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Prevalence of malnutrition in HIV/AIDS orphans in the Nyanza Province of Kenya

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PREVALENCE OF MALNUTRITION IN HIV/AIDS ORPHANS IN THE NYANZA PROVINCE OF KENYA

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ABSTRACT

PREVALENCE OF MALNUTRITION IN HIV/AIDS ORPHANS IN THE NYANZA PROVINCE OF KENYA

By Michelle Rose Berger

This project compared the Conventional Index (CI) with a Composite Index of Anthropometric Failure (CIAF) to determine the prevalence of malnutrition in the population and to assess the potential impacts of the indexes on nutrition programming decisions. A subset of anthropometric data from a larger dataset gathered during a feeding trial targeting orphans and vulnerable children (OVC) impacted by HIV/AIDS in Kenya were analyzed for children under five years of age (n=170). The CI suggests the prevalence of malnutrition included 31.2% stunted, 14.1% underweight, and 5.9% wasted. However, of the 53 children identified by the CI as stunted, CIAF identified 36 (67.9%) as stunted only, and 17 (32.1%) as stunted and underweight. CIAF was able to distinguish children with multiple failures who may be at greater risk for poor health and survival outcomes, and suggests that the complexity and prevalence of malnutrition may be underestimated using conventional categories. The ability of CIAF to identify children with multiple anthropometric failures may have profound implications for prioritizing, designing, and implementing nutritional programs.

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PREFACE

The following is a publication style thesis. Chapters I and III are written according to the guidelines outlined in the *Publication Manual of the American Psychological Association,* 5th edition, 2001. Chapter II is written in journal format and was submitted to the *Journal of the American Dietetic Association.*

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

The consequences of untreated malnutrition are debilitating and often life threatening. Approximately 850 million people around the world were malnourished according to 2006 estimates (WHO, 2006). The complexity of malnutrition transcends health issues, impacting child growth and development, productivity, poverty, and overall quality of life for millions of people. Combating the effects of malnutrition requires the creation of a sustainable environment to raise healthy children, provide education, and create opportunities for economic and personal growth. Good nutrition is the foundation required to achieve these goals (WHO, 2006).

In populations with widespread malnutrition, creating an environment that fosters good nutrition requires extensive planning and meticulous policy design. Determining the need for the implementation of nutrition programming requires reliable health data, which is often difficult to obtain. Since the 1970s, the World Health Organization (WHO) has examined ways to assess the nutritional status of populations using anthropometric measurements (de Onis & Blossner, 1997). Characterizing the prevalence and incidence of poor nutritional status accurately is necessary for successful population targeting, advocacy, intervention, and evaluation in nutrition-related programming. Currently there are several criteria used to assess the nutritional status of a population, and additional guidelines for the implementation of nutritional programming. The prevalence of malnutrition in a population will often determine the programming needs and strategies, yet the most appropriate method to

determine the prevalence of malnutrition remains controversial. Failure to implement or inappropriate implementation of nutrition programming based on inaccurate prevalence data limits the effectiveness of malnutrition outreaches, and threatens the vitality of nutrition programs due to poor outcomes and financial strains.

Traditionally the prevalence of undernutrition in children under the age of five is reported using a Conventional Index (CI), which identifies three conventional categories: stunting, underweight, and wasting. While this method allows for a differentiation in the types of malnutrition it does not provide the opportunity to determine the overall prevalence of malnutrition or the severity of malnutrition as a risk for adverse health and survival outcomes, as discussed on page 13. In 2005, researchers from India tested an alternate Composite Index of Anthropometric Failure (CIAF) to categorize undernutrition in children into seven mutually exclusive categories including single failures (stunting, underweight, or wasting) and multiple failures (stunting plus underweight, stunting plus wasting, underweight plus wasting, and stunting plus underweight plus wasting) (Nandy, Irving, Gordon, Subramanian, & Smith, 2005). Using the revised CIAF categories, the authors were able to determine the overall prevalence of malnutrition in the Indian study population. Additionally, CIAF provided a detailed description of the overlapping types of malnutrition present in a population that may present more or less immediate threats to the well-being and survival (Nandy, Irving, Gordon, Subramanian, & Smith, 2005).

The three objectives of this study were to compare the CI method of describing anthropometric failure to the CIAF method, to determine the overall prevalence of undernutrition in this population, and to explore and suggest the potential impact that indices of anthropometric failure may have on nutrition-related programming and reported outcomes.

Review of the Literature

Malnutrition

"Malnutrition is the single most important risk factor for disease" (WHO, 2000). The term malnutrition literally translates as "bad nourishment", thus encompassing both under and over nutrition. A person's nutritional status is the result of the interaction between the food eaten, one's health status, and the environment in which one resides (WHO, 2000). Although under and overnutrition are both types of malnutrition, for the purposes of this review, the term malnutrition will refer to undernutrition, which can result from a deficiency of energy, protein, or any micronutrients including vitamins or essential minerals. Protein-energy, vitamin A, iron, iodine, and zinc deficiencies are the major manifestations of inadequate nutrition in developing countries (Muller & Krawinkel, 2005a). Physically, malnutrition can cause permanent disability, stunted growth, impaired development, disease, and even death. However, malnutrition is not only a medical condition but also a social issue. Malnutrition is often the manifestation of or exacerbated by poverty, food insecurity, HIV/AIDS, and underdevelopment.

Health Impacts of Malnutrition

Between the years 2000 and 2002, 852 million people were characterized as undernourished (Muller & Krawinkel, 2005). Undernutrition is a main contributory factor to high mortality in children due to infectious diseases (Rao et al., 2005). The dietary insufficiency of energy, protein, fat and/or micronutrients leaves millions of people vulnerable to further health complications including infections. Malnutrition is associated with suppressed immune function in children, leaving them vulnerable for infection and disease (Kikafunda, Walker, Collett, & Tumwine, 1998). In children five years of age and younger malnutrition may be indirectly responsible for over half of all deaths (Muller & Krawinkel, 2005). Nutritional deficiencies negatively impact children's growth, development, mental capacity and increase the risk of morbidity and mortality (Darnton-Hill et al., 2005). Specific nutritional deficiencies are difficult to identify because most undernourished people are often deficient in multiple nutrients. However, it has been estimated that iron deficiency alone is responsible for the mental impairment of 40-60% of children aged 6 to 25 months in the developing countries (Darnton-Hill et al., 2005). Diarrhea, pneumonia, malaria, and measles are the top four causes of death in children five years old and younger (Caulfield, de Onis, Blossner, & Black, 2004). In fact, approximately three million children die every year from diarrheal diseases (Kikafunda, Walker, Collett, & Tumwine, 1998). While other studies have shown that malnutrition is linked to child mortality from malaria and measles (Rice, Sacco, Hyder, & Black, 2000). Although the exact mechanism

underlying the connection between inadequate nutrition and disease symptoms are not entirely understood, the correlation between malnutrition and poor health outcomes remains indisputable.

Additional challenges surrounding malnutrition arise from the fact that the majority of undernourished people reside in developing countries. In these environments the problems with malnutrition are often intensified by the additional risks from living in unsanitary environments with unsafe drinking water and inadequate access to health care. The WHO contends that "1 out of 2 children in Africa with severe malnutrition dies during hospital treatment due to inappropriate care" (WHO,2006) adding another complicating factor to the multifaceted spectrum of malnutrition.

Overweight and obesity. The emergence of overweight and obesity further exacerbates the malnutrition scenario. Obesity is an epidemic in developed countries and a rising concern for those residing in developing countries. Overweight and obesity are associated with cardiovascular disease, cancer, stroke and pre-mature mortality. The WHO estimates by the year 2010, more of the overweight and obese people will be living in the developing world (WHO, 2006). According to the International Association for the Study of Obesity, the rise in obesity in the developing world has created a "double-burden" of disease because the rise in obesity poses many health risks, but the existence of undernutrition is still an immense concern (International Association For the Study of Obesity, 2004). The coexistence of overweight/obesity and stunting (an indicator of undernutrition) in Latin America and the Caribbean are indicators of

the double-burden of disease (Duran, Caballero, & de Onis, 2006). The coexistence of overweight/obesity and stunting may represent an added health risk that exists in nutritional transition and influences the types of health risks seen in malnourished populations.

HIV/AIDS. HIV/AIDS can greatly influence the outcomes of interventions for malnutrition. The advent of chronic infection with the HIV and its symptomatic manifestation as AIDS has slowed and even reversed progress of many of the efforts to reduce the incidence and prevalence of malnutrition (WHO, 2004). Part of the health and economic impact of HIV/AIDS is the millions children of left orphaned as a result of losing their mother or both parents to AIDS or complications with HIV/AIDS (UNAIDS/WHO, 2003). Approximately 8.2 million children worldwide have been orphaned due to the HIV/AIDS epidemic (UNAIDS/WHO, 2003). An estimated 6-11% of children in Sub-Saharan Africa under the age of 15 were orphaned due to HIV/AIDS as of the year 2000 (Lindblade, Odhiambo, Rosen, & DeCock, 2003). Orphans and vulnerable children are a large part of HIV/AIDS programming because of an increase in risk for poverty, lack of education, malnutrition, disease and premature morbidity (Nyambedha, Wandibba, & Aagaard-Hansen, 2001).

The death of the family breadwinner from AIDS related death can push family members deeper into poverty. In one study, it was estimated that household income dropped by up to 80% after the loss of the main family wage earner (UNAIDS, 2001). Sub-Saharan Africa is expected to lose 10-30% of their labor force by 2020 from the HIV/AIDS epidemic, thus likely increasing the

demand for child labor (UNAIDS, 2001). The loss of the adult labor force and the increased demand for child labor may lead to a declining number of educated children and a continued cycle of poor health and poverty.

Economic Impacts of Malnutrition

The connection between malnutrition and poverty is well documented (Darnton-Hill et al., 2005). Although the direction of this relationship is unclear (i.e. if poverty causes malnutrition or malnutrition causes poverty), the connection between the two problems is evident. Good nutritional status is often associated with higher productivity and increased capital growth, whereas malnutrition is often seen in combination with low productivity and stagnant or decreased capitol. Darnton-Hill et al (2005) found a high prevalence of micronutrient deficiencies in nearly all developing countries, and in lower socioeconomic areas of the United States and Europe. Similarly, studies by Fogel (as cited in Mayers-Foulkes, 2004) found that one third of economic growth in England over the past 200 years was related to improvements in nutrition. While it is unclear that the alleviation of poverty would result in decreased nutritional deficiencies, the association between poor nutrition and poverty remains strong.

Gross Domestic Product (GDP) is the output of goods and services produced by labor and property (Bureau of Economic Analysis, 2007). The economic impact of malnutrition on the GDP of a country is often estimated by mathematical formulas developed by economists. Through such equations, it was estimated that South Asia lost five billion dollars annually due to the cognitive impairments from iron deficiency (Darnton-Hill et al., 2005).

Additionally it was calculated that Pakistan lost 3-4% of their GDP due to the impacts of protein-energy malnutrition, iron and iodine deficiencies (Darnton-Hill et al., 2005). Other economists claim that while micronutrient deficiencies have a direct negative impact of 2% on the economy due to loss in adult productivity, the long-term intergenerational impact may represent the larger impact (Mayer-Foulkes, 2004). Economist and professor, Dr. David Mayer-Foulkes contends that low human capital is the result of the failed pursuit of higher education, poor early child health and nutrition, all of which are likely to be carried through to poor health status during adulthood (Mayer-Foulkes, 2004). These factors which make up what Mayer-Foulkes calls the "intergenerational low human capitol trap" or the vicious cycle of poor health and low economic outcomes (Darnton-Hill et al., 2005).

Malnutrition is often seen in connection to poor economic situations and outcomes. Malnutrition can therefore be viewed as more than merely a state of health but also an important contributory factor influencing economic growth and development.

Measuring Malnutrition

Growth charts. Growth charts were created to assess children's nutritional status by determining if a child's physiological needs for growth and development are being met (de Onis, Onyango, Borghi, Siyam, & Pinol, 2006). Growth charts were introduced in 1976, by the United States National Center for Health Statistics (NCHS). NCHS compiled large-scale child studies data to generate an international reference population referred to as the *WHO/NCH*

International Reference Population (de Onis & Blossner, 1997). The data used to create the reference population included data from infants and children who were breast-fed and formula-fed, all of whom resided in the United States. This original reference population was accepted as the norm because it was once believed that all children around the world had the same growth potential, despite major differences in environment and economic prosperity (de Onis & Blossner, 1997). The reference population was used to generate growth curves which were believed to depict the normal growth of a healthy child, and would serve as a benchmark for child growth for all children around the world. Over the past thirty years, growth charts have been implemented and used to measure individual growth and to assess the overall health of a population. The most commonly utilized growth charts compare height-for-age, weight-for-age, and weight-for-height, each of which represents an important indicator for child growth and development. However, in 1994, the WHO investigated the use of the original reference data and determined the data inadequate for international used because the original methodology, which included the use of formula-fed infants from the United States was not representative of the international population (de Onis, Onyango, Borghi, Siyam, & Pinol, 2006).

Due to the inadequacy of the original growth charts to include norms more appropriate for international use, the WHO recently developed new growth charts from a Multi-Growth Reference Study (RGRS), which included data on infants and children from several countries and ethnic backgrounds, thus representing a true international reference population. In April of 2006, the

WHO introduced New Child Growth Standards (WHO, Geneva, Switzerland) based on this reference population all of whom were exclusively breastfed for the first six months of life, and fed for the following six months according to the guidelines recommended in the *Global Strategy for Infant and Young Child Feeding* (de Onis, Onyango, Borghi, Siyam, & Pinol, 2006). The new WHO Child Growth Standards were created to more accurately illustrate healthy growth patterns of all infants and young children throughout the world, and to serve as a single international standard (de Onis, Onyango, Borghi, Siyam, & Pinol, 2006).

Z-score. The evaluation of anthropometric data including height, weight, head circumference and mid-upper arm circumference are some of the most common measurements utilized to determine a child's nutritional status. The measurements can be compared to a reference population to determine how close a child is to normal growth patterns. A z-score is a unit of measurement that represents the number of standard deviations a data point is away from the reference population mean. The z-score is commonly used to analyze anthropometric data and to determine the nutritional status of a child or population of children. Two z-score away from the mean is considered abnormal, and indicates to its users that the nutritional status of a child or population may be compromised. The cut-off points of ± 2 z-score was established based on statistics which conclude that 95% of the population would fit into the normal distribution of ± 2 z-score from the mean. Data lying outside of this range (i.e., above +2 z-score or below - 2z-score may be considered "atypical". Z-score are derived from the three most commonly used growth

charts: weight-for age, height-for-age, and weight-for-height. These z-score values are calculated in order to classify the specific type of malnutrition present in a child or population. A child may be categorized as stunted (low height-for-age) or wasted (low weight-for-height) or underweight (low weight-for-age). Stunting indicates chronic malnutrition, wasting is an indication of acute malnutrition, and underweight may be an indicator of both chronic and acute malnutrition. These categories of anthropometric failure are used in various indexes to determine the prevalence of malnutrition in a population. The prevalence data are then used to design and implement nutrition policy and programming, to meet the nutritional demands of the malnourished population.

Prevalence and Reporting Malnutrition

The prevalence of malnutrition in a population often determines the design and timing of nutrition programming (Nandy, Irving, Gordon, Subramanian, & Smith, 2005). Accurate growth charts, z-score and prevalence data in addition to an understanding of the relative risk for single and multiple anthropometric failures could improve the appropriate targeting and design for nutrition programming.

Conventional Index (CI). The CI is widely accepted and used as a tool to describe the nutritional status of a population. The prevalence of malnutrition in children is commonly reported using this index, which identifies three conventional categories: stunting, underweight, and wasting. While this method allows for a differentiation into the general categories of malnutrition it does not provide the opportunity to determine the overall prevalence of malnutrition or

the risk for adverse health and survival outcomes that are associated with multiple failures. Developmental economist Peter Svedberg proposed that the CI method, which attempts to measure the prevalence of malnutrition in children, is not sufficient (Svedberg, 2000). Svedberg argued that the number of malnourished children is underestimated due to the overlap found in children who fall into multiple categories of anthropometric failure (i.e. children who are both stunted and underweight). The CI cannot determine the overall prevalence of malnutrition in a population because it requires its users to "choose" one category of anthropometric failure to represent the nutritional status of the targeted population.

Composite Index of Anthropometric Failure (CIAF). The CIAF method was developed to address the need to determine multiple failures and report accurate prevalence data. CIAF utilizes mutually exclusive categories to determine overall prevalence of anthropometric failure. The CIAF method can identify children who experience single and multiple anthropometric failures and better describe the complexity of undernutrition. In 2005 researchers from India tested an alternate scheme to categorize undernutrition in children into seven mutually exclusive categories including single (stunting, underweight, or wasting) and multiple failures (stunting plus underweight, stunting plus wasting, underweight plus wasting, and stunting plus underweight plus wasting) through the use of CIAF (Nandy, Irving, Gordon, Subramanian, & Smith, 2005). Figure 1 illustrates both methods of categorizing anthropometric failure. Unlike CI, CIAF takes into account the possibility for overlap between the three

conventional categories: stunting, wasting, and underweight. This key difference has the potential to alter the determination of malnutrition prevalence and significantly alter programming decisions.

Potential Impacts of CI and CIAF Indexes

The CIAF is comprised of seven mutually exclusive categories of anthropometric failure. The nature of these categories enables its user to calculate the total prevalence of malnutrition by calculating the sum of the seven categories. Contrarily, CI requires its users to "choose" one category of anthropometric failure to represent the nutritional status of the targeted population. Therefore it is possible that when using CI, malnutrition is likely underestimated due to its inability to determine overall prevalence.

CIAF may be a useful tool to more accurately identify the prevalence of all types of malnutrition for children 0 to 5 years of age. CIAF is able to identify children with single and multiple anthropometric failures, highlighting the complexity of malnutrition. Programming for food and nutrition assistance in limited resource settings may be best served by the CIAF method that identifies children who are at highest risk for adverse health and survival outcomes through types and overlap of anthropometric failures. In addition, CIAF may better determine if the prevalence of higher risk malnutrition warrants therapeutic feeding programs that target malnourished individuals or blanketed feeding interventions that provide rations in geographical areas or populations with a higher prevalence of malnutrition (ARC/RCRC, 2001).

Nutrition Programming

Food programming can be general or selective. General food distribution entails the distribution of food to all people in a given population. Selective food distribution targets a particular group based on the vulnerability and prevalence of malnutrition in that particular population (Mason, 2002). Within the selective feeding programs are sub-categories of programs targeting specific sectors of the population. Supplementary Food Programs (SFPs) and Therapeutic Food Programs (TFPs) are the two main types of selective feeding programs. SFPs are either "targeted" generally for treating the moderately malnourished, or "blanketed" which target all vulnerable groups. TFPs are designed to treat the severely malnourished individuals (Mason, 2002). The type of nutrition programming used in a particular population is commonly selected based on the prevalence of malnutrition in a population. The success of a nutrition intervention is often dependent on how accurately the program has targeted the most vulnerable population (Morris, Flores, & Zuniga, 2000). Identifying the most vulnerable depends on accurate prevalence data and categories of malnutrition that most accurately describe the population.

Program Criteria Guidelines

The implementation of a food program is determined by guidelines, which are provided by various donor organizations and their implementing partners. The American Red Cross (ARC) bases its decision on prevalence data for a given population. For example, if 10-19% of a population is categorized as malnourished based on anthropometric data, a targeted supplementary feeding

program will be implemented. Whereas the response for a 20% malnutrition rate is blanketed feeding programs (ARC/RCRC, 2001). The guidelines provided by the ARC do not distinguish between the types of malnutrition (i.e. wasting or stunting). The WHO provides the most widely used classification system for assessing the severity of malnutrition by prevalence ranges for children under five years of age as shown in Table 1. According to the WHO, by identifying the prevalence category of malnutrition in a population (low, medium, high, and very high), the correct public health action can be implemented (de Onis & Blossner, 1997).

Table 1. Classification for assessing severity of malnutrition by prevalence ranges among children under 5 years of age*

Indicator	Severity Category (%)			
	Low	Medium	High	Very High
Stunting	<20	20-29	30-39	≥40
Underweight	<10	10-19	20-29	≥30
Wasting	<5	5-9	10-14	≥15

*Table from the report of the WHO Expert Committee, 1995

Programming Decisions

Reporting accurate prevalence data may help to target highest risk populations to implement appropriate interventions and improve the quality and outcomes of global nutrition efforts. The number of children in anthropometric failure according to each index influences the timing and the type of feeding program to be implemented. CIAF is able to identify children with multiple failures and determine the overall prevalence of malnutrition in a population. CIAF may allow for the prioritization of feeding programs to those

most at risk (multiple failures, and high overall prevalence), a helpful tool that may lead to better health outcomes. Thus, the use of CIAF may have profound implications on prevalence reporting as well as nutrition programming and outcomes.

General Food Distribution

The existence of food insecurity and an inadequate food supply often leads to the demand for outside resources. General food distribution entails the distribution of a food ration to the population at large. This ration is designed to be a supplementation to the existing food supply, not a substitution for the food currently being consumed.

Supplementary Food Programs (SFP)

Supplementary Food Programs (SFPs) are designed to provide food in addition to the general ration given during emergency situations. The goals of SFPs are to rehabilitate malnourished people and to prevent the deterioration of those most at-risk especially young children and pregnant and nursing mothers (UCHCR/WFP, 1999). By providing food to those who are malnourished and unable to access and/or afford food, SFPs can temporarily improve the nutritional status of those most at-risk. Two types of SFPs are used to target high-risk populations of children.

Targeted food programs. Targeted SFPs select a specific at-risk sub-population for nutrition interventions. The main goal of Targeted SFPs is to prevent those people with moderate malnutrition from progressing to severely malnourished. These interventions often focus on children who are wasting, an

indicator of acute malnutrition that requires immediate intervention (UCHCR/WFP, 1999). Targeted SFPs are implemented when the prevalence of wasted children reaches a set threshold.

Blanketed food programs. Blanketed SFPs provide food to all people in a particular population with high levels of health risk. This often includes rations for children under five years of age, pregnant and post-partum women, the elderly, and those suffering from diseases such as HIV/AIDS or malaria. The main goal of blanket programming is to prevent the deterioration of overall nutritional status by focusing on global and severe acute malnutrition and chronic micronutrient deficiencies (ENCU, 2004). Similar to Targeted SFPs, Blanket SFPs are implemented and discontinued according to the prevalence rate of acute malnutrition in the population and determined by the governing organization (UCHCR/WFP, 1999).

Therapeutic Food Programs

When normal foods will not alleviate the severity of malnourishment, Therapeutic Food Programs (TFP) are often implemented. TFPs combine medical and nutrition treatment to meet the needs of those who are severely malnourished. The goal of this food programming strategy is to reduce the risk of excess mortality and morbidity in individuals with sever malnutrition (UCHCR/WFP, 1999).

Potential Impacts of CI and CIAF on Programming Decisions

Critical nutrition programming and policy decisions are determined by the prevalence of malnutrition in a population. As described above, the type of nutrition program implemented in a population is dependent on the prevalence and/or severity of malnutrition. The CI has typically been used to determine the prevalence of malnutrition in a population, however new evidence has indicated that the CI may have shortcomings in accurately portraying levels and categories of malnutrition (de Onis, Onyango, Borghi, Siyam, & Pinol, 2006). Because the CI cannot calculate the total prevalence of malnutrition we want to compare the use of the CI and the CIAF to examine if the CIAF may improve the accuracy of prevalence reporting to support better programming decisions.

CHAPTER II

JOURNAL ARTICLE

Prevalence of Malnutrition in HIV/AIDS Orphans in the Nyanza Province of Kenya: A Comparison of Conventional Indexes (CI) with a Composite Index of Anthropometric Failure (CIAF)

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ABSTRACT

The prevalence of undernutrition in children under the age of five is commonly reported using a Conventional Index (CI), which identifies three conventional categories: stunting, underweight, and wasting. Recently, an alternate index Composite Index of Anthropometric Failure (CIAF) was developed to categorize undernutrition into seven mutually exclusive categories including single (stunting, underweight, or wasting) and multiple failures (stunting and underweight, stunting and wasting, underweight and wasting, and stunting, underweight, and wasting). This cross-sectional study used a subset of existing data gathered during a feeding program trial targeting orphans and vulnerable children (OVC) impacted by Human Immunodeficiency Virus and/or the Acquired Immune Deficiency Syndrome (HIV/AIDS) in Kenya to compare the CI with CIAF methods. Children who participated in the larger feeding trial and who were under five years of age were included in the analysis (n=170). The CI suggests the prevalence of undernutrition included 31.2% stunted, 14.1% underweight, and 5.9% wasted. Since the categories of the CI are not mutually

exclusive the total prevalence of undernutrition could not be determined; therefore, the highest prevalence of undernutrition for the population would be 32.1% (stunted). Utilizing the CIAF categories, the overall prevalence rate could be calculated and is more severe (38.2%), which could alter the decisions to implement nutrition-related interventions. In addition, the complexity of malnutrition experienced is not made clear by the CI method. Of the 53 children indicated by the CI as stunted, CIAF identified 36 (67.9%) as stunted alone, while 17 (32.1%) were both stunted and underweight. Thus, CIAF was able to distinguish children with multiple anthropometric failures who may be at increased risk for poor health and survival outcomes. In total, multiple anthropometric failures were shown in one-third (22 of 65) of the children in anthropometric failure. These data suggests that the complexity and prevalence of undernutrition may be underestimated using conventional categories because the CI cannot identify children experiencing multiple anthropometric failures. The ability of CIAF to identify children with multiple anthropometric failures may have profound implications for prioritizing, designing and targeting nutritional interventions for children under five years of age.

INTRODUCTION

Throughout the world malnutrition is a primary cause of childhood morbidity and premature mortality. The complexity of malnutrition transcends health issues, impacting child growth and development, productivity, poverty, and overall quality of life for millions of people. Combating the effects of malnutrition requires the creation of a sustainable environment to raise healthy

children, provide education, and create opportunities for economic and personal growth. Good nutrition is the foundation required to achieve these goals (1). In populations with widespread malnutrition, creating an environment that fosters good nutrition requires extensive planning and meticulous policy design. Determining the need for the implementation of nutrition programming requires reliable health data, which is often difficult to obtain. Since the 1970s, the World Health Organization (WHO) has examined ways to assess the nutritional status of populations using anthropometric measurements (2). Characterizing the prevalence and incidence of poor nutritional status accurately is necessary for successful population targeting, advocacy, intervention, and evaluation in nutrition-related programming.

The estimated prevalence of undernutrition in a population often determines the design and timing of nutrition programming (2). Accurate prevalence data and an understanding of the relative risk for single and multiple anthropometric failures could improve the appropriate targeting and design for successful programming.

The CI is widely accepted and used as a tool to describe the nutritional status of a population. The prevalence of malnutrition in children is commonly reported using this index, which identifies three conventional categories: stunting, underweight, and wasting. While this method allows for a differentiation into the general categories of malnutrition it does not provide the opportunity to determine the overall prevalence of malnutrition or the risk for adverse health and survival outcomes that are associated with multiple failures.

Developmental economist Peter Svedberg proposed that the CI method, which attempts to measure the prevalence of malnutrition in children, is not sufficient (3). Svedberg argued that the number of malnourished children is underestimated due to the overlap found in children who fall into multiple categories of anthropometric failure (i.e., children who are both stunted and underweight). The CI cannot determine the overall prevalence of malnutrition in a population because it requires its users to "choose" one category of anthropometric failure to represent the nutritional status of the targeted population.

The CIAF method was developed to address the need to determine multiple failures and report accurate prevalence data. CIAF utilizes mutually exclusive categories to determine overall prevalence of anthropometric failure. The CIAF method can identify children who experience single and multiple anthropometric failures and better describe the complexity of undernutrition. In 2005 researchers from India tested an alternate scheme to categorize undernutrition in children into seven mutually exclusive categories including single (stunting, underweight, or wasting) and multiple failures (stunting plus underweight, stunting plus wasting, underweight plus wasting, and stunting plus underweight plus wasting) through the use of CIAF (4). Table 1 illustrates both methods of categorizing anthropometric failure.

The three objectives of this study were to compare the CI method of describing anthropometric failure to the CIAF method, to determine the overall prevalence of undernutrition in this population, and to explore and suggest the

potential impact that indices of anthropometric failure may have on nutrition-related programming and reported outcomes. We hypothesize that CIAF will better describe the prevalence of anthropometric failure and improve the reporting of outcomes for nutrition-related programming due to its ability to categorize children in multiple anthropometric failure who may be at increased risk for poor health and survival outcomes.

METHODS

Study Setting and Sites

The project utilized existing data from a large feeding trial implemented by community-based organization partners of Catholic Relief Services-Kenya targeting orphans with a program funded to support orphans and vulnerable children impacted by HIV/AIDS. The feeding trial was conducted at four sites in the Nyanza Province of Kenya including Kisii, Kisumu, and two in Homa Bay. The study protocol and the use of existing de-identified human subject data was approved by the Institutional Review Board at San Jose State University.

Study Design

This cross-sectional study included data on all children under the age of five years gathered as part of the feeding trial. By definition the targeted population included orphans because one or both of their parents died with HIV infection. The disease status of the targeted population was not released for this study but likely included children with and without HIV/AIDS. Trained health educators and program directors of the feeding trial measured height, weight, and surveyed disease symptoms. Weights were measured using a standard hospital

electronic scale, and height was measured using a standard calibrated stadiometer. For all measurements children wore light clothing, but no shoes. Caretakers of the children were asked to provide gender, date of birth, and age information to the health educators. The data were analyzed independently of the feeding trial and, therefore, not influenced by the intervention study.

Statistical Analysis

Descriptive statistics including age, height, and weight were calculated as the mean ± the standard deviation. Z SCORE (standard deviations from the mean in a reference population) for the specific categories of anthropometric failure were calculated using the recently released draft of the WHO Anthro 2005 PC software (Beta Version, 2006, World Health Organization, Geneva, Switzerland) to categorize children into both the CI and CIAF schemes for comparison. A description of the conventional and composite index categories is shown in Figure 1.

RESULTS AND DISCUSSION

Existing de-identified data were provided on 173 children under the age of five years. Three children were excluded in the analysis due to missing age, height and/or weight data. Records for 170 children, including 93 (54.7%) girls and 77 (45.3%) boys, were evaluated. The mean age was 2.9 ± 1.4 years. The mean height was 89 ± 15.5cm and mean weight was 13.2 ± 4.3 kg.

Evaluations of undernutrition using the CI and CIAF methods are shown in Table 1. Using the CI the data suggest that 31.2% were stunted, 14.1% were underweight, and 5.9% were wasted. Since these categories are not mutually

exclusive the total prevalence of undernutrition could not be determined; therefore, the highest prevalence of undernutrition for the population would be 32.1% (stunted). On the other hand, since CIAF provides mutually exclusive categories it allows the determination of total prevalence of undernutrition. The total prevalence of undernutrition in this population using CIAF can be estimated to be much higher (38.2%). In addition, the CIAF method was able to distinguish children with multiple anthropometric failures and who may be at risk for poor health and survival outcomes. For example, of the 53 children identified as stunted by CI, CIAF indicated that 36 of the 53 (67.9%) were stunted alone, while 17 (33%) were both stunted and underweight. Overall, multiple anthropometric failures were shown in one-third (22 of 65) of the children in anthropometric failure. This includes 2.9% who are wasted and underweight (Category B) and 10.0% who are stunted and underweight (Category E). These data suggests that the complexity as well as the prevalence of undernutrition may be underestimated using the CI classifications especially for children who experience multiple anthropometric failures.

CIAF more accurately identify the prevalence of all types of malnutrition for children 0 to 5 years of age. Programming for food and nutrition assistance in limited resource settings may be best served by the CIAF method that identifies children who are at highest risk for adverse health and survival outcomes through types and overlap of anthropometric failures. In addition, CIAF may better determine if the prevalence of higher risk malnutrition warrants therapeutic feeding programs that target malnourished individuals or blanketed

feeding interventions that provide rations in geographical areas or populations with a higher prevalence of malnutrition (5). In a previous study of children in India by Nandy et al. 2005, children categorized with all three anthropometric failures (CIAF category D: stunting, wasting, and underweight) were also more likely to have symptoms of diarrheal diseases and upper respiratory infections. This relationship highlights the importance of identifying those most at risk for poor health outcomes and therefore most in need of nutritional assistance. In the present population multiple anthropometric failures that include higher-risk weight-related failure (CIAF categories C, D, and E) suggest that 22/170 (12.9%) may require urgent intervention to prevent adverse outcomes; CI does not differentiate this more severe nutrition and health risk. Thus, CIAF can allow more specific targeting for urgent and aggressive nutrition and food programming.

The number of children in anthropometric failure influences the timing and the type of feeding program to be implemented. According to the World Health Organization (WHO), using the CI schematic this population would be categorized as high severity if represented by stunting (>30% stunted), medium severity for underweight (10-19% underweight), and low to medium severity for wasting (≤5%) (2). However, if the total percentage of undernourished children by CIAF method was used this population would likely shift to high severity (>30%) (2,5). Planning and response decisions also depend on the percentage of malnutrition in a population. The type of nutrition-related programming could also be influenced by the use of the CI or CIAF methods. For instance, 10-19%

malnutrition rates trigger targeted responses only to those most at risk, while >20% results in blanket feeding program assistance (2). In this population, the total prevalence of undernutrition determined by CIAF would likely result in a blanketed feeding program. In contrast, the CI indicates the need for targeted response using the prevalence of underweight, no response using prevalence of wasting, and blanket feeding using prevalence of stunting.

Limitations

The sample population used for analysis represented the children under five who were involved in the feeding program intervention and is not representative of the population at large. Finally, as in most rural settings, birth dates are not always known and therefore discrepancy may exist in this population between a child's actual and reported birth date and age.

CONCLUSIONS

The importance of the present study highlights the value of using CIAF to determine the prevalence of malnutrition in a population. Specifically, the CIAF categories are able to account for the children in multiple anthropometric failure and determine the overall prevalence of malnutrition in a population. This valuable tool may have profound implications on prevalence reporting as well as nutrition programming and outcomes. Reporting of accurate prevalence data and targeting highest risk populations for appropriate interventions using CIAF may help to improve the quality and outcomes of global nutrition efforts in the face of varying funding and other cost constraints. Future research should include investigation of the relationship between anthropometric failure and

disease symptoms, such as upper respiratory infections and diarrheal diseases. Follow-up research should compare the two methods of evaluating under-five year old populations to determine the value in using CIAF versus CI for monitoring the impact of interventions. Additional categories to include overnutrition counterparts in the schematic, such as obesity with or without stunting, may be appropriate to fully evaluate prevalence of nutritional risk of all types and programming outcomes targeted to malnutrition.

The current study utilizes the current growth standards which were released by WHO in 2005, to categorize malnutrition and compare the indices of anthropometric failure (de Onis, Garza, Onyango, & Borghi, 2007). Based on this literature review, we hypothesize that the CIAF will better describe the prevalence of anthropometric failure and improve the reporting of outcomes for nutrition-related programming due to its ability to categorize children in multiple anthropometric failure who may be at increased risk for poor health and survival outcomes.

Table 1. Prevalence of undernutrition in children 5 years of age and younger (n=170) using conventional index (CI) and composite index of anthropomtetric failure (CIAF).

Indexes		Frequency	Percent of Population
Conventional Index			
No failure		105	61.8
Stunted		53	31.2
Underweight		24	14.1
Wasted		10	5.9
Total Prevalence of Anthropometric Failure		Undeterminable*	Undeterminable*
CIAF Categories			
A	No failure	105	61.8
B	Wasted only	5	2.9
C	Wasted and underweight	5	2.9
D	Wasted, stunted and underweight	0	0
E	Stunted and underweight	17	10.0
F	Stunted only	36	21.2
Y	Underweight only	2	1.2
Total Prevalence of Anthropometric Failure		65	38.2

*The total prevalence of anthropometric failure is undeterminable using the CI because the categories are not mutually exclusive.

Figure 1. Description of Conventional Index (CI) and Composite Index of Anthropometric Failure (CIAF)

Indexes		Description	Type of Indicator
Conventional Index			
Stunting		Low ht for age	Indicator of chronic undernutrition, prolonged food deprivation and/or disease.
Wasting		Low wt for ht	Indicator of acute undernutrition, more recent food deprivation.
Underweight		Low wt for age	Indicates both acute/chronic undernutrition but does not distinguish between them.
CIAF Categories*			
A	No failure	Adequate ht and wt (above -2 Z score)	Children in acceptable range for height and weight.
B	Wasting only	Low wt for ht	Indicator of acute undernutrition, more recent food deprivation.
C	Wasting and underweight	Low wt for age and low weight for height	Multiple failures indicating both acute and chronic undernutrition.
D	Wasting, stunting, and underweight	Low wt for age, low weight for height and low height for age	Multiple failures indicating both acute and chronic undernutrition.
E	Stunting and underweight	Low height for age, low weight for age	Multiple failures indicating chronic undernutrition.
F	Stunting only	Low ht for age	Indicator of chronic undernutrition, prolonged food deprivation and/or disease.
Y	Underweight only	Low wt for age	Indicates chronic undernutrition.

Key: wt=weight, ht=height

*Note: The CIAF category "stunting and wasting" does not exist because it is not physically possible to be both stunted and wasted and not be underweight (1)

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CHAPTER III

SUMMARY AND RECOMMENDATIONS

Summary and Recommendations

The use of the CIAF to assess the nutritional status of a population may lead to improved prioritization, targeting, and implementation of nutrition related programming. It has been suggested that the CIAF can describe the prevalence of malnutrition in a population more accurately by distinguishing those with single and multiple anthropometric failures through mutually exclusive categories of anthropometric failure. The present study used the most current growth standards to identify children with anthropometric failure and to categorize the failure according to each index. The data from the present study suggest that conventional categories may underestimate the number of malnourished children in a population due to its inability to determine the overall prevalence of malnutrition. In addition, CIAF highlights the complexity of malnutrition by identifying those children with multiple anthropometric failures, who were not previously distinguished by CI and who may be at increased risk for adverse health and survival outcomes. In previous research, children with multiple anthropometric failures experienced higher rates of diarrheal disease and upper respiratory infection symptoms, both of which are leading causes of childhood mortality.

The global overweight and obesity pandemic should also be considered when evaluating the prevalence of malnutrition in a population. Additional categories to include overnutrition counterparts in the CIAF schematic, such as overweight with or without stunting, may be appropriate to fully evaluate the

prevalence of all types of malnutrition. The addition of such categories may allow for the utilization of CIAF in both developed and developing countries.

Malnutrition is a multifaceted issue that greatly impacts the health, economic growth, and overall development of societies worldwide. Combating the effects of malnutrition requires the creation of a sustainable environment to raise healthy children, provide education, and create opportunities for economic and personal growth. Nutrition assessments that accurately depict the nutritional status of a population are critical for creating and implementing programs to help improve the nutrition and health status of a population. As seen in the present study, CIAF may be a valuable assessment tool to determine a population's health risk and need for intervention.

In conclusion, CIAF should be used to determine the prevalence of malnutrition in a population by categorizing the nutritional status of children five years of age and younger. Future research should continue to investigate the correlations between single and multiple anthropometric failures and disease symptoms to determine the health risks associated with each category of failure and to evaluate the use of CIAF as an assessment tool to prioritize and implement global nutrition programming efforts. Furthermore, nutrition programming efforts that target populations with a high prevalence of malnutrition as determined by both CI and CIAF indexes, should be compared to determine the effectiveness of the intervention for improving the nutritional status of the population based on the prevalence data. Implementing efficient and effective nutrition interventions is critical to decrease the prevalence rates of

malnutrition and to help improve the overall health and development of populations around the world.

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Appendix A
Collaborative Letter

WISHH

World Initiative for Soy in Human Health

Enhancing human well-being through soy

20 November 2005

Clarie Hollenbeck, PhD
Department of Nutrition and Food Science
San Jose State University
One Washington Square
San Jose, CA 95192-0058

Dear Dr. Hollenbeck,

This letter is to invite the participation of your graduate student, Michelle Berger, to evaluate and existing data set of de-identified data in order to test for appropriate methods to categorize malnutrition. The data set was gathered as a baseline and part of the efforts by WISHH to develop and implement a nutrition care and treatment program in Homa Bay and Kisii in the Nyanza Province of Kenya.

The work assigned will include the evaluation of de-identified data from an existing data set working with nutrition consultant, Cade Fields-Gardner, to determine best ways to report categories and overall malnutrition prevalence. We hope to use the results to design and implement our nutrition care and treatment programs.

It is our understanding that this project will serve as Ms. Berger's thesis project to satisfy requirements for your Master's degree in Nutritional Science through the Department of Nutrition and Food Science at San Jose State University. It is also my understanding that guidelines set forth for approval by the San Jose State University Institutional Review Board will be followed and is agreed to by all involved in her project work.

Please feel free to contact me or to have others contact me if there is anything you need to discuss regarding this project. Thank you for your willingness to share your expertise and time with your students and WISHH to add this important planning aspect of a nutrition care and treatment program to our work.

Best regards,

Shannon Ward

Shannon Ward
Project Development Manager
410-570-0716
Wishhdc1@yahoo.com

American Soybean Association 12125 Woodcrest Executive Dr. Suite 100
St. Louis, MO 63141 Phone: 314-576-1770 Fax: 314-576-2786 www.WISHH.org

Appendix B
Certifications of Human Subjects: San Jose State University

San José State
UNIVERSITY

Office of the Provost
Associate Vice President
Graduate Studies & Research

One Washington Square
San José, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2477

E-mail: gradstudies@sjsu.edu
http://www.sjsu.edu

To: Michelle Berger

From: Pam Stacks, Ph.D.
AVP, Graduate Studies & Research

Date: January 11, 2006

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Prevalence of Malnutrition in HIV/AIDS Orphans in the Nyanza District of Kenya: A Comparison of Conventional Indices with a Composite Index of Anthropometric Failure (CIAF)"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Pam Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond January 11, 2007 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Cc: Clarie Hollenbeck - 0058

Appendix C
Small Research Grant Award Letter

San José State
UNIVERSITY

College of Applied Sciences and Arts
Nutrition and Food Science
Central Classroom Bldg. 200

One Washington Square
San José, CA 95192-0058
Voice: 408-924-3100
Fax: 408-924-3114

June 5, 2006

Michelle Berger

Dear Michelle:

We are delighted to inform you that your research proposal, "*Prevalence of malnutrition in HIV/AIDS orphans in the Nyanza Province of Kenya: A comparison of conventional indices with a composite index of anthropometric failure (CIAF),*" has been selected by the Student Research Assistance Committee to receive the Circle of Friends Research Assistance Award in the amount of $500. Per university policy, the check will be mailed directly to you and will not be specifically identified as a Circle of Friends research grant.

The award amount is designed to augment the cost of research related supplies. Therefore, as a condition of receiving this award, you are required to submit, upon completion of your study, a one page final report with receipts. This report should explain how the items purchased with the Research Assistance Award contributed to your findings.

Please accept our admiration for this outstanding research proposal and congratulations on receiving this award.

Sincerely,

Caroline Fee, M.A.
Director, Circle of Friends

Lucy McProud, Ph.D., R.D.
Chair, Department of Nutrition and Food Science

Appendix D
Circle of Friends Award Letter

San José State
UNIVERSITY

College of Applied Sciences and Arts
Nutrition and Food Science
Central Classroom Bldg. 200

One Washington Square
San José, CA 95192-0058
Voice: 408-924-3100
Fax: 408-924-3114

May 1, 2006

Michelle Berger

Dear Michelle:

We are delighted to inform you that you have been selected as the recipient of the Department of Nutrition and Food Science Circle of Friends Rose T.L. Tseng Scholarship for the year 2006 in the amount of $1000.

By receiving this award, you have been recognized for your outstanding achievements. The check will be mailed to your home address.

Please accept our warmest congratulations and admiration for your accomplishments.

Sincerely,

Caroline Fee, M.A.
Director, Circle of Friends

Lucy Mc Proud

Lucy Mc Proud, Ph.D.
Chair, Department of Nutrition and Food Science

Appendix E
San Jose State University CASA Lottery Grant Award Letter

San José State
UNIVERSITY

College of Applied Sciences and Arts
Office of the Dean

One Washington Square
San Jose, CA 95192-0049
Voice: 408-924-2900
Fax: 408-924-2901
Internet: http://www.sjsu.edu/casa

Dean:
Dr. Inger Sagatun-Edwards

Departments/ Schools:

Aerospace
Health Science
Hospitality Management
Journalism & Mass Communications
Justice Studies
Kinesiology
Library & Information Science
Nursing
Nutrition & Food Science
Occupational Therapy
Recreation & Leisure Studies
Social Work

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, East Bay, Fresno,
Fullerton, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San Jose, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

December 18, 2006

Michelle Berger
Department of Nutrition & Food Science

Dear Michelle:

Congratulations! I am pleased to inform you that upon the recommendation of one of the Professional Development Lottery Funds committees of the College of Applied Sciences and Arts, your request for 2006-2007 Professional Lottery Development funding has been approved in the amount of $1,569.95.

Please process your Professional Development expense claims through the administrative staff in the Nutrition & Food Science. According to guidelines, funds must be spent by August 31, 2007.

The funds are approved for the activities/items you indicated in your proposal. Expenditures will be tracked and may not be for items not in your original proposal.

We commend you for your professional development efforts in support of the instructional programs of the College of Applied Sciences and Arts.

Sincerely,

R. Rangavajhula

Ramani Rangavajhula, Chair
Research & Faculty Development Committee

cc: Lucy McProud, Chair

Appendix F
SJSU Graduate Equity Fellowship Award Letter

San José State
UNIVERSITY

Office of the Provost
Associate Vice President
Graduate Studies & Research

One Washington Square
San José, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2477

E-mail: gradstudies@sjsu.edu
http://www.sjsu.edu

August 14, 2006

Michelle Bereer

Dear Michelle,

It is a great pleasure to inform you that the Graduate Equity Fellowship Committee has chosen you as a recipient of a fellowship grant in a total amount of $3,000.00 to be awarded in the Academic Year 2006-2007. This fellowship will be awarded in two equal installments with disbursements in October 2006 and March 2007. The Financial Aid Office will disburse checks using the mailing address indicated on MYSJSU.EDU. ***Please verify your address and update if necessary prior to September 26, 06.***

Remember, you must carry a minimum of six semester units of graduate course work in both the Fall and Spring semesters. These courses must be used as part of a master's degree program. Prerequisite courses not used as part of the units required for completion of the Master's degree may not be used to fulfill this requirement. In addition this course work cannot be used toward the completion of a Credential ONLY. To receive your spring allocation, Fall 2006 work must be complete and graded with a minimum GPA of at least 3.00. ***If you fail to meet the minimum GPA in either semester, you will not receive the award allocation and the remainder of your grant will be forfeited.***

In addition to the above the following must be performed and complete in order to receive your award:

- Recipients must work with a mentor in his/her department. It is your responsibility to select a mentor by the time your eligibility is determined in the Fall semester. Please bring written verification from your mentor with a list of your graduate classes scheduled for enrollment during AY 2006-2007.
- If you are a **continuing** SJSU student, submit a copy of your approved Advancement to Candidacy petition signed by the graduate advisor. If you are a **new** SJSU student, you will need to submit a preliminary candidacy petition before the first disbursement of award funds. These forms may be obtained at http://www.sjsu.edu/gradstudies/
- To confirm your plans to continue your education at San Jose State University by the same September 26th deadline, please return the attached form to Coleetta McElroy in Financial Aid. She can be reached at (408) 924-6086 or emailed at cmcelroy@sjsu.edu

Bring your mentor's letter and Advancement to Candidacy petition (or preliminary) signed by your graduate advisor to Ruth Bermea in the Office of Graduate Studies & Research, Student Services Center, no later than September 26, 2006. If you have questions regarding these documents, feel free to contact Ruth at (408) 924-2427 or email her at rbermea@sjsu.edu. This office will notify Financial Aid in early October for the release of Fall checks. All materials must be on file for your check to be released. NOTE: *In March 2007 we will need a brief follow-up letter from your mentor sharing your progress in your academic program and his/her involvement in supporting your success.*

Your achievements and promise, as well as your financial need, merit the special support of the University as you proceed with your graduate studies. We support your success in this wonderful endeavor.

Sincerely,

Rhea L. Williamson, Ph.D.
Associate Dean, Graduate Studies & Research

Attachment

cc: Department Chair

Appendix G
American Dietetic Association Abstract Acceptance Letter

AMERICAN DIETETIC ASSOCIATION
120 South Riverside Plaza, Suite 2000
Chicago, IL 60606-6995

April 21, 2006

Michelle Berger

Dear Michelle:

Congratulations! Your abstract was peer reviewed for the 2006 Food & Nutrition Conference & Expo (FNCE) and selected for a Poster Session in Honolulu, Hawai'i. Your presentation information is as follows:

Session: Sunday Poster Session
Presentation Title: Prevalence of Malnutrition in HIV/AIDS Orphans in the Nyanza Province of Kenya: A Comparison of Conventional Indices with a Composite Index of Anthropometric Failure (CIAF)
Date: 09/17/06 **Time:** 09:00AM - 01:30PM
Session ID: 101. (See Attached Timeline)

Posters present content utilizing charts, graphs, illustrations, and/or photographs during a half-day session in the Hawaii Convention Center. Materials are mounted on corkboard or are displayed on the table in front of the corkboard. The presentation style is an informal one-on-one or small group discussion with the author, who should remain at the display during the scheduled time to explain information and answer questions. Audiovisual equipment is not considered necessary during a poster presentation. Please note that the session information listed above is subject to change and presenting authors are notified promptly.

Enclosed is a Disclosure Statement Form, a Poster Session Timeline, and an Abstract Change/Cancellation Form. Please read all information carefully and return all forms before **Friday, May 19**, in order to secure your acceptance and have your abstract included in print supplement. You will receive correspondence in August with additional information and instructions for on-site procedures.

All presenters must register and pay for attendance at FNCE 2006. All presenters' and coauthors' names are printed in the abstract book that will be sent as a supplement to the August *Journal of the American Dietetic Association.* It is imperative that we know of any changes immediately in order to adjust programming. As mentioned in our Poster Presentation Guide, the ADA strictly monitors "No Show" presenters and abstract co-authors. "No Shows" will not be permitted to present at FNCE for the next two years.

If you have questions regarding your participation or the items enclosed, please call the Professional Development team at 312/899-4867, e-mail to apatterson@eatright.org, or fax to 312/899-0008. We look forward to presenting new research with you at FNCE, September 16-19, 2006!

Cordially,

Andrea Patterson
Coordinator, Professional Development

Enclosures