster, 2002). It seems likely that children living in these unstable environments would be at a heightened risk for malnutrition.

In sub-Saharan Africa, the vast majority of orphans are cared for by their extended family, often by grandparents (UNICEF, 2003). It has also been documented that orphans are more likely to be invited to live in homes that are headed by females
(UNICEF, 2003). Unfortunately, many times the extended family cannot provide adequate care to these children (UNICEF, 2003). With parents continuing to fall prey to the HIV/AIDS crisis, more and more orphans are left under the care of grandparents who may not have the resources or the health to adequately care for their growing families. Many grandparents report that they do not have money and are unable to earn enough money to provide for children living in their homes (Foster, Makufa, Drew, Kambeu, & Saurombe, 1996). It is also possible that children living with older relatives are working to help bring food and income into the house. These children may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers.

The rate of child malnutrition in Africa is high and has increased over the past decade (UNICEF, 2006b; World Bank, 2006). High rates of underweight and stunting have been reported to exist across the continent (UNICEF, 2006b). The national chronic malnutrition rate in Kenya is approximately 33% and it has been suggested that adolescents may suffer from higher rates of malnutrition (Semproli & Gualdi-Russo, 2007). It is estimated that the rates of children under 5 years suffering from anemia are high in sub-Saharan Africa (Desai, 2003). The Kenyan Ministry of Health (2004) reported that approximately 73% of Kenyan children less than 5 years of age are anemic. Although malaria is the most common cause of anemia in Africa, it can also be caused by malnutrition and micronutrient deficiencies (Akwara, 2004). Population growth and a lack of progress have been hypothesized as reasons for the low nutritional statuses of African children (UNICEF, 2006b). Furthermore, HIV/AIDS has been suggested as a major factor involved in the increasing rates of child malnutrition (World Bank, 2006).
Results from recent studies evaluating the impact of orphanhood on child nutrition are conflicting. Orphans may be expected to have a decreased nutritional status. Several studies have yielded results to support this hypothesis. Children who are orphaned have been documented to be at a heightened risk for malnutrition (Lindblade, Odhiambo, Rosen, & DeCock, 2003; UNICEF, 2003; Ainsworth & Semali, 2000; UNICEF/UNAIDS, 1999). A study performed in Siaya District of western Kenya reported that living with a nonbiological parent was a risk factor for stunting (Bloss, Wainaina, & Bailey, 2004). Death of a parent or another household family member was found to be associated with a decrease in height-for-age and an increase in stunting in Tanzania (UNICEF, 2003). UNICEF (2003) also reported that both maternal and paternal orphans were short for their age when compared to nonorphans. In Zimbabwe, orphans and vulnerable children were more likely to suffer from both illness and malnutrition (Watts et al., 2007). Research suggests that low food availability resulting from low household socioeconomic status may increase stunting in orphans (Deininger, Garcia, & Subbarao, 2003; UNICEF, 2003).

Other studies have found no difference between the nutritional status of orphans and nonorphans. Although Lindblade et al. (2003) determined that orphans suffered from a lower weight-for-height than nonorphans, they found no significant difference between the two groups of children for other health and nutrition variables, including height-for-age. Few studies look at differences in hemoglobin level between orphans and nonorphans. Lindblade et al. (2003) found no significant difference in hemoglobin level between orphans and nonorphans. In Malawi, no significant differences were found.
between weight-for-age, weight-for-height, and height-for-age between orphans and nonorphans (Panpanich, Brabin, Gonani, & Graham, 1999). Similarly, a study in Uganda did not find an association between orphan status and body composition, body mass index, or arm circumference (Barrientos, 2006). A study investigating AIDS orphans in rural China also found no difference in the nutritional status of orphans and nonorphans (He & Ji, 2007).

This paper examines the impact of orphanhood on the nutritional status of a sample of Luo children using anthropometric measures and hemoglobin level as markers. Specifically, the nutritional status of male orphans and male nonorphans, and female orphans and female nonorphans is compared. Orphans were hypothesized to have lower anthropometric measures and lower levels of hemoglobin than nonorphans. The differences were expected in both males and females.

Methods

Study Population

This project was conducted in Nyanza Province, Kenya from June-July 2007. With a 6.1% HIV/AIDS prevalence rate among adults aged 15-49 years, Kenya is the 17th hardest hit country in Africa (UNAIDS, 2006). Approximately 1.1 million orphans live in Kenya (UNAIDS, 2006). A large majority of these children are currently living in Nyanza Province, where 30-39% of adults are infected with HIV (UNAIDS, 2006; Nyambedha, Wandibba, & Aagaard-Hansen, 2003). This prevalence rate is one of the highest on the continent of Africa (UNAIDS, 2006; UNAIDS/UNICEF/WHO, 2002;
In Nyanza Province, it is estimated that 19% of children less than 15 years of age have lost one or both parents to AIDS (United Nations, 2005). The primary residents of Nyanza Province are members of the third largest ethnic group in Kenya, the Luo (National Council for Population and Development, 1999). Luo Nyanza is one of the poorest provinces in Kenya with a poverty rate of 63% (Human Rights Watch, 2001b). A recent increase in poverty has been seen in Nyanza Province and it is speculated that this increase is due to the high prevalence of HIV/AIDS in the region (National Council for Population and Development, 1999). Luo are primarily subsistence farmers and pastoralists (Nyambedha, Wandibba, & Aagaard-Hansen, 2001; Ayudo, 1996; Ocheing’, 1985; Ocholla-Ayayo, 1976). Women may take part in small-scale farming activities with men being responsible for cash crops (Ayudo, 1996). Common cash crops in the region include tobacco, cotton, ground nuts, and sugar cane (Ayudo, 1996). Types of livestock raised by Luo include cows, sheep, goats, and pigs. Many Luo raise chickens as well. Other economic practices include peasant farming, fishing, and working in the service industry (e.g. food, transport, and retail) (Ayudo, 1996). This male dominated society is both patriarchal and patrilocal (Reynar, 2000; Ayudo, 1996; Ocheing’, 1985). Polygamous marriage and “wife inheritance” are both common practices in Luo society (Reynar, 2000; Opiyo, 1996). Generally, a widow remarries someone from her husband’s family, therefore allowing her to remain on her husband’s property (Reynar, 2000). The practice of wife inheritance is one of the main cultural reasons for the high prevalence of HIV/AIDS in this ethnic group. Due to an
increased stigma and growing awareness of the disease, the practice is decreasing (Nyambedha et al., 2001).

Lutos typically eat three meals per day. The first is breakfast, which is regarded as a snack rather than a meal. Breakfast usually consists of a porridge made of sorghum, millet, and cassava. Other food items that may be consumed at this first meal include ground nuts, nyoyo (a mixture of maize and beans), or eggs. The food eaten for lunch and dinner is often the same. Dinner is considered the main meal of the day. Ugali, a carbohydrate rich food made out of maize, millet, and/or sorghum, is a large component of the Luo diet. Other sources of carbohydrates include potatoes, sweet potatoes, and rice. Common vegetables include kale, onions, cowpeas, cabbage, and tomatoes. Chicken, fish, and beef are the main forms of protein, but are rarely eaten due to their expense. One exception is omena, a small fish that is affordable for most Luo. The consumption of chicken and chicken products is a food taboo that may limit a child’s, but more often a woman’s, intake of protein (Akwara, 1996). The cultural explanation for this taboo is that the consumption of chicken can effect a woman’s fertility. This belief is generally held by older people, however, young girls living with traditional older grandmothers may be subjected to this taboo. It has been reported that children and pregnant women often eat dirt. This has been hypothesized to occur because of anemia or other nutritional deficiencies (Desai et al., 2002; Geissler, 2000).

In Luo culture children are highly revered. Every child is regarded as a child of the community and therefore must respect other adults in the homestead (Ayudo, 1996). The parent or grandparent who lives with the child is the individual who is primarily

null

null
concerned with his well-being, however, other adults in the homestead may also take part in childcare. Usually the female is considered the primary caretaker of children, while the male is responsible for protecting and providing for his wife (or wives) and children (Ayudo, 1996). Children are known to contribute to the household with boys helping with the animals and girls with housework and childcare. Currently approximately 27% of children ages 5-14 years living in Kenya participate in either paid and/or domestic labor (UNICEF, 2005). Children work in order to supplement family income or to pay school fees. They may participate in a variety of jobs including fetching water and firewood, shepherding, and childcare. Girl children are more likely to be pulled out of school in order to help with the care of an ill parent(s), with chores, and/or the care of younger brothers and sisters (Kenyan Ministry of Health, 2004; Human Rights Watch, 2001a; Human Rights Watch, 2001b).

Sample

Four hundred eleven children (age 9±1 yr.) were recruited from 17 schools in the Nyando District and Kisumu Rural. Both Nyando District and Kisumu Rural are located within Nyanza Province, and were chosen because of current affiliations that Ohio University College of Osteopathic Medicine has with community leaders in the area. The headmaster at each school was contacted and asked to select male and female children that could participate in the study. Approximately half of the children invited to participate in the study were orphans and half were nonorphans. An orphan was defined as a child who had lost at least one parent to AIDS or another cause. This definition of orphanhood is consistent with that accepted internationally as well as locally in Kenya.
(Nyambedha et al., 2003; UNICEF/UNAIDS, 1999). Consent for participation in the study was obtained from a parent/guardian and assent was obtained from the children in accordance with Ohio University’s Institutional Review Board (IRB) and the Kenya Medical Research Institute (KEMRI). Approval has been granted for this project by Ohio University’s IRB, and KEMRI’s scientific and ethics committees. Orphans and nonorphans were frequency-matched for age and gender. Selected sample characteristics are displayed in Table 2.1.

Based on published anthropometric data it was determined that there should be 85 children in each of the 4 groups (male orphans and nonorphans, and female orphans and nonorphans) for a total of 340 children in order to have a 90% chance of detecting a moderate effect size at a statistically significant level (alpha=0.05, medium Cohen’s effect size= 0.5 SD, power= 0.9). The effect size of 0.5 SD is similar to those found in comparisons between groups of children in previous studies investigating child nutrition (Hoffman, Sawaya, Martins, McCrory, & Roberts, 2006; Little, Buschang, & Malina, 1988; Buschang, Malina, & Little, 1986; Bogin & Macvean, 1982). These studies were chosen because the research investigated children of appropriate age ranges. Four hundred eleven children were invited to participate in the study in order to allow for multiple comparisons and missing data.

Individual planned comparisons were made using alpha=0.05. Alpha was adjusted using Sidak’s adjustment (a partial Bonferroni procedure for multiple comparisons) (Simple Interactive Statistical Analysis, 1998), which takes into account any correlations among the outcome variables while adjusting alpha for multiple
comparisons. With 15 planned comparisons and correlations among the outcome variables ranging from 0.03 to 0.89, the adjusted alpha was 0.01.

_Inclusion/Exclusion Criteria_

Children between ages 7-11 years and residents of Nyando District or Kisumu Rural were _included_ in the study. The narrow age range of 7-11 years was chosen for several reasons. This age minimized the opportunity of enrolling children infected with HIV/AIDS. Most children infected by their mothers die before the age of 5 years and the majority of children are not sexually active before the age of 11. Much of the current literature investigating the relationship between orphan status and nutrition focuses on children under the age of 5 years; other age groups should be evaluated as well. This age range was also chosen because it is prior to the beginning puberty, which is important as height and weight changes occur during this stage in development (Kaplan & Love-Osborne, 2007). When compared with female American adolescents, it has been reported that the beginning of puberty may begin up to 2 years later in female African adolescents (Leenstra et al., 2005). Therefore, few, if any, Luo children recruited to participate in this study were beginning to go through puberty. Since consent, assent, and other parts of the study were conducted in either Dholuo or Swahili, it was necessary that both the child and his guardian be fluent in either Dholuo and/or Swahili.

A child was _excluded_ from the study if after the clinical history and physical exam he was thought to be potentially infected with HIV/AIDS. These children were referred to a local clinic per the recommendation of the clinical officer.
Data Collection Methods

Anthropometry

Anthropometric measures were taken to assess nutritional status. Height was assessed with a GPM® anthropometer (cm) and weight by an Omeron® scale (kg). Circumferences (chest, waist, hip, arm, and calf) were measured using a tape measure (cm) and skinfolds (triceps, subscapular, suprailliac, abdominal, and calf) via a Lange® skinfold caliper (mm). Anthropometrics were performed using standard measurement techniques described by Lohman, et al. (1998). Body mass index was calculated from height and weight measurements (Centers for Disease Control and Prevention, 2007). Skinfold measurements (triceps and calf) were utilized to calculate percent body fat using equations from Slaughter et al. (1988).

Clinical History and Physical Exam

Each child participated in a clinical history and physical exam performed by an osteopathic medical student with the assistance of a research assistant/clinical officer. The clinical history and physical exam were not oriented to be nutritionally focused. The clinical history and physical exam were utilized to identify children potentially infected with HIV/AIDS. The Revised World Health Organization Clinical Staging of HIV/AIDS for Infants and Children under 15 Years (World Health Organization, 2005) was used to identify potentially infected children.
Hemoglobin Level

Blood was collected by use of sterile, disposable lancets. A HemoCue® system was used to determine hemoglobin (Hb) levels. Anemia is characterized as a decrease in the number of red blood cells in the body or a decrease in the amount of Hb (Sharman, 2000). In general, this decrease in Hb leads to a decrease in the oxygen carrying capacity of red blood cells. The resultant decrease in oxygen delivery to tissues leads to symptoms of anemia, i.e. fatigue, weakness, and exertional dyspnea (Davoren, 2006).

The World Health Organization’s criteria for anemia was used to differentiate between severe: Hb= <7.0g/dL; moderate: Hb= 7-9.9g/dL and mild: Hb= 10-11.5g/dL (Sharman, 2000).

The HemoCue® machine’s inability to function on hot days in the field limited the number of children who could participate in this portion of the study. Children cycled through this station haphazardly so there is no bias as to which children’s Hb levels were measured. Hb level was measured in 351 children.

Interview

Participant interviews were conducted in Dholuo by a trained Luo research assistant. Data collected included participant age and grade level and information on school attendance, work, and assistance provided to the child’s guardian(s) and other child(ren) living in the homestead. Orphans were also asked how many years they had been orphans. Nonorphans were asked if and how many orphans lived in their homestead. Data were entered in PalmPilots® using Entryware® software.
Immediately following this questioning, each child also participated in a qualitative questionnaire. Separate questionnaires existed for orphans and nonorphans (Appendix A, Boxes 1 and 2). Luo research assistants were instructed to ask the children the questions in Dholuo and record the children’s exact responses in English on the form.

**Analysis**

Prior to the analysis, four children were excluded from the study: two children were excluded because of questionable HIV status; one child was excluded because age was undeterminable; the last child was excluded for both factors leaving, 407 children in the analysis.

The nutritional status variables (height, weight, circumferences, skinfolds, body mass index [BMI], percent body fat, and hemoglobin level [Hb]) were compared between orphans and nonorphans using a t-test. The analysis was repeated for both males and females. Due to the large number of t-tests run, all interpretations are based on the p-value (0.01) that was calculated for multiple comparisons.

Z-scores for height, weight, and BMI were determined using the Centers for Disease Control and Prevention’s Epi-Info program (Centers for Disease Control, 2005). The 2000 reference data provided by the Centers for Disease Control and Prevention was used. The z-scores for height-for-age, weight-for-age, and BMI were compared between orphans and nonorphans using a t-test. The analysis was repeated for both male and female groups. Alpha=0.05 indicated a significant difference between the two groups.

In order to determine if an association existed between each individual nutritional status variable and length of orphanhood, a partial correlation analysis was used. Age
was entered as a control variable in this analysis because of the relationship that exists between the age of the child and his length of orphanhood. The analysis was run separately for male and female orphans. P=0.05 indicated a significant association. All analyses were performed using SPSS 15.0® statistical software.

Results

For the males, no significant differences were detected for any of the nutritional status variables (Table 2.2). Differences between female orphans and female nonorphans were not detected for any of the nutritional status variables (Table 2.3). Similarly, no differences were seen between the z-scores for height-for-age, weight-for-age, and body mass index between orphans and nonorphans (Table 2.4; Figure 2.1). This was true for both genders (Table 2.4; Figure 2.1).

Partial correlations indicated that after controlling for the relationship between age and length of orphanhood, there is no relationship between any of the nutritional status variables and length of orphanhood. This was true for both males and females.

Discussion

The data presented here suggest that there is no difference between the nutritional status of orphaned and nonorphaned Luo children. These results differ from much of the current orphan literature, which suggests that orphans are nutritionally disadvantaged. Qualitative data collected during the present study found that many orphans perceived their food intake to be decreased since the loss of a parent(s). Many children responded that food had decreased since the death of a father due to loss of the “breadwinner.” Children living with grandparent(s) commented that their grandparents were “too old and
“sick” to work to provide food for the family. This perception was not borne out in the anthropometric data.

Worldwide there has been a decrease in the prevalence of stunting and underweight in the developing world over the past decade (Svedberg, 2006; UNICEF, 2006b; deOnis, Blossner, Borghi, Morris, & Frongillo, 2004). The greatest increases in child nutrition have been seen in East Asia/Pacific, Latin America/Carribean, and North Africa (UNICEF, 2006b). Children in these regions are less likely to suffer from underweight and stunting than the children who participated in this study. Increases in child nutritional status are speculated to occur due to increases in socioeconomic status and parental education as well as better access to public health services (Svedberg, 2006). It has been reported that there has been little improvement in child nutritional status in sub-Saharan Africa and South Asia (Svedberg, 2006; UNICEF, 2006b).

According to analyses using growth standards from the United States’ Centers for Disease Control and Prevention (CDC) control, Luo children appear to be less malnourished than would be expected. In general, although Luo children fell below the U.S. mean for height-for-age, weight-for-age, and body mass index (BMI) all values were between 0.1- 0.7 standard deviations below the mean or between the 16th and 50th percentiles. This meaning that the children who participated in this study were not suffering from malnutrition (stunting and/or wasting) as would be indicated by children who were ≥2 standard deviations below the mean of the U.S. standards. Female orphans were actually 0.04 standard deviations above the mean for height-for-age. These results are relative to U.S. children and suggest that Luo children are relatively well-nourished
when compared to children living in the U.S. and they do not appear to be substantially smaller than U.S. children. That being said, these analyses should be interpreted with caution because the data used by the CDC does not incorporate growth data from any countries in Africa.

The Luo children who participated in this study are comparable in nutritional status to other children living in Kenya and South Africa. Semproli and Gualdi-Russo (2007) investigated growth and nutrition in Luo children living in Suba District. They gathered data from children ages 5-17 years of age (Semproli & Gualdi-Russo, 2007). In general, they found similar results to the present study for children ages 7-11. On average the height-for-age of Luo children living in the Suba District was slightly below the 50th percentile. The weight-for-age of these children were generally above the 50th percentile for children ages 7-11 (Semproli & Gualdi-Russo, 2007). A study investigating the nutritional status of children in rural South Africa found that majority of children between the ages of 7-11 were adequately nourished when compared to international growth standards (Madhavan & Townsend, 2007). In general for height-for-age and weight-for-age for both males and females, the children fell between the 5th and 50th percentile (Madhavan & Townsend, 2007).

There are several possible reasons for why results obtained in this paper differ from literature supporting an association between orphan status and poor nutrition. Children who were recruited to participate in this study are older (7-11 years) than children generally recruited to participate in studies investigating the impact of orphanhood. Many researchers investigating nutritional status in orphaned children
recruit children who are less than 5 or 6 years of age (Watts et al., 2007; Bloss et al., 2004; Lindblade et al., 2003; Ainsworth & Semali, 2000). Literature suggesting no difference in nutritional status between orphans and nonorphans consists of a participants under 6 years (Lindblade et al., 2003; Panpanich et al., 1999) as well as samples where the children were 2-8 years and 8-15 years (He & Ji, 2007; Barrientos, 2006). The Kenyan Ministry of Health (2004) suggests that age is an important factor to consider when looking at malnutrition caused by orphanhood. Younger orphans have been found to suffer differentially from malnutrition and perhaps are more vulnerable to orphanhood (Kenyan Ministry of Health, 2004).

Socioeconomic factors may explain the lack of significant differences between the nutritional status of orphaned and nonorphaned Luo children. Although orphans are most likely to live in homes that have the highest dependency ration, in Kenya and Tanzania it has been reported that orphans are “better off” economically than nonorphans (Bicego, Rutstein, & Johnson, 2003). It has been suggested this is because the poorest households are less likely to invite orphans to live with them (Bicego et al., 2003). Another research group suggested that the movement of orphans is “strategic” in that they are sent to live with relatives known to be capable of caring for them (Parikh et al., 2007). It is possible that a similar situation is occurring among the Luo households in this study and that orphans are only invited or sent to live with well-off relatives. Supporting this idea are results from the Kenyan Grandparents Study, which was conducted concurrently with this project. Results from this study suggest that caregivers are better off nutritionally than
noncaregivers, however, it is unknown if this is because they were better of before becoming caregivers (Ice, Yogo, & Juma, 2007).

Although the results reported in this paper suggest that there is no association between length of orphanhood and nutritional status variables in Luo children, some literature suggests that length of orphanhood may have an impact on child nutritional status. Length of orphanhood may not have been found to be significantly related to nutritional status because of the cross-sectional nature of this study. Results from studies in Kenya and South Africa suggest that the length of orphanhood may play a role in a child’s nutritional status (Parikh et al., 2007; Lindblade et al., 2003). Recently orphaned children may not yet show the nutritional impact of orphanhood that may occur as the result of a loss of the family “breadwinner” or being sent to live with a grandparent. It has also been suggested that families may be able to “cope” with the loss of an adult(s) immediately following his death thereby preventing any immediately negative effects of orphanhood (Parikh et al., 2007). Another possible theory suggested by Parikh et al. (2007) is that the difficult period for orphans is the period prior to parental death when the child may be responsible for care of their dying parent as well as being asked to miss school to earn money and/or perform chores around the homestead. A child who had been orphaned for several years may have had the chance to recover from this period and may not show any negative effects of orphanhood. Dayton and Ainsworth (2004) found that the BMI of elders was lower when there was a sick adult in the household, however, BMIs were found to increase following adult death. Therefore it is possible that both
orphans and their caregivers are most vulnerable when there is a sick adult living on the homestead.

Several limitations of this study must be acknowledged. The current study is cross-sectional and does not yield information about the long-term effects of orphanhood on children. Age determination was difficult in the present study as birth records are not normally kept in Luo society. Children over 11 years of age may have been included in the study because their true age could not be determined. Similarly, it is possible that some children may have entered puberty and may have developed more adolescent body features. A child’s stature may increase up to 20% and weight can double during the adolescent stage of growth (Kaplan & Love-Osborne, 2007). Therefore, anthropometric measurements obtained would be reflective of a growth spurt and not necessarily reflect a child’s nutritional status. It should also be noted that this study is not a complete nutritional assessment. In addition to anthropometric measurements, a complete nutritional assessment would include a “nutritionally focused physical exam”, a detailed dietary history, and laboratory testing (i.e. serum albumin) (Baron, 2008).

It is important to recognize that the results of the present study cannot be generalized to all Kenyan children as the children in the study were mainly Luo. The results should also be interpreted carefully within the Luo community itself because children from only two districts within Nyanza Province were recruited for participation in this study. Children were recruited from schools, and this may reduce the applicability of the data to all orphans because they are often forced to drop out of school to perform household chores, care for sick family members, and/or work. Sixty-six percent of both
male and female Kenya children are enrolled in primary school (World Health Organization, 2006), thus the children who participated in the present study may live in homes with a higher socioeconomic status than the general population. It is important to note that primary school in Kenya is free but school fees and uniforms are required for each child. Different results would potentially be found at a secondary school where children must pay for schooling as well as school fees and uniforms. Furthermore, it is possible that there may have been biases based on headmaster selection of children.

Despite its limitations, this study does add important information to the growing literature regarding the impact of orphanhood. It adds support to the increasing number of studies which suggest that orphanhood does not universally or adversely impact the nutritional status of orphaned children. Furthermore, the sample size in this study exceeds that of many current studies looking at orphans.

These data suggest that orphans may not be at higher risk for poor health. Based on the present work it is suggested that interventions targeted at participants of similar age as those included in this study should include both orphaned and nonorphaned children. Potential interventions include a daily meal at school and general nutritional education about healthy eating. Orphans are also at a high risk for living in food insecure environments. Interventions with the goal of helping to increase food security in homes with orphans include helping families to grow nutritious food as well as giving them food supplies. These interventions will increase the nutritional status of Luo children and will help to prevent malnutrition as they age.
Acknowledgements

This project was funded by Ohio University College of Osteopathic Medicine (OUCOM)/Research Award, OUCOM/OU Challenge Award, OU Graduate Senate Grant for Original Work, and the OUCOM D.O./Ph.D. program. The project infrastructure was additionally supported by the National Science Foundation (Grant No. 0515890; P.I. Ice). It was conducted in collaboration with the Kenya Medical Research Institute. Much appreciation goes to the Kenyan field team as well as the communities and people of the Nyando District. Thank you to the American field team and to Jaja Yogo for all of his work with translations and organization while in Kenya.

Literature Cited


the inadequate support systems for orphans in western Kenya. *Health Policy, 58*, 83-96.


Table 2.1

**Sample characteristics, Mean(SD) or %**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan N=210</th>
<th>Nonorphan N=197</th>
<th>Total N=407</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9.5(1.2)</td>
<td>9.2(1.4)</td>
<td>9.3(1.3)</td>
<td>0.2</td>
</tr>
<tr>
<td>Female</td>
<td>9.2(1.2)</td>
<td>8.9(1.3)</td>
<td>9.0(1.2)</td>
<td>0.1</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.7**</td>
</tr>
<tr>
<td>Male</td>
<td>57.6</td>
<td>45.7</td>
<td>46.7</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52.4</td>
<td>54.3</td>
<td>53.3</td>
<td></td>
</tr>
</tbody>
</table>

Length of orphanhood (yr)

<table>
<thead>
<tr>
<th>Variable</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>4.6(2.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.6(2.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The p-value for the difference between male and female age is 0.03.

**Value calculated from a chi-squared analysis
Table 2.2

*Anthropometric measures and hemoglobin level of males*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th></th>
<th>Nonorphan</th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>99</td>
<td>134.2(8.0)</td>
<td>90</td>
<td>133.5(9.4)</td>
<td>0.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>99</td>
<td>28.5(4.8)</td>
<td>90</td>
<td>28.1(4.5)</td>
<td>0.7</td>
</tr>
<tr>
<td>Chest circum. (cm)</td>
<td>98</td>
<td>66.6(3.5)</td>
<td>90</td>
<td>65.6(4.0)</td>
<td>1.0</td>
</tr>
<tr>
<td>Waist circum. (cm)</td>
<td>98</td>
<td>61.8(3.9)</td>
<td>90</td>
<td>60.8(3.2)</td>
<td>1.0</td>
</tr>
<tr>
<td>Hip circum. (cm)</td>
<td>98</td>
<td>70.1(5.0)</td>
<td>90</td>
<td>69.3(4.8)</td>
<td>0.9</td>
</tr>
<tr>
<td>Arm circum. (cm)</td>
<td>98</td>
<td>18.9(1.6)</td>
<td>90</td>
<td>18.7(1.6)</td>
<td>0.8</td>
</tr>
<tr>
<td>Calf circum. (cm)</td>
<td>97</td>
<td>25.8(1.9)</td>
<td>90</td>
<td>25.6(2.0)</td>
<td>0.7</td>
</tr>
<tr>
<td>Triceps skin. (mm)</td>
<td>98</td>
<td>7.5(2.3)</td>
<td>90</td>
<td>7.4(2.3)</td>
<td>0.7</td>
</tr>
<tr>
<td>Subscapular skin. (mm)</td>
<td>98</td>
<td>6.6(1.5)</td>
<td>90</td>
<td>6.4(1.3)</td>
<td>0.9</td>
</tr>
<tr>
<td>Suprailiac skin. (mm)</td>
<td>98</td>
<td>5.2(1.8)</td>
<td>90</td>
<td>5.5(2.2)</td>
<td>0.2</td>
</tr>
<tr>
<td>Abdominal skin. (mm)</td>
<td>98</td>
<td>5.4(1.8)</td>
<td>90</td>
<td>5.8(2.5)</td>
<td>0.4</td>
</tr>
<tr>
<td>Calf skin. (mm)</td>
<td>98</td>
<td>7.1(2.2)</td>
<td>90</td>
<td>7.2(2.1)</td>
<td>0.4</td>
</tr>
<tr>
<td>Body mass index</td>
<td>99</td>
<td>15.9(2.7)</td>
<td>90</td>
<td>15.7(1.4)</td>
<td>0.8</td>
</tr>
<tr>
<td>Percent body fat</td>
<td>98</td>
<td>11.8(2.9)</td>
<td>90</td>
<td>11.7(2.8)</td>
<td>0.5</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>77</td>
<td>11.3(1.5)</td>
<td>87</td>
<td>11.9(1.1)</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Table 2.3

*Anthropometric measures and hemoglobin level of females*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>109</td>
<td>134.3(9.5)</td>
<td>106</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>110</td>
<td>28.3(5.6)</td>
<td>106</td>
</tr>
<tr>
<td>Chest circum. (cm)</td>
<td>110</td>
<td>65.3(5.2)</td>
<td>106</td>
</tr>
<tr>
<td>Waist circum. (cm)</td>
<td>110</td>
<td>62.0(4.1)</td>
<td>106</td>
</tr>
<tr>
<td>Hip circum. (cm)</td>
<td>110</td>
<td>69.9(5.9)</td>
<td>106</td>
</tr>
<tr>
<td>Arm circum. (cm)</td>
<td>110</td>
<td>19.0(2.0)</td>
<td>106</td>
</tr>
<tr>
<td>Calf circum. (cm)</td>
<td>110</td>
<td>26.0(2.3)</td>
<td>106</td>
</tr>
<tr>
<td>Triceps skin. (mm)</td>
<td>110</td>
<td>9.2(2.8)</td>
<td>105</td>
</tr>
<tr>
<td>Subscapular skin. (mm)</td>
<td>110</td>
<td>7.7(2.4)</td>
<td>106</td>
</tr>
<tr>
<td>Suprailiac skin. (mm)</td>
<td>110</td>
<td>8.3(3.4)</td>
<td>106</td>
</tr>
<tr>
<td>Abdominal skin. (mm)</td>
<td>110</td>
<td>8.9(3.3)</td>
<td>106</td>
</tr>
<tr>
<td>Calf skin. (mm)</td>
<td>110</td>
<td>9.2(2.4)</td>
<td>105</td>
</tr>
<tr>
<td>Body mass index</td>
<td>109</td>
<td>15.5(1.5)</td>
<td>106</td>
</tr>
<tr>
<td>Percent body fat</td>
<td>110</td>
<td>16.3(2.9)</td>
<td>104</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>91</td>
<td>11.7(1.5)</td>
<td>96</td>
</tr>
</tbody>
</table>
Table 2.4

*Z-scores for males and females*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean(SD)</td>
<td>Mean(SD)</td>
<td></td>
</tr>
<tr>
<td>Height-for-age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>89</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>-0.2(1.0)</td>
<td>-0.1(1.1)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>109</td>
<td>106</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>0.04(1.2)</td>
<td>-0.1(1.2)</td>
<td></td>
</tr>
<tr>
<td>Weight-for-age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>89</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>-0.5(1.0)</td>
<td>-0.4(0.8)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>110</td>
<td>106</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>-0.4(0.9)</td>
<td>-0.5(1.0)</td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>89</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>-0.6(0.9)</td>
<td>-0.4(0.9)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>109</td>
<td>106</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>-0.6(0.8)</td>
<td>-0.7(0.9)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2.1. z-scores for males and females
CHAPTER 3: HEALTH AND DISEASE SYMPTOMOLOGY IN A SAMPLE OF LUO CHILDREN

Abstract

The children of Africa are confronted with various health risks, many of which are exacerbated by the HIV/AIDS pandemic. Millions of children have become orphaned due to the disease. Orphanhood could impact health through several means, including malnutrition and greater exposure to disease from a living parent with HIV/AIDS or an elderly grandparent. The majority of studies investigating the impact of orphanhood on health have failed to find a correlation between orphan status and poor health. In this project, 411 Luo children (age 9±1 yr) were recruited to participate in a study examining health. Participants underwent an interview, a clinical history, and a physical exam. Health complaints and physical exam findings were compared across groups using a t-test. No significant differences in the clinical history and physical exam were found between the two groups of male children or the two groups of female children. In general, children complained most commonly of a cough, sore throat, nasal congestion, watery eyes, and abdominal pain. The most common findings on physical exam were parasitic and fungal infections. Overall, there does not appear to be a significant difference in the health of orphaned and nonorphaned Luo children. Results from this study suggest that in general, Luo children are healthy and that they would benefit from health education, i.e. the benefits of clean water and hygiene, as well as prevention and treatment for malaria, parasite, and fungal infections.
Introduction

According to the World Health Organization (2006), a child born today in Africa will face more health risks throughout his life than a child born on any other continent. This high risk of poor health may be the result of several factors, including the high HIV/AIDS prevalence on the continent and the high rates of poverty (World Health Organization, 2006). A geography and climate that is a welcome environment for diseases such as malaria, along with an increase in both noncommunicable diseases (heart disease, stroke, and cancer) and injuries amplify the risk of suffering from poor health for Africans (World Health Organization, 2006). Currently, the leading causes of death among children 5-14 years old are lower respiratory tract infections, HIV/AIDS, traffic accidents, measles, and trypanosomiasis (African sleeping sickness) (World Health Organization, 2006). Many Africans also face a lack of access to adequate healthcare.

Child health in Nyanza Province, the site of data collection, is considered to be poor. For children under the age of 5 years, causes of morbidity and mortality in the region are consistent with those seen across Kenya: malaria, diarrhea, measles, malnutrition, and respiratory, parasitic, and skin infections (Kenyan Ministry of Health, 2004; Central Bureau of Statistics, 2003). Although both infant mortality and under-5 child mortality rates are extremely high in Nyanza Province (Kenyan Ministry of Health, 2004), over 50% of the families surveyed in the Kenyan Demographic and Health Survey 2003 reported seeking healthcare for child illness (Central Bureau of Statistics, 2003). The Kenyan Ministry of Health (2004) reported that orphans should be considered vulnerable children and they are at a higher risk for poor health because they have a “lack
of protection of family.” Orphans often live in poor socioeconomic homes where there may be a lack of food, education, and even clothing (Kenyan Ministry of Health, 2004).

The HIV/AIDS pandemic is having a major effect on the children of Africa. It is estimated that by the year 2010, approximately 18 million African children <18 years of age will be orphaned as a result of the pandemic (UNICEF, 2005). The death of a parent permeates all aspects of a child’s life - he may experience a decline in health, nutrition, and psychological well-being (UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). In sub-Saharan Africa, the vast majority of orphans are cared for by their extended family, often times grandparents (UNICEF, 2003). It has also been documented that orphans are more likely to be invited to live in homes that are headed by females (UNICEF, 2003). Unfortunately, many times the extended family cannot provide adequate care to these children (UNICEF, 2003). As parents continue to fall prey to the HIV/AIDS crisis, more and more orphans are left under the care of grandparents who may not have the resources or the health to adequately care for their growing families. Many times grandparents either do not have money or are unable to earn enough money to provide for children living in the home (Foster, Makufa, Drew, Kambeu, & Saurombe, 1996). It is possible that children living with older relatives are working to help bring food and income into the house. These children may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers.

Several means exist through which orphanhood could impact child health. Although research findings differ regarding how orphanhood affects nutritional status (Barrientos, 2006; Lindblade, Odhiambo, Rosen, & DeCock, 2003; Ainsworth & Semali,
rates of malnutrition are high in Africa regardless of orphan status (UNICEF, 2006). Malnutrition increases the likelihood of infectious disease because without adequate nourishment the body can no longer maintain its “essential daily functions”, one of which is resistance to infectious diseases (UNICEF, 2006; Muller & Krawinkel, 2005). Disease can both lead to and increase malnutrition (Muller & Krawinkel, 2005). The cycle that is created between malnutrition and disease is common and can be very difficult to overcome in low resource areas where access to healthcare is poor. Orphaned children who are living in households in which one or more persons are infected with HIV/AIDS will be exposed and potentially infected with more diseases than children living in non-AIDS affected homes. Bridge, Kipp, Jhangri, Laing, & Konde-Lule (2006) found that the length of disease episodes was longer in those children living in homes where someone was infected with HIV/AIDS. Children living with grandparents may suffer from poorer health as elderly people are more susceptible to many infectious diseases. Furthermore, children living with an elderly caregiver may not receive adequate healthcare if the elder does not have the resources to pay for a physician and pharmacy visit.

Many studies investigating the impact of orphanhood on health have failed to find a relationship between orphan status and poor health. These studies have not found a correlation between the morbidity and/or mortality of children who have been impacted by HIV/AIDS and those who have not (Parikh et al., 2007; Crampin et al., 2003; Kamali et al., 1996; Ryder, Kamenga, Nkusu, Batter, & Heyward, 1994). A study in western Kenya found no significant difference between a recent history of fever or malaria
between orphans and nonorphans (Lindblade, Odhiambo, Rosen, & DeCock, 2003). No difference was found in the incidence of disease between orphans and nonorphans living in Uganda (Bridge et al., 2006).

Several researchers have found orphans to have poorer health than nonorphans. In one study, orphan self-reported morbidity was higher than that of nonorphans. However, no differences were found in treatment seeking behavior between the two groups of children (Sarker, Neckermann, & Muller, 2005). This suggests that although orphans may report being sicker often, their caregivers may have the ability to meet their healthcare needs. Poor health was found to exist in orphans living in Zimbabwe (Watts et al., 2007). In Zimbabwe, orphans and other vulnerable children were more likely to have reported recent illness that manifested as either diarrhea or respiratory tract infection (Watts et al., 2007).

This paper aims to add to knowledge regarding orphan health through several means. A more comprehensive approach to child health will be taken in this paper. Clinical histories and physical exams allowed for an investigation of overall health as well as commonly reported disease symptoms. Males and females were investigated separately, which allowed for investigation of health to be gender specific. Finally, length of orphanhood was investigated as a covariate to determine its impact on orphan health. This paper examines the impact of orphanhood on the health of Luo children through the use of a clinical history and physical exam. Specifically, orphans were hypothesized to have poorer health as determined by a clinical history and a physical exam than nonorphans. The differences were expected in both males and females.
Methods

Study Population

This project was conducted in Nyanza Province, Kenya from June-July 2007. With a 6.1% HIV/AIDS prevalence rate among adults aged 15-49 years, Kenya is the 17th hardest hit country in Africa (UNAIDS, 2006). Approximately 1.1 million orphans live in Kenya (UNAIDS, 2006). A large majority of these children are currently living in Nyanza Province, where 30-39% of adults are infected with HIV (UNAIDS, 2006; Nyambedha, Wandibba, & Aagaard-Hansen, 2003a). This prevalence rate is one of the highest on the continent of Africa (UNAIDS, 2006; UNAIDS/UNICEF/WHO, 2002; Human Rights Watch, 2001b). In Nyanza Province, it is estimated that 19% of children less than 15 years of age have lost one or both parents to AIDS (United Nations, 2005).

The primary residents of Nyanza Province are members of the third largest ethnic group in Kenya, the Luo (National Council for Population and Development, 1999). With a poverty rate of 63%, Luo Nyanza is one of the poorest provinces in Kenya (Human Rights Watch, 2001b). A recent increase in poverty has been seen in Nyanza Province and it is speculated that this increase is due to the high prevalence of HIV/AIDS in the region (National Council for Population and Development, 1999). Luo are primarily subsistence farmers and pastoralists (Nyambedha, Wandibba, & Aagaard-Hansen, 2001; Ayudo, 1996; Ochering’, 1985; Ocholla-Ayayo, 1976). Women may take part in small-scale farming activities with men being responsible for cash crops (Ayudo, 1996). Common cash crops in the region include tobacco, cotton, ground nuts, and sugar cane (Ayudo, 1996). Types of livestock raised by Luo include cows, sheep, goats, and
pigs. Many Luo raise chickens as well. Other economic practices include peasant farming, fishing, and working in the service industry (e.g. food, transport, and retail) (Ayudo, 1996). This male dominated society is both patriarchal and patrilocal (Reynar, 2000; Ayudo, 1996; Ocheing’, 1985). Polygynous marriage and “wife inheritance” are both common practices in Luo society (Reynar, 2000; Opiyo, 1996). Generally, a widow remarries someone from her husband’s family, therefore allowing her to remain on her husband’s property (Reynar, 2000). The practice of wife inheritance is one of the main cultural reasons for the high prevalence of HIV/AIDS in this ethnic group. Due to an increased stigma and growing awareness of the disease, the practice is decreasing (Nyambedha et al., 2001).

Luos typically eat three meals per day. The first is breakfast, which is regarded as a snack rather than a meal. Breakfast usually consists of a porridge made of sorghum, millet, and cassava. Other food items that may be consumed at this first meal include ground nuts, nyoyo (a mixture of maize and beans), or eggs. The food eaten for lunch and dinner is often the same. Dinner is considered the main meal of the day. Ugali, a carbohydrate rich food made out of maize, millet, and/or sorghum, is a large component of the Luo diet. Other sources of carbohydrates include potatoes, sweet potatoes, and rice. Common vegetables include kale, onions, cowpeas, cabbage, and tomatoes. Chicken, fish, and beef are the main forms of protein, but are rarely eaten due to their expense. One exception is omena, a small fish that is affordable for most Luo. The consumption of chicken and chicken products is a food taboo that may limit a child’s, but more often a woman’s, intake of protein (Akwara, 1996). The cultural explanation for
this taboo is that the consumption of chicken can effect a woman’s fertility. This belief is generally held by older people, however, young girls living with traditional older grandmothers may be subjected to this taboo. It has been reported that children and pregnant women often eat dirt; this has been hypothesized to occur because of anemia or other nutritional deficiencies (Desai et al., 2002; Geissler, 2000). Households containing orphans may lack the resources to provide adequate nutrition to all members. This could be because the head of household is incapable of performing work or because he does not have the income to feed additional mouths (Nyambedha, Wandibba, & Aagaard-Hansen, 2003b). Possible solutions to inadequate household food include household members either eating less or going without food, or the orphan(s) participating in wage labor.

In Luo culture children are highly revered. Every child is regarded as a child of the community and therefore must respect other adults in the homestead (Ayudo, 1996). The parent or grandparent who lives with the child is the individual who is primarily concerned with his well-being, however, other adults in the homestead may also take part in childcare. Usually the female is considered the primary caretaker of children, while the male is responsible for protecting and providing for his wife (or wives) and children (Ayudo, 1996). Children are known to contribute to the household with boys helping with the animals and girls with housework and childcare. Currently approximately 27% of children living in Kenya participate in either paid and/or domestic labor (UNICEF, 2005). Children work in order to supplement family income or to pay school fees. They may participate in a variety of jobs including fetching water and firewood, shepherding, and childcare. Girl children are more likely to be pulled out of school in order to help
with the care of an ill parent(s), with chores, and/or the care of younger brothers and sisters (Kenyan Ministry of Health, 2004; Human Rights Watch, 2001a; Human Rights Watch, 2001b).

**Sample**

Four hundred eleven children (age 9±1 yr) were recruited from 17 schools in the Nyando District and Kisumu Rural. Both Nyando District and Kisumu Rural are located within Nyanza Province, and were chosen because of current affiliations that Ohio University College of Osteopathic Medicine has with community leaders in the area. The headmaster at each school was contacted and asked to select male and female children that could participate in the study. Approximately half of the children invited to participate in the study were orphans and half were nonorphans. An orphan was defined as a child who had lost at least one parent to AIDS or another cause. This definition of orphanhood is consistent with that accepted internationally as well as locally in Kenya (Nyambedha et al., 2003a; UNICEF/UNAIDS, 1999). Consent for participation in the study was obtained from a parent/guardian and assent was obtained from the children in accordance with Ohio University’s Institutional Review Board (IRB) and the Kenya Medical Research Institute (KEMRI). Approval has been granted for this proposal by Ohio University’s IRB, and KEMRI’s scientific and ethics committees. Orphans and nonorphans were frequency-matched for age and gender. Selected sample characteristics are displayed in Table 3.1.

Another aim of this study was to investigate child nutritional status. Power was calculated to determine a sample size large enough to detect statistical significance for
the anthropometric measurements. Based on published anthropometric data it was determined that there should be 85 children in each of the 4 groups (male orphans and nonorphans, and female orphans and nonorphans) for a total of 340 children in order to have a 90% chance of detecting a moderate effect size at a statistically significant level (alpha=0.05, medium Cohen’s effect size= 0.5 SD, power= 0.9). The effect size of 0.5 SD is similar to those found in comparisons between groups of different nutritional statuses in previous studies (Hoffman, Sawaya, Martins, McCrory, & Roberts, 2006; Little, Buschang, & Malina, 1988; Buschang, Malina, & Little, 1986; Bogin & Macvean, 1982). These studies were chosen because the research investigated children of appropriate age ranges. Four hundred eleven children were invited to participate in the study in order to allow for multiple comparisons and missing data.

Inclusion/Exclusion Criteria

Children between ages 7-11 years and residents of Nyando District or Kisumu Rural were included in the study. The narrow age range of 7-11 years was chosen for several reasons. This age minimized the opportunity of enrolling children infected with HIV/AIDS. Most children infected by their mothers die before the age of 5 years and the majority of children are not sexually active before the age of 11. The majority of current literature investigating the impact of orphanhood focuses on children under the age of 5 years and other age groups should be evaluated as well. This age range was also chosen because it is prior to the beginning of puberty, which is important as height and weight changes occur during this stage of development (Kaplan & Love-Osborne, 2007). Since consent, assent, and other parts of the study were conducted in either Dholuo or Swahili,
it was necessary that both the child and his guardian be fluent in either Dholuo and/or Swahili.

A child was excluded from the study if after the clinical history and physical exam he was thought to be potentially infected with HIV/AIDS. These children were referred to a local clinic per the recommendation of the clinical officer.

Data Collection Methods

Clinical History and Physical Exam

A clinical history was obtained for each study participant by an osteopathic medical student and a local research assistant. Each child also participated in a physical exam performed by an osteopathic medical student and a local clinical officer. The clinical history and physical exam investigated the following systems: cardiovascular, respiratory, eyes/ears/nose and throat (EENT), gastrointestinal, urinary, musculoskeletal, endocrine, neurological and integumentary (skin). For example, during the EENT portion of the clinical history children were asked if they had recently experienced a runny nose or stuffy nose. When the respiratory system was being examined during the physical exam, lungs were auscultated to identify potential pathologies, i.e. wheezing (indicative of asthma) or rales (indicative of pneumonia). In addition to providing general health information, the clinical history and physical exam were also utilized to identify children potentially infected with HIV/AIDS. The “Revised World Health Organization Clinical Staging of HIV/AIDS for Infants and Children under 15 Years” (World Health Organization, 2005) was used to identify potentially infected children.
To prevent stigmatization, the clinical history and physical exam were conducted in private areas within the research site (typically a church or school). All information obtained during the clinical history and physical exam was kept confidential and was only available to the principal investigator, the osteopathic medical student, and the research assistant/clinical officer who performed the history/exam.

Abnormal (pathological) findings in the clinical history and physical exam were recorded. For example, in the clinical exam, complaints of nausea, vomiting, and/or diarrhea were recorded as abnormal findings for the gastrointestinal system. A rash or fungal infection observed during the physical exam was reported as an abnormal finding for the integumentary system. Each abnormal finding was recorded and a system was considered to be abnormal if at least one pathological finding was reported per system. The number of abnormal systems was summed for analysis. A total of 7 systems were investigated during the clinical history, therefore the number of abnormal systems could range from 0-7. A total of 10 systems were investigated during the physical exam, therefore the total number of abnormal systems could range from 0-10. The same process was repeated for clinical history and the physical exam.

**Interview**

Participant interviews were conducted in Dholuo by a trained Luo research assistant. Data collected included information on school attendance, work, and assistance provided to the child’s guardian(s) and other child(ren) living in the homestead. Orphans were also asked how many years they had been orphans. Nonorphans were asked if and
how many orphans lived in their homestead. Data were entered in PalmPilots® using Entryware® software.

**Analysis**

Prior to analysis, four children were excluded from the study: two children were excluded because of questionable HIV status; one child was excluded because age was undeterminable; the last child was excluded for both factors, leaving 407 children in the analysis.

The clinical history and physical exam scores were compared between orphans and nonorphans using a t-test. Using confidence intervals of 95%, a p-value of $p \leq 0.05$ was considered indicative for a significant correlation. The analysis was repeated for both males and females.

In order to determine if an association existed between the clinical history and physical exams scores, and length of orphanhood, a partial correlation analysis was used. Age was entered as a control variable in this analysis because of the relationship that exists between the age of the child and his length of orphanhood. The analysis was run separately for male and female orphans. Alpha=0.05 indicated a significant association. All analyses were performed using SPSS 15.0® statistical software.

**Results**

No significant differences were detected between the two groups of males for the clinical history and physical exam (Table 3.2). Similarly, there was no significant difference for the clinical history and the physical exam between the two groups of females (Table 3.3).
Common complaints emerged during both the clinical history and physical exam for males and females. Male children often reported symptoms that could be due to a viral infection or the common cold. They reported having a cough (72.6%), sore throat (61.1%), runny nose (74.2%), stuffy nose (74.7%), and red eyes (75.8%). Two gastrointestinal complaints, diarrhea (54.7%) and abdominal pain (77.4%), were often reported by male children. Male children also reported suffering from dry skin (70.5%) and a rash (55.8%). Female children also reported many findings representative of a cold. They reported suffering from a cough (76.3%), sore throat (66.5%), runny nose (80.5%), stuffy nose (82.8%), and red eyes (71.6%). Abdominal pain (76.7%) and dry skin (50.2%) were also reported by females. Neurological complaints were common complaints mentioned by the female children. They reported that they were acting differently (50.7%), crying (56.7%), sleeping more (65.1%), and were often inconsolable (54.9%). Headaches (54.0%) were another common complaint from the females.

The physical exam yielded several common findings. Lymphadenopathy (swollen lymph nodes) was common finding among both male (74.60%) and female children (77.21%). Rashes were also commonly seen in both groups of children. Most rashes were described by the examiners as being either dry or crusted.

Partial correlations indicated that there is no relationship between the clinical history and physical exam scores, and length of orphanhood, after controlling for age and length of orphanhood. This was true for both males and females.
Discussion

The data presented here suggest that no difference exists between the health of orphaned and nonorphaned Luo children. Furthermore, no association was found between length of orphanhood and the clinical history and physical exam scores. The children who participated in this study appeared to be in good health. These results support much of the current orphan literature which suggests that there is no difference between the health of orphans and nonorphans (Parikh et al., 2007; Bridge et al., 2006; Lindblade et al., 2003; Kamali et al., 1996; Ryder et al., 1994).

This study is different from previous studies because it is a more comprehensive perspective of child health. The use of a standardized clinical history and physical exam yielded both subjective and objective findings. An overall picture of health was obtained from the physical exam, while the clinical history yielded information about common health complaints among Luo children. Other studies obtained health information per guardian self-reports (Bridge et al., 2006; Sarker et al., 2005) and several from child self-reports (Parikh, et al., 2007; Geissler et al., 2000). The studies where the use of child self-report was employed did not report whether the children were asked to describe any current disease symptoms they were having or if a more standard form of questioning, similar to that used in this study, was utilized. Two other studies focused on specific disease, i.e. malaria and diarrhea, as opposed to investigating general health (Lindblade et al., 2003; Ryder et al., 1994).

Several common complaints emerged from the clinical history. Cough, sore throat, nasal congestion, watery eyes, and abdominal pain were symptoms commonly
reported by both males and females regardless of status. These complaints are similar to those reported by the Kenyan Ministry of Health (2004) as being common in Kenyan children. A study investigating the self-treatment of adolescent children found the most common reported complaints to be cold, abdominal issues, injuries, and headache (Geissler et al., 2000). Many of the complaints reported by the children in the present study could be considered to be symptoms of a “cold.” Abdominal issues were also a common complaint in the present study sample. Other common complaints among the females included acting differently, crying, and sleeping more. They also reported feeling inconsolable as well as having headaches. The females were not questioned in depth concerning these complaints, however, it is possible that these symptoms could be the result of depression. Male and female children also reported having a rash, most often described as being dry or crusted. Many of the complaints made by the Luo children who participated in this project are very similar to those often seen in American pediatrics clinics.

Fungal and parasitic infections were the most common findings seen during the physical exam. Tineal infection was very common in the children and when present on the torso and extremity can appear to be dry skin, which was a commonly reported complaint of male and female children. Parasitic infestation was also seen in many children. The Kenyan Ministry of Health (2004) reported that the occurrence of parasitic and fungal infections in children is high. All children who participated in this study were treated with mebendazole (100mg), an anti-worm agent. Lymphadenopathy or swollen lymph nodes were commonly noted by examiners during the physical exam. Swollen
lymph nodes commonly represent previous or current infection, therefore it is probable that many of the children who participated in this study were either recovering from an illness or were currently sick. The former is most likely because few children were reported as being sick per the examiner. No other physical exam findings emerged as being commonly seen in this sample of Luo children.

The children in this study, regardless of orphan status, were healthier than expected. Several reasons could account for the unexpected results obtained in this study. One study investigating the health of Luo schoolchildren suggested that illnesses were frequently experienced by the study participants (Geissler et al., 2000). Self-treatment was prevalent among these children, either through herbal remedies or the purchase of pharmaceuticals (Geissler et al., 2000). Dealing with illness was thought to be an “adaptive skill” as opposed to an event that would hinder their daily routine (Geissler et al., 2000). It is possible that the Luo children in this study are employing similar means of treatment.

Some literature suggests that grandparents may not have the ability to provide adequate care for their orphaned grandchildren (UNICEF, 2003; Nyambedha et al., 2001; Foster et al., 1996), but this does not appear to be the case in the present study. Results from several studies in Africa indicate that the extended family is capable of providing adequate care for orphans (Sarker et al., 2005; Crampin et al., 2003; Ryder et al., 1994). It is possible that the orphans in this study are living in high socioeconomic status homesteads, which has been reported to be a common characteristic of the homes where
orphans live (Parikh, 2007; Bicego, Rutstein, & Johnson, 2003). Older children may also be working to help provide a means for adequate healthcare.

The limitations of this study must be acknowledged. The current study is cross-sectional and therefore does not yield information about the long term effects of orphanhood on children. Age determination was difficult in this study as birth records are not normally kept in Luo society, which means that children outside of the study’s desired age range may have been included. It is important to recognize that these results cannot be generalized to all Kenyan children as the children in the study were mainly Luo. The results should also be interpreted carefully within the Luo community itself because only children from two districts within Nyanza Province were recruited for participation in the study. Since children were recruited from schools, it is not possible to generalize these results to orphans, as many times orphans are forced to drop out of school to perform household chores, care for sick family members and/or work. Thus it is highly probably that these children live in homes with a higher socioeconomic status than the general population because they are all attending school. These children and their family members may be more likely to be taken to a clinic and receive treatment because they have the money for healthcare. Although the clinical history was carefully translated by a native speaker of Dholuo, it is possible that many of the children had difficulty with understanding the questions being asked about their health. The overall assessment of health was subjective and it is possible that physical exam results would differ between clinical officers.
Despite the limitations this study presents, it adds to the already existing literature investigating orphanhood and its impact on the health of children. The majority of literature investigating orphan health suggests that there is not a strong correlation between orphan status and health. Results from this study lend credence to this theory and suggest that Luo children are in relatively good health despite the malnutrition that is known to exist in western Kenya (Semproli & Gualdi-Russo, 2007). The age range investigated in this research is different from that in much of the current literature, thus this project increases knowledge about the impact of orphanhood on older children. Furthermore, the sample size in this study exceeds that of many current studies looking at orphans.

These data suggest that orphans may not be at risk for poor health. Results from this study indicate the health of Luo orphans is similar to the health of nonorphans. Although both groups of children were found to be in good health, the majority of children were diagnosed as suffering from parasitic infections. Health interventions targeted at this age group should include health education, *i.e.* strategies to clean water, and ways to improve hygiene. Since the female children in this study had many psychosomatic complaints that could be indicative of depression, it is possible that they would benefit from counseling. When considering findings from the physical exam, education on fungal, parasite, and malaria prevention and treatment would be beneficial for this population. Access to healthcare should also be improved and made more cost effective to ensure that children living in the most interior of the rural areas are also able to obtain preventative education and treatment.
Acknowledgements

This project was funded by Ohio University College of Osteopathic Medicine (OUCOM)/Research Award, OUCOM/OU Challenge Award, OU Graduate Student Senate Grant for Original Work and the OUCOM D.O./Ph.D. program. The project infrastructure was additionally supported by the National Science Foundation (Grant No. 0515890, P.I. Ice). It was conducted in collaboration with the Kenya Medical Research Institute. Much appreciation goes to the Kenyan field team, as well as the communities and people of the Nyando District. Thank you to the American field team, and to Jaja Yogo for all of his work with translations and organization while in Kenya.

Literature Cited


the inadequate support systems for orphans in Western Kenya. Health Policy, 58, 83-96.


Table 3.1

**Sample characteristics, Mean(SD) or %**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan N=210</th>
<th>Nonorphan N=197</th>
<th>Total N=407</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9.5(1.2)</td>
<td>9.2(1.4)</td>
<td>9.3(1.3)</td>
<td>0.2</td>
</tr>
<tr>
<td>Female</td>
<td>9.2(1.2)</td>
<td>8.9(1.3)</td>
<td>9.1(1.2)</td>
<td>0.1</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.7**</td>
</tr>
<tr>
<td>Male</td>
<td>57.6</td>
<td>45.7</td>
<td>46.7</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52.4</td>
<td>54.3</td>
<td>53.3</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>134.2(8.0)</td>
<td>133.5(9.4)</td>
<td>133.9(8.6)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>134.3(9.5)</td>
<td>132.1(8.6)</td>
<td>133.2(9.1)</td>
<td>0.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.5(4.8)</td>
<td>28.1(4.5)</td>
<td>28.3(4.7)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>28.3(5.6)</td>
<td>26.9(4.9)</td>
<td>27.6(5.4)</td>
<td>0.05</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15.9(2.7)</td>
<td>15.7(1.4)</td>
<td>15.8(2.2)</td>
<td>0.5</td>
</tr>
<tr>
<td>Female</td>
<td>15.5(1.5)</td>
<td>15.3(1.5)</td>
<td>15.3(1.5)</td>
<td>0.3</td>
</tr>
<tr>
<td>Length of orphanhood (yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.6(2.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.6(2.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The p-value for the difference between male and female age is 0.03.

**Value calculated from a chi-squared analysis**
Table 3.2

*Nutritional measures for males*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Clinical history</td>
<td>100</td>
<td>5.9(1.2)</td>
<td>90</td>
</tr>
<tr>
<td>Physical exam</td>
<td>98</td>
<td>2.1(1.2)</td>
<td>91</td>
</tr>
</tbody>
</table>

Table 3.3

*Nutritional measures for females*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Clinical history</td>
<td>110</td>
<td>5.8(1.2)</td>
<td>105</td>
</tr>
<tr>
<td>Physical exam</td>
<td>109</td>
<td>2.0(1.3)</td>
<td>106</td>
</tr>
</tbody>
</table>
CHAPTER 4: ARE KENYAN LUO ORPHANS MORE DEPRESSED THAN NONORPHANS?

Abstract

The HIV/AIDS pandemic is creating a generation of orphaned children in Africa. These children are often left to care for themselves or be raised by elderly grandparents. The death of a parent permeates into all aspects of a child’s life- he may experience a decline in health, nutrition, and psychological well-being. Existing studies that investigate the psychosocial implications of orphanhood in Africa suggest that orphaned children are at a higher risk for suffering from mental health disorders, including depression, than nonorphans. In the United States children self-report depression at higher rates if they have been orphaned by AIDS or are living with parents infected with HIV/AIDS. Four hundred eleven children (9±1 years) were recruited to participate in a study investigating the impact of orphanhood on Luo children. The present study investigates the association between orphanhood and depression utilizing the Beck Depression Inventory-Youth (BDI-Y), a self-report questionnaire. Orphan and nonorphans BDI-Y raw scores were compared using a Mann-Whitney U test. Orphans had higher BDI-Y raw scores than nonorphans (p<0.001). Male orphans had significantly higher BDI-Y raw scores than nonorphans (p=0.001). Similar results were found for females (p<0.001). Chi-squared analysis showed that there was a higher tendency toward depressive feelings and clinical categories of depression in orphans (p=0.001). Similar results were found between female orphans and nonorphans (p=0.003). No significant difference was seen in the male groups (p=0.08). Qualitative
interviews suggest that orphans perceive their quality of life to be poor. Nonorphans shared this perception and many suggested that orphans should be aided by the community. Results suggest that Luo orphans are more likely to self-report depression and would benefit greatly from counseling and social support to help with their grief over losing a parent(s) and the life transition that they will experience.

Introduction

The HIV/AIDS pandemic is producing a generation of orphaned children in Africa. These children are often left to care for themselves or be raised by elderly grandparents. It is estimated that by 2010, approximately 18 million African children less than 18 years of age will be orphaned as a result of the pandemic (UNICEF, 2005). The death of a parent permeates into all aspects of a child’s life- he may experience a decline in health, nutrition, and psychological well-being (UNAIDS/UNICEF/USAID, 2004; UNICEF, 2003). In addition to an increase in research focusing on orphan health and nutrition (Zidron, Juma, Yogo, & Ice, 2008; Parikh et al., 2007; Barrientos, 2006; Crampin et al., 2003; Lindblade, Odhiambo, Rosen, & DeCock, 2003; Ainsworth & Semali, 2000; Kamali et al., 1996), there is also a growing interest in the psychosocial effects of orphanhood on children living in Africa (Cluver & Gardner, 2007; Atwine, Cantor-Grace, & Bajunirwe, 2005). Research in this area is important because the death of a parent is a risk factor for the development of psychosocial issues in children (Bauman & Germann, 2005). In fact, children who experience the death of a parent(s) are at twice the risk of suffering from a psychiatric disorder than children who have two live parents (Rutter, 1966). Furthermore, many AIDS orphans are at risk for suffering
from a “cumulative loss” as they may not only experience the death of their parents from HIV/AIDS but other family members as well (Bauman & Germann, 2005). Bauman & Germann (2005) report that there is lack of research investigating the consequences of being a double orphan and it is highly possible that double orphans may suffer from a high risk of experiencing a decline in mental health.

As is true for most African countries, there is a general lack of psychological and social services and mental health research in Kenya (Centre for the Study of Adolescents, 2003; Acuda, 1983). The Centre for the Study of Adolescents (2003) suggested that rates of depression are high among young Kenyans. It reported that 6.9% of young females and 10.2% of young males reported being depressed almost all of the time (Centre for the Study of Adolescents, 2003). Depression and anxiety were the most common psychological diagnoses found in secondary school children in a general clinic in rural Kenya (Acuda, 1983). The prevalence of psychiatric diagnoses in children and adolescents was found to be approximately 20% in both rural Kenya and Nairobi (Kiima, Njenga, Okonji, & Kigamwa, 2004; Acuda, 1983).

Depression rates among children and adolescents living in the United States are much better defined. Symptoms of depression can be seen in 10-15% of children and adolescents (United States Department of Health and Human Services, 1999). In general it is estimated that at any point in time approximately 1% of children and 5% of adolescents may be depressed (Brent & Birmaher, 2002). A diagnosis of major depressive disorder is present in approximately 5% of children between the ages of 9 and 17 (United States Department of Health and Human Services, 1999). Females in the
United States are almost twice as likely to be depressed as males (Brent & Birmaher, 2002; Reus, 2000).

Orphanhood could lead to an increase in depression and poor mental health in children though several means. A qualitative study performed in Cape Town, South Africa identified several risk factors for poor mental health in orphaned children (Cluver & Gardner, 2007). Risk factors included the type of relationship with the new caregiver and his family, movement from home and potential separation from siblings, poverty, an inability to attend school, and HIV/AIDS-related stigma (Cluver & Gardner, 2007). Similar risk factors were thought to contribute to psychological problems in orphans living in Zimbabwe (Foster, Makufa, Drew, Mashumba, & Kambeu, 1997). Orphans in Nyanza Province, Kenya reported feeling stressed by parental death and that their stress increased when separated from siblings (Landry, Luginaah, Maticka-Tyndale, & Elkins, 2007). Kenyan orphans in this study also reported being treated differently at school (Landry et al., 2007). Stigma has been reported to be a source of distress for orphans not only in Africa (Cluver & Gardner, 2007; Andrews, Skinner, & Zuma, 1990) but also in the United States (Lee, Detels, Rotheram-Borus, & Duan, 2007). Both the loss of school and peer interaction as well as increased responsibility on the homestead have been identified as being risk factors for poor psychological well-being (Cluver & Gardner, 2007; Bauman & Germann, 2005). Literature suggests that orphaned children may be abused and required to work more than their new caregiver's biological children (Foster et al., 1997).
In sub-Saharan Africa, the majority of orphans are cared for by their extended family which often involves leaving their home and moving to a new town (UNICEF, 2003). Orphans are more likely to be invited to live in homes that are headed by females and the number of grandparents acting as primary caregivers is increasing all over Africa (UNICEF, 2003). Unfortunately, many times the extended family cannot provide adequate care to these children (UNICEF, 2003). As parents continue to fall prey to the HIV/AIDS crisis, more and more orphans are left under the care of grandparents who may not have the resources or the health to adequately care for an increased number of dependents (Foster, Makufa, Drew, Kambeu, & Saurombe, 1996). Children living with older relatives may be working to help bring food and income into the house. These children may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers.

Current research in Africa suggests that orphanhood has a negative impact on a child’s mental health (Earls, Raviola, & Carlson, 2008; Andrews et al., 2006; Bauman & Germann, 2005; Wild, 2001). Several studies investigating emotional problems in AIDS orphans reported that orphans are more likely to suffer from poor mental health, including post-traumatic stress, depression, and anxiety than nonorphans (Cluver, Gardner, & Operario, 2007; Cluver & Gardner, 2006; Atwine et al., 2005; Makame, Ani, & Grantham-McGregor, 2002; Sengendo & Nambi, 1997). A study investigating the psychological health of orphans found that they were at a heightened risk for suffering from anxiety, depression, and anger (Atwine et al., 2005). Similarly, a study in Uganda reported that orphans felt **sad** and **hopeless** during parental illness (Sengendo & Nambi,
Orphans also described being both angry and depressed concerning their subsequent adoption (Sengendo & Nambi, 1997). A study comparing child caregiving behavior for AIDS mothers in New York and Zimbabwe found that although both groups of children were depressed, on average Zimbabwean children were more depressed (Bauman & Foster, 2004). Research also indicates that orphans are more likely to suffer from post-traumatic stress, suicidal thoughts, and behavioral or conduct problems than nonorphans (Cluver et al., 2007; Cluver & Gardner, 2006).

Research investigating the stress of losing a parent(s) to HIV/AIDS has also been well-researched in the United States. Similar to what has been suggested in the literature from African countries, research in the United States has found orphaned children to be more likely to suffer from internalizing problems such as depression and anxiety (Pivnick & Villegas, 2000; Forehand et al., 1998; Forehand et al., 1997). Children in the United States also reported having severe anxiety and depression concerning new living situations and caregivers following parental death (Pivnick & Villegas, 2000). All of the children (N=129) who participated in a study in New York City were found to have some psychiatric and/or behavioral symptoms at least once during the study (Bauman, Silver, Draimin, & Hudis, 2007). Chronic psychological problems were determined to exist in two-thirds of the children (Bauman et al., 2007). The children of HIV positive mothers are reported to be more likely to be depressed, withdrawn, and to have attention problems than children of healthy mothers (Forsyth, Damour, Nagler, & Adnopoiz, 1996). The authors suggested that the effects seen in their research would be more profound after the death of the parent (Forsyth, et al., 1996).
Literature investigating AIDS orphans in both Africa and the United States suggest that orphans are more likely to suffer from poor mental health, including depression, than nonorphans. In Africa there are few studies investigating depression in orphans, therefore the validity of Western-based assessment tools on the continent is still largely unknown. Many studies use general interviews and focus group discussion to investigate orphan mental health (Cluver & Gardner, 2007; Landry et al., 2007; Sengendo & Nambi, 1997). Although the Child Depression Inventory (CDI) has been used by few researchers in Africa (Cluver et al., 2007; Bauman & Foster, 2004; Sengendo & Nambi, 1997), the Beck’s Youth Depression Inventory (BDI-Y), a self-report questionnaire, is rarely used. The BDI-Y is a useful tool because it can be used to look specifically at depression in AIDS orphans. A study in Uganda used the BDI-Y, however, the study participants were adolescents and analyses were not gender specific (Atwine et al., 2005).

In this paper the BDI-Y and a qualitative interview are used to evaluate a child’s mental health. Males and females will be investigated separately, which will allow for the investigation of self-reported depression to be gender specific. Orphans were hypothesized to be more likely to have higher BDI-Y raw scores than nonorphans. The differences were expected in both males and females.

Methods

Study Population

This project was conducted in Nyanza Province, Kenya from June-July 2007. With a 6.1% HIV/AIDS prevalence rate among adults aged 15-49 years, Kenya is the 17th hardest hit country in Africa (UNAIDS, 2006). Approximately 1.1 million orphans live
in Kenya (UNAIDS, 2006). A large majority of these children are currently living in Nyanza Province, where 30-39% of adults are infected with HIV (UNAIDS, 2006; Nyambedha, Wandibba, & Aagaard-Hansen, 2003). This prevalence rate is one of the highest on the continent of Africa (UNAIDS, 2006; UNAIDS/UNICEF/WHO, 2002; Human Rights Watch, 2001b). In Nyanza Province, it is estimated that 19% of children less than 15 years of age have lost one or both parents to AIDS (United Nations, 2005).

The primary residents of Nyanza Province are members of the third largest ethnic group in Kenya, the Luo (National Council for Population and Development, 1999). With a poverty rate of 63%, Luo Nyanza is one of the poorest provinces in Kenya (Human Rights Watch, 2001b). A recent increase in poverty has been seen in Nyanza Province and it is speculated that this increase is due to the high prevalence of HIV/AIDS in the region (National Council for Population and Development, 1999). Luo are primarily subsistence farmers and pastoralists (Nyambedha, Wandibba & Aagaard-Hansen, 2001; Ayudo, 1996; Ocheing’, 1985; Ocholla-Ayayo, 1976). Women may take part in small-scale farming activities with men being responsible for cash crops (Ayudo, 1996). Common cash crops in the region include tobacco, cotton, ground nuts, and sugar cane (Ayudo, 1996). Types of livestock raised by Luo include cows, sheep, goats, and pigs. Many Luo raise chickens as well. Other economic practices include peasant farming, fishing, and working in the service industry (e.g. food, transport, and retail) (Ayudo, 1996). Luo society is male dominated and is both patriarchal and patrilocal (Reynar, 2000; Ayudo, 1996; Ocheing’, 1985). Polygynous marriage and “wife inheritance” are both common practices in Luo society (Reynar, 2000; Opiyo, 1996).
Generally, a widow remarries someone from her husband’s family, therefore allowing her to remain on her husband’s property (Reynar, 2000). The practice of wife inheritance is one of the main cultural reasons for the high prevalence of HIV/AIDS in this ethnic group. Due to an increased stigma and growing awareness of the disease, the practice of wife inheritance is decreasing (Nyambedha et al., 2001).

In Luo culture children are highly revered. Every child is regarded as a child of the community and therefore must respect other adults in the homestead and help with chores if asked to do so (Ayudo, 1996). The parent or grandparent who lives with the child is the individual who is primarily concerned with his well-being, however, other adults in the homestead may also take part in childcare. Usually the female is considered the primary caretaker of children, while the male is responsible for protecting and providing for his wife (or wives) and children (Ayudo, 1996). Children are known to contribute to the household with boys helping with the animals and girls with housework and childcare. Currently approximately 27% of children living in Kenya participate in either paid and/or domestic labor (UNICEF, 2005). Children who work do so in order to supplement family income or to pay school fees. They may participate in a variety of jobs including fetching water and firewood, shepherding, and childcare. Female children are more likely to be pulled out of school in order to help with the care of an ill parent(s), with chores, and/or the care of younger brothers and sisters (Kenyan Ministry of Health, 2004; Human Rights Watch, 2001a; Human Rights Watch, 2001b).
Sample

Four hundred eleven children (age 9±1 yr) were recruited from 17 schools in Nyando District and Kisumu Rural. Both Nyando District and Kisumu Rural are located within Nyanza Province. The headmaster at each school was contacted and asked to select male and female children that could participate in the study. Approximately half of the children were orphans and half were nonorphans. An orphan was defined as a child who had lost at least one parent to AIDS or another cause. This definition of orphanhood is consistent with that accepted internationally as well as locally in Kenya (Nyambedha et al., 2003; UNICEF/UNAIDS, 1999). Consent for participation in the study was obtained from a parent/guardian and assent was obtained from the children in accordance with Ohio University’s Institutional Review Board (IRB) and the Kenya Medical Research Institute (KEMRI). Approval has been granted for this study by Ohio University’s IRB and KEMRI’s scientific and ethics committees. Orphans and nonorphans were frequency-matched for age and gender. Selected sample characteristics are displayed in Table 4.1.

Another aim of this study was to investigate child nutritional status. Power was calculated to determine a sample size large enough to detect statistical significance for the anthropometric measurements. Based on published anthropometric data it was determined that there should be 85 children in each of the 4 groups (male orphans and nonorphans, and female orphans and nonorphans) for a total of 340 children in order to have a 90% chance of detecting a moderate effect size at a statistically significant level (alpha=0.05, medium Cohen’s effect size= 0.5 SD, power= 0.9). The effect size of 0.5
SD is similar to those found in comparisons between groups of different nutritional statuses in previous studies (Hoffman, Sawaya, Martins, McCrory, & Roberts, 2006; Little, Buschang, & Malina, 1988; Buschang, Malina, & Little, 1986; Bogin & Macvean, 1982). These studies were chosen because the research investigated children of appropriate age ranges. Four hundred eleven children were invited to participate in the study in order to allow for multiple comparisons and missing data.

**Inclusion/Exclusion Criteria**

Children between the ages of 7-11 years and residents of Nyando District or Kisumu Rural were *included* in the study. The age range of 7-11 years was chosen for several reasons. This age minimized the opportunity of enrolling children infected with HIV/AIDS. Most children infected by their mothers die before the age of 5 years and the majority of children are not sexually active before the age of 11. The majority of current literature investigating the impact of orphanhood focuses on children under the age of 5 years and other age groups should be evaluated as well. This age range was also chosen because it is prior to the beginning of puberty, which is important as height and weight changes occur during this stage in development (Kaplan and Love-Osborne, 2007). Since consent, assent, and other parts of the study were conducted in either Dholuo or Swahili, it was necessary that both the child and his guardian be fluent in either Dholuo and/or Swahili.

A child was *excluded* from the study if after the clinical history and physical exam he was thought to be infected with HIV/AIDS. These children were referred to a local clinic per the recommendation of the clinical officer.
Data Collection Methods

Beck’s Depression Inventory for Youth

The Beck’s Depression Inventory for Youth (BDI-Y) was chosen for several reasons. This tool is widely used in the United States and Europe and is thus readily available. Furthermore, it was thought that its simple question structure would be most appropriate for use with Luo children.

The BDI-Y is one of five self-report scales that are part of the Beck Youth Inventories- 2nd edition (Beck, Beck, Jolly & Steer, 2005). The five scales, which assess depression, anxiety, anger, disruptive behavior, and self-concept, can be used separately or in combination. The 20 item questionnaires are appropriate for children and adolescents ages 7-18 years and are written at a second grade reading level. The goal of the BDI-Y is to identify symptoms of depression in children and adolescents.

Participants are questioned about negative thoughts they may be having about self, life, future, and sadness as well as any physiological indicators of depression they may be experiencing (i.e. sleeping more and somatic symptoms such as stomach pain). Children were asked to respond to statements, such as “I think my life is bad,” “I feel sad,” and “I feel like crying,” with a focus on the last two weeks. Answer choices for all of the statements were never, sometimes, often and always (Beck et al., 2005).

The BDI-Y was scored per the instructions described by Beck et al. (2005). Each item from the questionnaire was given a score- 0, 1, 2, or 3 for never, sometimes, often or always, respectively. A raw score was then calculated for each child. Raw scores on the BDI-Y can range from 0-60. Raw scores were then converted to a T-score, a
standardized score, which allows for comparison of a child’s raw score in relation to a normative sample. The BDI-Y was standardized using the scores obtained from American children. A T-score of less than 55 is reflective of average stress whereas a higher score is indicative of a higher level of distress (Table 4.2).

Not all children chose to participate in this portion of the interview. Research assistants commented that children who chose to end the interview did so because they did not understand the questions. A total of 378 children completed the BDI-Y. The BDI-Y was translated from English to Dholuo by trained Luo research assistants using a consensus method. The BDI-Y was completed during the interview portion of the study and therefore was given orally to each child. Data were entered in PalmPilots® using Entryware® software.

Clinical History and Physical Exam

Each child participated in a clinical history performed by an osteopathic medical student with the assistance of a research assistant/clinical officer. The clinical history and physical exam were also utilized to identify children thought to be infected with HIV/AIDS. The “Revised World Health Organization Clinical Staging of HIV/AIDS for Infants and Children under 15 Years” (World Health Organization, 2005) was used to for this purpose.

Interview

Participant interviews were conducted in Dholuo by a trained Luo research assistant. The research assistant and child sat in a private area at the research site to
allow for confidentiality. In addition to the Beck’s Depression Inventory for Youth (BDI-Y), children were asked questions pertaining to school attendance, work, and assistance provided to the child’s guardian(s) and other child(ren) living in the homestead. Orphans were also asked how many years they had been orphans. Nonorphans were asked if and how many orphans lived in their homestead. Data were entered in PalmPilots® using Entryware® software.

Immediately following this questioning, each child also participated in a qualitative questionnaire. Separate questionnaires existed for orphans and nonorphans (Appendix A, Boxes 1 and 2). Luo research assistants were instructed to ask the children the questions in Dholuo and record the children’s exact responses in English on the form.

**Analysis**

Prior to the analysis, four children were excluded from the study: two children were excluded because of questionable HIV status; one child was excluded because age was undeterminable; the last child was excluded for both factors, leaving 407 children in the analysis. Some children chose to end the interview and therefore did not answer the questions pertaining to the Beck’s Depression Inventory for Youth (BDI-Y). Three hundred seventy-eight children were left in the analysis.

The BDI-Y raw scores were positively skewed therefore a nonparametric test was performed. The raw scores obtained from the BDI-Y were compared between orphans and nonorphans using a Mann-Whitney U test. The analysis was repeated for both males and females. Using confidence intervals of 95%, a p-value of \( p \leq 0.05 \) was considered indicative for significant correlation.
To compare the prevalence of self-reported depression across the groups, orphans and nonorphans, a chi-squared test was used. The analysis was repeated for both males and females. The results from the chi-squared test should be interpreted with caution because the T-score and corresponding ranges of depression severity were normalized using an American population.

In order to determine if an association existed between BDI-Y raw scores and length of orphanhood, a partial correlation analysis was used. Age was entered as a control variable in this analysis because of the relationship that exists between the age of a child and his length of orphanhood. The analysis was run separately for male and female orphans. Alpha=0.05 indicated a significant association. All analyses were performed using SPSS 15.0® statistical software.

Results

Orphans had significantly higher BDI-Y raw scores than nonorphans (p<0.001) (Table 4.3). When the genders were analyzed separately, similar results were found. Male orphans had significantly higher BDI-Y raw scores than male nonorphans (p=0.001) (Table 4.3). Similar findings were found when comparing across groups for females (p<0.005) (Table 4.3).

Partial correlations indicated that there is no relationship between BDI-Y raw scores and length of orphanhood. This was true for both males and females.

Raw scores were also transformed to T-scores. A significant difference was found between orphan and nonorphan BDI-Y scores suggesting a higher tendency towards depressive feelings and clinical categories of depression in orphans (p=0.001).
(Table 4.4). Similar results were found for females (p=0.003), however, no significant difference was found when comparing male orphans and nonorphans (p=0.08) (Table 4.4). The majority of children, orphans (N=179) and nonorphans (N=181) had average BDI-Y self-report scores. All nonorphans had average scores. Eighteen orphans self-reported some level of depression. Thirteen orphans had scores that placed them within the mildly elevated range of depression and 2 orphans were placed within the moderately elevated range of depression. Three orphans had T-scores over 70 and were therefore placed within the extremely elevated range of depression.

Qualitative interview responses shed light into the life experiences that accompany the level of distress, which may be seen in children with a T-score at or above the 95th percentile. Of the three orphaned children who fell within the extremely elevated range of depression, the highest scoring orphan, a 10 year old male who has been an orphan for 2 years with a T-score of 80, reported his personal struggles:

Socially, this boy reported that he was teased, however, he did not know why other children teased him. He was asked to describe how his activities and chores had changed since becoming an orphan. He commented, “[They have] increased because nobody speaks for me.” He further elaborated that “[Being an orphan] is a very bad life because nobody cares about me.” This young man also reported that the amount of food in his homestead had decreased since becoming an orphan. He remarked, “My mum could work harder to get me enough food but granny is old.”

The next child falling within the extremely elevated range of depression is also a male orphan. He is 11 years old who has been orphaned for 3 years. His T-score was 78.
This young man reported being teased by other children, but did not know the cause of teasing. When asked to describe how his activities and chores had changed since becoming an orphan he commented, “[They have] increased and life is now hard for me because before [my father’s] death I could not miss out on school for money or uniform.” He added, “I feel people mistreat me because my dad is dead. I feel bad.” He was also asked if orphan status affected the amount of food he ate. He responded, “Sometimes I miss food. Even yesterday night we did not take supper.”

A female orphan, age 11 years, had a T-score (70) that placed her within the extremely elevated range of depression. She has been an orphan for 2 years. Although she reported being teased, she chose not to respond when asked why other children teased her. This young woman reported an increase in the activities and chores she performed on the homestead. She elaborated, “[I am] left alone to perform all of the household chores.” She reported further struggles, “[I am] not dressed properly. [I am] not happy.” She commented, “[We] are poor and the amount of food is not surplus.”

Overall, the qualitative responses given by orphans indicated that they perceive their lives to be poor:

“It’s so difficult, many people don’t care about you and some discriminate against you.”

“I feel so sad and bitter. Sometimes I feel like dying too. Sometimes I feel like I have no one to turn to in times of crisis. I also feel insecure.”

Orphaned children reported feeling bad about being an orphan and/or commented it is a bad life (29.4%). Children also reported feeling sad about being an orphan
Orphans reported that it was painful to lose a parent(s) (7.5%). Feelings of loneliness were also described (5.5%).

When asked about their perception of orphans, nonorphans commented on orphan quality of life. Overall nonorphans perceived orphanhood to be a difficult life. They identified orphans as children who are suffering (11.1%), sad (4.8%), and lonely (11.1%). Children reported that orphans are missing parental love and care, in addition to basic needs, i.e. food and clothing. A female nonorphan commented, “Orphans feel bad and lonely since they don’t experience what parental love is.” Many children also mentioned that orphans should be supported by the community with food, school fees and clothing:

“Orphans should be supported in food, [school] fees, and books.”

“[Orphans] should be given clothes. I feel they really suffer and I pity them.”

“Orphans are suffering and should therefore receive love and care from everyone. They should not be abandoned.”

Discussion

In this present paper Luo orphans had higher BDI-Y raw scores than Luo nonorphans. This data suggests that orphans may be more likely to self-report depression than nonorphans. According to qualitative data, orphans perceive their quality of life to be bad. Many children reported feeling sad and lonely as well as missing their parent(s):

“[Being an orphan] is very sad because I miss my parents so much and I really miss their love.”

“Being an orphan is so sad and painful because whenever [I] see [my] friends walking with their parents…I can even cry.”
“I have a very bad feeling since I really miss my parents so much.”

Nonorphans had a similar perception concerning the orphan lifestyle. They commented that it was a bad and sad life. Many commented that orphans should receive aids from the community.

In Kenya, a general lack of mental healthcare exists. Although mental health has been acknowledged by the Kenyan government to be a part of primary healthcare, little has been done to increase mental healthcare services in the country (Kiima et al., 2004). Kiima et al. (2004) reported that in addition to a lack of mental health research, few individuals are trained in mental healthcare. In 2004 there were 50 trained psychiatrists in the entire country and only 15 of these psychiatrists worked in the public sector. The lack of trained mental healthcare professionals means that many mental disorders are either missed or incorrectly diagnosed as physical ailments (Kiima et al., 2004). This general lack of mental health knowledge and care is unfortunate as research suggests that the prevalence of mental health disorders in Africa is similar to that of the developed world (German, 1987). Furthermore, some research suggests that the prevalence of mental health disorders may be even higher in Africa than elsewhere in the world (German, 1987). The majority of research on mental health has focused primarily on the adult population, meaning that there is little research studying mental health in African children (Acuda, 1983).

Currently in Kenya, there is still a stigma surrounding mental health. According to Kiima et al. (2004), similar cultural beliefs concerning mental illness exist across Kenya. Based on the personal experiences of an author (J.Y.), a Luo who grew up on a
homestead located in Kisumu Rural (one of the sites of data collection), a stigma concerning mental health exists in Luo society. Evil spirits and gods are thought to be one cause of mental health disturbances. Mental health disorders are also thought to develop as punishment for a sin or as a result of witchcraft. Many of these cultural beliefs are not shared by younger generations of Kenyans, so it is possible that the stigmatization associated with mental health disturbances may begin to decrease.

Furthermore, the perception of mental illness is often dependent on the family. More traditional families may perceive mental illness to be the result of witchcraft. In general, the community makes an effort to help people who are mentally disturbed, however, individuals who are severely mentally disturbed are often looked down upon. These individuals may be referred to as *janeko*, or crazy person. Most families will seek treatment for these individuals. Treatment may be obtained from the more traditional witch doctors and healers as well as from modern health clinics and hospitals.

With the number of orphans living in Kenya continually increasing, it is important that any mental health disorders associated with orphanhood be recognized and treated. It is necessary to ensure that orphaned children be given the opportunity to lead happy and healthy childhoods. The majority of orphans in this study reported that their quality of life was not good. Similarly, Sengendo & Nambi (1997) reported that orphaned children noted a quality of life change before parental illness, during the illness, and after parental death. The children reported feelings of sadness and hopelessness while their parent(s) was sick followed by depression after the parent(s) had died (Sengendo & Nambi, 1997). In the long-term, recognition of mental health disorders is important in
these children because parental death during childhood is a risk factor for adult depression (McLeod, 1991; Singh, Pandey, Kumar, Jain, & Yadav, 1981). Little research currently exists investigating the long-term effect of the death of both parents, but it is possible that the effect could be cumulative and that children who lose both parents are at a greater risk for experiencing a depressive disorder later in life (Bauman & Germann, 2005; Siegel & Gorey, 1994). The World Health Organization (2001) reported that depression is a leading cause of disability as measured by years lost to disability.

Depression caused the second highest burden in the age group 15-44 years (World Health Organization, 2001). Thus, children who are at risk for suffering from depression during adulthood should have access to adequate treatment so that they may lead productive and healthy adult lives.

It is possible that there are protective factors at work that are preventing depression in Luo children. The caregiver-child relationship is very important for orphans. Those children who live in homes with supportive and loving caregivers are less likely to be depressed (Cluver & Gardner, 2007; Bauman & Germann, 2005; Wild, 2001). Caregiving Luo grandparents had favorable reports of their grandchildren’s “adjustment” to their new homestead (Oburu, 2005). Several orphans in the present study reported that they were well-cared for:

“[I do] not have the desire for mother/parents since [I have] been brought up with [a] loving father and grandmother who has been like [my] real mom.”

“My grandmother is taking good care of me.”

“[My] grandmother takes good care of [me] and [my] elder siblings hence she is
Similarly, a study investigating AIDS orphans in New York City found that adolescents with social support were less likely to report depressive symptoms and conduct problems (Lee et al., 2007). In Tanzania, traditional healers have begun to take on the role of support providers to orphaned children (Kayombo, Mbwambo, & Massila, 2005). The healers interviewed were not only providing psychosocial support to the orphans but were also providing basic needs and treating their illnesses (Kayombo et al., 2005). This is an example of how members of the community, other than the child’s own family, can help orphans to recover from parental death. Wild (2001) reported that remaining with siblings is also a protective factors against the development of depression after parental death. Other protective factors are thought to include high socioeconomic status, school attendance, and friendship (Cluver & Gardner, 2007; Wild, 2001).

The limitations of this study must be acknowledged. The current study is cross-sectional and therefore does not yield information about the long term effects of orphanhood on children. Age determination was difficult in this study as birth records are not normally kept in Luo society, which means that children outside of the study’s desired age range may have been included. It is important to recognize that these results cannot be generalized to all Kenyan children as the children in the study were mainly Luo. The results should also be interpreted carefully within the Luo community itself because only children from two districts within Nyanza Province were recruited for participation in the study. Since children were recruited from schools, it is not possible to generalize these results to all orphans, as many times orphans are forced to drop out of
school to perform household chores, care for sick family members, and/or work. It is highly probable that the children who participated in this study live in homes with a higher socioeconomic status than the general population because they are all attending school. Since lack of school attendance and poverty are considered risk factors for the development of depression in orphans (Cluver & Gardner, 2007), it is possible that orphans in this study are less likely to be depressed than the general orphan population. Furthermore, different results would potentially be found at a secondary school where children must pay for schooling.

The limitations of the Beck’s Depression Inventory for Youth (BDI-Y) in Kenya should also be discussed. Several translational issues existed with the BDI-Y. Luo research assistants used a consensus method for translation and difficulty arose in the translation of several of the items. For example, one item on the BDI-Y states, *I feel empty*. This is not a phrase that Luo use to describe feelings so there was much discussion over the most appropriate translation. Similarly, the cultural appropriateness and validity of the BDI-Y among Kenyan children is largely unknown. It is possible that the language used to describe depression in the BDI-Y does not match with that used to describe depression in Luo society. Bauman & Gardner (2005) mention that there is a need for research that investigates the reliability and validity of tools such as the BDI-Y in non-Western cultures.

Despite its limitations, this study does add important information to the growing literature regarding the impact of orphanhood. It adds support to the increasing number of studies which suggest that orphanhood has an adverse affect on the mental health of
orphaned children. The age range investigated in this research is different from that in much of the current literature, thus this project increases knowledge about the impact of orphanhood on children in middle childhood. Furthermore, the sample size in this study exceeds that of many current studies looking the impact of orphanhood on child mental health. As discussed above, this study adds to research investigating the cultural appropriateness of Western-based diagnostic tools for depression in Kenya.

The higher BDI-Y raw scores among orphans suggest that they are more likely to self-report depression than nonorphans. Luo orphans would greatly benefit from counseling and social support to help with their grief over losing a parent(s) and the life transitions that they will experience. They would also profit from various forms of support from the community including money for clothes, school fees, and food.

Acknowledgements

This project was funded by Ohio University College of Osteopathic Medicine (OUCOM)/Research Award, OUCOM/OU Challenge Award, OU Graduate Student Senate Grant for Original Work, and the OUCOM DO/PhD program. Additional support was provided by the Centers for Osteopathic Research and Education, OUCOM Tropical Disease Institute, OUCOM Social Medicine Department, and OUCOM Center of Excellence in Minority Medicine. The project infrastructure was additionally supported by the National Science Foundation (Grant No. 0515890, P. I. Ice). The project was conducted in collaboration with the Kenya Medical Research Institute. Much appreciation goes to the Kenyan field team as well as the communities and people of
Nyando District and Kisumu Rural. Thank you to the American field team for their help with data collection.

Literature Cited


Centre for the Study of Adolescence (2003). *The situation faced by young people in*


Forehand, R., Armistead, L., Wierson, M., Brody, G. H., Neighbours, B., Hannan, J., et


nutritional status of orphans <6 years old cared for by relatives in western Kenya.

*Tropical Medicine and International Health, 8*, 67-72.


Oburu, P. O. (2005). Caregiving stress and adjustment problems of Kenya orphans raised


Siegel, K., & Gorey, E. (1994). Childhood bereavement due to parental death from


http://www.afro.who.int/home/countries/fact_sheets/kenya.pdf


Table 4.1

Sample characteristics, Mean(SD) or %

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan N=210</th>
<th>Nonorphan N=197</th>
<th>Total N=407</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9.5(1.2)</td>
<td>9.2(1.4)</td>
<td>9.3(1.3)</td>
<td>0.2</td>
</tr>
<tr>
<td>Female</td>
<td>9.2(1.2)</td>
<td>8.9(1.3)</td>
<td>9.1(1.2)</td>
<td>0.1</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.7**</td>
</tr>
<tr>
<td>Male</td>
<td>57.6</td>
<td>45.7</td>
<td>46.7</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52.4</td>
<td>54.3</td>
<td>53.3</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>134.2(8.0)</td>
<td>133.5(9.4)</td>
<td>133.9(8.6)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>134.3(9.5)</td>
<td>132.1(8.6)</td>
<td>133.2(9.1)</td>
<td>0.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.5(4.8)</td>
<td>28.1(4.5)</td>
<td>28.3(4.7)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>28.3(5.6)</td>
<td>26.9(4.9)</td>
<td>27.6(5.4)</td>
<td>0.05</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15.9(2.7)</td>
<td>15.7(1.4)</td>
<td>15.8(2.2)</td>
<td>0.5</td>
</tr>
<tr>
<td>Female</td>
<td>15.5(1.5)</td>
<td>15.3(1.5)</td>
<td>15.3(1.5)</td>
<td>0.3</td>
</tr>
<tr>
<td>Length of orphanhood (yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.6(2.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.6(2.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The p-value for the difference between male and female age is 0.03.
**Value calculated from a chi-squared analysis
Table 4.2

*T-score ranges and corresponding clinical severity*

<table>
<thead>
<tr>
<th>T-score</th>
<th>Depression</th>
<th>Severity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥70</td>
<td>Extreme Elevated</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>Moderately Elevated</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>Mildly Elevated</td>
<td></td>
</tr>
<tr>
<td>&lt;55</td>
<td>Average</td>
<td></td>
</tr>
</tbody>
</table>

(Beck et al., 2005)

Table 4.3

*BDI-Y raw score by orphan status*

<table>
<thead>
<tr>
<th></th>
<th>BDI-Y raw score</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
</tr>
<tr>
<td>Orphan</td>
<td>190</td>
<td>9.67(7.16)</td>
</tr>
<tr>
<td>Nonorphan</td>
<td>160</td>
<td>5.95(4.93)</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orphan</td>
<td>91</td>
<td>9.82(7.42)</td>
</tr>
<tr>
<td>Nonorphan</td>
<td>72</td>
<td>6.33(4.96)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orphan</td>
<td>99</td>
<td>9.51(6.94)</td>
</tr>
<tr>
<td>Nonorphan</td>
<td>88</td>
<td>5.66(4.91)</td>
</tr>
</tbody>
</table>

*Mann-Whitney U test*
Table 4.4

*Self-reported depression severity and orphan status*

<table>
<thead>
<tr>
<th></th>
<th>Average elevated T&lt;55</th>
<th>Mildly elevated T=55-59</th>
<th>Moderately elevated T=60-69</th>
<th>Extremely elevated T&gt;70</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orphan</strong></td>
<td>179</td>
<td>13</td>
<td>2</td>
<td>3</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Nonorphan</strong></td>
<td>181</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orphan</td>
<td>90</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>Nonorphan</td>
<td>79</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orphan</td>
<td>89</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>0.003</td>
</tr>
<tr>
<td>Nonorphan</td>
<td>102</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5: A COMPARISON OF FOOD INTAKE AND ENERGY EXPENDITURE AMONG LUO ORPHANS AND NONORPHANS

Abstract

HIV/AIDS is considered to be a major threat to food security in Africa. Although several researchers suggest that orphaned children are living in food insecure households and not receiving adequate care, this may not be the case. Literature suggests that the extended family is capable of providing for orphaned children and is not taking advantage of them. In this project, 411 Luo children (age 9±1yrs) were recruited to participate in a study on the impact of orphanhood. Participants underwent an interview, anthropometric measurements, testing for anemia, a clinical history and physical exam, and a 24-hour dietary recall. The energy expenditure of the participants was estimated using an Actical® activity monitor. Energy, carbohydrate, fat and protein intake, as well as estimated energy expenditure and estimated activity, were compared across groups using a t-test. Male orphans consumed significantly less fat (p=0.01) and protein (p=0.001) than male nonorphans. No significant difference was found between the two groups of males for the other food intake variables or the energy expenditure variables. The same was true for the female groups. The association between age, anthropometric variables, hemoglobin level, energy expenditure variables, and food intake variables were examined with Pearsons correlation coefficients. Various relationships were seen between the variables. Results from this study indicate that extended families are coping and in general are providing orphans with adequate food. Furthermore, Luo orphans are not being over-worked by their new guardians. Although nutritional interventions may
want to focus on ensuring that male orphans are consuming enough protein, all children would benefit from education on healthy eating strategies. Furthermore, the children’s caregivers would also benefit from similar types of education and support to ensure that their homes continue to be food secure.

Introduction

HIV/AIDS is considered to be a major threat to food security in Africa (Food and Agricultural Association of the United Nations [FAO], 2000a; FAO, 2000b; FAO, 2000c). Food security is present when “all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.” (FAO, 2003). HIV/AIDS may have many adverse effects on food security in rural households. When considering its effects on agricultural production, there may be a resultant decrease in the quality and quantity of household labor, as well as a decrease in “disposable” income, because the individuals most likely to be infected with HIV/AIDS are society’s most productive members (Schroeder & Nichola, 2006; FAO, 2000b; FAO, 2000c; Baier, 1997). Furthermore, agricultural knowledge is lost in many AIDS-affected homes (FAO, 2000a; FAO, 2000b; FAO, 2000c). FAO (2000a) estimated that only 7% of orphan-headed households surveyed in a study performed in Kenya had adequate agricultural knowledge. AIDS affected households are likely to suffer from a loss of income, unemployment, and many times are forced to shift from cash crop farming to subsistence farming (FAO, 2000b; Kinabo, 2001).
Research has identified several coping mechanisms that are used by AIDS-affected households to deal with the loss of productive members. Many of these coping mechanisms may lead to food insecurity. Coping mechanisms utilized by AIDS-affected households in Uganda included a diet consisting of nonpreferred foods, borrowing money, a decrease in portion size, and skipping entire meals or not eating for the whole day (Bukusuba, Kikafunda, & Whitehead 2007). Similar coping mechanisms have been employed by households in South Africa (Oldewage-Theron, Dicks, & Napier, 2006). It is important to note that having adequate food security does not guarantee a healthy child. Children living in food secure households often have low heights and weights because of inappropriate infant care and feeding practices, poor access to healthcare, and/or poor sanitation (World Bank, 2006).

The addition of orphan(s) to the home can cause a decrease in food security because of the increase in household dependents (Schroeder & Nichola, 2006; FAO 2000a). The amount of food available for each household member may decrease with the addition of an orphan(s) (FAO, 2000a). A study in South Africa found that orphan adoption was likely to decrease the food security of a household (Schroeder & Nichola, 2006). It has been suggested that there is an increase in orphan stunting and a decrease in food consumption in the household when a member of the family dies (FAO, 2000b). Results from a study in Blantyre, Malawi found an association between child malnutrition (underweight and stunting) and food insecurity (Rivers, Silvestre, & Mason, 2004). In this same study orphans living in food insecure homes often reported that they were still hungry after meals (Rivers et al., 2004). Furthermore, of the homes with
orphans, approximately 40% with more than one orphan were classified as “food insecure with child hunger” (Rivers et al., 2004). The dietary diversity in both low socioeconomic status homes and those affected by HIV/AIDS has been found to be low (Bukusaba et al., 2007). It is possible that these children living in food insecure homes many not have a balanced diet.

In sub-Saharan Africa, the vast majority of the 12 million orphans living in the region are cared for by their extended family, commonly grandparents (UNAIDS, 2006; UNICEF, 2003). It has been documented that orphans are more likely to be invited to live in homes that are headed by females (UNICEF, 2003). Unfortunately, many times the extended family cannot provide adequate care to these children (UNICEF, 2003). Many grandparents report that they do not have money and are unable to earn enough money to provide for children living in the home, therefore it is possible that children may be moving into homes that are food insecure (Foster, Makufa, Drew, Kambeu, & Saurombe, 1996). It has been reported that young children are often malnourished prior to moving in with grandmothers (Whyte & Kariuki, 1991). Therefore, many orphans may be moving from one home lacking food security to another.

Despite the increasing prevalence of food insecure households in Africa, current studies investigating the impact of orphanhood on orphan nutritional status are equivocal. Several studies report that orphans are disadvantaged and are more likely to suffer from malnutrition (Lindblade, Odhiambo, Rosen, & DeCock, 2003; UNICEF, 2003; Ainsworth & Semali, 2000), while other studies report no difference between the nutritional status of orphans and nonorphans (Zidron, Juma, Yogo, & Ice, submitted; Barrientos, 2006; Saker,
Neckermann, & Muller, 2005; Lindblade et al., 2003; Panpanich, Brabin, Gonani, & Graham, 1999). In fact, studies conducted in Uganda and The Gambia both suggest that living with a grandmother increases child survival and nutritional status (Saker et al., 2005; Sear, Mace, & McGregor, 2000). More specifically, Saker et al. (2005) found that children cared for by grandmothers were less likely to be stunted. In The Gambia, grandmothers had a positive effect on both the nutritional status and mortality of the children they were caring for (Sear et al., 2000). Although female-headed households may be at a heightened risk for lacking food security, a study in Kenya and Malawi found that even though female-headed households had the lowest income, child nutritional status was higher in female-headed homes (Kennedy & Peters, 1992). A study in South Africa reported that in food insecure homes portion sizes fed to children were larger than those consumed by caregivers (Oldewage et al., 2006). Therefore, it is possible that methods of coping with food insecurity may allow for children to receive adequate nutrition. Orphaned children living with grandparents and other extended family members may have adequate nutritional statuses, however, it is largely unknown if they have balanced diets that contain adequate amounts of carbohydrates, fat, and protein.

Many factors can contribute to a child’s nutritional status (i.e. height and weight). Although few patterns for the development of child nutrition are thought to exist around the world, several risk factors have emerged as being common (Saloojee, Maayer, Garenne, & Kahn, 2007). These factors include low socioeconomic status and household education level, poor nutrition (including issues related to breastfeeding and introduction of solid foods), family issues, and environmental conditions (Saloojee et al., 2007).
These risk factors are common within food secure homes and may impact the food intake and energy expenditure of the children living in the home. Studies investigating household food security and children have found that children living in food insecure homes have lower weights and body mass indexes (BMI) than children living in food secure homes (Isanaka, More-Plazas, Lopez-Arana, Baylin, & Villamour, 2007; Rose & Bodor, 2006; Matheson, Varady, Varady, & Killen, 2002). Undernutrition is thought to be associated with a decrease in physical activity (Dufour, 1997). Therefore, it is likely that children living in food insecure homes will show a decrease in energy expenditure.

Nutrition can also be impacted by disease. A common cycle is created between malnutrition and disease, and this cycle may be very difficult to overcome. Malnutrition increases the likelihood of infectious disease, and disease can both lead to and increase malnutrition (Muller & Krawinkel, 2005). Sick children are less likely to participate in physical activities, such as chores or playing.

Even though orphaned children may be a drain on already meager household resources, it has been suggested that the presence of children on the homestead can be advantageous to the caregiver. The child can work to increase to household income and care for other children living on the homestead (Ainsworth, 1996). In Kenya, children, regardless of orphan status, are known to contribute to the household. Boys generally help with the animals and girls with housework and childcare. Currently approximately 27% of children ages 5-14 years living in Kenya participate in either paid and/or domestic labor (UNICEF, 2005). For children between the ages of 5-11, the definition of child labor includes 1 hour of paid labor or 28 hours of household chores per week; for
children 12-14 it is either 14 hours of wage earning activity or a minimum of 42 hours that includes wage earning activities and domestic chores.

Children work in order to supplement family income or to pay school fees. They may participate in a variety of jobs including fetching water and firewood, shepherding, and childcare. Children who are older may move to other rural areas to work and will send their wages back to the homestead (du Guerny, 1998). Unfortunately, children who participate in labor may be asked to sacrifice their education in order to work or perform chores for their elderly caregivers. Female children are more likely to be pulled out of school in order to help with the care of an ill parent(s), with chores, and/or the care of younger brothers and sisters (Kenyan Ministry of Health, 2004; Human Rights Watch, 2001a; Human Rights Watch, 2001b).

Few studies exist that quantitatively measure orphan workload. A study done in Zimbabwe suggested that the workload of orphans may be higher than that performed by their nonorphaned peers (Foster, Makufa, Drew, Mashumba, & Kambeu, 1997). Focus group responses indicated that orphans may not be treated as equals to other children in the homestead, and may be required to work both on and off the homestead (Foster et al., 1997). One respondent said that although many orphans are well-cared for, some are thought to be “cheap laborers.” Results from a study in western Kenya suggest that caregivers are receiving help from their grandchildren (Ice, Zidron, & Juma, 2008). In this study female caregivers had an increased nutritional status when compared to female noncaregivers, and these caregivers reported orphan assistance (Ice et al., 2008). Furthermore, child assistance was associated with several variables indicative of good
health in both men and women (Ice et al., 2008). Although Luo children may be assisting their grandparents, it is important to note that Luo orphans do not appear to be nutritionally disadvantaged when compared to nonorphans (Zidron et al., submitted). Results from a household survey in Siaya District, Kenya found that a higher percentage of children were seen working in homes with an HIV/AIDS death (K’Oyugi & Muita, 2002). The study in Siaya District also found that children in the HIV/AIDS-affected homes spent the least amount of time in personal activities (K’Oyugi & Muita, 2002). On the other hand, in South Africa, no difference was found in the amount of labor performed by orphans and nonorphans who lived in the same household (Parikh et al., 2007).

This paper examines the impact of orphanhood on food intake and energy expenditure in a sample of Luo children using a 24-hour dietary recall and Actical® activity monitors. Specifically, the food intake and energy expenditure of orphans and nonorphans is compared. Orphans were hypothesized to have lower food intake and higher energy expenditure than nonorphans. The differences were expected in both males and females. This paper also aims to determine what correlations exist between anthropometrics, hemoglobin level, age, food intake, and energy expenditure. More specifically, it is expected that food intake will be correlated with the anthropometric variables and hemoglobin level. It was also expected that energy expenditure would be correlated with the anthropometric variables. Correlations were expected in both males and females. Major differences that exist between male and female correlations were also investigated.
Methods

Study Population

This project was conducted in Nyanza Province, Kenya from June-July 2007.

With a 6.1% HIV/AIDS prevalence rate among adults aged 15-49 years, Kenya is the 17\textsuperscript{th} hardest hit country in Africa (UNAIDS, 2006). In Nyanza Province, 30-39\% of adults are infected with HIV (UNAIDS, 2006; Nyambedha, Wandibba, & Aagaard-Hansen, 2003). This prevalence rate is one of the highest on the continent of Africa (UNAIDS, 2006; UNAIDS/UNICEF/WHO, 2002; Human Rights Watch, 2001b). It is estimated that 19\% of children under 15 years living in Nyanza Province have lost one or both parents to AIDS (United Nations, 2005).

The primary residents of Nyanza Province are members of the third largest ethnic group in Kenya, the Luo (National Council for Population and Development, 1999). With a poverty rate of 63\%, Luo Nyanza is one of the poorest provinces in Kenya (Human Rights Watch, 2001b). A recent increase in poverty has been seen in Nyanza Province and it is speculated that this increase is due to the high prevalence of HIV/AIDS in the region (National Council for Population and Development, 1999). Luo are primarily subsistence farmers and pastoralists (Nyambedha, Wandibba & Aagaard-Hansen, 2001; Ayudo, 1996; Ocheing’, 1985; ; Ocholla-Ayayo, 1976). Women may take part in small-scale farming activities with men being responsible for cash crops (Ayudo, 1996). Common cash crops in the region include tobacco, cotton, ground nuts, and sugar cane (Ayudo, 1996). Types of livestock raised by Luo include cows, sheep, goats, and pigs. Many Luo raise chickens as well. Other economic practices include peasant
farming, fishing, and working in the service industry (e.g. food, transport, and retail) (Ayudo, 1996). Luo society is male dominated and is both patriarchal and patrilocal (Reynar, 2000; Ayudo, 1996; Oche’i, 1985). Polygnous marriage and “wife inheritance” are both common practices in Luo society (Reynar, 2000; Opiyo, 1996). Generally, a widow remarries someone from her husband’s family, therefore allowing her to remain on her husband’s property (Reynar, 2000). The practice of wife inheritance is one of the main cultural reasons for the high prevalence of HIV/AIDS in this ethnic group; however, due to an increased stigma and growing awareness of the disease, the practice is decreasing (Nyambedha et al., 2001).

Luos typically eat three meals per day. The first is breakfast, which is regarded as a snack rather than a meal. Breakfast usually consists of a porridge made of sorghum, millet, and cassava. Other food items that may be consumed at this first meal include ground nuts, nyoyo (a mixture of maize and beans) or eggs. The food eaten for lunch and dinner is often the same. Dinner is considered the main meal of the day. Ugali, a carbohydrate-rich food made out of maize, millet, and/or sorghum, is a large component of the Luo diet. Other sources of carbohydrates include potatoes, sweet potatoes, and rice. Common vegetables include kale, onions, cowpeas, cabbage, and tomatoes. Chicken, fish, and beef are the main forms of protein, but are rarely eaten due to their expense. One exception is omena, a small fish that is affordable for most Luo. The consumption of chicken and chicken products is a food taboo that may limit a child’s and more often a woman’s, intake of protein (Akwara, 1996). The cultural explanation for this taboo is that consumption of chicken can have an effect on a woman’s fertility. This
belief is generally held by older people, however, young girls living with traditional older grandmothers may be subjected to this taboo. It has been reported that children and pregnant women often eat dirt. This has been hypothesized to occur because of anemia or other nutritional deficiencies (Desai et al., 2002; Geissler, 2000).

**Sample**

Four hundred eleven children (age 9±1 yr) were recruited from 17 schools in the Nyando District and Kisumu Rural. Both Nyando District and Kisumu Rural are located within Nyanza Province and were chosen because of current affiliations that Ohio University College of Osteopathic Medicine has with community leaders in the area. The headmaster at each school was contacted and asked to select male and female children that could participate in the study. Approximately half of the children were orphans and half were nonorphans. An orphan was defined as a child who had lost at least one parent to AIDS or another cause. This definition of orphanhood is consistent with that accepted internationally as well as locally in Kenya (Nyambedha et al., 2003; UNICEF/UNAIDS, 1999). Consent for participation in the study was obtained from a parent/guardian and assent was obtained from the children in accordance with Ohio University’s Institutional Review Board (IRB) and the Kenya Medical Research Institute (KEMRI). Approval has been granted for this study by Ohio University’s IRB and KEMRI’s scientific and ethics committees. Orphans and nonorphans were frequency-matched for age and gender. Selected sample characteristics are displayed in Table 5.1.

Another aim of this study was to investigate child nutritional status. Power was calculated to determine a sample size large enough to detect statistical significance for
the anthropometric measurements. Based on published anthropometric data it was determined that there should be 85 children in each of the 4 groups (male orphans and nonorphans, and female orphans and nonorphans) for a total of 340 children in order to have a 90% chance of detecting a moderate effect size at a statistically significant level (alpha=0.05, medium Cohen’s effect size= 0.5 SD, power= 0.9). The effect size of 0.5 SD is similar to those found in comparisons between groups of different nutritional statuses in previous studies (Hoffman, Sawaya, Martins, McCrory, & Roberts, 2006; Little, Buschang, & Malina, 1988; Buschang, Malina, & Little, 1986; Bogin & Macvean, 1982). These studies were chosen because the research investigated children of appropriate age ranges. Four hundred eleven children were invited to participate in the study in order to allow for multiple comparisons and missing data.

Inclusion/Exclusion Criteria

Children between the ages 7-11 years and residents of Nyando District or Kisumu Rural were included in the study. The narrow age range of 7-11 years was chosen for several reasons. This age will minimize the opportunity of enrolling children infected with HIV/AIDS. Most children infected by their mothers die before the age of 5 years and the majority of children are not sexually active before the age of 11. The majority of current literature investigating the impact of orphanhood focuses on children under the age of 5 years and other age groups should be evaluated as well. This age range was also chosen because it is prior to the beginning puberty, which is important as height and weight changes occur during this stage in development (Kaplan & Love-Osborne, 2007). Since consent, assent, and other parts of the study were conducted in either Dholuo or
Swahili, it was necessary that both the child and his guardian be fluent in either Dholuo and/or Swahili.

A child was excluded from the study if after the clinical history and physical exam he was thought to be potentially infected with HIV/AIDS. These children were referred to a local clinic per the recommendation of the clinical officer.

**Data Collection Methods**

*Anthropometry*

Anthropometric measures were taken to assess nutritional status. Height was assessed with a GPM® anthropometer (cm) and weight by an Omeron® scale (kg). Circumferences (chest, waist, hip, arm, and calf) were measured using a tape measure (cm) and skinfolds (triceps, subscapular, suprailiac, abdominal, and calf) via a Lange® skinfold caliper (mm). Anthropometrics were performed using standard measurement techniques described by Lohman et al. (1998).

*Clinical History and Physical Exam*

Each child participated in a clinical history performed by an osteopathic medical student with the assistance of a research assistant/clinical officer. In addition to providing general health information, the clinical history and physical exam were also utilized to identify children thought to be infected with HIV/AIDS. The “Revised World Health Organization Clinical Staging of HIV/AIDS for Infants and Children under 15 Years” (World Health Organization, 2005) was used to for this purpose.
Energy Expenditure

Actical physical activity monitors® were used to estimate energy expenditure. Research has shown this device to be an accurate estimator of activity energy expenditure in children (Puyau, Firoz, Vohra, Zakeri, & Butte, 2004; Heil & Klippel, 2003; Finn, Finn, & Flack, 2001). Actical® is a waist-worn, battery-operated activity monitor resembling a wristwatch (Mini Mitter Company, 2004). The device records activity every 5 seconds in all planes of motion.

Children were asked to wear the monitors for one 24-hour time period. The Actical® was programmed with the child’s gender, age, height, and weight. The device was secured around the child’s waist, under his clothes, during the physical exam. Members of the research team collected the Acticals® from each participant the day following placement. Recorded data was transferred to a laptop computer via the Actical® reader for data analysis.

Resources limited the number of children who could participate in this portion of the study. Energy expenditure was estimated in 329 children. Children were given the Acticals® after having their height and weight measured. Children cycled through this portion of the study haphazardly, so there is no bias as to which children received an Actical®. Estimated energy expenditure (kcal/min) and estimated activity (counts/min) were used in analysis.

Food Intake

A 24-hour dietary recall method was used to determine food intake. A multiple pass method, known to help improve subject recall, was utilized (Raper, Perloff,
Ingwesen, Steinfeldt, & Anand, 2004). Research assistants conducted the 24-hour recalls in Dholuo. In the first pass the participant was asked to report all foods and beverages consumed during the previous 24-hours. During the second pass, the participant was questioned further for any foods that he may have forgotten to mention (i.e. a snack). In the third pass foods were sorted chronologically into meals and snacks. During the fourth pass, the participant was asked to describe in detail the amount and description of foods and beverages. Local household utensils (i.e. a cup and a gourd) were available as visual references (Raper et al., 2004; Rose & Tschirley, 2003).

The 24-hour dietary recall method has been used to measure the food intake of children in many studies in the United States (Montgomery et al., 2005; Warren et al., 2003; McPherson, Hoelscher, Alexander, Scanlon, & Serdula, 2000) as well as several studies in Kenya (Kigutha, 1997; Mayatepek, Atinga, Mrotzek, & Bremer, 1991). Although frequently used, the reliability and validity of this method in children are still unknown. It has been suggested that the 24-hour recall method may not be a suitable method for determining dietary intake for children less than 7 years of age (Warren et al., 2003). Studies agree that there is an increase in the accuracy of the recall with increasing age (Warren et al., 2003; Livingstone & Robson, 2000; Emmons & Hayes, 1973). One study found that children aged 8-10 years were as reliable as their parents in recalling the previous day’s food intake (Livingstone & Robson, 2000).

Each participant’s food intake was entered into the Nutribase7® program. Recipes of local food dishes were entered into the program. When possible recipes and individual food items and beverages were based on the Food Composition Table for Use
in Africa (Leung, Busson, & Jardin, 1968), however, the USDA and Canadian Nutrient databases contained in NutriBase7® were also used for nutrient calculation. Total energy intake (kcal), carbohydrate intake (g), protein intake(g), and fat intake (g) were used in analysis.

**Hemoglobin Level**

Blood was collected by use of sterile, disposable lancets. A HemoCue® system was used to determine hemoglobin levels. Anemia is characterized as a decrease in the number of red blood cells in the body or a decrease in the amount of hemoglobin (Hb) (Sharman, 2000). The World Health Organization’s criteria for anemia was used to differentiate between severe: Hb= <7.0g/dl; moderate: Hb= 7-9.9g/dl and mild: Hb= 10-11.5g/dl (Sharman, 2000).

**Interview**

Participant interviews were conducted in Dholuo by a trained Luo research assistant. Data collected included information on school attendance, work, and assistance provided to the child’s guardian(s) and other child(ren) living in the homestead. Orphans were also asked how many years they had been orphans. Nonorphans were asked if and how many orphans lived in their homestead. Both groups were also asked how food and work had changed since becoming orphaned or since an orphan moved into the homestead. Data were entered in PalmPilots® using Entryware® software.
Analysis

Prior to the analysis, four children were excluded from the study; two children were excluded because of questionable HIV status; one child was excluded because age was undeterminable; the last child was excluded for both of those factors, leaving 407 children in the analysis.

Energy expenditure and food intake variables were compared between orphans and nonorphans, genders separated, using t-tests. Using confidence intervals of 95%, a p-value of $p \leq 0.05$ was considered indicative for significant correlation.

In order to determine if an association existed between the food intake and energy expenditure variables and length of orphanhood, a partial correlation analysis was used. Age was entered as a control variable in this analysis because of the relationship that exists between the age of a child and his length of orphanhood. The analysis was run separately for male and female orphans. Alpha=0.05 indicated a significant association.

The association between age, anthropometric variables, hemoglobin level, energy expenditure variables, and food intake variables were examined for males and females (pooling orphans and nonorphans) with Pearsons correlation coefficients, with a $p \leq 0.05$ indicating a significant correlation. All analyses were performed using SPSS 15.0® statistical software.

Results

Male orphans had significantly lower protein ($p=0.001$) and fat intake ($p=0.01$) than male nonorphans (Table 5.2). No other significant differences existed between male orphans and male nonorphans for the other food intake variables or for any of the energy
expenditure variables (Table 5.2). No significant differences were seen between female orphans and female nonorphans for any of the food intake or energy expenditure variables (Table 5.3).

Partial correlations indicated that there is no relationship between any of the food intake or energy expenditure variables, and length of orphanhood. This was true for both males and females.

Relationships were demonstrated between age, anthropometric variables, hemoglobin (Hb) level, food intake variables, and energy expenditure variables. For the males, various correlations were found to be significant at the $p \leq 0.05$ level (Appendix B, Table 1). Correlations were found between the anthropometric variables, body mass index (BMI), percent body fat, and age. Hb level was positively correlated with age, height, weight, and hip, arm, and calf circumference measurements. For males, the food intake variables were only correlated with each other. Percent body fat, arm and calf circumferences, and triceps and subscapular skinfolds were positively correlated with estimated energy expenditure in males. Estimated activity was significantly correlated with triceps skinfold.

For the females, many correlations were seen among the different variables (Appendix B, Table 2). Various correlations were seen between female anthropometric variables, BMI, percent body fat, and age. Hb level was significantly correlated with energy, carbohydrates, height, weight, BMI, and chest, hip, and calf circumferences. Energy intake was positively correlated with all of the food intake variables and negatively correlated with subscapular skinfold. Carbohydrate intake was significantly
correlated with fat and negatively correlated with subscapular skinfold. The estimated energy expenditure of females was significantly correlated with estimated activity, height, weight, all of the circumference measurements, and BMI.

For both genders, many correlations were found between the anthropometric variables themselves and age. Different correlations existed between the males and females. Hb level was significantly correlated with energy and carbohydrate intake for the females. No correlations were seen between Hb level and any of the food intake variables for the males. Although for the males the food intake variables were only correlated with each other, for the females, both energy and carbohydrate intake were negatively correlated with subscapular skinfold. Estimated energy expenditure for both genders was correlated with various anthropometric variables. More correlations were seen between the female’s estimated energy expenditure and the anthropometric variables. Male estimated activity was significantly correlated with triceps skinfold only and no correlations were present between female estimated activity and the anthropometric variables.

Discussion

The data presented in this paper suggest that Luo orphans are receiving similar nourishment and are similarly active when compared to their nonorphaned peers. Male orphans did have significantly lower protein and fat intake when compared to male nonorphans. The energy expenditure of male orphans and male nonorphans did not vary significantly between the two groups. No significant difference existed between female orphans and female nonorphans for any of the food intake or energy expenditure
variables. Therefore, it appears that orphaned children in Luo society are being adequately cared for and may be living in food secure homes. These results also suggest that orphans are not being taken advantage of by their caregivers.

Various correlations were demonstrated between age, anthropometric variables, hemoglobin (Hb) level, food intake variables, and energy expenditure variables. Correlations were run separately for males and females. Similarities existed between the two genders. For both groups of children, height, weight, skinfolds, and circumferences were highly correlated. The anthropometric variables for both males and females were also often correlated with body mass index (BMI), percent body fat, Hb, and age. The differences that exist between specific correlations may be due to differences that exist in male and female body types, type and amount of food consumed, and types of physical activity.

Although it may be expected to see correlations between food intake and nutritional status, results obtained in the present study suggest that few relationships exist in Luo children. Rodríguez and Moreno (2006) suggest that body fatness and dietary intake may not be associated. Similarly, Atkin & Davies (2000) found no relationship between percent body fat and energy from protein, fat, or carbohydrates in preschool children. In the present study for males there were no correlations between the food intake variables and the nutritional status variables. Although total energy intake and carbohydrate intake were negatively correlated with subscapular skinfold for the females, the correlations were weak (r²=0.03 and r²=0.04).
For both males and females in this study, measures of nutritional status were positively correlated with estimated energy expenditure. However, the measures of nutritional status that were correlated with estimated energy expenditure varied between the two genders. It is possible that these differences could be the result of the different types of chores performed by male and female children. Similarly, the children may participate in different types of activities when playing, and this could also account for the different relationships seen between male and female Luo children. Other studies investigating child nutrition and physical activity have also found there to be differences in the relationships seen between physical activity and nutritional status for males and females (Ball et al., 2001; Spurr & Reina, 1989).

In general, undernutrition is expected to be associated with a subsequent decline in physical activity (Dufour, 1997). Various studies around the world have found results that support this conclusion. This literature suggests that children who are malnourished are more likely to engage in sedentary and less vigorous activities than well-nourished children (Meeks Gardner, Grantham-McGregor, Chang, & Powell, 2000; Shetty, 1999; Hardenbergh, 1996; Spurr & Reina, 1988; Rutishauser & Whitehead, 1972). In general children in this study were found to be relatively well-nourished (Zidron et al., submitted), therefore, a positive relationship between nutritional status and energy expenditure may not be surprising. On the other hand, the recent increase in childhood obesity has also spurred investigations into physical activity levels in overweight and obese children. Many of these studies have found an inverse relationship to exist between physical activity and body fat (Ball et al., 2001; Davies, Gregory, & White,
1995; Moore, Ngyuen, Rothman, Cupples, & Ellison, 1995). However, studies in this area have also found conflicting results, so the association between physical activity and obesity is unclear (Dufour, 1997).

Luo orphans have a food consumption pattern and workload similar to Luo nonorphans. This research supports studies suggesting that orphans have adequate nutritional statuses (i.e. Zidron et al., submitted; Barrientos, 2006; Saker et al., 2005; Sear, 2000). Similar to results from a South African study (Parikh et al., 2007), Luo orphans are expending a similar amount of energy compared to nonorphans. Although AIDS-affected homes have been found to be food insecure, which may result in orphans mistreatment (Schroeder & Nichola, 2006; Rivers et al., 2004), results from this study suggest that Luo communities are able to cope with the addition of child(ren) to the homestead.

Results from the present study suggest that on average Luo children are expending more energy than American children. Puyau et al. (2004) used Acticals® to monitor the estimated energy expenditure of American children performing a range of activities from sitting at a computer to jogging/running. Luo males and females, regardless of orphan status, had higher estimated energy expenditures than American children who were jogging/running (Puyau et al., 2004). Luo children may be expending higher amounts of energy for several reasons. Luo children often have to walk long distances to school. They also perform chores that may require higher amounts of energy to be expended including fetching sticks and water or shepherding.
Based on the personal experiences of an author (J.Y.), a Luo who grew up on a homestead located in Kisumu Rural (one of the sites of data collection), treatment of orphans concerning food distribution and workload may vary depending on whom they live with after the death of a parent(s). Typically children of all ages eat separately from adults. Unintentional competition for food may result because food is placed in the center of the table for the children to share. Older children may consume more because they eat faster than young children. This may be prevented if the children are supervised when they are eating or if young children are given a small portion so that they do not have to share with others. Generally orphans will eat with all of the other children who live on a homestead; however, this can vary depending on the caregiver. Grandparents and maternal uncles are thought to be the best caregivers for orphans. Grandparents are felt to spread both work and food out evenly among all children on the homestead.

Living with a stepmother may be a more difficult living situation for orphans. Biological children are often given preference over the orphans for food. Orphans may be asked to work more if living with a stepmother. Since the food intake and energy expenditure of the orphans who participated in this study are similar to their nonorphaned peers, it would appear that the orphan in this study are not being discriminated against on the homestead.

The amount and quality of food eaten by a child may be dependent on the socioeconomic status of the homestead. Poor families will have less food in general as well as a lower variety of food. These families mainly eat ugali, vegetables, and occasionally omena. Wealthier families are able to incorporate a wider variety of foods into their diet. Furthermore, fish and meat (beef or poultry) are often served daily in high
socioeconomic status homes as opposed to only being eaten on special occasions. Despite the limitations that may be placed on a child based on his socioeconomic situations, the children in this study have been shown to have adequate nutritional statuses (Zidron et al., submitted).

The food intake of both orphaned and nonorphaned Luo children is comparable to dietary recommendations for American children (American Heart Association, 2006; United States Department of Health and Human Services, 2005). The average energy intake for both groups of males meets what is recommended for males in the United States. The average energy intake for both orphaned and nonorphaned female children is higher than that recommended for females aged 9-13 years of age (American Heart Association, 2006; United States Department of Health and Human Services, 2005). Both males and female, regardless of orphan status, are consuming more protein(g) and carbohydrates(g) than is recommended. Similar to the results concerning protein in this study, Mayatepek et al. (1991) found that Luo children consume appropriate amounts of protein. The fat intake of Luo children is within the recommended range (American Heart Association, 2006; U.S. Department of Health and Human Services, 2005).

Several limitation of this study should be mentioned. It is possible that these results could be explained by limitations of the use of the 24-hour recall in Kenya. In this study the accuracy of the 24-hour recall was not verified by any method. Twenty-four hour recalls may result in an underestimation of actual food intake (Carriquiry, 2003, Dwyer, Picciano, & Raiten, 2003; Sawaya et al., 1996). Furthermore, they do not accurately represent intrahousehold food allocation. Plate sharing is well-known to occur
in Luo culture therefore it may be difficult for a child to accurately report how much he had eaten at any particular meal. Another study found that children often did not accurately report what they had eaten (Carter, Sharbaugh, & Stapell, 1989). However, the 24-hour recall method was performed successfully in over 200 Luo children in an attempt to determine the chemical composition of their meals (Mayatepek et al., 1991). Another study in Kenya found that results obtained from a 24-hour recall and the records from multi-day food weighing were similar (Kigutha, 1997).

The results obtained from the Actical® activity monitor should be interpreted with caution. Although this device has been widely used as well as validated in many child and adolescent populations, these types of studies have not been done in Africa children. The children in this study were not observed for any period of time other than when they were at the study site, so the accuracy of the Actical’s® estimation of energy expenditure in this sample is unknown. Furthermore, the children wore the Actical® on days they were in school, meaning that a child’s activity level may be underestimated if he is required to work more on the weekends.

Other limitations of this study must be acknowledged as well. The current study is cross-sectional and does not yield information about the long term effects of orphanhood on children. Age determination was difficult in this study as birth records are not normally kept in Luo society, therefore, children outside of the age range may have been included. It is important to recognize that these results cannot be generalized to all Kenyan children as the children in the study were mainly Luo. The results should also be interpreted carefully within the Luo community itself because children from two
districts within Nyanza Province were recruited for participation in this study. Children were recruited from schools and this may reduce the applicability of the data to all orphans because they are often forced to drop out of school to perform household chores, care for sick family members and/or work. The children who participated in the present study may live in homes with a higher socioeconomic status than the general population. It is important to note that although primary school in Kenya is free, school fees and uniforms are required for each child. Different results could potentially be found at secondary schools where children must pay for schooling.

Despite its limitations, this study adds important information to the growing literature regarding the impact of orphanhood. It adds support to the increasing number of studies which suggest that the extended family, including grandparents, have the ability to provide adequate nourishment to children. Furthermore, it also suggests that orphans are not being asked to work more than their nonorphaned peers. The dietary recall allowed for a specific investigation into the energy and nutritional value of foods being consumed by orphans. This information will help those designing nutritional interventions to provide appropriate foods. The Actical® allows for estimation of energy expended by children as opposed to merely questioning them about their activities. The sample size in this study exceeds that of many current studies looking at orphans and the results are gender specific. This allows for investigation of how orphanhood may impact the lives of male and female children differently.

Results from this study suggest that, in general, Luo orphans are consuming an adequate amount of food and are not being exploited in terms of workload by their
caregivers. Male orphans were found to consume less fat and protein than male nonorphans, however, according to dietary recommendations for American children, they are still consuming adequate amounts of fat and protein. Nutritional interventions aimed at increasing food security may want to focus on helping families to grow their own food or by giving them food supplies. In addition to food supplies, all children in this study would benefit from education on healthy eating strategies. Furthermore, the children’s caregivers would also benefit from similar types of education and support to ensure that their homes continue to be food secure.

Acknowledgements

This project was funded by Ohio University College of Osteopathic Medicine (OUCOM)/Research Award, OUCOM/OU Challenge Award, the OUCOM D.O./Ph.D. program, and an OU Graduate Student Senate Grant for Original Work. The project infrastructure was additionally supported by the National Science Foundation (Grant No. 0515890; P.I. Ice). It was conducted in collaboration with the Kenya Medical Research Institute. Much appreciate goes to the Kenyan field team as well as the communities and people of the Nyando District. Thank you to the American field team for their help with data collection.

Literature Cited


K’Oyugi, B. O., & Muita, J. (2002). The impact of a growing HIV/AIDS epidemic on the


Parikh, A., Bachman De Silva, M., Cakwe, M., Quinlan, T., Simon, J. L., Slalicky, A., &


http://www.iom.edu/Object.File/Master/21/372/0.pdf


Table 5.1

**Sample characteristics, Mean(SD) or %**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan N=210</th>
<th>Nonorphan N=197</th>
<th>Total N=407</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9.5(1.2)</td>
<td>9.2(1.4)</td>
<td>9.3(1.3)</td>
<td>0.2</td>
</tr>
<tr>
<td>Female</td>
<td>9.2(1.2)</td>
<td>8.9(1.3)</td>
<td>9.1(1.2)</td>
<td>0.1</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.7**</td>
</tr>
<tr>
<td>Male</td>
<td>57.6</td>
<td>45.7</td>
<td>46.7</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52.4</td>
<td>54.3</td>
<td>53.3</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>134.2(8.0)</td>
<td>133.5(9.4)</td>
<td>133.9(8.6)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>134.3(9.5)</td>
<td>132.1(8.6)</td>
<td>133.2(9.1)</td>
<td>0.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.5(4.8)</td>
<td>28.1(4.5)</td>
<td>28.3(4.7)</td>
<td>0.6</td>
</tr>
<tr>
<td>Female</td>
<td>28.3(5.6)</td>
<td>26.9(4.9)</td>
<td>27.6(5.4)</td>
<td>0.05</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15.9(2.7)</td>
<td>15.7(1.4)</td>
<td>15.8(2.2)</td>
<td>0.5</td>
</tr>
<tr>
<td>Female</td>
<td>15.5(1.5)</td>
<td>15.3(1.5)</td>
<td>15.3(1.5)</td>
<td>0.3</td>
</tr>
<tr>
<td>Length of orphanhood (yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.6(2.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.6(2.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The p-value for the difference between male and female age is 0.03.

**Value calculated from a chi-squared analysis**
### Table 5.2

**Comparison of food intake and energy expenditure for males**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Energy intake (kcal)</td>
<td>100</td>
<td>1561.9(654.0)</td>
<td>90</td>
</tr>
<tr>
<td>Protein intake (kcal)</td>
<td>100</td>
<td>43.5(21.5)</td>
<td>90</td>
</tr>
<tr>
<td>Carbohydrate intake (kcal)</td>
<td>100</td>
<td>227.1(96.7)</td>
<td>90</td>
</tr>
<tr>
<td>Fat intake (kcal)</td>
<td>100</td>
<td>53.8(30.0)</td>
<td>90</td>
</tr>
<tr>
<td>Estimated energy expenditure (kcal/min/kg)</td>
<td>80</td>
<td>0.3(0.2)</td>
<td>72</td>
</tr>
<tr>
<td>Estimated activity (count/min)</td>
<td>80</td>
<td>276.7(285.9)</td>
<td>72</td>
</tr>
</tbody>
</table>

### Table 5.3

**Comparison of food intake and energy expenditure for females**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Orphan</th>
<th>Nonorphan</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
</tr>
<tr>
<td>Energy intake (kcal)</td>
<td>109</td>
<td>1761.9(552.5)</td>
<td>107</td>
</tr>
<tr>
<td>Protein intake (kcal)</td>
<td>109</td>
<td>53.6(24.1)</td>
<td>107</td>
</tr>
<tr>
<td>Carbohydrate intake (kcal)</td>
<td>109</td>
<td>248.4(74.4)</td>
<td>107</td>
</tr>
<tr>
<td>Fat intake (kcal)</td>
<td>109</td>
<td>62.6(29.7)</td>
<td>107</td>
</tr>
<tr>
<td>Estimated energy expenditure (kcal/min/kg)</td>
<td>94</td>
<td>0.2(0.1)</td>
<td>83</td>
</tr>
<tr>
<td>Estimated activity (count/min)</td>
<td>94</td>
<td>205.9(101.4)</td>
<td>83</td>
</tr>
</tbody>
</table>
CHAPTER 6: SYNTHESIS, LIMITATIONS, AND FUTURE DIRECTIONS

Synthesis

This research investigated the impact of orphanhood on a group of Luo children. Four different aspects of orphan life have been investigated: nutritional status, physical health, mental health, and food intake and energy expenditure.

In Chapter 2, the impact of orphanhood on child nutrition was investigated. The nutritional status of all children was determined through the use of anthropometrics (height, weight, circumferences, and skinfolds) and hemoglobin level. The data presented in this dissertation suggest that there is no difference between the nutritional status of orphaned and non orphaned Luo children. This was true for both males and females. These results differ from much of the current orphan literature, which suggests that orphans are nutritionally disadvantaged.

Chapter 3 investigated the impact of orphanhood on child health. Child health was determined through the use of both a clinical history and a physical exam. In general, all of the children who participated in this study were found to be in good health. No difference was found between the health of orphaned and non orphaned children. This was true for both males and females. Common complaints among males and females, regardless of orphan status, included cough, sore throat, nasal congestion, watery eyes, and abdominal pain. Fungal and parasitic infections were commonly seen during child physical exams. Results from this chapter are similar to those from the majority of current orphan studies investigating the impact of orphanhood on child health.
The mental health of Luo children was investigated in Chapter 4. The Beck’s Depression Inventory for Youth (BDI-Y), a self-report questionnaire, was used to determine if orphaned children were more likely to be depressed than nonorphaned children. Similar to what is currently reported in the literature, orphans were more likely to self-report depression than nonorphans among both male and female orphans.

According to qualitative data collected, orphans perceived their quality of life to be “bad”. Children reported feelings of “sadness” and “loneliness”. Questioning of nonorphans revealed that they had a similar perception of orphaned life. They commented that orphan life appeared “bad” and “sad.” Several children suggested that orphans should receive aid from the community.

Chapter 5 examined the food intake and energy expenditure of Luo children. The data presented suggests that Luo orphans are adequately nourished and are working a similar amount when compared to their nonorphaned peers. Results from the 24-hour recall indicated that all children, regardless of orphan status, have adequate food intake (American Heart Association, 2006; United States Department of Health and Human Services, 2005). In fact, female children consumed more calories than is recommended for the age group. Both males and females consumed more protein and carbohydrates than is recommended. Although male orphans were consuming significantly less protein and fat than their nonorphaned peers, the amount of protein they consumed still met daily recommendations. No significant difference existed for the food intake between the two groups of female children. Estimated energy expenditure did not differ significantly
between orphans and nonorphans. This was true for both males and females. Results suggest that orphans are not being treated differently than nonorphans.

In general, results from this research suggest that Luo orphans are not disadvantaged when compared to nonorphans. Orphans appear to have adequate nutritional status and health. Although all children who participated in this study were generally healthy, tineal and parasitic infections were commonly found during the physical exam. The occurrence of fungal and parasitic infections in children is known to be high in Kenya (Kenyan Ministry of Health, 2004). Children who participated in this research were all treated with an anti-worming agent, however, their families may not be able to afford treatment if infections returned. Interventions that would be of use in this community should include both health education (i.e. hand-washing and strategies to clean water, such as boiling) and ways to improve hygiene. Results suggest that the orphans who participated in this research are consuming a sufficient amount of food and are not being asked by their caregivers to work more than nonorphans.

The orphans in this study were found to self-report depression to a greater extent than nonorphans. These results are not surprising considering the death of a parent is a risk factor for the development of mental health problems in children (Bauman & German, 2005). In fact, children who experience the death of a parent(s) are at twice the risk of suffering from a psychiatric disorder than children who have two live parents (Rutter, 1996). Furthermore, many AIDS orphans are at risk for suffering from a “cumulative loss” as they may not only experience the death of both of their parents from HIV/AIDS but other family members as well (Bauman & German, 2005). Orphans
would likely benefit from counseling and social support to help with their grief over losing a parent(s) and the life transition they will experience.

The results reported in this dissertation may be different from current orphan literature for several reasons. The children recruited to participate in this study were older (7-11 years) than children generally recruited to participate in studies investigating the impact of orphanhood. Many researchers investigating the impact of orphanhood focus on children under 5 years of age. Younger orphans have been found to suffer differentially from malnutrition and perhaps are more vulnerable to orphanhood (Kenyan Ministry of Health, 2004). Infectious disease could also account for the differences in results found between this research and orphan literature. During the physical exam portion of the study, the majority of children who participated were diagnosed with a parasitic infection. These infections would have a negative effect on growth as well as on energy available to work and play.

Socioeconomic factors may explain the lack of significant differences between orphaned and nonorphaned Luo children. All children who participated in this research were recruited from primary schools in either Nyando District or Kisumu Rural. Although attendance at primary school in Kenya is free, schools fees and uniforms are required for each child, therefore, it is possible that the children who participated in this study are at a socioeconomic advantage. In addition this means that children did not have to drop-out of school in order to perform chores on the homestead or to generate income. In Kenya and Tanzania it has been reported that orphans are “better off” economically than nonorphans (Bicego, Rutstein, & Johnson, 2003). It has been suggested this is
because the poorest households usually do not invite orphans to live with them (Bicego et al., 2003). Another research group suggested that the movement of orphans is “strategic” in that they are sent to live with relatives known to be capable of caring for them (Parikh et al., 2007). It is possible that a similar situation is occurring among the Luo households in this study and that orphans are only invited or sent to live with relatively well-off relatives. Supporting this idea are results from the Kenyan Grandparents Study, which was conducted concurrently with this project. Results from that study suggest that caregivers are better off nutritionally than noncaregivers (Ice, Yogo, & Juma, 2007). Similarly, researchers in Tanzania have found that caregivers do not appear to be suffering from poor health (Dayton & Ainsworth, 2004; Ainsworth & Filmer, 2002; Ainsworth & Dayton, 2000; Ainsworth & Semali, 2000). Dayton & Ainsworth (2004) reported that the body mass index (BMI) of caregivers was higher than that of noncaregivers.

Length of orphanhood may also influence the nutritional status of Luo children. Results from studies in Kenya and South Africa suggest that the length of orphanhood may play a role in a child’s nutritional status (Parikh et al., 2007; Lindblade, Odhiambo, Rosen, & DeCock, 2003). Recently orphaned children may not yet show the nutritional impact of orphanhood that may occur as the result of a loss of the family “breadwinner” or being sent to live with a grandparent. It has also been suggested that families may be able to “cope” with the loss of an adult(s) immediately following his death and prevent the negative effects of orphanhood that may occur soon after parental death (Parikh et al., 2007). Another possible theory suggested by Parikh et al. (2007) is that the difficult
period for orphans is the period prior to parental death when the child may be responsible for care of their dying parent as well as being asked to miss school to earn money and/or perform chores around the homestead. A child who had been orphaned for several years may have had the chance to recover from this period and may not show any negative effects of orphanhood. Dayton & Ainsworth (2004) found that the BMI of elders was lower when there was a sick adult in the household, however, BMIs were found to increase following adult death. Therefore it is possible that both orphans and their caregivers are most vulnerable when there is a sick adult living on the homestead.

This research adds important information to the growing bank of literature investigating the impact of orphanhood. In general, this is a more comprehensive study that looks at four different aspects of Luo orphan life: nutritional status, physical health, mental health, and food intake and energy expenditure. The age range (7-11 years) is different from that in much of the current orphan literature, thus this project increases knowledge about the impact of orphanhood on children in middle childhood. Furthermore, the sample size in this study exceeds that of many current studies looking at orphans. Males and females were investigated separately, which allowed for the investigation of whether the impact of orphanhood is gender specific. The addition of a length of orphanhood analysis was also incorporated into all aspects of this research. This allowed for investigation of whether this variable had a significant impact on the aspects of orphan life studied.

More specifically, this dissertation looked at nutritional status and health in a comprehensive way. Nutritional status was assessed through determination of
hemoglobin level and a full anthropometric assessment using height, weight, skinfolds, and circumferences. As a result, body mass index and percent body fat could be calculated for all participants. Similarly, a more complete look at child health occurred in this research. Clinical histories and physical exams allowed for investigation of overall health as well as determination of common diseases among Luo children living in Nyanza Province.

In general, there is a lack of knowledge about the validity and reliability of the BDI-Y in Africa and other non-Western cultures (Bauman & Gardner, 2005). Few studies in Africa have used the BDI-Y in a group of orphans, and this research suggests that it can be used successfully. That being said, more research is needed to determine if the BDI-Y is an accurate measurement of self-reported depression in children.

Few studies quantitatively measure workload in orphans. The use of Actical® activity monitors allowed for a quantitative determination of the estimated physical activity being performed by Luo children. The dietary recall allowed for a specific investigation into the caloric and nutritional value (protein, carbohydrate, and fat) of foods being consumed by orphans.

Limitations

When originally proposed, the focus of this dissertation was to investigate orphan growth and nutritional status, and associated factors such as household socioeconomic status (SES) and composition. This information was going to be collected during the proposed second data collection period, which was to occur during January-March of 2008. During this trip, a second series of anthropometric measures was scheduled to be
collected in order to allow for investigation of growth velocity as well as the impact of seasonality on Luo children. Due to the violence occurring as a result of the Kenyan elections at the end of December 2007, this trip was cancelled. Therefore, the focus of the dissertation shifted to an overall look at the impact of orphanhood Luo children by investigating nutritional status, physical health, mental health, and food intake and energy expenditure.

Several limitations of this study must be acknowledged. The current study is cross-sectional and does not yield information about the long-term effects of orphanhood on children. Age determination was difficult in this study as birth records are not normally kept in Luo society. Children outside of the desired age range of 7-11 years of age may have been included in the study because their true age could not be determined. Similarly, it is possible that some children may have entered puberty and may have developed more adolescent body features. A child’s stature may increase up to 20% and weight can double during the adolescent stage of growth (Kaplan & Love-Osborne, 2007). Therefore anthropometric measurements obtained would be reflective of a growth spurt and not necessarily reflect a child’s nutritional status.

It is important to recognize that these results cannot be generalized to all Kenyan children as the children in the study were mainly Luo, nor was this a random sample. The results should also be interpreted carefully within the Luo community itself because children from two districts within Nyanza Province were recruited for participation in this study. Children were recruited from schools and this may reduce the applicability of the data to all orphans because they are often forced to drop out of school to perform
household chores, care for sick family members, and/or work. Primary school in Kenya is free, however, schools fees and uniforms are required for each child. Therefore, it is possible that the orphans recruited to participate in this study may be socioeconomically advantaged when compared to orphans not attending school. Different results could potentially be found at a secondary school where children must pay for schooling.

Furthermore, the children who participated in this study and their family members may be more likely to be taken to a clinic and receive treatment because they have the money for healthcare. In homes with higher SES, more food is available and children may not have to work to help support the homestead. Since lack of school attendance and poverty are considered to be risk factors for the development of depression in orphans (Cluver & Gardner, 2007), it is possible that the orphans who participated in this study are less likely to be depressed than the general orphan population.

Another limitation in this study is the language barrier that existed. Although the clinical history was carefully translated by a native speaker of Dholuo, it is possible that children may have had difficulty with understanding the questions being asked about their health. Similarly, several translational issues existed with the Beck’s Depression Inventory for Youth (BDI-Y). Luo research assistants used a consensus method for translation and difficulty arose in the translation of several of the items. Similarly, the cultural appropriateness and validity of the BDI-Y among Kenyan children is largely unknown.

It is possible that the results obtained in Chapter 5 could be explained by limitations of the use of the 24-hour recall in Kenya. In this study the accuracy of the 24-
hour recall was not verified by any method. Twenty-four hour recalls may result in an underestimation of actual food intake (Carriquiry, 2003, Dwyer, Picciano, & Raiten, 2003; Sawaya et al., 1996). Furthermore, they do not accurately represent intrahousehold food allocation. Plate sharing is well-known to occur in Luo culture therefore it may be difficult for a child to accurately report how much he had eaten at any particular meal. Another study found that children often did not accurately report what they had eaten (Carter, Sharbaugh, & Stapell, 1989). The 24-hour recall method was performed successfully in over 200 Luo children in an attempt to determine the chemical composition of their meals (Mayatepek, Atinga, Mrotzek, & Bremer, 1991). Another study in Kenya found that results obtained from a 24-hour recall and the records from multi-day food weighing were similar (Kigutha, 1997).

The results obtained from the Actical® activity monitor should be interpreted with caution. Although this device has been widely used as well as validated in many child and adolescent populations, these types of studies have not been done in Africa children. The children in this study were not observed for any period of time other than when they were at the study site, so the accuracy of the Actical’s® estimation of energy expenditure in this sample is unknown. Furthermore, the children wore the Actical® on days they were in school, meaning that a child’s activity level may be underestimated if he is required to work more on the weekends.

Future Directions

The chapters in this dissertation examine various aspects of orphan life. Although orphans were more likely to self-report depression, results from this research suggest that
in general Luo orphans are adequately nourished and healthy. Several things could be done in the future to help improve and strengthen the results from this dissertation.

Future studies investigating the impact of orphanhood on Luo children should increase recruitment to include children who are no longer attending school. Ideally, recruitment should occur from the communities and not schools so that a random sampling of participants could occur. Since all of the children who participated in this study were enrolled in school it is possible that they come from homes with a higher socioeconomic status (SES). Therefore it is possible that children who are not attending school are differentially impacted by orphanhood. Children not in school may come from homes with a lower SES and may be required to perform more chores around the homestead or to work so in order to increase household income.

It would be ideal for a study investigating orphanhood to be longitudinal. This would allow for investigation of how orphans and their caregivers cope over time. Although this study did not find an association between length of orphanhood and the variables studied, literature does suggest that a relationship exists (Parikh, et al., 2007; Lindblade et al., 2003). A longitudinal study would be able to determine if such a relationship exists and what the long term impact of orphanhood is on a child.

In the future maternal, paternal, and double orphans should be investigated separately because it is possible that the effects of orphanhood differ among the three groups. Currently there are more paternal orphans than maternal orphans, however, the number of women infected with HIV/AIDS is on the rise. It is suggested that the number of children losing mothers will eventually exceed that of those losing fathers.
Furthermore, the number of double orphans is also increasing (UNICEF, 2006). It has been suggested that the socioeconomic impact felt by the family following the death of a father is greater than that of a mother and that paternal orphans are more likely to live in homes with low socioeconomic statuses (Nyamukapa, Foster, & Gregson, 2003; Sengendo & Nambi, 1997). Paternal orphans are more likely to be sent to live with another family members, often with grandmothers, who may not have the resources to adequately provide care for them (Gillespie, Norman, & Finley, 2005). Bicego et al. (2003) suggested that although paternal orphans may initially remain in school, they are at risk for not being able to continue school because of a lack of financial resources. Some research suggests that maternal orphans are at a heightened risk for suffering from poor health and nutrition (Ainsworth & Semali, 2000), however, others find paternal orphans to be at a higher risk (Lindblade et al., 2003). It has been suggested that maternal orphans may suffer from a lack of childcare and that they are initially at a higher risk for being withdraw from school (Bicego et al., 2003).

The incorporation of socioeconomic and household composition data into the study may help explain the results seen in this dissertation. As previously discussed, SES may play a role in determining orphan health and nutritional status. Household composition may play a similar role. A house with more adults may be able to achieve a higher level of productivity and household income. A household with more young children would increase the dependency ratio, thus there may not be enough food for all household members to be adequately nourished. All household and socioeconomic data would need to be collected from a parent or guardian, and should include information
about the number, gender, and age of each adult and child living on the homestead. A potential tool that could be used to determine socioeconomic status is a scale adapted from the Kenyan Demographic Health Survey. This scale and similar scales have been used successfully in subsistence-based economics.

Currently in Nyanza Province researchers are investigating the stress of caregiving on a population of Luo elders. The Kenyan Grandparents Study (KGS) began in 2002 with an initial focus on the stress of caregiving and the aim has since shifted to focus on the nutritional consequences of caregiving. It would be very interesting to link a grandparent participating in KGS with a child participating in this research. This type of collaboration would allow for investigation of the types of interactions occurring between children and their grandparents. Little research exists which examines intrahousehold food allocation in caregiving households. Results from this dissertation suggest that grandparents are providing adequate care for orphans. By linking the studies it will be possible to see how grandparents are able to adjust to and cope with the burden of having additional children on the homestead. Furthermore, adding a longitudinal component will also allow for tracking of child and adolescent health as their grandparents age and decline in health.

Wangui (under review) has identified several strategies used by Luo caregivers that are allowing them to maintain “nutritional security.” She found that although both nutritionally secure and insecure caregivers had more land than they had the man-power to farm, the nutritionally secure caregivers were using this land to their advantage. Tactics utilized by caregivers included land leasing and share-cropping, both of which
brought in food, labor, and income (Wangui, under review). Nutritionally secure caregivers were also more likely to have access to credit and to participate in social networks. These networks provided social support as well as income through farming project (Wangui, under review). Wangui’s research highlights an important topic rarely covered in the HIV/AIDS literature, that of resiliency. Perhaps research investigating the impact of the HIV/AIDS pandemic on orphans and their caregivers should focus on the successes of these family units. It is would be interesting to determine the strategies used by these families that allow both children and caregivers to remain healthy.

Based on the results obtained from this research, several interventions would help to increase the quality of life of Luo orphans. First of all, all children and community members should participate in an HIV/AIDS awareness program that emphasizes the importance of prevention. Orphans are at high risk for contracting HIV (UNICEF, 2006; Brown & Sittitrai, 2005) and learning about prevention early will give them the opportunity to make educated decisions about sexual practices. Interventions targeted at age groups similar to the one that participated in this research (7-11 years) should include both orphaned and nonorphaned children. Potential interventions include a daily meal at school and general nutritional education about healthy eating. Orphans are also at a high risk for living in food insecure environments. Interventions with the goal of helping to increase food security in homes with orphans include helping families to grow nutritious food as well as giving them food supplies. Health information collected during this study suggests that for both orphans and nonorphans, useful health interventions could include health education, i.e. strategies to clean water, including boiling, as well as ways to
improve hygiene. Furthermore, education on fungal, parasite, and malarial prevention
could also help to increase the health of Luo children. The orphans in this study were
more likely to self-report depression than nonorphans. Furthermore, many orphans
reported feeling *bad, sad, and lonely* when asked about their lives. Luo orphans may
benefit greatly from counseling and social support to help with their grief over losing a
parent(s) and the life transitions that they will face.

Literature Cited

targeting dilemma.* Policy Research Working Paper no. 2885, World Bank,
wdsworldbank.org/external/default/WDSContentServer/IW3P/IB/2002/10/12/00
0094946_02100204022275/Rendered/PDF/multi0page.pdf

coping behavior and health status of the elderly? Evidence from northwestern
D.C.

Ainsworth, M., & Semali, I. (2000). *The impact of adult deaths on children’s health in
Northwestern Tanzania.* Policy Research Working Paper no. 2266, World Bank,
wdsworldbank.org/servlet/WDSContentServer/WDSP/IB/2000/02/09/000094946
_00012505525064/Rendered/PDF/multi_page.pdf


Wangui, E. E. (*under review*). Livelihood strategies and nutritional security of
grandparent caregivers of AIDS orphans in Nyando District, Kenya. *Qualitative Health Research (under review).*
APPENDIX A: OPEN ENDED QUESTIONNAIRES

Box 1

**Orphan open-ended questionnaire**

1. How long have you been an orphan? *(answer choices were given in 1 year intervals from <1 year to 11 years)*

2. Do other children tease you?  
   *If participant answer yes, ask him/her why s/he is teased.*

3. How are the activities and chores you perform different since you lost your parent(s)?  
   Have they: increased, decreased or stayed the same?  
   *Please have participant explain his/her answer.*

4. Please describe your feelings about being an orphan.

5. How has being an orphan affected the amount of food you eat?  
   Has the amount: increased, decreased or stayed the same?  
   *Please have participant explain his/her answer.*

Box 2

**Nonorphan open-ended questionnaire**

1. Do other children tease you?  
   *If participant answer yes, ask him/her why s/he is teased.*

2. What is your perception of orphans?

3. Do you have orphans living on your homestead?  
   *If participant answers yes, ask him/her how many: 1, 2, 3, 4 or >4.*

4. How have the activities and chores you perform become different since an orphan(s) has come to live on your homestead?  
   Have they: increased, decreased or stayed the same?  
   *Please have participant explain his/her answer.*

5. Has the amount of food you eat become different since an orphan(s) has come to live on your homestead?  
   Has the amount: increased, decreased or stayed the same?  
   *Please have participant explain his/her answer.*
APPENDIX B: FOOD INTAKE AND ENERGY EXPENDITURE CORRELATION TABLES

Table 1  
Correlations between age, nutritional status, food intake, and energy expenditure (males only)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wht.</td>
<td>0.8*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chest circ.</td>
<td>0.7*</td>
<td>0.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waist circ.</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hip circ.</td>
<td>0.7*</td>
<td>0.8*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Arm circ.</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.4*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triceps skin.</td>
<td>-0.05</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2*</td>
<td>0.4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subscap. skin.</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.4*</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Supra. skin.</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ab. skin.</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calf circ.</td>
<td>0.7*</td>
<td>0.8*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>0.6*</td>
<td>0.1</td>
<td>0.2*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calf skin.</td>
<td>0.1</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.6*</td>
<td>0.4*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.3</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BMI</td>
<td>0.1</td>
<td>0.5*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3*</td>
<td>0.2*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>% Body fat</td>
<td>0.04</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3*</td>
<td>0.4*</td>
<td>0.9*</td>
<td>0.5*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.2*</td>
<td>0.9</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.04</td>
<td>0.001</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Energy</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.02</td>
<td>0.1</td>
<td>0.03</td>
<td>0.1</td>
<td>0.2</td>
<td>0.02</td>
<td>0.1</td>
<td>0.0</td>
<td>0.04</td>
<td>-0.01</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Protein</td>
<td>-0.03</td>
<td>-0.01</td>
<td>-0.03</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.01</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbs.</td>
<td>-0.04</td>
<td>-0.03</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.1</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.1</td>
<td>0.1</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.01</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fat</td>
<td>0.03</td>
<td>0.03</td>
<td>-0.1</td>
<td>-0.004</td>
<td>-0.01</td>
<td>-0.05</td>
<td>0.4</td>
<td>0.1</td>
<td>-0.1</td>
<td>0.04</td>
<td>0.04</td>
<td>0.1</td>
<td>0.04</td>
<td>-0.04</td>
<td>0.04</td>
<td>0.9</td>
<td>0.8</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Est. energy expend.</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.2</td>
<td>0.2</td>
<td>0.004</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.04</td>
<td>0.2</td>
<td>-0.1</td>
<td>-0.04</td>
<td>0.1</td>
<td>-0.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Est. activity</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.2</td>
<td>0.004</td>
<td>0.1</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.1</td>
<td>0.02</td>
<td>-0.03</td>
<td>-0.1</td>
<td>0.0</td>
<td>-0.03</td>
<td>0.1</td>
<td>-0.1</td>
<td>0.9*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*p<0.05
Table 2
Correlations between age, nutritional status, food intake, and energy expenditure (females only)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wght.</td>
<td>0.9*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chest circ.</td>
<td>0.8*</td>
<td>0.9*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waist circ.</td>
<td>0.6*</td>
<td>0.7*</td>
<td>0.8*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hip circ.</td>
<td>0.8*</td>
<td>0.9*</td>
<td>0.8*</td>
<td>0.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Arm circ.</td>
<td>0.6*</td>
<td>0.8*</td>
<td>0.7*</td>
<td>0.6*</td>
<td>0.8*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triceps skin</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subscap. skin</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Supra. skin</td>
<td>0.4*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ab. skin.</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calf circ.</td>
<td>0.7*</td>
<td>0.8*</td>
<td>0.8*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calf skin.</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BMI</td>
<td>0.3*</td>
<td>0.7*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.7*</td>
<td>0.5*</td>
<td>0.6*</td>
<td>0.4*</td>
<td>0.3*</td>
<td>0.3*</td>
<td>0.5*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.4*</td>
<td>0.3*</td>
<td>0.2*</td>
<td>0.5*</td>
<td>0.3*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hb level</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.04</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.1</td>
<td>0.02</td>
<td>0.1</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.2*</td>
<td>0.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>% Body fat</td>
<td>0.3*</td>
<td>0.5*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.4*</td>
<td>0.6*</td>
<td>0.6*</td>
<td>0.9*</td>
<td>0.7*</td>
<td>0.5*</td>
<td>0.5*</td>
<td>0.9*</td>
<td>0.6*</td>
<td>0.3*</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Energy</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.04</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.04</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02</td>
<td>0.0</td>
<td>0.2*</td>
<td>-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Protein</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.05</td>
<td>0.04</td>
<td>-0.05</td>
<td>-0.05</td>
<td>0.1</td>
<td>0.04</td>
<td>0.02</td>
<td>0.05</td>
<td>0.01</td>
<td>0.1</td>
<td>0.1</td>
<td>-0.004</td>
<td>0.8*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbs.</td>
<td>-0.03</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.04</td>
<td>-0.1</td>
<td>-0.2*</td>
<td>-0.1</td>
<td>-0.05</td>
<td>-0.1</td>
<td>-0.03</td>
<td>0.2*</td>
<td>-0.1</td>
<td>0.8*</td>
<td>0.5*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fat</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.1</td>
<td>0.004</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>-0.01</td>
<td>0.2*</td>
<td>0.01</td>
<td>0.8*</td>
<td>0.7*</td>
<td>0.4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Est. energy expan.</td>
<td>0.2*</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.2*</td>
<td>0.3*</td>
<td>0.04</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2*</td>
<td>0.1</td>
<td>0.01</td>
<td>0.1</td>
<td>0.02</td>
<td>-0.03</td>
<td>-0.02</td>
<td>0.03</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Est. activity</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>0.04</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
<td>0.004</td>
<td>-0.1</td>
<td>-0.05</td>
<td>-0.1</td>
<td>-0.01</td>
<td>0.05</td>
<td>-0.03</td>
<td>0.04</td>
<td>0.02</td>
<td>0.9*</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*p<0.05