SOCIO-ECONOMIC DETERMINANTS OF CHILD NUTRITIONAL STATUS IN ARMENIA: THE ANALYSIS OF 2000 AND 2005 DEMOGRAPHIC AND HEALTH SURVEYS

by

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A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
Health Services Research

Charlotte

2011

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ABSTRACT

TSOVINAR HARUTYUNYAN. Socio-economic determinants of child nutritional status in Armenia: The analysis of 2000 and 2005 Demographic and Health Surveys
(Under the direction of Dr. JAMES N. LADITKA and Dr. SARAH B. LADITKA)

Objectives: The study examined the association between an index of household wealth and key nutritional status indicators in children under age five in Armenia. The study compared the distribution of the child nutritional status indicators across socio-economic groups in 2000 and 2005. It also examined the correlation between the Wealth Index and subjective measures of socio-economic status (SES), as well as the relationship between all of those SES measures and child nutritional status in Armenia in 2005.

Methods: Data were from the Armenia Demographic and Health Survey (DHS) conducted in 2000 and 2005. The analyses accounted for sampling features, including the stratification of the sample by regions and urban/rural areas and the primary sampling units, as well as the clustering of children within households. Three measures of undernutrition were examined: stunting (low height-for-age), wasting (low weight-for-age), and underweight (low weight-for-height). Analyses included chi-square, the Kappa statistic, unadjusted and adjusted logistic regression, and calculation of poor/rich odds ratios and concentration indices. Independent variables included the Wealth Index, an objective SES measure, and three subjective SES measures, respondents' perceptions about: "having enough money to meet needs," "making ends meet in the household," and "satisfaction with living space." Covariates included urban/rural residence, region, education in years for mothers and fathers, marital status of mothers, work status of mothers, mother's age in years at the time of the child's birth, mother's body mass index,

child's age in months, child gender, birth weight in kilograms, and the number of months the child was breastfed.

Results: The prevalence of stunting in the combined and weighted DHS populations for 2000 and 2005 was 17.4%, using the 2006 World Health Organization standards for child growth. The prevalence of wasting was 3.3%, and for being underweight 2.9%. In bivariate results, children in the second wealth quintile, those who were "poorer" but not the most poor, had lower rates of wasting and underweight than those in most of the richer quintiles. In adjusted analyses, none of the associations for the Wealth Index and child undernutrition indicators were statistically significant. Each additional year of a father's or partner's education was associated with significantly lower adjusted odds of stunting (OR 0.93, 95% CI 0.88-0.98) and underweight (OR 0.85, 95% CI 0.76-0.95). Each additional kilogram of the child's birth weight was associated with 53% lower odds of stunting (OR 0.47, 95% CI 0.35-0.63) and 72% lower odds of being underweight (OR 0.28, 95% CI 0.17-0.46). Armenian regions that had less favorable nutritional indicators were Gegharkunik (children had higher risk of stunting and underweight), Shirak (children had higher risk of wasting and underweight), and Vayots Dzor (children had higher risk of wasting and underweight). Residents in these three regions have poorer SES compared to those living in other Armenian regions. The calculation of poor/rich odds ratios showed a significant differential in the risk for stunting in 2000 (poor/rich OR 2.12; 95% CI 1.29-3.50), but no significant difference in 2005. The analysis of concentration curves and indices indicated a higher concentration of stunting and underweight in poorer households in 2000, and a slightly higher concentration in the richer quintiles in 2005. The "making ends meet in the household" indicator might be a

better predictor of child undernutrition than the Wealth Index or the other two subjective indicators examined.

Discussion: Findings suggest that the Wealth Index has limited ability to predict nutritional status of children in Armenia. Region and paternal education had highly significant associations with undernutrition; these results suggest that they are important independent socio-economic determinants of nutritional outcomes for Armenian children. The regional variation in malnutrition rates and malnutrition inequalities show the importance of examining community and regional level socio-economic variables in addition to individual and household level factors, and of targeting selected regions for further studies and public health interventions designed to improve child nutrition.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my dissertation chairs, Dr. Jim Laditka and Dr. Sarah Laditka, for being strong and supportive advisors, for sharing their knowledge and expertise, and for thoughtful and meticulous revisions of my work. I am also thankful for the example they provided as rigorous and successful professionals and scholars. I thank the members of my dissertation committee: Dr. Michael Thompson, Dr. Jacek Dmochowski, and Dr. Lori Thomas, who have generously provided their time and expertise to improve my work, their comments and suggestions were very valuable. Special thanks to Dr. Michael Thompson for encouraging me to enroll in the PhD program at the UNC Charlotte, and for his continuous support throughout my stay in Charlotte. I would also like to thank the faculty of the Health Services Research Doctoral Program; I learned much from them.

I thank my son Paruyr for his patience and his company throughout my study years. I am very thankful to my sister, my brothers, and many friends and relatives who supported me from a distance. I thank my parents for inspiring me to further my education.

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CHAPTER ONE: INTRODUCTION

1.1.Socio-economic status and health

The fundamental association of socio-economic status and health has been recognized for decades (N. E. Adler et al., 1994). It is generally expected that poverty will have a negative effect on health. For most countries, a close relationship exists between socioeconomic circumstances and most health indicators (Wilkinson, 1997). However, while the socio-economic gradient in health is relatively well-studied in the developed world, less information about the relationship between absolute and relative socio-economic status and health in less-developed countries is available.

A particularly wide gap exists in our knowledge about the relationship between socio-economic status and health in former Soviet countries. The transition to democracies and market economies after the collapse of the Soviet Union and the end of the Communist era in these countries may be of particular interest to the international community. The relationship between socio-economic status and health is not unique to any given country; however, the distributions of wealth, income, or other socio-economic measures, as well as the access to social goods that could be determined by socio-economic status can vary substantially across countries.

Social determinants of health reflect the environment in which people are born, grow, live, and work; they also include the health systems that they are using (Stringhini et al., 2011). These conditions might be influenced by the ways that money, power, and

resources are distributed in a society and might be shaped by policy choices in a country (Stringhini et al., 2011). The association between socio-economic determinants and health has been found in almost all developed countries, although the strength of the association may not be uniform (N. E. Adler & Ostrove, 1999). For instance, the gradient has been found to be less pronounced in more egalitarian countries, such as the Scandinavian countries, as compared to more unequal societies (N. E. Adler & Ostrove, 1999).

1.2.The Republic of Armenia

The Republic of Armenia is a small land-locked country located at the cross-roads of Europe, Asia, and the Middle East. Armenia's socio-economic situation significantly deteriorated after the collapse of Soviet Union and independence in 1991, leading to the deterioration of almost all institutions, including the health care system (von Schoen-Angerer, 2004). The health of the Armenian population, which had positive measures for indicators such as infant mortality and life expectancy during the Soviet times, began a rapid decline after 1991 (Center for Health Services Research and Development, 2002; Hakobyan et al., 2006; Hovhannisyan, 2004; Torosyan, Romaniuk, & Krajewski-Siuda, 2008; von Schoen-Angerer, 2004).

Independence and the transition to a market economy redefined social classes, and led to the loss of economic and social safety nets and safeguards in all post-Soviet countries (McKee & Fister, 2004). In most of these countries, including Armenia, living standards declined sharply and inequality increased substantially following independence, as reflected by increasingly unequal distributions of income and wealth (McKee & Fister, 2004; Tonoyan, 2005).

Living standards have improved since 2000, as Armenia experienced a growth in gross domestic product (GDP) of more than 10% annually (Mkrtchyan, 2006), an achievement that continued through 2009. However, research has suggested that the positive changes have not benefited all segments of the population equally, as marked by increasing disparities between poor and rich households in indicators likely to be associated with economic improvement, such as asset ownership, childhood education, and use of health care services (Johnson, 2007).

The proportion of the population living in poverty declined since 2004. According to a Statistical Analytical report by the World Bank and National Statistical Services (NSS), with incomes adjusted for inflation the percentage of the population that was poor decreased between 2004 and 2008 (23.5% in 2008 vs. 34.6% in 2004) (*World Bank, National Statistical Service of Armenia*, 2009). The proportion of the population living in extreme poverty decreased even more prominently reaching 3.1% in 2008 compared to 6.4% in 2004.

Nevertheless, poverty remains a problem in Armenia, as 23.5% of the population, more than 760,000 permanent residents, live in poverty. About 100,000 of these residents are extremely poor (*World Bank, National Statistical Service of Armenia*, 2009). Poverty rates remain high in urban areas outside Yerevan, the capital and largest city in Armenia, although rural and less educated population groups are also vulnerable to poverty (*European Neighborhood policy*, 2010).

Income inequality (dispersion of the income distribution) increased by at least 136% between 1989 and the late 1990s, putting Armenia among the countries with the highest level of income inequality in the world (Tonoyan, 2005). Economists often use

the Gini coefficient to evaluate income inequality. The Gini coefficient is the most commonly used measure of inequality. The coefficient varies between 0, which reflects complete equality, and 1, which indicates complete inequality (*World Bank*, 2011). Between 1999 and 2004 the Gini coefficient associated with household incomes in Armenia dropped from 0.593 to 0.395 (Tonoyan, 2005; *World Bank, National Statistical Service of Armenia*, 2009), reaching 0.389 in 2008; the Gini coefficient for consumption fluctuated from 0.320 in 1999 to 0.260 in 2004, and to 0.272 in 2008 (Mkrtchyan, 2006; Tonoyan, 2005; *World Bank, National Statistical Service of Armenia*, 2009). However, some researchers suggest that the large reported decline in income inequality during 1999-2004 are overstated due to inaccurate income reporting in household surveys (Mkrtchyan, 2006; Tonoyan, 2005).

Maternal and child health is an area that is particularly sensitive to economic changes in a country (Mendoza & Rees, 2009; Reidpath & Allotey, 2003). Poverty and social inequality negatively influence child health regardless of the cultural setting or the availability of health care (Marmot & Wilkinson, 2006). Several key maternal and child health indicators have deteriorated following independence (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005; Demirchyan & Thompson, 2008). However, few attempts have been made to examine associations between economic inequality and child health in Armenia, or changes in the level of inequity, that might have resulted from changes in the national economy and the social structure of Armenian society.

1.3.Malnutrition in children

Malnutrition in children adversely influences brain growth, delays motor,

cognitive, and behavioral development, weakens immune systems, and lowers intelligence, while also increasing morbidity and mortality (Martorell, 1999; Mosley & Chen, 1984; Pelletier & Frongillo, 2003; Reyes et al., 2004). Several authors suggest that child malnutrition is a "syndrome of developmental impairment" caused by a complex of factors, including insufficient access to food, poor water and sanitation, inadequate health services, and poor maternal and child health care practices (Martorell, 1999).

Malnutrition in children under five is commonly assessed through stunting, wasting, and underweight indicators. Each indicator measures different aspects of malnutrition. Stunting (low height-for-age) is a useful indicator for tracking trends in child malnutrition. Stunting measures the cumulative faltered growth associated with long-term factors, including chronic insufficient daily protein intake (M. de Onis & Blössner, 1997; Wagstaff & Watanabe, 2000). It is also associated with frequent illness (Wagstaff & Watanabe, 2000). Since it is an indicator of past growth failure, stunting is often used for long-term planning of policies and programs in non-emergency situations (Wagstaff & Watanabe, 2000). The worldwide variation of stunting prevalence is significant, with less developed countries having rates of stunting ranging from 5% to 65% (M. de Onis & Blössner, 1997).

The underweight indicator (low weight-for-age) reflects body mass relative to age. Unlike height, weight fluctuates over time and therefore this indicator represents both acute and chronic malnutrition (Wagstaff & Watanabe, 2000). Its composite nature complicates its interpretation. For example, the indicator fails to distinguish between short children of adequate body weight and tall, thin children (M. de Onis & Blössner, 1997). The worldwide variation of low weight-for-age is similar to that of the stunting

indicator (M. de Onis & Blössner, 1997).

Wasting (low weight-for-height) indicates in most cases a recent and severe process of weight loss, often associated with acute starvation or severe disease (M. de Onis & Blössner, 1997). In the absence of severe food shortage, the prevalence of wasting even in developing countries is usually below 5% (M. de Onis & Blössner, 1997).

The common recommendation is to assess and analyze all three indicators (underweight, stunting, and wasting) when possible, to have a complete picture of malnutrition in a population (UN, 2002).

1.4.Child Malnutrition in Armenia

The Demographic and Health Surveys (DHSs) conducted in Armenia by Macro International in 2000 and 2005 are large-scale studies that raised concern among public health professionals and researchers in Armenia about the high rates of child malnutrition. According to DHS data, 13% of children under 5 were stunted in Armenia in 2000, with 3% severely stunted, and the prevalence in different geographic regions ranging from 8% in Kotayk and Yerevan to 32% in Gegharkunik region. The survey also showed that 2% of children were wasted and 3% were underweight with 11% were wasted and 9% were underweight in Kotayk. DHS 2005 data showed no improvement in rates of stunting, with the percentage of children who were wasted or underweight rising to 5% percent and 4%, respectively (*Armenia Demographic and Health Survey* 2005).

1.5.Measurement of Socio-Economic Status (SES)

Socio-Economic Status (SES) is of interest to those who study children's health and development, based on the expectation that families with high SES provide their

children with the services, goods, parental care, and social network that benefit children, whereas lower SES families cannot afford those resources (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997). The influence of SES on children's development has been widely studied (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Mosley & Chen, 1984). There is evidence of wide variability in children's experience in every SES level, as well as evidence that the link between SES and child well-being depends on many factors including geography, culture, and immigration status (Bradley & Corwyn, 2002). Several authors stress the importance of multiple environmental and socio-economic factors that are more distal determinants of malnutrition and morbidity/mortality in children (Mosley & Chen, 1984; Pongou, Ezzati, & Salomon, 2006). They also suggest studying the influence of socio-economic factors on several levels, including the individual, household, and community levels (Pongou et al., 2006).

Several authors conclude there is no agreement on what SES represents (Bradley & Corwyn, 2002; Liberatos, Link, & Kelsey, 1988). SES is often interpreted broadly as an individual's or household's position in society, which can be shaped by educational attainment, prestige, career, wealth, or another indicator of "social standing" (Lindelow, 2006). Many proxies for SES are described in the literature, each of them differently related to health outcomes through different etiological pathways (Butterfield et al., 2010). Many different measures of SES have been studied, including social (or occupational) class, level of education, income, dwelling size, consumption, and the availability of goods and amenities in the household represented by a "wealth" index (Wagstaff & Watanabe, 2003).

Various subjective measures of SES have been shown to be good predictors of health indicators in the recent studies (N. E. Adler, Epel, Castellazzo, & Ickovics, 2000; Howe, Hargreaves, Ploubidis, & De Stavola, 2010; Operario, Adler, & Williams, 2004; Singh-Manoux, Marmot, & Adler, 2005). Subjective measures are assessments of the socio-economic status of respondents based on their own perceptions. Several studies have shown the subjective measures to be even better predictors of health than comprehensive, composite objective measures of SES (Singh-Manoux et al., 2005). Growing evidence, mainly coming from developed countries suggests the relationship between subjective socio-economic status and a number of health outcomes, such as poor self-rated health, higher mortality, depression, cardiovascular risk, diabetes, and respiratory illness (MacArthur & MacArthur, 2007). No studies have compared objective and subjective socio-economic status measures in terms of the magnitude of their association with the nutritional status of children under age 5 in the former Soviet region, and the ability of these SES indicators to predict child nutritional status.

1.6.Innovation and Significance

No study has explored relationships between multiple socio-economic and demographic variables and the nutritional status of children in Armenia using nationally representative data. This dissertation research addresses this gap. It explores and compares the impact of various socioeconomic and demographic factors on child nutritional status in Armenia, and examines the temporal changes in the distribution of child nutritional outcomes across socio-economic groups using data from the Demographic and Health Surveys conducted in 2000 and 2005. This study supplies unique information about the socio-economic gradient in health in the former Soviet

region, which should be of particular interest for those who study global health, as well as for policy-makers in Armenia and in its region.

1.7.Research Aims

The specific aims of this study are to:

1. Describe the distribution of the child nutritional status indicators among wealth index quintiles for the years 2000 and 2005. This study is presented in Chapter 2.
2. Examine temporal changes in the distribution of the child nutritional status indicators among wealth index quintiles comparing data for the years 2000 and 2005. The study addressing this aim is presented in Chapter 2.
3. Assess the association of household wealth index with key child nutritional status indicators, including stunting, wasting, and weight-for-age, controlling for characteristics or factors that might affect the relationship, using the DHS data for 2000 and 2005. This analysis is presented in Chapter 3.
4. Compare the household wealth index and subjective socio-economic measures in terms of their ability to predict child nutritional status indicators using the DHS data for 2005. This analysis is presented in Chapter 4.

CHAPTER TWO: SOCIO-ECONOMIC INEQUALITIES IN CHILD UNDERNUTRITION IN ARMENIA: A COMPARATIVE ANALYSIS OF 2000 AND 2005 DEMOGRAPHIC AND HEALTH SURVEYS

2.1.Introduction

The socio-economic gradient in health in the developed world is well-documented (Marmot & Wilkinson, 2006). Information about the relationship between socio-economic status and health in developing countries and countries in transition is less comprehensive. The relationship between socio-economic status and health is not unique to any given country; however, the distributions of wealth, income, or other socio-economic measures, as well as the access to social goods that could be determined by socio-economic status can vary substantially across countries. For instance, the socio-economic gradient in health has been found to be less pronounced in more egalitarian countries, such as the Scandinavian countries, as compared to more unequal societies (Stringhini et al., 2011).

A particularly wide gap exists in our knowledge about the relationship between socio-economic status and health in former Soviet countries. These formerly Communist countries experienced dramatic socio-economic changes after the collapse of the Soviet Union, with the transition to democracies and market economies (Bobak & Marmot, 2009; McKee & Fister, 2004). These changes increased social and economic inequality. Thus, the socio-economic gradient in health in these countries should be of interest to researchers, public health practitioners, and policy makers.

2.2. Background

2.2.1. The Republic of Armenia

The Republic of Armenia is a small land-locked country located at the cross-roads of Europe, Asia, and the Middle East. Armenia's socio-economic situation significantly deteriorated after the collapse of Soviet Union and independence in 1991, leading to the deterioration of almost all institutions including the health care system (von Schoen-Angerer, 2004). The health of the Armenian population, indicated by low infant mortality and long life expectancy during the Soviet times, began rapid decline after 1991 (Center for Health Services Research and Development, 2002; Hakobyan et al., 2006; Hovhannisyan, 2004; Torosyan et al., 2008; von Schoen-Angerer, 2004).

Before independence and the transition to a market economy, Armenia was a remarkably equitable society (Tonoyan, 2005). The transition redefined social classes, and led to the loss of economic and social safety nets and safeguards in all post-Soviet countries (McKee & Fister, 2004). In most of these countries living standards declined sharply and inequality of income and wealth distribution increased substantially following independence (McKee & Fister, 2004; Tonoyan, 2005).

Living standards have improved since 2000, as Armenia experienced a growth in GDP of more than 10% annually (Mkrtchyan, 2006), an achievement that continued through 2009. However, some research has suggested that the positive changes have not benefited all segments of the population equally, as marked by increasing disparities between poor and rich households in indicators likely to be associated with economic improvement, such as asset ownership, childhood education, and use of health care services (Johnson, 2007).

The proportion of the population living in poverty declined since 2004. According to a Statistical Analytical report by the World Bank and National Statistical Services (NSS), with incomes adjusted for inflation the percentage of the population that was poor decreased between 2004 and 2008 (23.5% in 2008 vs. 34.6% in 2004) (*World Bank, National Statistical Service of Armenia,* 2009). There was an even more prominent decrease in the proportion of the population living in extreme poverty reaching 3.1% in 2008 compared to 6.4% in 2004.

Nevertheless, poverty remains a problem in Armenia, as 23.5% of the population, more than 760,000 permanent residents, live in poverty. About 100,000 of these residents are extremely poor (*World Bank, National Statistical Service of Armenia,* 2009). Poverty rates remain high in urban areas outside Yerevan, the capital and largest city in Armenia, although rural and less educated population groups are also vulnerable to poverty (*European Neighborhood policy,* 2010).

Income inequality (dispersion of the income distribution) increased by at least 136% between 1989 and the late 1990s, putting Armenia among the countries with the highest level of income inequality in the world (Tonoyan, 2005). Economists often use the Gini coefficient to evaluate income inequality. The Gini coefficient is the most commonly used measure of inequality. The coefficient varies between 0, which reflects complete equality, and 1, which indicates complete inequality (*World Bank,* 2011). Between 1999 and 2004 the Gini coefficient associated with household incomes in Armenia dropped from 0.593 to 0.395 (Tonoyan, 2005; *World Bank, National Statistical Service of Armenia,* 2009), reaching 0.389 in 2008; the Gini coefficient for consumption fluctuated from 0.320 in 1999 to 0.260 in 2004, and to 0.272 in 2008 (Mkrtchyan, 2006;

Tonoyan, 2005; *World Bank, National Statistical Service of Armenia*, 2009). However, some researchers suggest that the large reported decline in income inequality during 1999-2004 are overstated due to inaccurate income reporting in household surveys (Mkrtchyan, 2006; Tonoyan, 2005).

2.2.2. Previous Studies

Maternal and child health is particularly sensitive to economic changes in a country (Mendoza & Rees, 2009; Reidpath & Allotey, 2003). Several key maternal and child health indicators have deteriorated following independence (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005; Demirchyan & Thompson, 2008). However, few attempts have been made to examine associations between economic inequality and maternal and child health or other population health outcomes in Armenia, or changes in the level of inequity, that might have resulted from changes in the national economy and social structure of Armenian society. One such study explored determinants of poor self-rated health among adult women during a period of socio-economic transition in Armenia (Demirchyan & Thompson, 2008). The study suggested that a reduction in material deprivation as well as better educational status strongly predicted improved self-rated health. However, that analysis was limited to data representing women in only one of the eleven Armenian regions.

Another relevant study based on the 2000 and 2005 Demographic Health Survey (DHS) was published as an Armenia Trend Report by Macro International in 2007 (Johnson, 2007). The report examined trends in economic disparities in Armenia between 2000 and 2005, and associations between those trends and selected demographic and health indicators. However, most of the child health outcomes assessed in the DHS 2000

and 2005 were not included in the analysis.

2.3. Study Objective

This study describes and compares the distribution of child nutritional status indicators across socio-economic groups in 2000 and 2005, through an analysis of the Demographic and Health Survey data for Armenia. The research supplies unique information about the socio-economic gradient in health in the former Soviet region. This information should be of particular interest to those who study global health, and to policy-makers in Armenia and in the region. Findings may help to identify the extent and the geographic distribution of inequalities in child malnutrition across the DHS study years, allowing the development of targeted nutritional interventions.

2.4. Methods

2.4.1. Materials and Methods

Data were obtained from the DHS conducted in Armenia in 2000 and 2005. Both DHS surveys were similar in design, and included the same variables, which permits comparison of results from 2000 and 2005. Also, the survey design permits detailed analysis of the health indicators for the nation, for Yerevan (the capital), and separately for the combined urban regions and the combined rural regions. Results for many indicators, including child health and nutritional status, can also be estimated for individual regions. Two-stage probabilistic sampling selected clusters at the first level, and households at the second level.

In 2000, 6,524 households were selected for the sample, of which 6,150 were occupied at the time of fieldwork. Of the occupied households, 97% were successfully interviewed. In these households, 6,685 women were identified as eligible for the

individual interviews. Interviews were completed with 96% of eligible women. In 2005, 7,565 households were selected for the sample, of which 7,003 were occupied at the time of fieldwork. Of the occupied households, 96% were successfully interviewed. Of 6,773 eligible women, interviews were completed with 97%.

All children under 5 in the surveyed households were eligible for anthropometric measurements in 2005. In 2000, the children of interviewed mothers were measured. Height was measured standing up for children age two years and above, and lying down for children below two years, using specially designed portable measuring boards (Shorr Boards). Weight was measured using electronic Seca scales.

The data for the current study were obtained from the DHS Height & Weight databases for 2000 and 2005, available at the DHS project website (ICF, 2011). The Height & Weight database for 2000 initially contained 1,726 records, while the database for 2005 contained 1,449 records. Each database was merged with the children's database and household database for the corresponding year. Children with the following characteristics were excluded: 1) no information on age at the time of interview; 2) did not sleep in the household the night before the survey; 3) might have been a household guest at the time of interview. After these exclusions, the databases for 2000 and 2005 were merged, resulting in an analytical dataset representing 3,017 children under age five.

2.4.2. Study Variables

The outcome variables of interest in this study included stunting, wasting, and underweight in children under five. Each indicator measures different aspects of malnutrition. Stunting (low height-for-age) is a useful indicator for tracking trends in

child malnutrition. Stunting measures the cumulative faltered growth associated with long-term factors, including chronic insufficient daily protein intake (M. de Onis & Blössner, 1997; Wagstaff & Watanabe, 2000). It is also associated with frequent illness (Wagstaff & Watanabe, 2000). Since it is an indicator of past growth failure, it is often used for long-term planning of policies and programs in non-emergency situations (Wagstaff & Watanabe, 2000). The worldwide variation of stunting prevalence is significant, with less developed countries having rates of stunting ranging from 5% to 65% (M. de Onis & Blössner, 1997).

The underweight indicator (low weight-for-age) reflects body mass relative to age. Unlike height, weight fluctuates over time and therefore this indicator represents both acute and chronic malnutrition (Wagstaff & Watanabe, 2000). Its composite nature complicates its interpretation. For example, the indicator fails to distinguish between short children of adequate body weight and tall, thin children (M. de Onis & Blössner, 1997). The worldwide variation of low weight-for-age is similar to that of the stunting indicator (M. de Onis & Blössner, 1997).

Wasting (low weight-for-height) indicates in most cases a recent and severe process of weight loss, often associated with acute starvation or severe disease (M. de Onis & Blössner, 1997). In the absence of severe food shortage, the prevalence of wasting even in developing countries, is usually below 5% (M. de Onis & Blössner, 1997).

The common recommendation is to assess and analyze all three indicators (underweight, stunting, and wasting) when possible, to have a complete picture of malnutrition in a population (UN, 2002).

The nutritional indicators for children for this study were calculated based on standard deviations from an international reference population's median, as recommended by the World Health Organization (WHO) in April 2006 (WHO, 2006). Children whose measurements were two standard deviations below the reference median were regarded as undernourished (stunted, wasted, or underweight). Children whose measurements were more than three standard deviations below the reference median were considered severely undernourished (severely stunted, severely wasted, or severely underweight). Given the small numbers of undernourished children, severely undernourished and undernourished children were combined into one category for each of the three indicators of interest.

A household wealth index, constructed based on the availability of durable goods and amenities in the household, was used as a measure of socio-economic status. Household assets included in questions for 2000 and 2005, which are included in the wealth index, are shown in Table 2.1. The household wealth index was developed by the DHS, by assigning a weight or factor score to each household asset through principal components analysis. A wealth index score for a household was calculated by weighting the response with respect to each item in a household by the coefficient of the first principal component. The scores were summed by household, and standardized. Individuals were ranked according to the total score of the household in which they resided. The sample was then divided into quintiles based on these scores. Each quintile was designated a rank, from one (poorest) to five (wealthiest). The wealth index for 2005 was based on more items than the 2000 wealth index (Table 2.1); it is possible, therefore, that the 2005 index measures household wealth more accurately than the 2000 index,

although this is an empirical question that has not been examined in the literature. In addition, the 2005 index contained more items relevant for defining wealth in rural households. The quintiles were constructed similarly in 2000 and 2005; with the two possible exceptions just mentioned, they should therefore be comparable, at least to the extent that they rank each household into 5 quintiles of relative household wealth (Johnson, 2007).

2.4.3. Data Analysis

To study the association of the level of economic inequality with the outcomes of interest, poor/rich odds ratios and Concentration Indices were used. Poor/rich odds ratios compare respondents in the poorest quintile with respondents in the wealthiest quintile with regards to health outcomes. These ratios are commonly used to assess inequality (Hosseinpoor et al., 2005).

While the poor/rich odds ratio compares only the poorest and the richest households, the Concentration Index measures inequality across the entire socioeconomic distribution (Hosseinpoor et al., 2005; Wagstaff & Watanabe, 2000). A negative value suggests that the health problem or characteristic is concentrated among disadvantaged people; a positive value indicates the concentration of a health outcome in more affluent populations (Fenn, Kirkwood, Popatia, & Bradley, 2007; Hosseinpoor et al., 2005; Wagstaff & Watanabe, 2000).

Child nutritional status indicators were cross-tabulated with the wealth index and poor/rich odds ratios, with corresponding 95% confidence intervals calculated for each outcome of interest for 2000 and 2005. The Concentration Indicies for 2000 and 2005 were calculated and the concentration curves were graphed to illustrate the presence and

the strength of unequal socio-economic distribution of the above-mentioned indicators.

A stratified analysis was performed to obtain poor/rich odds ratios and Concentration Indices for child undernutrition in each of the 11 Armenian regions.

To account for the clustering and to obtain appropriate standard errors, the SPSS 19 Complex Samples add-on module was used. The module accounts for sampling features, including the stratification of the sample by regions and urban/rural areas and the primary sampling units, as well as the clustering of children within households. The data were weighted in each of the databases (2000 and 2005) based on the household weight multiplied by the inverse of the individual response rate of the mother's individual response rate group. The household weight for a particular household is the inverse of its household selection probability multiplied by the inverse of the household response rate of its household response rate group (Rutstein, 2006). Response rate groups are groups of cases for which response rates are calculated. In DHS surveys, response rates are calculated for each sampling domain (Rutstein, 2006). The weights were scaled in the combined database using a method that minimizes the variance of combined survey estimates (Westat, 2001).

2.5.Results

Table 2.2 and Figures 2.1, 2.2, and 2.3 show the distribution of stunted, wasted, and underweight children among wealth quintiles by DHS year (2000 and 2005). Chi-square analysis was performed to assess the association between the variables. A higher proportion of stunted children were in the poorest (first) and the poorer (second) wealth quintiles in 2000 (23.0% and 18.3%) as compared to 2005 (20.2% and 9.5% respectively). For 2000, the percentage of stunted children appeared to be highest in the

poorest (first) and the poorer (second) wealth quintile (23.0% and 18.3% respectively) , while the “richer” (fourth) and the richest quintiles had the smallest percentages of stunted children (11.8% and 12.3% respectively) (p=0.008). For 2005, no clear trend was observed, with the lowest percentage of stunted children recorded in the “poorer” (second) wealth quintile (16.4%), followed by the “middle” (third) wealth quintile (16.4%).

Associations between wealth quintile and the proportion of undernourished children were statistically significant only for the stunting indicator in 2000. Thus, the analysis found no differences in the prevalence of wasting or underweight among wealth quintiles.

Table 2.3 presents the odds ratios of the nutritional indicators for the poorest group of children compared with the richest group in 2000, 2005, and for the combined data. The odds of stunting were more than twice as great for the poorest children than for those in the wealthiest quintile in 2000 (Odds Ratio, OR 2.12; 95% Confidence Interval, CI 1.29-3.50). There was no evidence of statistically significant associations between the wealth quintiles and the nutritional outcome measures for 2005. The combined odds ratio (2000 and 2005) was significant only for the stunting indicator, where the poorest children had 60% higher odds of stunting than did children in the richest households (OR 1.60, CI 1.04-2.57).

The breakdown of the poor/rich odds ratios for the “undernutrition” indicator (any of the three nutritional outcomes present in the combined data from 2000 and 2005) by Armenian regions suggests a greater tendency for children in the poorest households in Armenia to have malnutrition than children in the richest households (Figure 2.4). The

greatest differential was seen in Armavir region (OR 14.89, CI 1.74-127.59), although the wide confidence interval suggests the estimate provides only limited information about the specific magnitude of the association. In Lori region, the odds of undernutrition for children living in the poorest households were almost 8 times higher than the corresponding odds for those living in the richest households (OR 7.78, CI 1.04-57.99). In Gegharkunik the odds were over 4 times higher (OR 4.41, CI 1.47-13.20). The remaining comparisons were not statistically significant.

Figures 2.5, 2.6, and 2.7 depict the concentration curves for the stunting, wasting, and underweight variables for the years 2000, 2005, and for the combined data from both years. The Concentration Index is defined as twice the area between the concentration curve, and the line of equality running from the bottom-left corner to the top-right (Wagstaff & Watanabe, 2000). The index has a negative value when the curve lies above the line of equality, indicating disproportionate concentration of the outcome among the poor, and a positive value when it lies below the line of equality indicating larger concentration of the outcome among the rich. A curve coinciding with the equality line suggests an equal distribution of the outcome (Wagstaff & Watanabe, 2000).

As indicated in Figure 2.5, stunting in children under 5 was more concentrated among poorer households in 2000 (Concentration Index= -0.134), while in 2005 it was slightly more pronounced in the richer quintiles (Concentration Index=0.064). A similar picture was obtained for the weight-for-age indicator (Concentration Index for 2000= -0.173, Concentration Index for 2005=0.022). Regarding wasting, both the 2000 and 2005 concentration curves lie below the equality line, indicating a tendency for the wasting to be more concentrated among the richer households; however, the

Concentration Indices reached only 0.039 in 2000 and 0.079 in 2005 (Figure 2.6). The curve for stunting for both 2000 and 2005 has a smooth shape and does not cross the equality line. The curves for 2005 for wasting and underweight have a tendency to stay above the equality line at the upper and the lower ends of the curve, and drop below at the middle, indicating an ambiguous distribution of both outcomes across the wealth categories.

The patterns of inequality for the combined "undernutrition" indicator for children under 5 in Armenian regions according to the Concentration Indices are illustrated in Figure 2.8. The picture of inequality is only partially similar to the one obtained using poor/rich ratios, with all regions except Yerevan having a higher concentration of undernutrition in poorer households. The largest of the negative indices was recorded in Armavir, reaching -0.249, while the only positive index, in Yerevan, was close to zero (0.086). Thus, the tendency of having higher concentration of undernutrition in richer households in Yerevan is slight.

2.6.Discussion

This study found limited difference in malnutrition rates across the socioeconomic quintiles among children under 5 in Armenia in 2000 and 2005. The analysis of the distribution of malnutrition indices in the poorest and the richest population quintiles with the use of poor/rich odds ratios showed a significant differential in the risk for stunting in 2000, with the poorest children having about twice the odds of being stunted than children in the wealthiest category. The corresponding result for 2005 was not statistically significant. There were also no statistically significant associations detected between socio-economic status and the wasting and underweight indicators for 2000 or

2005. These findings are consistent with previous studies showing that socioeconomic status has a smaller effect on the conditions that may lead to wasting (for instance, unexpected changes in the environment and disease) than on the long-term conditions that contribute to stunting (E. Van de Poel, Hosseinpoor, A., Speybroeck, N., Van Ourtia,T., Vegab, J., 2008; Wagstaff & Watanabe, 2000). The measure for underweight, which refers to weight-for-age, does not discriminate well between temporary and more permanent malnutrition (E. Van de Poel, Hosseinpoor, A., Speybroeck, N., Van Ourtia,T., Vegab, J., 2008). It is therefore also less likely to identify inequality than stunting.

The results obtained using the the Concentration Indices were partially similar to the results obtained with poor-rich odds ratios described above. Stunting in children under 5 was more concentrated among poorer households in 2000, with a Concentration Index of -0.134, and was slightly more pronounced in the richer quintiles in 2005, with a very small positive Concentration Index. Concentration Indices for underweight were very similar to what was found for stunting. For wasting, both the 2000 and 2005 concentration curves showed a tendency for wasting to be more concentrated among the richer households, although with very small positive Concentration Indices, which is different from what was found using the poor/rich odds ratios, with only the 2005 odds ratio less than one.

The comparison of the undernutrition indicators across the socio-economic categories in 2000 and 2005 suggests declining inequality. The Concentration Indices for stunting and underweight indicators demonstrate the change in the direction of the association, with relatively large negative values of the Concentration Indices in 2000,

and small positive values in 2005. The observed trend seems to correspond to changes in the underlying economic situation in the country between 2000 and 2005, marked by fast growth of GDP and a decrease in income inequality (Johnson, 2007; Mkrtchyan, 2006). Although only five years passed between the DHS surveys in Armenia, the country experienced substantial economic improvements during that time period, with the GDP growing 13.2% in 2002, 14% in 2003, 10.1% in 2004, and 13.9% in 2005 (Johnson, 2007). Income inequality measured by the Gini coeficient dropped from 0.6 in 1999 to 0.395 in 2004 (Mkrtchyan, 2006). These advances might have contributed to declining inequality in child malnutrition.

The break down of the poor/rich odds ratios for the "undernutrition" indicator, which combined all three malnutrition indices, showed different magnitude of inequality in Armenian regions, with the poorest households having higher malnutrition rates than the richest ones in eight regions out of eleven. However, the only statistically significant differences were for the Armavir, Gegharkunik, and Lori regions. The Concentration Index showed that all regions except Yerevan have a higher concentration of malnutrition among poorer households. Overall, the use of Concentration Indices along with the poor/rich odds ratios seems to be appropriate based on the results of our analysis, as these two measures provided similar, but not identical results.

The plaucity of research and available data limit explaination of the patterns that were found for the Armenian regions, especially the socio-economic distribution of malnutrition in Yerevan versus all other regions. The difference is likely caused by the unique socio-economic position of Yerevan, which is the capital and the largest urban center in Armenia, while the rest of the regions also have large rural components. That

might have led to the dissimilar classification of households according to wealth quintiles in Yerevan versus other regions. The limited ability of the wealth index to define rural household wealth has been noted in the literature (Rutstain, 2008). Both Gegharkunik and Lori are among the most economically disadvantaged Armenian regions. However, little is known about the underlying socio-economic inequalities in these regions, so there there is little bases for drawing conclusions about the large inequality indices observed in these regions. Small sample sizes for regions did not allow calculating poor/rich odds ratios and Concentration Indices for each of the undernutrition indicators in 2000 and 2005. A crude generalizaion of the indicators into the "undernutrition" category, with the inclusion of both 2000 and 2005 data, might have obscured inequality patterns that are likely to be time and indicator sensitive.

The use of a wealth index to capture socioeconomic status has shortcomings (E. Van de Poel, Hosseinpoor, Speybroeck, Van Ourti, & Vega, 2008). First, the choice of assets in the index can influence the magnititude of the health inequality measure (E. Van de Poel et al., 2008) . Also, although in the DHS it is assumed that the possession of observable assets, services, and amenities is related to the relative economic position of the household in the country (Rutstain, 2008), no studies have shown the effectiveness of the wealth index that is derived from these observable factors for predicting health outcomes in Armenia or other post-Soviet countries. Other measures of socio-economic status might be more valid for assessing inequality in child malnutrition in these countries, and might demonstrate a higher degree of inequality in child malnutrition in Armenia.

Several other study limitations are acknowledged. The findings are based an

analysis of aggregated data for 2000 and 2005 without accounting for the overall changes in the country's socio-economic profile that might have taken place between those years. Changes during the years between the two surveys may have affected the socio-economic situation in the households. This potential bias is minimized since all analytic models were adjusted for the study year. In addition, the household wealth index used in this study was based on the number of different goods and commodities present in the household, rather than on measures of overall income or salaries, the values of which are more likely to fluctuate between the years. The wealth index for 2005 included more items than the 2000 index. The recalculation of the index for 2000 was not possible since some of the items included in the 2005 index were missing in the 2000 database.

The main limitation of the study is the relatively small number of wasted and underweight children. There were 89 children who were wasted, and 80 who were underweight in the combined sample. Small sample sizes may have limited the statistical power of the analysis.

2.7.Implications for Policy, Practice, and Research

This study is the first to examine socioeconomic inequality in childhood malnutrition in Armenia using the WHO growth standards released in 2006. The present study contributes to the literature by using two different measures of inequality: poor/rich odds ratios and Concentration Indices. As the findings from the two methods differed slightly, it may be useful to use both measures to obtain a more complete picture of inequality. Also, although the Concentration Index shows the overall concentration of the nutritional outcome among the poor or the rich, the poor/rich ratio may help policy makers to identify indicators and areas where the difference between the poorest and the

richest is greatest. This would help to focus policies and programs.

Patterns of the distribution of malnutrition across socioeconomic groups in the regions of Armenia can serve as a useful tool for health policy-makers, as the regions with high inequality can be easily distinguished and targeted for further studies and public health interventions.

Table 2.1. Household assets used for the construction of Household Wealth Index (Gwatkin et al., 2007)[a]

Asset variable	DHS 2000	DHS 2005
Electricity	+	+
Radio	+	+
Television*	+	+
Refrigerator	+	+
Washing machine	-	+
Vacuum cleaner	-	+
Computer	-	+
Camera	-	+
Watch	-	+
Bicycle	+	+
Motorcycle, scooter	+	+
Car, truck	+	+
Telephone*	+	+
Source of water	+	+
Type of latrine	+	+
Type of flooring	+	+
Type of cooking fuel	+	+
Agricultural land	+	+
Farm animals	-	+
Horse cart	-	+

Table 2.1. (continued)

Boat	-	+
Bank account	-	+
Household had a vacation	-	+
Number of sleeping rooms	-	+
Number of members per sleeping room	-	+

Demographic and Health Survey, Armenia, 2000 and 2005

*- In 2000, respondents were asked about telephone and TV in general, while in 2005 the ownership of black and white TV and color TV, as well as cell phones versus land phones were assessed separately. Notes: + = participants were asked about the asset; - = participants were not asked about the asset.

Table 2.2. Nutritional status of children by wealth quintiles and DHS year (2000 and 2005)

	Wealth Quintile									
	Lowest *"Poorest"*		*Second* *"Poorer"*		*Middle* *"Middle "*		*Fourth* *"Richer"*		*Highest* *"Richest"*	
Nutritional status	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
of children	(188)	(103)	(202)	(106)	(137)	(104)	(153)	(107)	(165)	(97)
Stunted* (≤ -2SD)	23.0	20.2	18.3	9.5	17.6	16.4	11.8	26.1	12.3	18.8
	(43)	(21)	(37)	(10)	(24)	(17)	(18)	(28)	(20)	(18)
Wasted (≤ -2SD)	2.6	5.6	1.6	3.1	2.4	5.2	3.3	2.7	2.4	8.4
	(5)	(6)	(3)	(3)	(3)	(5)	(5)	(3)	(4)	(8)
Underweight	3.3	4.6	2.2	2.7	4.1	2.6	1.3	6.2	1.1	3.2
(≤ -2SD)	(6)	(5)	(4)	(3)	(6)	(3)	(2)	(7)	(2)	(3)

***-**p=0.008 (for the year 2000)

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

Table 2.3. Poor/rich odds ratios for the three nutritional indicators (2000, 2005, and combined)

	DHS Year					
Nutritional status	*2000*		*2005*		*Combined*	
	OR	*CI*	*OR*	*CI*	*OR*	*CI*
Stunted	2.12	1.29, 3.49	1.09	0.49, 2.42	1.63	1.04, 2.57
Wasted	1.10	0.37, 3.28	0.64	0.22, 1.90	0.79	0.35, 1.77
Underweight	3.10	0.77, 12.48	1.44	0.30, 7.01	2.04	0.67, 6.18

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

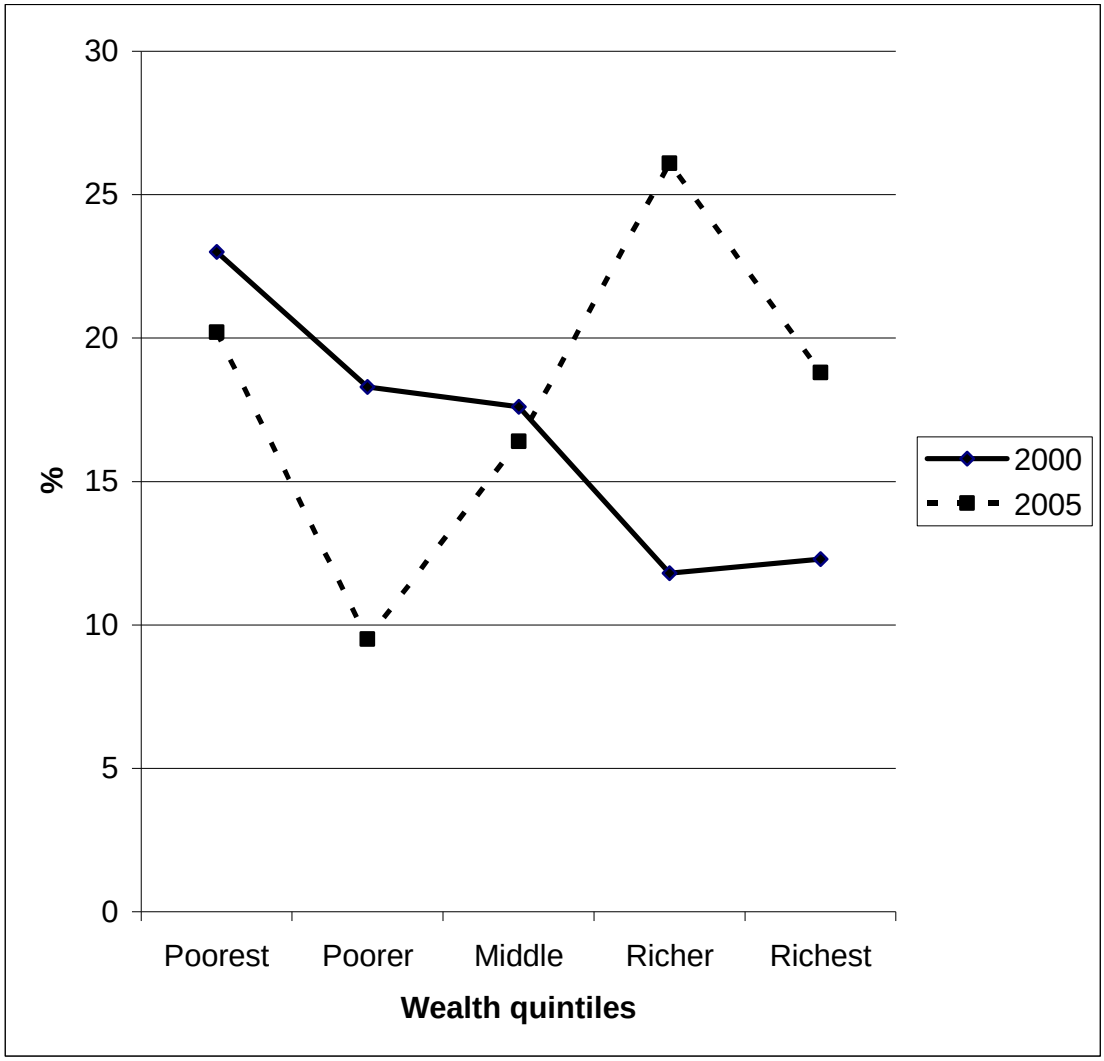

Figure 2.1. Stunting by wealth quintiles and DHS year.

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

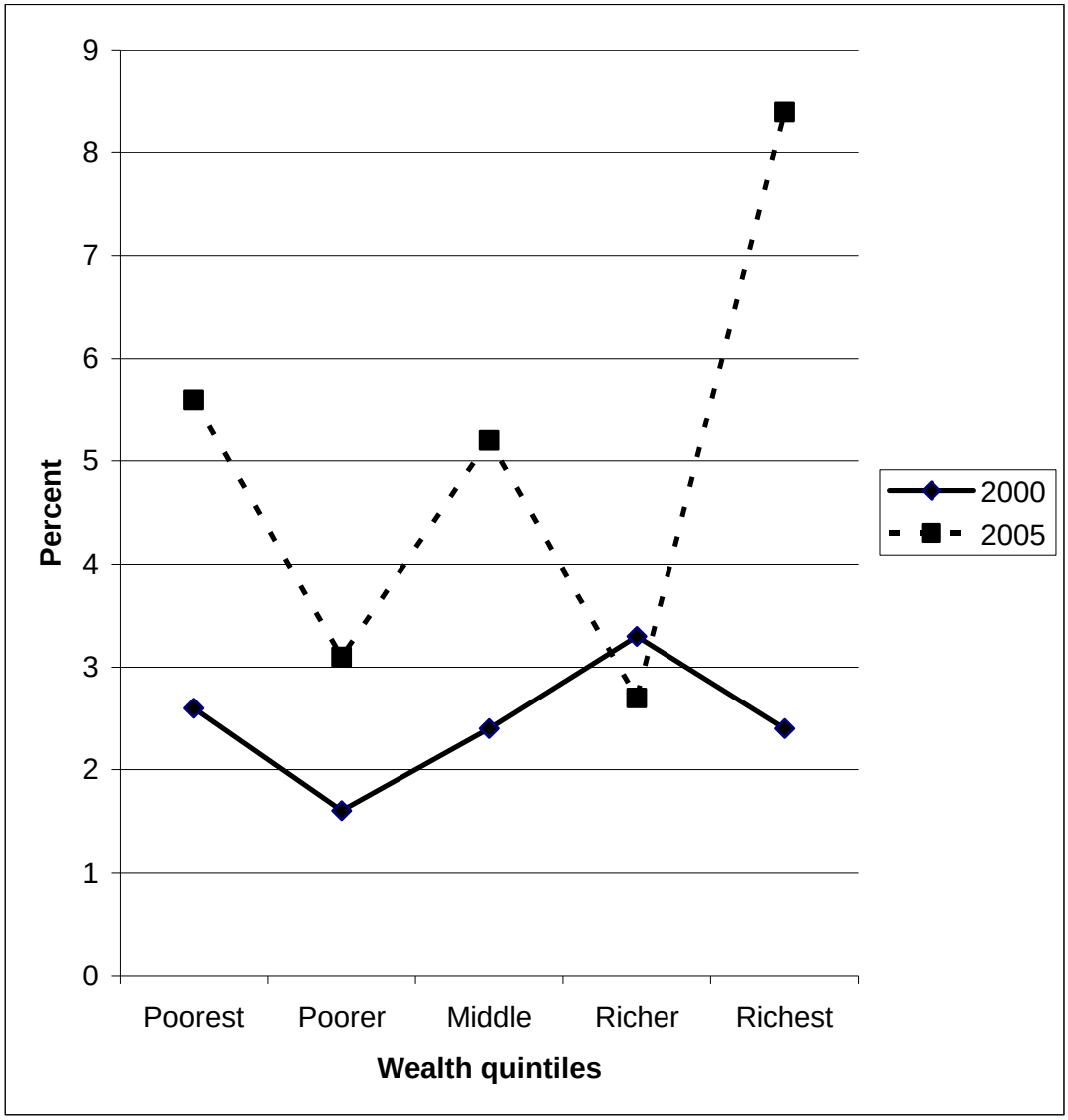

Figure 2.2. Wasting by wealth quintiles and DHS year.

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

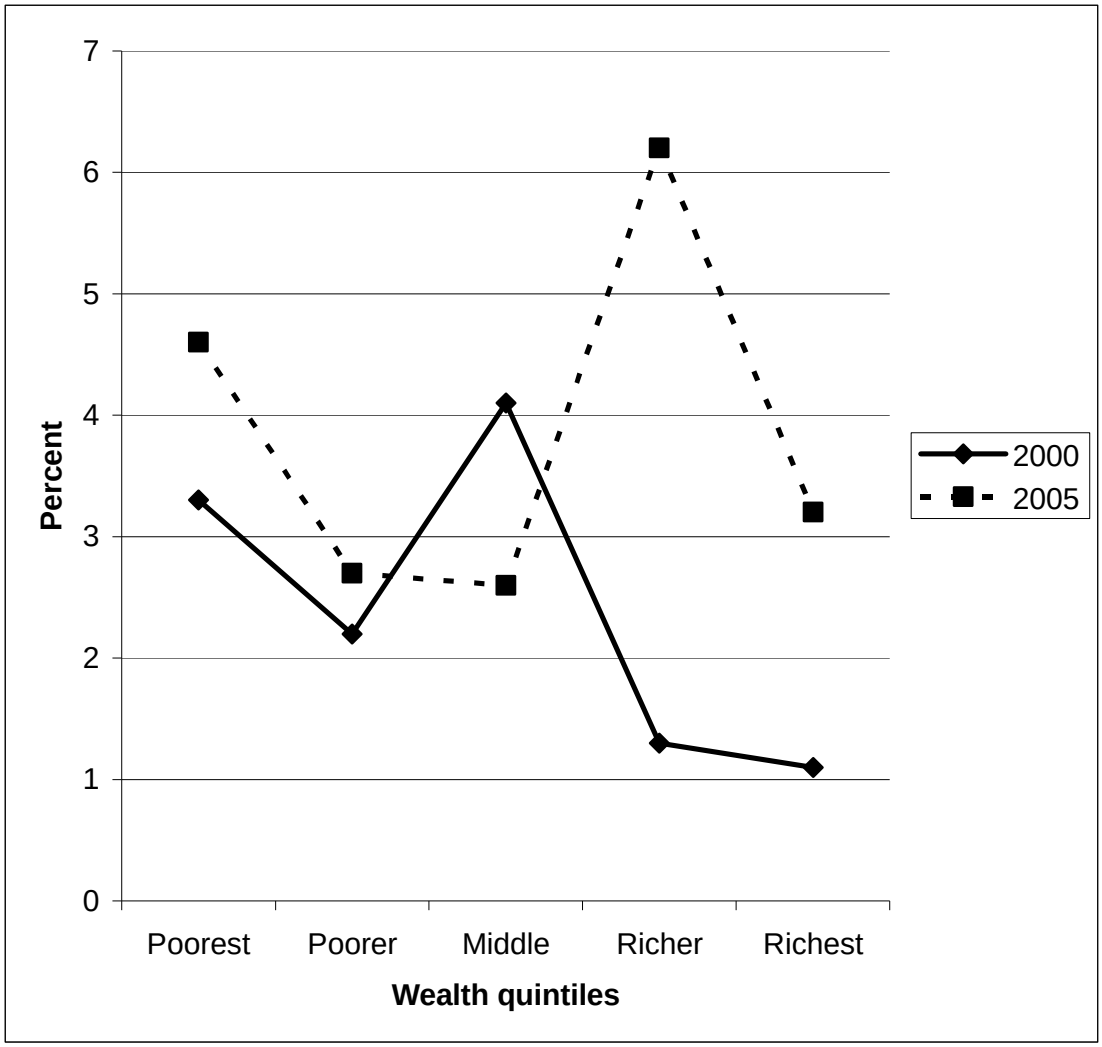

Figure 2.3. Underweight by wealth quintiles and DHS year.

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

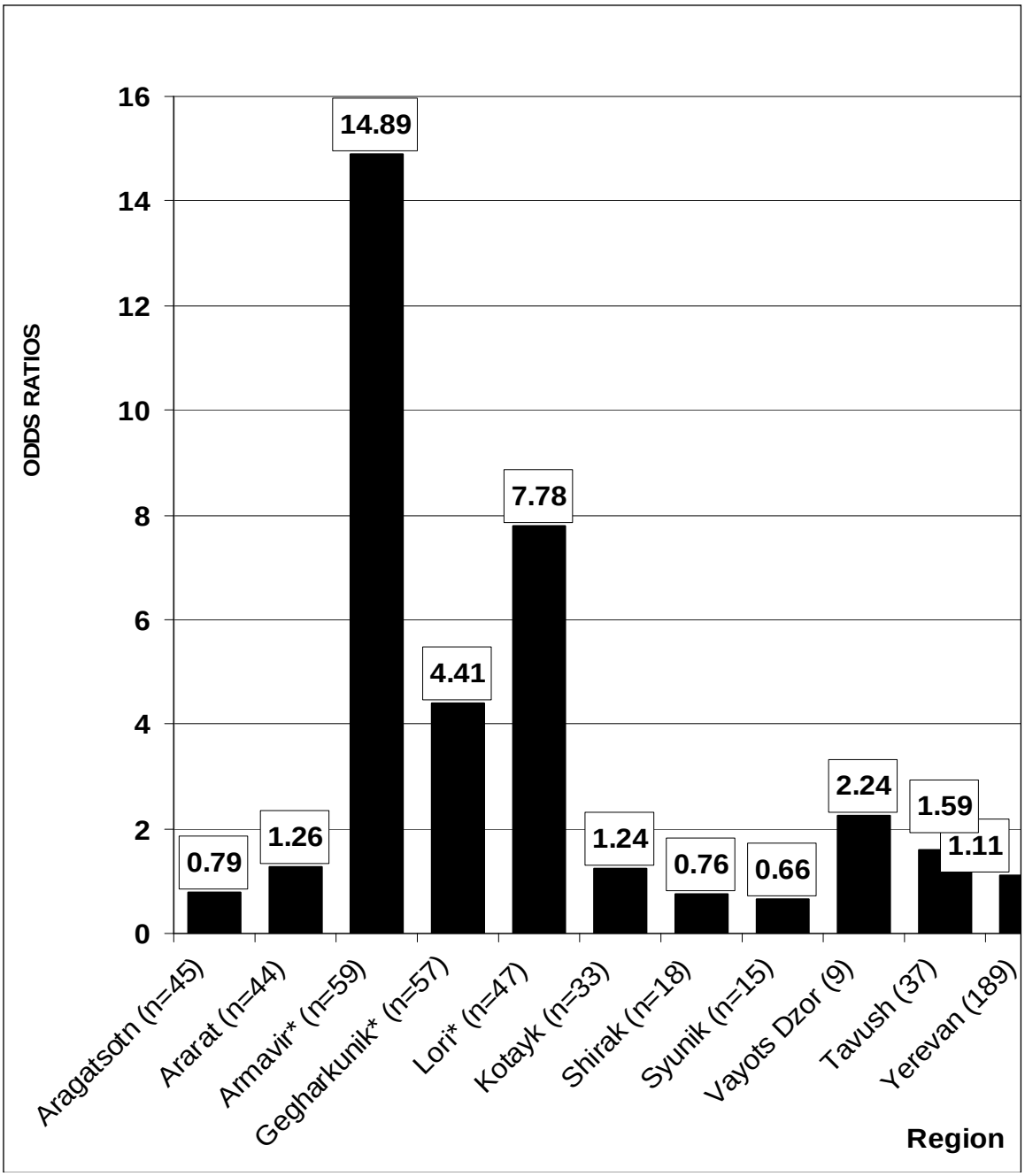

Figure 2.4. Poor/rich odds ratios for undernutrition, by region, Armenia, 2000 and 2005 combined.

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

The poor/rich odds ratio represents the ratio of the odds of undernourished children in the poorest households over the percent of undernourished children in the wealthiest households

*$p<0.05$.

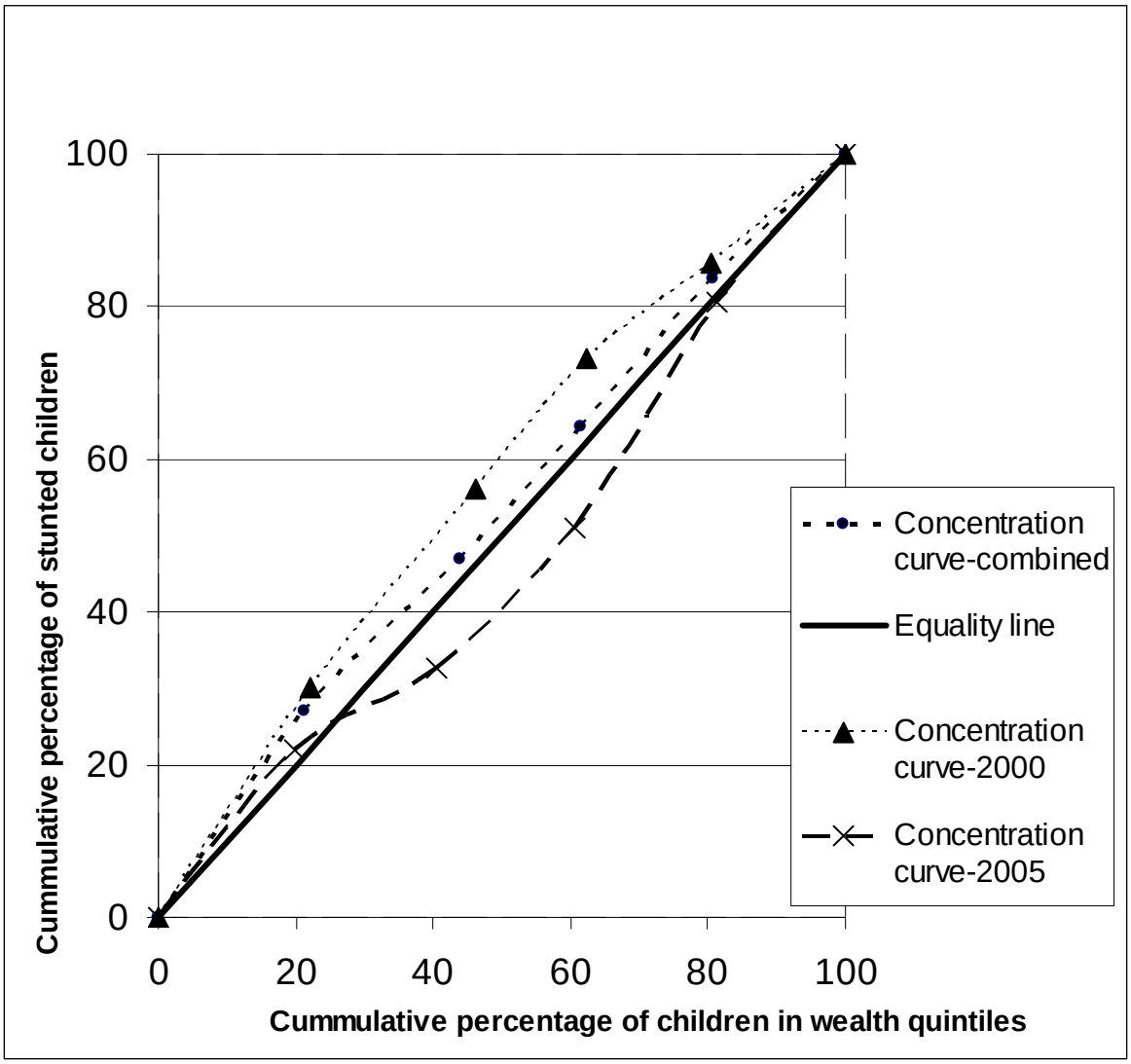

Figure 2.5. Concentration curves for stunting in children under 5 in Armenia (DHS 2000, 2005, and combined).

Data source: Demographic and Health Surveys, Armenia, 2000 and 2005.

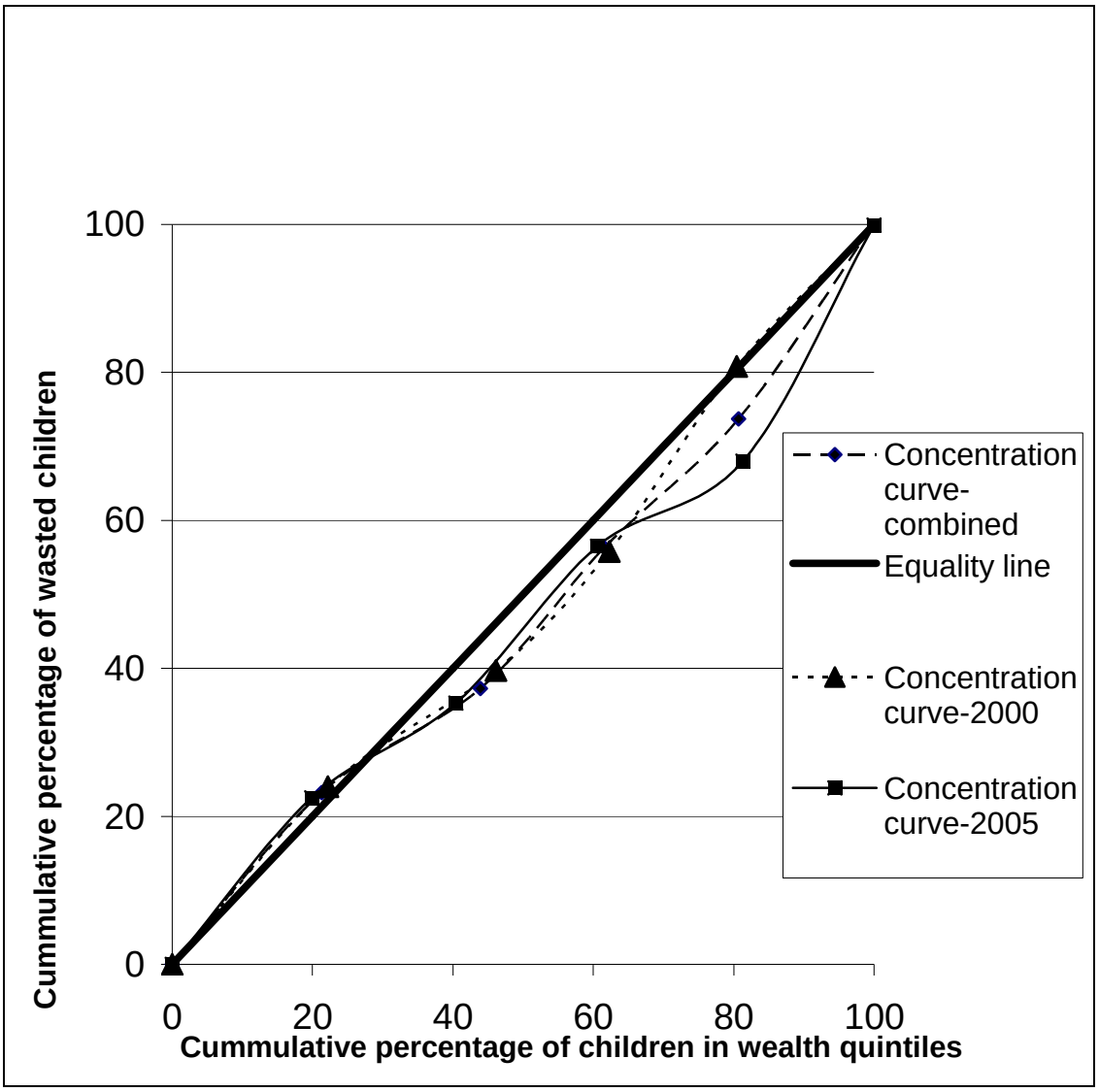

Figure 2.6. Concentration curves for wasting in children under 5 in Armenia (DHS 2000, 2005, and combined).

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

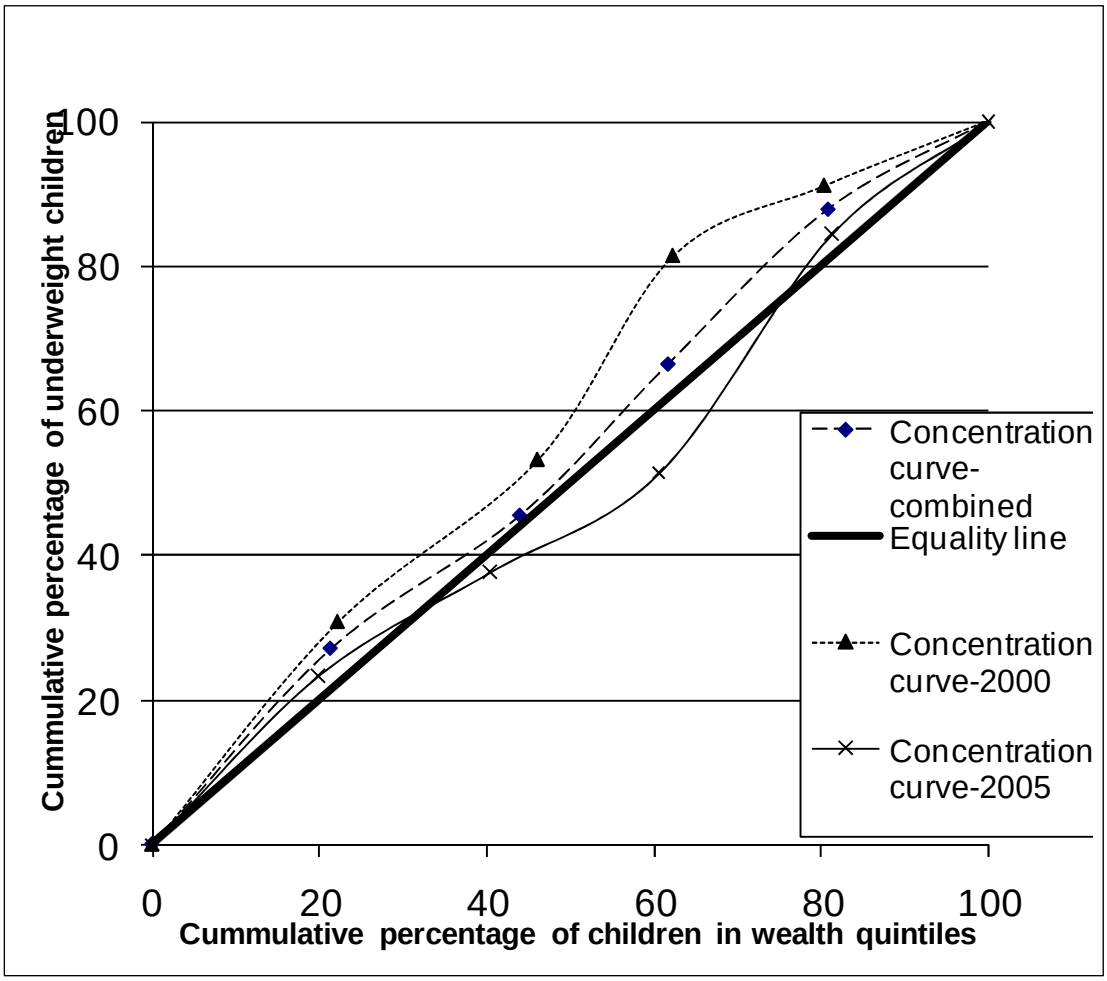

Figure 2.7. Concentration curves for underweight in children under 5 in Armenia (DHS 2000, 2005, and combined).

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

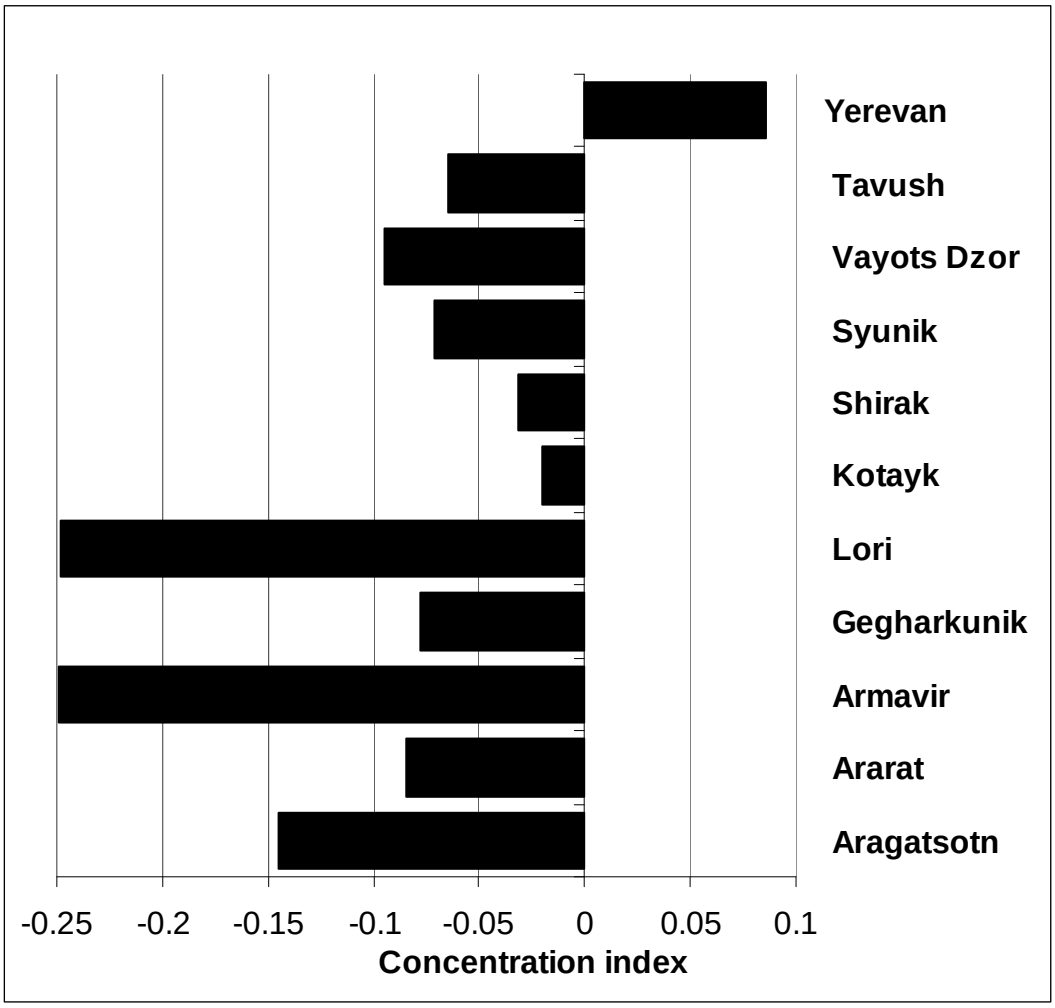

Figure 2.8. Concentration indices for child undernutrition by region, Armenia 2000 and 2005.

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

CHAPTER THREE: DOES HOUSEHOLD WEALTH PREDICT THE NUTRITIONAL STATUS OF CHILDREN IN ARMENIA? AN ANALYSIS OF THE 2000 AND 2005 DEMOGRAPHIC AND HEALTH SURVEYS

3.1.Introduction

The social gradient in health is a well-recognized phenomenon (Marmot & Wilkinson, 2006). It is generally expected that poverty will have a negative effect on health. For most countries, a close relationship exists between socioeconomic circumstances and most health indicators (Wilkinson, 1997). However, while the socio-economic gradient in health is relatively well-studied in the developed world, less information is available about the relationship between absolute and relative socio-economic status and health in less-developed countries.

A particularly wide gap exists in our knowledge about the relationship between socio-economic status and health in former Soviet countries. The transition to democracies and market economies after the collapse of the Soviet Union and the end of the Communist era in these countries may be of particular interest to the international community. Although the relationship between socio-economic status and health is not unique to any country, the extent to which access to social goods that may influence health is controlled by socio-economic status may substantially vary across countries. The social determinants of health represent the environment in which people are born, grow, live, and work; they also include the health systems that

they are using (Stringhini et al., 2011). These conditions might be influenced by the ways that money, power, and resources are distributed in a society, and might be shaped by policy choices in a country (Stringhini et al., 2011). Differences in the strength and shape of the gradient may be expected for various race/ethnic populations and genders (N. E. Adler & Ostrove, 1999). The association between socio-economic determinants and health has been found in almost all developed countries, although the strength of the association may not be the same (N. E. Adler & Ostrove, 1999). For instance, the gradient has been found to be less pronounced in more egalitarian countries, such as the Scandinavian countries, as compared to more unequal societies (N. E. Adler & Ostrove, 1999).

3.2.Background

3.2.1 The Republic of Armenia

The Republic of Armenia is a small land-locked country located at the cross-roads of Europe, Asia, and the Middle East. Armenia's socio-economic situation significantly deteriorated after the collapse of the Soviet Union and independence in 1991, leading to the destruction of almost all institutions including the health care system (von Schoen-Angerer, 2004). The health of the Armenian population, which had positive measures for indicators such as infant mortality and life expectancy during the Soviet times, began a rapid decline after 1991 (Center for Health Services Research and Development, 2002; Hakobyan et al., 2006; Hovhannisyan, 2004; Torosyan et al., 2008; von Schoen-Angerer, 2004).

Before independence and the transition to a market economy, Armenia was a very equitable society (Tonoyan, 2005). The transition redefined social classes, and led to the

loss of economic and social safety nets and safeguards in all post-Soviet countries (McKee & Fister, 2004). In most of these countries living standards declined sharply ,and the inequality of income and wealth distribution increased substantially following independence (McKee & Fister, 2004; Tonoyan, 2005).

Maternal and child health is particularly sensitive to economic changes in a country (Mendoza & Rees, 2009; Reidpath & Allotey, 2003). Several key maternal and child health indicators have deteriorated following independence (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005; Demirchyan & Thompson, 2008). Despite efforts of the Armenian government that led to substantial improvement in some areas of maternal and child health, including infant mortality rates, the latest available data from the Demographic and Health Surveys in 2000 and 2005 show no improvement, and negative trends in malnutrition indicators (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005).

3.2.2 The Demographic and Health Surveys in Armenia

The Demographic and Health Surveys (DHSs) conducted in Armenia by Macro International in 2000 and 2005 are large-scale studies that raised concern among public health professionals and researchers in Armenia about high rates of child malnutrition. DHS study reports evaluated three indices of nutritional status that generally indicate children's vulnerability to illnesses and survival chances: low height-for-age, known as "stunting," which reflects chronic malnutrition; low weight-for-height, known as "wasting," which reflects acute or recent nutrition deficit; and low weight-for-age, known as "underweight," which reflects either chronic and acute malnutrition (Armenia Demographic and Health Survey 2000; Armenia Demographic and Health Survey 2005).

According to DHS data, 13% of children under 5 were stunted in Armenia in 2000, with 3% severely stunted, and the prevalence in different geographic regions ranging from 8% in Kotayk and Yerevan to 32% in Gegharkunik. The survey also showed that 2% of children were wasted and 3% were underweight, with 11% wasted and 9% underweight in Kotayk. DHS 2005 data showed no improvement in rates of stunting, with the percentage of children who were wasted or underweight rising to 5% percent and 4%, respectively (*Armenia Demographic and Health Survey* 2005).

Malnutrition in children adversely influences brain growth, delays motor, cognitive, and behavioral development, weakens immune systems, and lowers intelligence, while also increasing morbidity and mortality (Martorell, 1999; Mosley & Chen, 1984; Pelletier & Frongillo, 2003; Reyes et al., 2004). Several authors suggest that child malnutrition is a "syndrome of developmental impairment" caused by a complex of factors, including insufficient access to food, poor water and sanitation, inadequate health services, and poor maternal and child health care practices (Martorell, 1999).

3.3.Study Objective

No study has explored relationships between multiple socio-economic and demographic variables and the nutritional status of children in Armenia using nationally representative data. This study examined the association between an index of household wealth and key child nutritional status indicators, including stunting, wasting, and weight-for-age, controlling for characteristics or factors that might affect the relationship, using the DHS data for 2000 and 2005. The research provides unique information about the influence of socio-economic factors on health in the former Soviet region. This information should be of particular interest for those who study global health, as well as

for policy-makers in Armenia and in its region. Findings may help to attract the attention of policy makers to the issue of child malnutrition in Armenia, and serve as an evidence base for interventions that address child malnutrition or take socio-economic factors into account.

3.4.Methods

3.4.1. Conceptual Model

Causes of child malnutrition are complex, ranging from biological and social to environmental factors (Wamani, Nordrehaug, Peterson, Tumwine, & Tylleska, 2006). This study uses the theoretical frameworks developed by Wamani (Wamani et al., 2006) and Hien (Hien & Kam, 2008), which describe the influence of multiple determinants of nutritional status in children. This study modified those conceptual models to explain the influence of multiple factors on children's nutritional status in Armenia.

According to Hien's model, socioeconomic factors may directly or indirectly influence all other risk factors with the exception of sex and age. In their model, socio-economic factors are grouped into distal determinants and include region of residence, ethnicity, mother's education and employment, and family income. Intermediate factors include environment variables (household size, house structure, kind of latrine and source of water) and maternal characteristics such as mother's age at the time of the child's birth, mother's BMI, and number of children. The most proximate factors include weight at birth, child health status (diarrhea), time that breastfeeding was initiated, and duration of exclusive breastfeeding.

The notion that the multiple determinants influencing nutritional status can be grouped into distal, intermediate, and proximate factors is also a basis for the conceptual

model that guides this study, shown in Figure 3.1. The main difference between Hien's model and the model shown in Figure 3.1 is that the latter mainly focuses on socio-economic variables and their interrelationships while controlling for some of the more proximal factors described by Hien (Hien & Kam, 2008). Also, the model shown in Figure 1 includes maternal and paternal education as separate factors. Including these factors separately is useful because although maternal education contributes to the family's socio-economic level, which in turn affects child nutritional status, it is also believed to have an independent effect on child nutritional status (Frost, Forste, & Haas, 2005). In this model socio-economic status includes household wealth, considered to be a more comprehensive measure of economic status of the household than per-capita income, which was used in Hien's model, because it is calculated based on the data on a household's ownership of selected assets, such as televisions and bicycles, materials used for housing construction, and types of water access and sanitation facilities (Rutstain, 2008). Also, type of latrine and source of water, which are included in Hien's model as separate factors, are the components of the household wealth index along with other items measuring the long-term accumulated wealth in a household in the suggested model. Some research suggests that the Wealth Index better represents long-term (permanent) wealth than per-capita income (Rutstein, 2008), and allows measuring the relative economic position of a household in the country (Rutstein, 2008).

3.4.2. Materials and Methods

Data were obtained from the DHS conducted in Armenia in 2000 and 2005. Both DHS surveys were similar in design, and included the same variables, which permits comparison of results from 2000 and 2005. Also, the survey design permits detailed

analysis of the health indicators for the national level, for Yerevan (the capital), and separately for the total of urban and the total of rural areas. Many indicators, including child health and nutritional status, can also be estimated at the regional level. Armenia is divided into 11 administrative/geographical territories, or regions, including the capital Yerevan. The regions are governed by local administrative bodies that are accountable to the Federal Government. A two-stage probabilistic sampling technique was used to select clusters (geographical segments or localities) at the first level and households at the second level.

In 2000, 6,524 households were selected for the sample, of which 6,150 were occupied at the time of fieldwork. Of the occupied households, 97% were successfully interviewed. In these households, 6,685 women were identified as eligible for the individual interviews. Interviews were completed with 96% of eligible women. In 2005, 7,565 households were selected for the sample, of which 7,003 were occupied at the time of fieldwork. Of the occupied households, 96% were successfully interviewed. Out of 6,773 eligible women, interviews were completed with 97%.

All children under age 5 in the surveyed households were eligible for anthropometric measurements in 2005, while in 2000 children of the interviewed mothers were measured. Height was measured standing up for children age two years and above and lying down for children below two years, using specially designed portable measuring boards (Shorr Boards). Weight was measured using electronic Seca scales.

The data for the current study were obtained from the DHS Height & Weight databases for 2000 and 2005, available at the DHS project website (ICF, 2011). The Height & Weight database for 2000 initially contained 1,726 records, while the database

for 2005 contained 1,449 records. Each database was merged with the children's database and household database for the corresponding year. Children with the following characteristics were excluded: 1) no information on age at the time of interview; 2) did not sleep in the household the night before the survey; 3) might have been a household guest at the time of interview. After these exclusions, the databases for 2000 and 2005 were merged, resulting in an analytical dataset representing 3,017 children under age five.

Missing data for anthropometric measures affected 9.7% of the records. To examine the possibility that this missing data might be a source of meaningful bias, a comparison of characteristics of children with missing anthropometric measurements was conducted.

3.4.3. Outcome Variables

The outcome variables of interest in this study included stunting, wasting, and underweight in children under five. Each indicator measures different aspects of malnutrition. Stunting (low height-for-age) is a useful indicator for tracking trends in child malnutrition. Stunting measures the cumulative faltered growth associated with long-term factors, including chronic insufficient daily protein intake (M. de Onis & Blössner, 1997; Wagstaff & Watanabe, 2000). It is also associated with frequent illness (Wagstaff & Watanabe, 2000). Since it is an indicator of past growth failure, stunting is often used for long-term planning of policies and programs in non-emergency situations (Wagstaff & Watanabe, 2000). The worldwide variation of stunting prevalence is significant, with less developed countries having rates of stunting ranging from 5% to 65% (M. de Onis & Blössner, 1997).

The underweight indicator (low weight-for-age) reflects body mass relative to age. Unlike height, weight fluctuates over time and therefore this indicator represents both acute and chronic malnutrition (Wagstaff & Watanabe, 2000). Its composite nature complicates its interpretation. For example, the indicator fails to distinguish between short children of adequate body weight and tall, thin children (M. de Onis & Blössner, 1997). The worldwide variation of low weight-for-age is similar to the stunting indicator (M. de Onis & Blössner, 1997).

Wasting (low weight-for-height) indicates in most cases a recent and severe process of weight loss, often associated with acute starvation or severe disease (M. de Onis & Blössner, 1997). In the absence of severe food shortage, the prevalence of wasting even in developing countries is usually below 5% (M. de Onis & Blössner, 1997).

The common recommendation is to assess and analyze all three indicators (underweight, stunting, and wasting) when possible, to have a complete picture of malnutrition in a population (UN, 2002).

The nutritional indicators for children for this study were calculated based on standard deviations from an international reference population's median, as recommended by the World Health Organization (WHO) in April 2006 (WHO, 2006). Children whose nutritional status measures were two standard deviations below the reference median were regarded as undernourished (stunted, wasted, or underweight). Children whose nutritional status measures were more than three standard deviations below the reference median were considered to be severely undernourished (severely stunted, severely wasted, or severely underweight). Given the small numbers of children

in these categories, severely undernourished and undernourished children were combined into one category for all three indicators.

3.4.4. Independent Variable of Interest

A household wealth index, constructed based on the availability of durable goods and amenities in the household, was used as a measure of socio-economic status. Household assets included in questions for 2000 and 2005 are shown in Table 3.1. The household wealth index was developed by the DHS, by assigning a weight or factor score to each household asset through principal components analysis. The scores were summed by household. Individuals were ranked according to the total score of the household in which they resided. The sample was then divided into population quintiles, five ordered groups with the same number of individuals in each. Each quintile was designated a rank, from one (poorest) to five (wealthiest). The wealth index for 2005 was based on more items than the 2000 wealth index (Table 3.1); it is possible, therefore, that the 2005 index measures household wealth more accurately than the 2000 index, although that is an empirical question that has not been examined in the literature. In addition, the 2005 index contained more items relevant for defining wealth in rural households. The quintiles were constructed similarly in 2000 and 2005; with the two possible exceptions just mentioned, they should therefore be comparable, at least to the extent that they rank each household into 5 quintiles of relative household wealth (Johnson, 2007).

3.4.5. Control Variables

The other socio-economic independent variables were: urban/rural residence (dichotomous); region (categorical); education in years for mothers and fathers (continuous); marital status of mothers (dichotomous); and the work status of mothers

(dichotomous). Intermediate covariates for mothers were: age in years at the time of the child's birth (continuous); mother's body mass index (BMI) categorized as normal (18.5 and over) or undernourished (less than 18.5) (categorical). Additional covariates for children were intermediate and proximal factors discussed earlier in the theoretical model (Figure 1): age in months (continuous), child gender (dichotomous), birth weight in kilos (continuous), and the number of months the child was breastfed (continuous).

3.4.6. Data Analysis

To account for the clustering and to obtain appropriate standard errors, the SPSS 19 Complex Samples add-on module was used. The module accounts for sampling features, including the stratification of the sample by regions and urban/rural areas and the primary sampling units, as well as the clustering of children within households. The data were weighted in each of the databases (2000 and 2005) based on the household weight multiplied by the inverse of the individual response rate of mother's individual response rate group. In DHS datasets the household weight for a particular household is the inverse of its household selection probability multiplied by the inverse of the household response rate of its household response rate group (Rutstein, 2006). Response rate groups are groups of cases for which response rates are calculated. In DHS surveys, response rates are calculated for each sampling domain (Rutstein, 2006). The weights were scaled in the combined database using a method that minimizes the variance of combined survey estimates (Westat, 2001).

Simple frequencies, percentages, means, and standard errors of all variables of interest were calculated using descriptive analysis. Chi-square tests were used for the bivariate analysis. Logistic regression was used for the multivariate analysis.

3.5.Results

3.5.1. Descriptive Characteristics of the Sample

Table 3.2 shows selected characteristics of the sample. As shown in the table, most of the mothers of children under 5 were married (97.3%) and unemployed (82.6%). About 54% of the sample resided in urban areas. The highest percentage of respondents was from Yerevan, the capital, while the lowest percentage was from Vayots Dzor region. Mothers had completed an average of 10.6 years of education. Similarly, the husbands had completed an average of 10.8 years of education. The average age of mothers at the time of the child's birth was 24.6 years. About 5% of mothers had BMI less than 18.5, which is a suggested cut-off point for indicating chronic deficiency in women (pregnant women were excluded from the calculation of BMI category). There were more male than female children in the sample (56% versus 44%). The average age of children was 30 months, and they were breastfed for 8.4 months on average. The average birth weight was 3.2 kilos.

Figure 3.2 shows the mean "household wealth scores" in Armenian regions calculated based on the wealth quintiles. As shown in the figure, Yerevan households have the highest average score (4.12), while the households from Aragatsotn have the lowest (1.72).

Figure 3.3 shows the mean number of education years for mothers and their partners across the wealth quintiles. As shown in the figure, the means were substantially higher in wealthier households.

3.5.2. Bivariate Results

Table 3.3 shows the distribution of children who were stunted, wasted, or

underweight by wealth quintiles. In the combined sample, 17.4% of children were stunted, 3.3% were wasted, and 2.9% were underweight. The highest percentage of children who were stunted (22%) was found in the poorest (first) wealth quintile, while the lowest percentage (14.7%) was found in the richest (fifth quintile). Unexpectedly, the poorer (second) quintile had a smaller proportion of children who were stunted (15.3%) than the middle (third) and richer (fourth) quintiles (17.1% and 17.75, respectively), although the differences among these proportions were not statistically significant (p=0.167). The highest percentage of children who were wasted was recorded in the wealthiest quintile (4.6%), whereas the lowest percentage (2.1%) was in the poorer category. Only five children (1.9%) were underweight in the fifth quintile as compared to 3.7% in the poorest quintile, 3.5% in the middle quintile, and 3.3% in the fourth quintile), although again the differences among these proportions were not statistically significant (p=0.471). As with the stunting and wasting indicators, the proportion of children who were underweight was quite low in the poorer (second) quintile (2.4%) (p=0.545).

Table 3.4 shows the results of unadjusted logistic regression examining associations between the three nutritional status indicators and the wealth index. As shown in the table, the unadjusted odds of stunting were significantly higher for children in the poorest quintile than for children in the richest quintile, the reference category (Odds Ratio, OR 1.63, 95% Confidence Interval, CI 1.04-2.57). The results of the unadjusted regression for the underweight variable were similar to the ones obtained for stunting; however, none of the results were statistically significant.

3.5.3. Multivariate Analysis

The results of adjusted logistic regressions for the three nutritional indicators are

shown in Tables 3.5, 3.6, and 3.7. In the adjusted results for the risk of stunting (Table 3.5), none of the results for the wealth index were statistically significant. In the results for region, children living in Gegharkunik had higher odds of stunting compared to children living in Yerevan (OR 2.23, CI 1.26-3.96). A partner's years of education were associated with significantly lower adjusted odds of stunting in children (OR 0.93, CI 0.88-0.98). Each additional kg of birth weight was associated with 53% lower odds of stunting (OR 0.47, CI 0.35-0.63).

In adjusted results for the risk of wasting, shown in Table 3.6, no statistically significant findings were observed for the wealth index. Two of the results were statistically significant in this model: the child's age in months (OR 0.98, CI 0.96-0.99), and being a resident of Shirak (OR 3.55, CI 1.35-9.34), Vayots Dzor (OR 3.34, CI 1.07-10.43), or Syunik (OR 0.09, CI 0.01-0.74) regions.

Table 3.7 shows adjusted results for the risk of a child being underweight. None of the findings for the wealth indicators were significant. Children from Gegharkunik, Shirak, and Vayots Dzor regions had higher odds of being underweight than children from Yerevan (OR 3.83, CI 1.41-10.40; OR 4.27, CI 1.47-12.41; OR 3.96, CI 1.36-11.54, respectively). Each additional year of a partner's education was associated with 15% lower odds of a child being underweight (OR 0.85, CI 0.76-0.95). For birth weight, every 1 kg increase was associated with more than 70% lower odds of being underweight (OR 0.28, CI 0.17-0.46).

3.5.4. Additional Results for Respondents in the "Poorer" Quintile

For all nutritional indicators, children in the second wealth quintile had better status than children in the middle quintile, and in some cases also better status than

children in the richer quintiles. This finding prompted an additional analysis of the characteristics of respondents in the second quintile. A dummy variable with "poorer" and "all other" categories was created, and included as the outcome variable in a logistic regression model, with the rest of the independent variables as covariates. The analysis revealed that respondents in the second ("poorer") quintile were considerably more likely to be rural residents than others (OR 2.66, CI 1.84-3.83). In addition, children from Aragatsotn, Ararat, Armavir, Gegharkunik, Shirak, and Vayots Dzor were significantly more likely to be included in the "poorer" quintile than children who lived in Yerevan (all $p<0.0001$). Older mothers were also more likely to be included in the second quintile. Figure 3.4 shows the cross-tabulation of the additional created dummy variable with the variable representing residence type. Seventy-four percent of children in the "poorer" quintile lived in rural areas, compared to 25.6% in urban areas ($p<0.001$).

3.5.5. Results of Multicollinearity Analysis

All of the adjusted models showed high overall significance (using the F-test), but few significant odds ratios. To examine whether this result might be associated with substantial multicollinearity among the independent variables in the model, variance inflation factors were calculated. None of the independent variables had inflation factors that would indicate a high degree of multicollinearity, suggesting that the small number of significant results is not an analytical artifact.

3.5.6. Analysis of Missing Data

Children with missing or invalid anthropometric measurements represented 9.7% of the sample. To examine associations between these missing values and other measures in the model, I examined all of the data, including observations with missing values for

the anthropometric measurements, and created a dummy variable indicating whether each observation had missing values for those measurements. A logistic regression, with that variable as the outcome, examined whether the other measures in the model were associated with missingness. As shown in Table 3.8, children with missing or invalid anthropometric measures did not differ significantly from the analytic sample on most characteristics. Children who had fewer months of breastfeeding were less likely to have missing measurements; this also was the case for children living in Armavir, Syunik, and Tavush regions compared to Yerevan. In general, however, missing or invalid anthropometric data did not appear to be systematically associated with other measured characteristics of households, mothers or their partners, or children.

3.6.Discussion

The prevalence of stunting in the combined DHS populations for 2000 and 2005 was 17.4%, using the 2006 WHO standards for child growth (WHO, 2006). The combined prevalence for wasting was 3.3% and for being underweight 2.9%. Thus, the stunting rate found in this study is higher than the prevalence reported either for 2000 (13.0%) or 2005 (13.0%) based on the previous NCHS reference population (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005). Several studies that have compared the new WHO standards with the previous NCHS reference found that average malnutrition is higher when using the latest standards (M. de Onis, Onyango, Borghi, Garza, & Yang, 2006; E. Van de Poel et al., 2008), with elevated stunting rates observed at all stages of childhood.

In results for relationships between wealth quintiles and different forms of malnutrition, there were mixed findings. A substantially larger percentage of children in

the poorest households were affected by stunting or underweight than children in wealthier households. However, none of the results were statistically significant in adjusted models.

An unexpected finding was that children in the second wealth quintile, those who were “poorer” but not the most poor, had lower rates of wasting and underweight than those in most of the higher wealth quintiles. Additional analyses revealed that this “poorer” quintile included a significantly larger percentage of rural families. Families in rural households in the “poorer” quintile may be able to provide adequate nutrition to children from home-grown foods or other local products, and thus have less risk of substantial nutrition disparities. It is also possible that rural households are misclassified as poor or poorer due to a limited ability of the wealth index to define rural household wealth (Rutstain, 2008). The misclassification just described may be the case particularly for 2000 data, as the wealth index for 2000 omitted some of the items that were included in the 2005 index, items that may better define rural poverty and rural wealth in Armenia (i.e., the ownership of farm animals, horse cart, and boat). However, the limited ability of the wealth index to define wealth in rural areas applies to the later versions of the index as well (Johnson, 2007).

The findings also may indicate the limited ability of the wealth index to predict nutritional status of children under 5 in Armenia. The wealth index is a composite measure of the cumulative living standard of a household. It is calculated based on the household’s ownership of selected assets, such as televisions and bicycles, materials used for housing construction, and types of water access and sanitation facilities (Rutstain, 2008). It has been shown to be a good measure of a long-run household wealth in many

countries (Rutstain, 2008). In the DHS, it is assumed that the possession of observable assets, services, and amenities is related to the relative economic position of the household in the country (Rutstain, 2008). However, no studies have shown the effectiveness of the wealth index for predicting health outcomes in Armenia or other post-Soviet countries. These countries may have differing patterns of wealth distribution that are not adequately described by the wealth index. Other measures of socio-economic status might be more valid for these countries, particularly those based on household consumption or spending. Post-Soviet countries are still undergoing a vast socio-economic transition, which might affect the distribution of wealth in these societies. For example, a given household might have "inherited" accumulated household wealth from Soviet times, but lack adequate income to assure adequate child nutrition.

Mothers' employment was not associated with the child nutrition outcome measures. It is often assumed that a mother's employment will increase household income, which may in turn lead to better child nutrition. Also, maternal income is more likely to be controlled by the mother herself, and spent directly to improve children's nutrition (Mekonnen, 2005). The lack of an association between mothers' employment and child nutrition outcomes in Armenia may be related to limitations in reporting employment for women, having husbands as the main economic household providers, and/or having sources of income in the household other than salaries.

The latter is very typical for Armenian families. Many families in Armenia receive support from relatives and friends living and working abroad. This phenomenon is so widespread that economists have emphasized the reliance of the Armenian economy on the influx of remittances from Armenians working abroad (Bertelsmann Stiftung,

2009). This phenomenon also may have contributed to the lack of association between the wealth index and the child nutrition outcomes, again because this unmeasured income, which may not be reflected in the wealth index, can be used to support child nutrition.

In the adjusted models for stunting and underweight, each additional year of education for husbands or partners was associated with lower odds of malnutrition. The findings for education are consistent with other studies (Cochrane, Leslie, & O'Hara, 1982; Semba et al., 2008; Vella et al., 1992). Overall, the educational level of mothers and their husbands or partners in the sample for the present study was quite high, and almost the same (average of 10.6 years for mothers and 10.8 years for husbands or partners). More education for husbands or partners may result in better family living conditions, better nutrition, and other benefits that can positively influence the nutritional status of children in Armenian families.

In the present study, each additional kilogram in the child's birth weight was associated with 53% lower odds of stunting and 72% lower odds of being underweight. This result is consistent with studies that have shown associations between low birth weight and child malnutrition (Christian, 2009; El Taguri et al., 2009; Marins & Almeida, 2002; Varela-Silva, Azcorra, Dickinson, Bogin, & Frisancho, 2009). Studies that have examined this association have found considerably high adjusted odds ratios for stunting and wasting (Christian, 2009). Some authors suggest that the association between low birth weight and under-nutrition is due to inadequate catch-up growth, which normally helps children to gain the necessary weight later in infancy and childhood; the mechanisms of this process are not well-understood (Christian, 2009). In one study, birth

weight and family income were found to be the most notable determinants of under-nutrition for children from birth to 12 months, and also for those age 13 months and older (Marins & Almeida, 2002). The authors noted that many low birth weight children in their sample were not able to recover normal health years after birth; thus, interventions addressing birth weight may be the most important single factor for children's survival and appropriate growth (Marins & Almeida, 2002; WHO, 1986).

No association between child breastfeeding and child nutritional status indicators was observed in this study. This result, however, should be interpreted with caution, since child age in months and the number of breastfeeding months may be correlated, and the model may not adequately adjust for the breastfeeding among different age groups, particularly for the youngest children.

Significant differences in malnutrition measures were observed among the regions of Armenia. The Armenian regions with less favorable nutritional indicators were Gegharkunik (children had higher risk of stunting and underweight), Shirak (children had higher risk of wasting and underweight), and Vayots Dzor (children had higher risk of wasting and underweight). Residents in these three regions have poorer socio-economic status compared to those living in other Armenian regions, particularly in the mountainous zones (IFAD, 2011). Gegharkunik is known for its relatively harsh environmental conditions, which are unfavorable for agriculture, and for having the highest rate of labor migration in the country (Sevoyan & Agadjanian, 2009). Shirak is the region devastated by a massive earthquake in 1988, from which the economy and society have not fully recovered. The present study findings are consistent with research that found significant variations in malnutrition among regions within countries (Hien &

Kam, 2008; Pongou et al., 2006; Zere & McIntyre, 2003). The geographical differences in malnutrition rates might be explained by the underlying socio-economic compositions of the regions, as well as by varying environmental and structural factors (Pongou et al., 2006). Thus, the regional variation in malnutrition rates found in this study shows the importance of examining community and regional socio-economic variables beyond the individual and household factors in studies of childhood malnutrition. It may also support our earlier hypothesis that the wealth index might not be sufficiently sensitive to capture the real socio-economic conditions of the surveyed households in Armenia, especially since the mean "household wealth scores" calculated for regions do not seem to correspond to their actual socio-economic settings.

The major limitation of the study is the relatively small number of wasted and underweight children. There were 89 children who were wasted in the combined sample (2000 and 2005), and 80 who were underweight. Small sample sizes may have limited the statistical power of the analysis.

The findings of this study are based on the analysis of aggregated data for 2000 and 2005 without accounting for the overall changes in the country's socio-economic profile that might have taken place between those years, and which might have affected the socio-economic situation in the households. This potential bias is minimized since all analytic models were adjusted for the study year. In addition, the household wealth index used in this study is based on the goods and commodities present in the household, rather than on direct measures of overall income or salaries, the values of which are more likely to fluctuate between the years.

The wealth index for 2005 included more items than the 2000 index, and also was

better equipped to capture rural wealth. The recalculation of the index for 2000 was not possible since some of the items included in the 2005 index were missing in the 2000 database; thus, the 2000 wealth index might have had lower ability to accurately predict the nutritional status of children in rural areas.

3.7.Implications for Policy, Practice, and Research

It may be useful for future studies on child malnutrition in Armenia and the region to examine children's food consumption patterns. Regardless of household economic status, children's foods of choice may have different nutritional value (Pradhan, 2010), or children may get better nutrition than the rest of the family even under conditions of substantial poverty. Another area for future research suggested by the findings of this study involves examining other socio economic status variables in relation to nutritional status indicators in Armenia and other post-Soviet countries, along with household wealth status.

The child's birth weight had the most significant effect on the nutritional status of children under 5 in Armenia. This finding suggests the usefulness of placing more emphasis on programs designed to improve the nutritional status and health of women during pregnancy to prevent low birth weight and subsequent growth detriment in children.

The geographical inequality in malnutrition rates observed in this study is an alarming finding for policy makers. The likelihood of undernourishment was high in three Armenian regions that are known for their relatively harsh environmental, economic, and social conditions. This study provides information that policy makers can use to develop policies and programs addressing the socio-economic and health gap

between the regions in the country, by targeting populations in the most disadvantaged areas.

Table 3.1. Household assets used for the construction of the Wealth Index (Gwatkin et al., 2007).

Asset variable	DHS 2000	DHS 2005
Electricity	+	+
Radio	+	+
Television*	+	+
Refrigerator	+	+
Washing machine	-	+
Vacuum cleaner	-	+
Computer	-	+
Camera	-	+
Watch	-	+
Bicycle	+	+
Motorcycle, scooter	+	+
Car, truck	+	+
Telephone*	+	+
Source of water	+	+
Type of latrine	+	+
Type of flooring	+	+
Type of cooking fuel	+	+
Agricultural land	+	+
Farm animals	-	+
Horse cart	-	+
Boat	-	+

Table 3.1. (continued)

Bank account	-	+
Household had a vacation	-	+
Number of sleeping rooms	-	+
Number of members per sleeping room	-	+

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

*- In 2000, respondents were asked about telephone and TV in general, while in 2005 the ownership of black and white TV and color TV, as well as cell phones versus land phones were assessed separately. Notes: + = participants were asked about the asset; - = participants were not asked about the asset.

Table 3.2. Selected background characteristics of children under age 5 and their mothers and fathers.

	%/ mean	Weighted n/ Standard Error (SE)
Wealth quintile (%)		1,363
Poorest	21.3	290
Poorer	22.6	308
Middle	17.7	242
Richer	19.1	260
Richest	19.3	263
Marital status (%)		1,355
Married	97.3	1,318
Not married	2.7	37
Employment status (mother) (%)		1,358
Employed	17.4	237
Unemployed	82.6	1,121
Residence (%)		1,363
Urban	53.8	733
Rural	46.2	630
Region (%)		1,363
Aragatsotn	5.8	79

Table 3.2. (continued)

Ararat	10.8	148
Armavir	10.2	139
Gegharkunik	9.3	126
Lori	7.8	106
Kotayk	7.5	102
Shirak	6.6	91
Syunik	3.9	54
Vayots Dzor	1.7	23
Tavush	5.7	77
Yerevan	30.7	419
Child gender (%)		1,363
Female	44.0	600
Male	56.0	763
Mother's BMI category		1,269
Normal	94.7	1,201
Below 18.5 (%)	5.3	68
Mother's education in years (mean)	10.6	SE=0.1
Husband's or Partner's education in years (mean)	10.8	SE=0.1
Mother's age at the time of the child's birth	24.6	SE=0.1
Birth weight (kilos)	3.2	SE=0.0

Table 3.2. (continued)

Child age in months (mean)	29.9	SE=0.4
Breastfeeding in months (mean)	8.4	SE=0.2

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

Table 3.3. Nutritional status of children by wealth quintiles.

	Wealth Quintile, %(n)						
Nutritional status of children	*Poorest (291)*	*Poorer (308)*	*Middle (241)*	*Richer (260)*	*Richest (263)*	*Total (1,363)*	*P-value*
Stunted (≤-2SD)*	22.0 (64)	15.3 (47)	17.1 (41)	17.7 (46)	14.7 (39)	17.4 (237)	0.167
Wasted (≤-2SD)*	3.6 (11)	2.1 (6)	3.6 (9)	3.1 (8)	4.6 (12)	3.3 (46)	0.471
Underweight (≤-2SD)*	3.7 (11)	2.4 (7)	3.5 (8)	3.3 (9)	1.9 (5)	2.9 (40)	0.545

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

* - Minus 2 standard deviations from an international reference population's median (WHO, 2006)

Table 3.4. The likelihood of child stunting, wasting, and underweight according to wealth quintiles: results of unadjusted logistic regression.

Parameter	OR	95% Confidence Interval for OR	
		Lower	Upper
Height for age (stunting)			
Poorest vs highest quintile	1.63	1.04	2.57
Poorer vs highest quintile	1.05	0.65	1.70
Richer vs highest quintile	1.19	0.76	1.87
Richest vs highest quintile	1.24	0.74	2.09
Weight for height (wasting)			
Poorest vs highest quintile	0.79	0.35	1.76
Poorer vs highest quintile	0.45	0.19	1.06
Richer vs highest quintile	0.77	0.33	1.84
Richest vs highest quintile	0.66	0.24	1.80
Weight for age (underweight)			
Poorest vs highest quintile	2.03	0.67	6.18
Poorer vs highest quintile	1.28	0.42	3.97
Richer vs highest quintile	1.89	0.60	5.93
Richest vs highest quintile	1.79	0.53	6.04

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

Table 3.5. The likelihood of child stunting according to wealth quintiles and other maternal and child characteristics: results of adjusted logistic regression.*

Parameter	OR	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintile			
Poorest vs highest quintile	1.03	0.57	1.84
Poorer vs highest quintile	0.67	0.38	1.18
Middle vs highest quintile	0.89	0.54	1.46
Richer vs highest quintile	0.99	0.57	1.73
DHS year 2005 vs 2000	0.75	0.54	1.03
Not married vs married	2.01	0.84	4.84
Unemployed vs employed (mother)	0.95	0.69	1.32
Rural residence vs urban	1.05	0.72	1.53
Regions vs Yerevan			
Aragatsotn	0.78	0.40	1.52
Ararat	1.53	0.85	2.76
Armavir	0.63	0.33	1.21
Gegharkunik	2.23	1.26	3.96
Lori	0.66	0.34	1.28
Kotayk	0.76	0.41	1.39
Shirak	2.01	0.98	4.12
Syunik	0.91	0.52	1.62
Vayots Dzor	0.75	0.32	1.77

Table 3.5. (continued)

Tavush	0.77	0.38	1.57
Mother's education in years	0.93	0.85	1.01
Husband's or partner's education in years	0.93	0.88	0.98
Number of household members	1.02	0.96	1.10
Mother's age at birth	1.00	0.98	1.03
Mother's BMI category, Low vs Normal	0.49	0.23	1.05
Breastfeeding in months	1.02	1.00	1.04
Child age in months	1.01	1.00	1.02
Birth weight in kilos	0.47	0.35	0.63
Female children vs male	0.91	0.70	1.18

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

*- All covariates are included in the table

Table 3.6. The likelihood of child wasting according to wealth quintiles and other maternal and child characteristics: the results of adjusted logistic regression (2005 DHS).*

Parameter	OR	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintile			
Poorest vs highest quintile	1.82	0.60	5.51
Poorer vs highest quintile	0.71	0.25	2.02
Middle vs highest quintile	0.67	0.27	1.67
Richer vs highest quintile	0.59	0.19	1.75
DHS year 2005 vs 2000	1.80	0.83	3.92
Not married vs married	1.81	0.45	7.23
Unemployed vs employed (mother)	2.19	0.84	5.73
Rural residence vs urban	0.57	0.25	1.29
Regions vs Yerevan			
Aragatsotn	0.32	0.08	1.37
Ararat	0.19	0.03	1.18
Armavir	0.19	0.03	1.38
Gegharkunik	0.45	0.13	1.55
Lori	0.91	0.33	2.56
Kotayk	2.17	0.68	6.87
Shirak	3.55	1.35	9.34
Syunik	0.09	0.01	0.74

Table 3.6. (continued)

Vayots Dzor	3.34	1.07	10.43
Tavush	0.28	0.06	1.32
Mother's education in years	0.98	0.86	1.11
Husband's or partner's education in years	0.97	0.84	1.12
Number of household members	0.96	0.83	1.10
Mother's age at birth	1.00	0.95	1.05
Mother's BMI category, Low vs Normal	1.22	0.29	5.16
Breastfeeding in months	0.98	0.95	1.02
Child age in months	0.98	0.96	0.99
Birth weight in kilos	0.84	0.48	1.47
Female children vs male	0.96	0.56	1.65

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

*- All covariates are included in the table

Table 3.7. The likelihood of a child being underweight according to wealth quintiles and other maternal and child characteristics: results of adjusted logistic regression*

Parameter	OR	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintile			
Poorest vs highest quintile	1.35	0.37	4.97
Poorer vs highest quintile	0.79	0.27	2.31
Middle vs highest quintile	1.11	0.37	3.34
Richer vs highest quintile	1.42	0.42	4.82
DHS year 2005 vs 2000	0.84	0.44	1.59
Not married vs married	0.85	0.20	3.53
Unemployed vs employed (mother)	1.30	0.56	3.04
Rural residence vs urban	0.75	0.36	1.56
Regions vs Yerevan			
Aragatsotn	0.41	0.08	2.23
Ararat	1.87	0.57	6.14
Armavir	0.65	0.17	2.52
Gegharkunik	3.83	1.41	10.40
Lori	0.97	0.26	3.63
Kotayk	2.34	0.80	6.86
Shirak	4.27	1.47	12.41
Syunik	1.35	0.39	4.70
Vayots Dzor	3.96	1.36	11.54

Table 3.7. (continued)

Tavush	1.27	0.35	4.58
Mother's education in years	0.93	0.79	1.09
Husband's or partner's education in years	0.85	0.76	0.95
Number of household members	1.03	0.91	1.16
Mother's age at birth	1.02	0.97	1.08
Mother's BMI category, Low vs Normal	0.59	0.17	2.06
Breastfeeding in months	1.01	0.97	1.05
Child age in months	0.98	0.96	1.00
Birth weight in kilos	0.28	0.17	0.46
Female children vs male	1.01	0.57	1.80

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

*- All covariates are included in the table

Table 3.8. The likelihood of having missing anthropometric measurements according to wealth quintiles and other maternal and child characteristics: results of adjusted logistic regression for missing data.*

Parameter	OR	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintile			
Poorest vs highest quintile	1.13	0.49	2.57
Poorer vs highest quintile	1.23	0.57	2.65
Middle vs highest quintile	1.48	0.80	2.72
Richer vs highest quintile	0.99	0.54	1.82
DHS year 2005 vs 2000	2.18	1.31	3.63
Not married vs married	0.34	0.05	2.25
Unemployed vs employed (mother)	0.95	0.55	1.63
Rural residence vs urban	0.72	0.41	1.28
Regions vs Yerevan			
Aragatsotn vs Yerevan	0.94	0.43	2.05
Ararat vs Yerevan	0.88	0.40	1.94
Armavir vs Yerevan	0.37	0.16	0.86
Gegharkunik vs Yerevan	0.44	0.15	1.27
Lori vs Yerevan	0.49	0.19	1.32
Kotayk vs Yerevan	0.52	0.23	1.21
Shirak vs Yerevan	1.04	0.42	2.55
Syunik vs Yerevan	0.44	0.20	0.99

Table 3.8. (continued)

Vayots Dzor vs Yerevan	1.13	0.50	2.59
Tavush vs Yerevan	0.31	0.10	0.92
Mother's education in years	0.99	0.91	1.09
Husband's or partner's education in years	1.03	0.94	1.13
Number of household members	0.91	0.81	1.02
Mother's age at birth	1.00	0.96	1.04
Mother's BMI category, Low vs Normal	1.42	0.65	3.08
Breastfeeding in months	0.97	0.94	0.99
Child age in months	1.00	0.99	1.01
Birth weight in kilos	1.03	0.72	1.45
Female children vs male	0.68	0.46	1.00

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

*- All covariates are included in the table

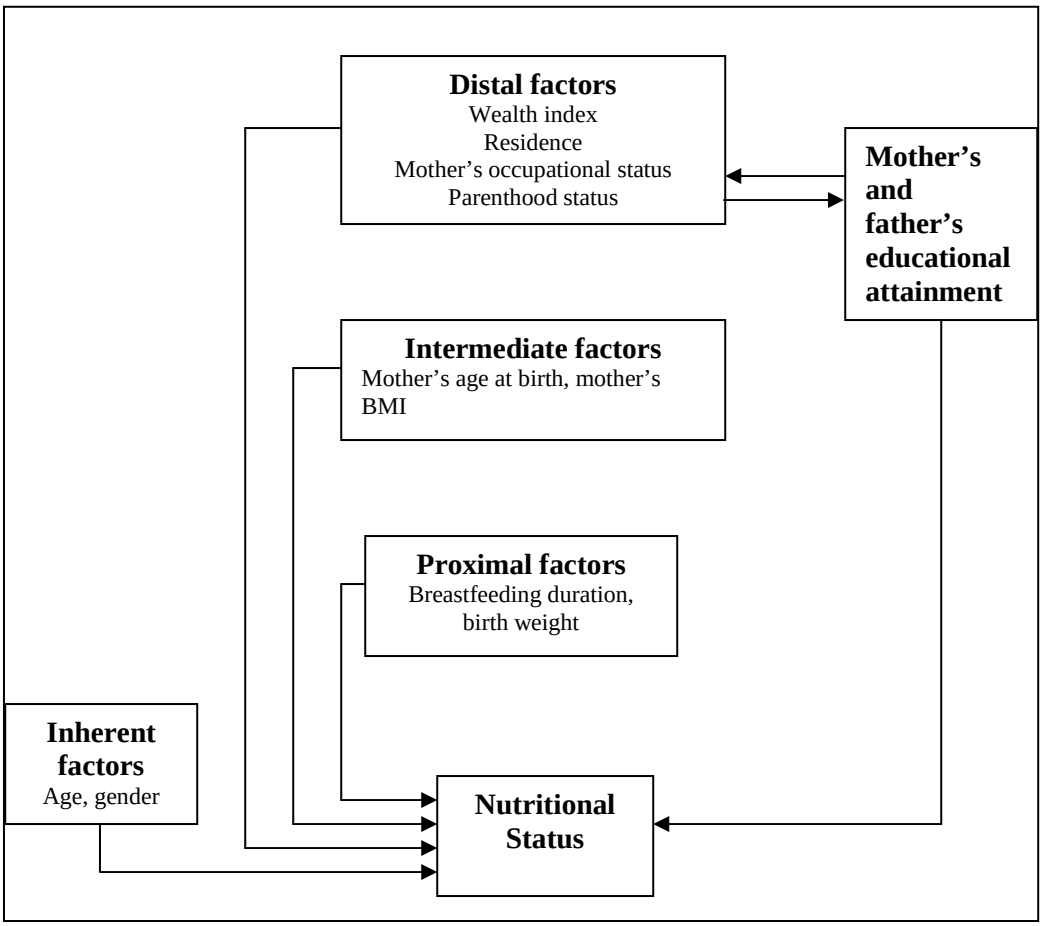

Figure 3.1. Conceptual framework of determinants of nutritional status.*

*- Adapted from the conceptual model by Hien (Hien & Kam, 2008)

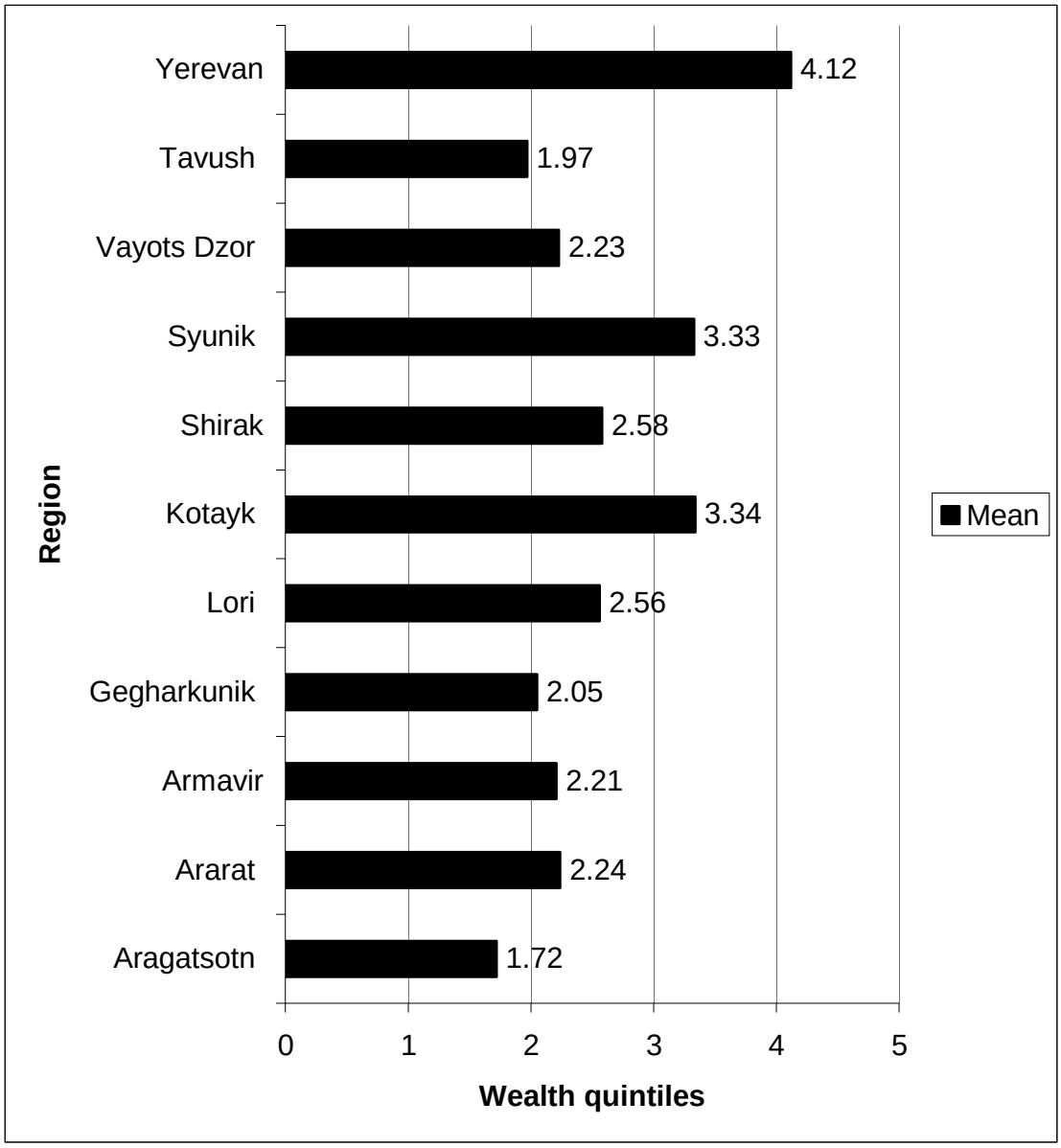

Figure 3.2. Mean quintile score by region (DHS 2000 and 2005).

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

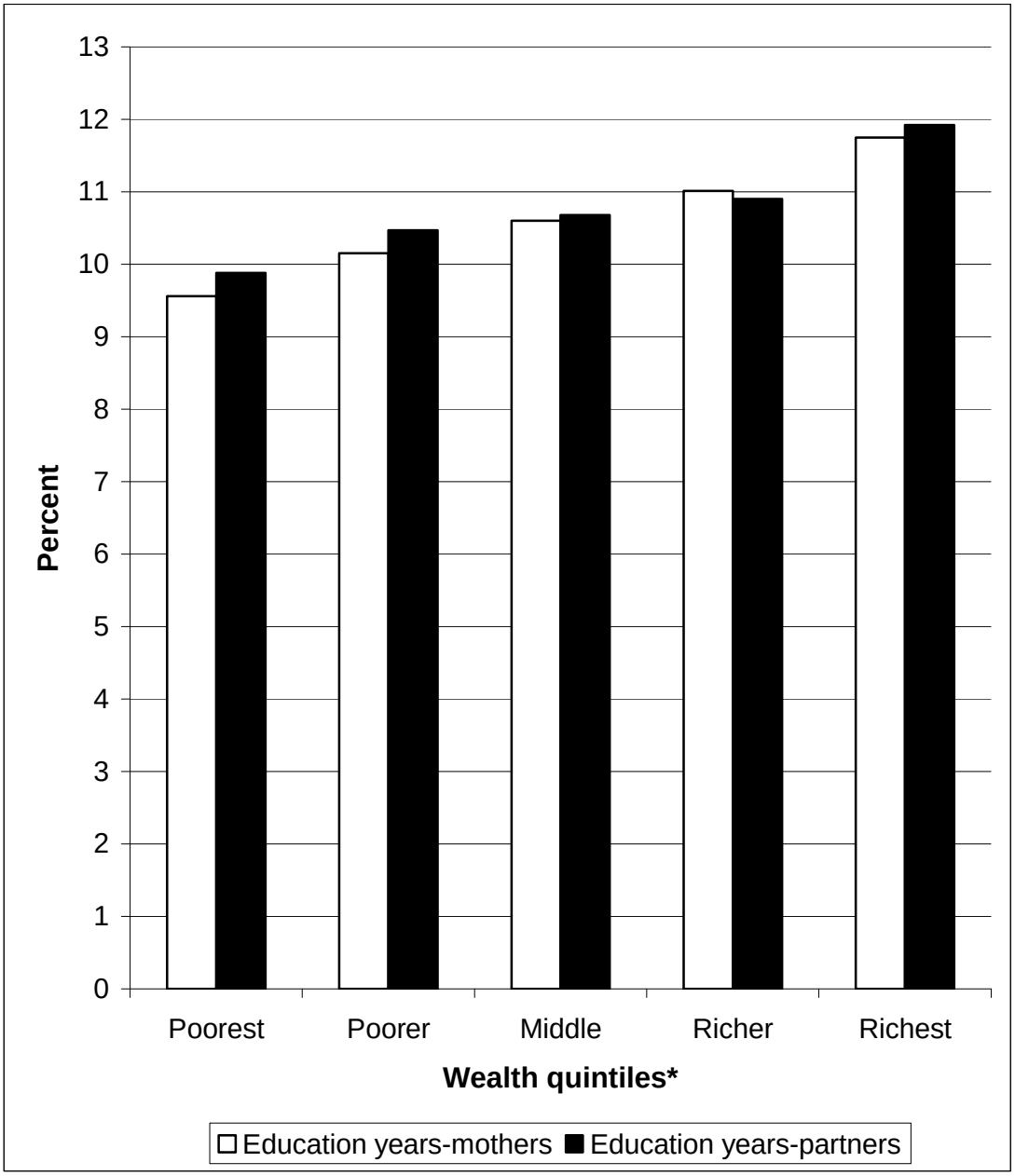

Figure 3.3. Mean number of education years by wealth quintile for mothers and partners (DHS 2000 and 2005).

* - The differences are statistically significant for mothers and partners, $p<0.05$

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

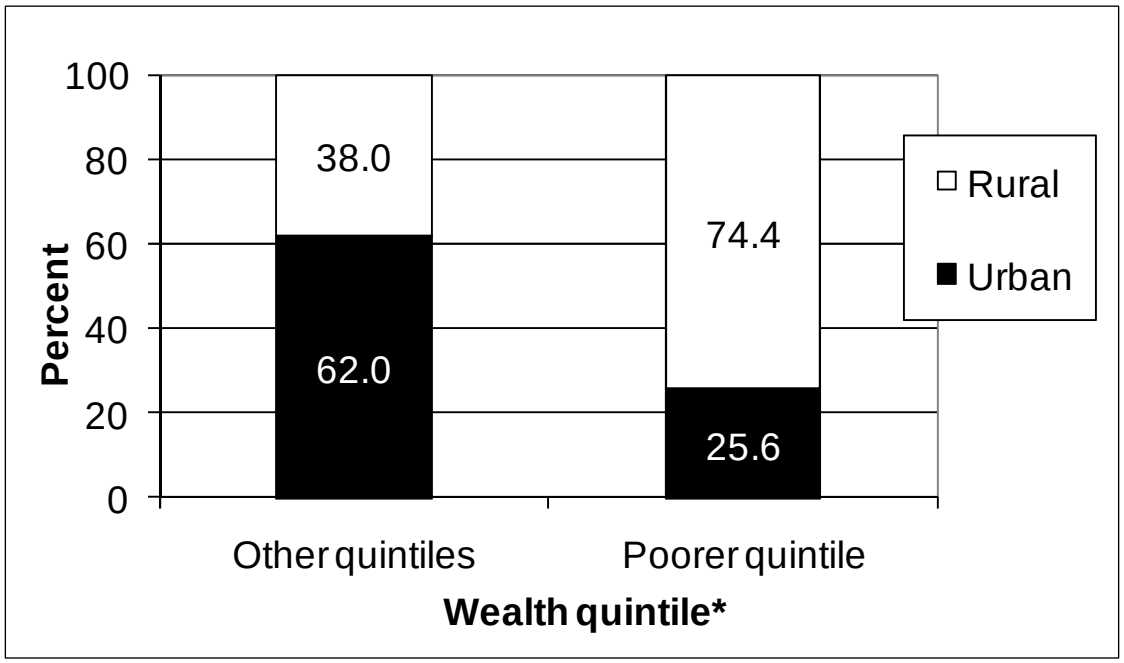

Figure 3.4. Type of residence by wealth quintile.

*- The difference is statistically significant, $p<0.05$

Data Source: Demographic and Health Survey, Armenia, 2000 and 2005.

CHAPTER FOUR: AN INDEX OF WEALTH AND SUBJECTIVE SOCIO-ECONOMIC STATUS INDICATORS AS PREDICTORS OF UNDERNUTRITION IN CHILDREN UNDER 5 IN ARMENIA

4.1 Introduction

The socio-economic gradient in health in the developed world is well-documented (Marmot & Wilkinson, 2006). Information about the relationship between socio-economic status and health in developing countries and countries in transition is less comprehensive. The relationship between socio-economic status and health is not unique to any country. However, the extent to which access to social goods that may influence health affects socio-economic status may vary substantially across countries. For instance, the gradient is less pronounced in more egalitarian countries, such as the Scandinavian countries compared to more unequal societies (N. E. Adler & Ostrove, 1999).

A particularly wide gap exists in our knowledge about the relationship between socio-economic status and health in former Soviet countries. These formerly Communist countries experienced dramatic socio-economic changes after the collapse of the Soviet Union, with the transition to democracies and market economies (Bobak & Marmot, 2009; McKee & Fister, 2004). Thus, the socio-economic gradient in health in these countries should be of interest to researchers, public health practitioners, and policy makers.

4.2 Background

4.2.1. The Republic of Armenia

The Republic of Armenia is a small land-locked country located at the cross-roads of Europe, Asia, and the Middle East. Armenia's socio-economic situation significantly deteriorated after the collapse of the Soviet Union and independence in 1991, leading to the destruction of almost all institutions including the health care system (von Schoen-Angerer, 2004). The health of the Armenian population, which had positive measures for indicators such as infant mortality and life expectancy during the Soviet times, began a rapid decline after 1991 (Center for Health Services Research and Development, 2002; Hakobyan et al., 2006; Hovhannisyan, 2004; Torosyan et al., 2008; von Schoen-Angerer, 2004).

Before independence and the transition to a market economy, Armenia was a very equitable society (Tonoyan, 2005). The transition redefined social classes, and led to the loss of economic and social safety nets and safeguards in all post-Soviet countries (McKee & Fister, 2004). In most of these countries there was a sharp decline in living standards and a substantial increase in the inequality of income and wealth distribution following independence (McKee & Fister, 2004; Tonoyan, 2005).

Maternal and child health is particularly sensitive to economic changes in a country (Mendoza & Rees, 2009; Reidpath & Allotey, 2003). Several key maternal and child health indicators have deteriorated in Armenia following independence (*Armenia Demographic and Health Survey* 2000; *Armenia Demographic and Health Survey* 2005; Demirchyan & Thompson, 2008). However, few attempts have been made to examine associations between economic inequality and maternal and child health or other

population health outcomes in Armenia, or changes in the level of inequality, that might have resulted from changes in the national economy and social structure of Armenian society. One such study explored determinants of poor self-rated health among adult women during a period of socio-economic transition in Armenia (Demirchyan & Thompson, 2008). The study suggested that a reduction in material deprivation as well as better educational status strongly predicted improved self-rated health. However, that analysis was limited to data representing women in only one of the eleven Armenian regions.

Another relevant study, based on the 2000 and 2005 Demographic and Health Surveys, was published as an Armenia Trend Report by Macro International in 2007 (Johnson, 2007). The report examined trends in economic disparities in Armenia between 2000 and 2005, and associations between these trends and selected demographic and health indicators. However, most of the child health outcomes assessed in the DHS 2000 and 2005 were not included in the Trend Report analysis.

4.2.2. The Demographic and Health Surveys in Armenia

The Demographic and Health Surveys (DHSs) conducted in Armenia by Macro International in 2000 and 2005 are large-scale studies that raised concern among public health professionals and researchers about high rates of child malnutrition. DHS study reports evaluated three indices of nutritional status that generally indicate children's vulnerability to illnesses and survival chances: low height-for-age, known as "stunting," which reflects chronic malnutrition; low weight-for-height, known as "wasting," which reflects acute or recent nutrition deficit; and low weight-for-age, known as "underweight," which can indicate either chronic or acute malnutrition (Armenia

Demographic and Health Survey 2000; Armenia Demographic and Health Survey 2005). According to DHS data, 13% of children under age 5 were stunted in Armenia in 2000, with 3% severely stunted, and the prevalence in different geographic regions ranging from 8% in Kotayk and Yerevan to 32% in Gegharkunik. The survey also showed that 2% of children were wasted and 3% were underweight; in the Kotayk region, where the rates of undernutrition were particularly high, 11% were wasted and 9% were underweight. DHS 2005 data showed that the percentage of children who were wasted or underweight rose to 5% percent and 4%, respectively, with no improvement in the rate of stunting (*Armenia Demographic and Health Survey* 2005).

Malnutrition in children adversely influences brain growth, delays motor, cognitive, and behavioral development, weakens the immune system, and lowers intelligence, while also increasing morbidity and mortality (Martorell, 1999; Mosley & Chen, 1984; Pelletier & Frongillo, 2003; Reyes et al., 2004). Several authors suggest that child malnutrition is a "syndrome of developmental impairment" caused by a complex of factors, including insufficient access to food, poor water and sanitation, inadequate health services, and poor maternal and child health care (Martorell, 1999).

4.2.3. The Effect of Socio-Economic Status (SES)

Socio-Economic Status (SES) is of interest to those who study children's health and development, based on the notion that high SES families provide their children with the services, goods, parental care, and social network that benefit children, whereas lower SES families cannot afford those resources (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997). The influence of SES on children's development has been widely studied. There is evidence of wide variability in children's experience in every SES level,

as well as evidence that the link between SES and child well-being depends on many factors including geography, culture, and immigration status (Bradley & Corwyn, 2002). Several authors stress the importance of multiple environmental and socio-economic factors that are more distal determinants of malnutrition and morbidity/mortality in children (Mosley & Chen, 1984; Pongou et al., 2006). They also suggest studying the influence of socio-economic factors on several levels, including the individual, household, and community levels (Pongou et al., 2006).

Several authors conclude there is no agreement on what SES represents (Bradley & Corwyn, 2002; Liberatos et al., 1988). SES is often interpreted broadly as an individual's or household's position in society, which can be shaped by educational attainment, prestige, career, wealth, or another indicator of "social standing" (Lindelow, 2006). There are many proxies for SES described in the literature, each of them differently related to health outcomes through different etiological pathways (Butterfield et al., 2010). Many different measures of SES have been studied, including social (or occupational) class, level of education, income, dwelling size, consumption, and the availability of goods and amenities in the household represented by a "wealth" index (Wagstaff & Watanabe, 2003).

Some authors have found no significant difference in the magnitude of socioeconomic health inequalities among children when SES is measured by consumption or wealth (Wagstaff & Watanabe, 2003). Others conclude that using alternative indices, which are constructed based on household assets (and therefore are considered to be measures of wealth), may result in a different size of inequalities in mortality rates for children under age 5 in developing countries (Houweling, Kunst, &

Mackenbach, 2003). Many authors suggest that SES measures should be outcome- and population-specific, and applied on specific conceptual grounds (Braveman, Cubbin, Marchi, Egerter, & Chavez, 2001). A substantial body of research exists on objective measures of socio-economic position in low-income countries, such as income, education level, occupation, and indices of wealth (Howe et al., 2010). Studies using subjective SES indicators are less common. Subjective measures are assessments of the socio-economic status of respondents based on their own perceptions. For example, asking respondents about the amount of their expenditures or earnings per month is an objective assessment, whereas asking them whether their income is sufficient to meet their needs is a subjective measure (Howe et al., 2010).

The most common types of subjective measurements include Economic Ladder questions, where respondents are asked to rate their socio-economic position relative to the richest and the poorest members of the society (Howe et al., 2010; Singh-Manoux et al., 2005), measures of perceived consumption adequacy, and questions about whether income is sufficient to meet the household's needs (Howe et al., 2010). Subjective welfare is known to be influenced by transient and fixed idiosyncratic factors, such as aspects of temperament, short lived peaks of happiness, and recent experiences (Ravallion & Lokshin, 1999).

Various subjective measures of SES have been shown to be good predictors of health indicators in the recent studies (N. E. Adler et al., 2000; Howe et al., 2010; Operario et al., 2004; Singh-Manoux et al., 2005). Several studies have shown the subjective indicators to be even better predictors of health than comprehensive, composite objective measures of SES (Singh-Manoux et al., 2005). Growing evidence,

mainly coming from developed countries suggests relationships between subjective socio-economic status and a number of health outcomes, such as poor self-rated health, higher mortality, depression, cardiovascular risk, diabetes, and respiratory illness (MacArthur & MacArthur, 2007). No studies have compared objective and subjective socio-economic status measures in terms of the magnitude of their association with the nutritional status of children under age 5 in the former Soviet region, and the ability of these SES indicators to predict child nutritional status.

4.3 Study Objective

The present study explored and compared the relationships of an objective indicator of SES (the Wealth Index) and subjective measures of SES with child nutritional status in Armenia using data from Armenia Demographic and Health Survey 2005. The study supplies unique information about the socio-economic gradient in health in the former Soviet region. Findings can help to identify measures of the gradient that are most relevant for that region. This information should be of interest to researchers studying child health in developing countries, and to those who examine approaches for measuring socio-economic status in relation to population health. Results may help researchers to utilize more adequate and comprehensive measures of SES, with implications for policy and practice.

4.4 Methods

4.4.1. Materials and methods

Data were obtained from the DHS conducted in Armenia in 2005. The survey design permits detailed analysis of health indicators for the national level, for Yerevan (the capital), and separately for the total of all urban areas and the total of all rural areas.

Many indicators, including child health and nutritional status, also can be estimated at the regional level. Armenia is divided into 11 administrative/geographical territories, or regions, including the capital Yerevan. The regions are governed by local administrative bodies that are accountable to the Federal Government. A two-stage probabilistic sampling technique was used to select clusters at the first level and households at the second level.

In 2005, 7,565 households were selected for the sample, of which 7,003 were occupied at the time of fieldwork. Of the occupied households, 96% were successfully interviewed. Out of 6,773 eligible women, interviews were completed with 97%. All children under age 5 in the surveyed households were eligible for anthropometric measurements. Height was measured standing for children age two years and above and lying down for children below two years, using specially designed portable measuring boards, known as Shorr Boards. Weight was measured using electronic Seca scales.

The data for the current study were obtained from the DHS Height & Weight databases for 2005, available at the DHS project website (ICF, 2011). The Height & Weight database for 2005 contained 1,449 records. The database was merged with the 2005 children's database and household database. Children with the following characteristics were excluded: 1) no information on the age at the time of interview; 2) did not sleep in the household the night before the survey; 3) might have been a household guest at the time of interview (i.e., if the value of the variable representing "number of children under 5 in the household" was zero). After these exclusions, the resulting analytical dataset contained 1,400 children under age five.

4.4.2. Outcome Variables

The outcome variable of interest in this study was undernutrition. Undernutrition was identified as stunting, wasting, or underweight in children under age 5. Each indicator measures different aspects of malnutrition. Stunting (low height-for-age) is a useful indicator for tracking trends in child malnutrition. Stunting measures the cumulative faltered growth associated with long-term factors, including chronic insufficient daily protein intake (M. de Onis & Blössner, 1997; Wagstaff & Watanabe, 2000). Stunting is also associated with frequent illness (Wagstaff & Watanabe, 2000). As stunting is an indicator of past growth failure, it is often used for long-term planning of policies and programs in non-emergency situations (Wagstaff & Watanabe, 2000). The worldwide variation of stunting prevalence is substantial, with less developed countries having rates of stunting ranging from 5% to 65% (M. de Onis & Blössner, 1997).

The underweight indicator (low weight-for-age) reflects body mass relative to age. Unlike height, weight fluctuates over time and therefore this indicator represents both acute and chronic malnutrition (Wagstaff & Watanabe, 2000). Its composite nature complicates its interpretation. For example, the indicator fails to distinguish between short children of adequate body weight and tall, thin children (M. de Onis & Blössner, 1997). The worldwide variation of low weight-for-age is similar to that of the stunting indicator (M. de Onis & Blössner, 1997).

Wasting (low weight-for-height) indicates in most cases a recent and severe process of weight loss, often associated with acute starvation or severe disease (M. de Onis & Blössner, 1997). In the absence of severe food shortage, the prevalence of

wasting even in developing countries is usually below 5% (M. de Onis & Blössner, 1997).

The nutritional indicators for children for this study were calculated based on standard deviations from an international reference population's median, as recommended by the World Health Organization (WHO) in April 2006 (WHO, 2006). Children whose measurements were two standard deviations below the reference median for stunting, wasting, or underweight were considered to be undernourished. Children whose measurements were more than three standard deviations below the reference median – children who were severely stunted, severely wasted, or severely underweight – were considered to be severely undernourished.

The common recommendation is to assess/analyze all three indicators (underweight, stunting, and wasting) when possible, to have a complete picture of malnutrition in a population (UN, 2002). Given the small numbers of undernourished children, severely undernourished and undernourished children were combined into one category for all three indicators of interest. The indicators were then grouped into a dichotomous "undernutrition" indicator, where the presence of any of the three malnutrition outcomes was taken to indicate that the child was "undernourished."

4.4.3. Independent Variables

A household Wealth Index, constructed based on the availability of durable goods and amenities in the household (Table 4.1), was used as a measure of socio-economic status. The Wealth Index was developed by the DHS, by assigning a weight or factor score to each household asset through principal components analysis. The scores were summed by household. Individuals were ranked according to the total score of the

household in which they resided. The sample was then divided into population quintiles—five ordered groups with the same number of individuals in each. Each quintile was designated a rank, from one (poorest) to five (wealthiest).

Three measures of subjective SES were used: 1) perceived income sufficiency, 2) perceived ability of the household to make ends meet, and 3) satisfaction with living space. The perceived income sufficiency question asked whether the respondent/household had enough money to meet needs. It included 5 response categories: “not at all,” “a little,” “moderately,” “mostly,” and “completely.” Based on an analysis of the frequency distribution of responses, perceived income sufficiency was recoded into 3 categories for the multivariate analysis: “not at all/a little,” “moderately,” and “mostly/completely.” The second measure asked about the ability of each household to make ends meet, with response categories: “great difficulty,” “some difficulty,” “a little difficulty,” “fairly easy,” “easy,” and “very easy.” Again based on an analysis of the frequency distribution of responses, this variable was recoded into 3 response categories for the multivariate analysis: “great difficulty/some difficulty,” “a little difficulty/fairly easy,” and “easy/very easy.” The third subjective measure asked respondents about their satisfaction with living space, with response categories: “very dissatisfied,” “dissatisfied,” “neither satisfied nor dissatisfied,” “satisfied,” and “very satisfied.” Again based on an analysis of the frequency distribution of responses, for the purposes of regression analysis the responses were grouped into “very dissatisfied/dissatisfied,” “neither satisfied nor dissatisfied,” and “satisfied/very satisfied.” For the crosstabulation of subjective measures with Wealth Index, the original 5-item scales were used for “having enough money to meet needs” and “satisfaction with living space” variables,

while the original 6-item scale for “making ends meet” variable was recoded into 5-item scale by grouping the two middle categories into one.

A secondary objective was to examine the association of undernutrition with four other variables related to socio-economic status: urban/rural residence (dichotomous); region (categorical); education in years for mothers and fathers (continuous), and the employment status of mothers (dichotomous).

4.4.4. Control Variables

Estimates of the associations between SES measures and undernutrition in children in all models were adjusted for mother’s age in years at the time of the child’s birth (continuous), and mother’s body mass index (BMI) categorized as normal (18.5 and over) or undernourished (less than 18.5) (categorical). Additional covariates for children included age in months (continuous), child gender (dichotomous), birth weight in kilos (continuous), and the number of months the child was breastfed (continuous).

4.4.5. Data analysis

Simple frequencies, percentages, means, and standard errors of all variables of interest were calculated using descriptive analysis. To compare the classification of households according to the objective and subjective SES measures, cross-tabulations were used, and the Kappa statistic was calculated. Unadjusted logistic regression was used for the bivariate analysis.

The Wealth Index and three subjective SES indices were entered into separate unadjusted and adjusted multivariate regression models and compared according to their performance based on global Wald F tests, and pseudo-R^2 indices.

To account for data clustering created by the sampling design, and to obtain

appropriate standard errors, the SPSS 19 Complex Samples add-on module was used. The module accounts for sampling features, including the stratification of the sample by the regions and urban/rural areas and the primary sampling units, as well as the clustering of children within households. The data were weighted based on the household weight multiplied by the inverse of the individual response rate of mother's individual response rate group. The household weight for a particular household is the inverse of its household selection probability multiplied by the inverse of the household response rate of its household response rate group (Rutstein, 2006). Response rate groups are groups of cases for which response rates are calculated. In DHS surveys, response rates are calculated for each sampling domain (Rutstein, 2006).

4.5 Results

4.5.1. Descriptive Characteristics of the Sample

Table 4.2 presents selected characteristics of the sample. As shown in the table, most of the mothers of children under 5 were married (97.2%) and unemployed (86.8%). Fifty-eight percent of the sample resided in urban areas. The respondents from Yerevan constituted the highest percentage of the sample (33.8%), while the respondents from Vayots Dzor constituted the lowest percentage (1.2%). Mothers and their husbands or partners had each completed an average of 9.3 years of education. The average age of mothers at the time of the child's birth was 24.8 years. Only 5.6% of mothers had BMI less than 18.5, which is a suggested cut-off point for indicating chronic nutritional deficiency in women (pregnant women were excluded from the calculation of BMI category, and were therefore also excluded from this analysis). The sample contained more male than female children (54% versus 46%). The average age of children was 28

months, and they were breastfed for 9.2 months on average. The average birth weight was 3.2 kilos.

About 41% of the mothers reported having moderately enough money to meet their needs, the highest percentage in the sample. The lowest proportions of respondents responded “completely” (1.4%) or “mostly” (6.1%). The majority of respondents reported “great difficulty” or “some difficulty” making ends meet in their households (69.6%). The “very easy” and “easy” response categories were chosen by 0.7% and 3.3% of respondents, respectively.

Approximately 18% of the children in the sample were stunted, 4.9% were wasted, and 3.9% were underweight. The “undernourished” category, which included children with any of these outcomes, was 22.8% of the sample.

4.5.2. Bivariate Results

Table 4.3 shows the cross-tabulation of the Wealth Index with each of the subjective measures, and the results of corresponding Kappa tests. Cohen's Kappa statistic is used to quantify the agreement between two methods of classification for categorical variables (Cook, 2005; Lowry, 2011; Viera & Garrett, 2005). A Kappa of 1 indicates perfect agreement, whereas a Kappa of 0 indicates agreement equivalent to chance. For ordinal variables, the use of either linearly or quadratically weighted Kappa, which takes into account relative concordance, is commonly recommended, with the weightings determined by the imputed relative distances between successive ordinal categories (Lowry, 2011). For the purposes of the current analysis, the imputed distances between successive categories in the measures of SES were assumed to be equal and linear. All subjective SES indicators showed very little agreement with the Wealth Index

(Table 4.3). Less than 28% of the respondents were in the same category for the Wealth Index and any of the subjective SES measures. Less than 27% of the respondents were in the same category, about 42% of the respondents were misclassified into the adjacent cell, 26% were shifted by two cells, and 6% were shifted by three cells in "having enough money to meet needs" and Wealth Index cross-tabulation (Kappa=0.058, Kappa with linear weighting =0.162). In the cross-tabulation of "making ends meet in the household" and the Wealth Index variables, 22.7% of the respondents fell in the same cell, while 37.6% were misclassified into the adjacent category. For the same cross-tabulation, 26.8% moved 2 cells, and 10.8% moved three cells (Kappa=0.021, Kappa with linear weighting = 0.120). Similar percentages were obtained for the cross-tabulation of the satisfaction with living space variable and Wealth Index, with a slightly higher percentage of respondents correctly classified (27.4%), and most of the other respondents misclassified into the adjacent cell (48.2%), or moved two cells (26.8%) (Kappa=0.079, Kappa with linear weighting = 0.237). The proportion of respondents shifted by 4 cells was quite low (2.0% for the having enough money to meet needs variable, and 0.2% for the other two subjective indicators).

The bivariate cross-tabulations of each of the three subjective measures of SES with the others showed somewhat higher agreement, with the highest Kappa value of 0.18 (Kappa with linear weighting = 0.283) obtained for the cross-tabulation of "having enough money to meet needs" and "making ends meet in the household." The Kappa value for the cross-tabulation of "having enough money to meet needs" and "satisfaction with living space" was 0.10 (Kappa with linear weighting = 0.224), while the Kappa value for the agreement between "making ends meet" and "satisfaction with living space"

was 0.02 (Kappa with linear weighting = 0.126).

Table 4.4 shows the results of unadjusted logistic regression for the Wealth Index and the three subjective SES indicators. As shown in the table, the unadjusted odds of undernutrition were significantly lower for those in the "poorer" quintile compared to those in the richest quintile, the reference category (Odds Ratio, OR 0.45; 95% Confidence Interval, CI 0.21-0.96); the p-value for the Wald's test was 0.013. "Having great difficulty/some difficulty making ends meet" versus "easy/very easy" was associated with more than 3 times higher odds of undernutrition, while "having a little difficulty/fairly easy" was associated with 4 times higher unadjusted odds of undernutrition (OR 3.74, CI 1.03-13.50, and OR 4.03, CI 1.10, 14.78, respectively); the p-value for the Wald's test was 0.109. The remaining findings were not statistically significant.

4.5.3. Multivariate analysis

The results of adjusted logistic regression for the four SES indicators are shown in Tables 4.5, 4.6, 4.7, and 4.8. In the adjusted results using the Wealth Index, shown in Table 4.5, the odds of undernutrition were significantly lower for the "poorer" versus richest quintile (OR 0.33, CI 0.14-0.75). Turning to the results for other socio-economic indicators in the same analysis, unemployed mothers had 2 times higher odds of having undernourished children compared to employed mothers (OR 2.00, CI 1.07-3.74). In the results for region, respondents from Shirak had over three times the odds of child undernutrition than did those from Yerevan (OR 3.10, CI 1.43-6.71). Each additional year of the father's or partner's education was associated with significantly lower adjusted odds of stunting in children (OR 0.91, CI 0.83-0.98). The remaining results for

socio-economic variables were not significant. The Wald F-test was highly significant for the overall model ($p<0.001$), while none of the pseudo-R^2 values exceeded 0.2 (Cox and Snell R^2 0.120, Nagelkerke R^2 0.183, McFadden R^2 0.120).

The adjusted results for "having enough money to meet needs" were not statistically significant (Table 4.6). There was suggestive evidence of higher odds of undernutrition for children of unemployed mothers versus employed mothers (OR 1.92, CI 1.00-3.69). Significant associations were found for region, with respondents from Armavir, Kotayk, and Syunik having lower odds of child undernutrition compared to those from Yerevan (OR 0.34, CI 0.14-0.86; OR 0.42, CI 0.21-0.85; and OR 0.40, CI 0.18-0.86, respectively). Respondents from Shirak had significantly higher odds of undernutrition compared to those from Yerevan (OR 2.34, CI 1.15-4.78). The remaining socio-economic variables were not significantly associated with undernutrition in this model. The p-value corresponding to the Wald F-test for the overall model was significant ($p<0.001$). Cox and Snell R^2 was 0.108, Nagelkerke R^2 was 0.164, and McFadden R^2 was 0.107.

Table 4.7 shows adjusted results for the association between "making ends meet" and undernutrition. There was suggestive evidence of higher odds of child undernutrition for those who reported having "great difficulty/some difficulty" making ends meet, compared to those who said that doing so was "easy/very easy" (OR 3.94, CI 1.00-15.59). Being in the "little difficulty/fairly easy" category was also associated with higher odds of undernutrition (OR 4.67, CI 1.10-19.86). Children of unemployed mothers had significantly higher odds of undernutrition than children of employed mothers (OR 2.05, CI 1.09-3.88). There was suggestive evidence of lower odds of undernutrition associated

with each additional year of the partner's education (OR 0.92, OR 0.85-1.00). Respondents from Armavir, Kotayk, and Syunik had significantly lower odds of undernutrition compared to Yerevan respondents (OR 0.35, CI 0.14-0.88; OR 0.41, CI 0.20-082; and OR 0.38, CI 0.17-0.85, respectively). Respondents from Shirak had higher odds of undernutrition in children compared to respondents from Yerevan (OR 2.22, CI 1.08-4.55). The remaining results for the socio-economic indicators were not significant. As with the previous two models, the p-value corresponding to the Wald F-test for the overall model was highly significant ($p<0.001$). The pseudo R^2 values were higher than the pseudo R^2 values in the model with the "having enough money to meet" needs variable, but slightly lower than in the model using the Wealth Index (Cox and Snell R^2 = 0.113, Nagelkerke R^2 = 0.172, and McFadden R^2 = 0.112).

The "satisfaction with living space" indicator was not significantly associated with child undernutrition in the adjusted analysis (Table 4.8). The mother's being unemployed was associated with significantly higher odds of undernutrition (OR 1.97, CI 1.03-3.76). Similar to the models using the other two subjective SES indicators, respondents from Armavir, Kotayk, and Syunik had significantly lower odds of undernutrition compared to respondents from Yerevan (OR 0.35, CI 0.14-0.88; OR 0.44, CI 0.22-0.88; and OR 0.42, CI 0.19-0.93, respectively). Respondents from Shirak had higher odds of child undernutrition than respondents from Yerevan (OR 2.41, CI 1.17-4.95). A marginally significant association was observed between each additional year of the father's or partner's education and child undernutrition (OR 0.92, OR 0.85-1.00). Other socio-economic variables were not associated with undernutrition. The lowest pseudo R^2 values were recorded for this model, with the Cox and Snell R^2 0.107,

Nagelkerke R^2 0.162, and McFadden R^2 0.105).

4.6 Discussion

This study examined relationships of an objective indicator of SES (the Wealth Index) and subjective indicators of SES with child nutritional status in Armenia, and compared the classification of households into different SES categories according to these indicators. The evidence suggests that the index of wealth used by the DHS may misclassify many households; however, this evidence relies on the assumptions that the subjective SES measures studied in this analysis provide reasonably accurate estimates of wealth, and also that the qualitative definitions of the categories of these variables map meaningfully to corresponding category definitions of the Wealth Index. The extent of the differential classification is substantial; when categorized using both the Wealth Index and the subjective SES measures, fewer than 28% of households were in categories of wealth and SES that corresponded for any one measure. This finding is consistent with results of a study using household survey data representing Malawi (Howe et al., 2010). Howe et al. (2010) also found that the same Wealth Index misclassified many households, again assuming that subjective SES measures provide reasonably accurate estimates of wealth. In another study examining the relationship between subjective and objective measures of economic welfare, based on data from Russia, researchers also found considerable differential classification (Ravallion & Lokshin, 1999).

Available data do not permit firm conclusions about whether the Wealth Index reflects the actual socio-economic status of households in Armenia. However, our findings show that the Wealth Index does not correspond to respondents' views about their economic status. While the Wealth Index mainly focuses on long-term or

accumulated household wealth, subjective measures might be more thorough in capturing certain aspects of social status that are not reflected in the inventory of household goods and assets used to assign the Wealth Index value for each household (Howe et al., 2010). For instance, the Wealth Index might not accurately capture a household's current spending ability; subjective indices of income sufficiency might be better measures of current spending ability, particularly in the absence of objective income and/or expenditure assessments.

However, these results should be interpreted with caution, as it is unclear what the "correct" pattern should be in the cross-tabulation of the above-mentioned subjective measures with Wealth index. The categories are not identical and do not necessarily measure the same concept.

The measure that showed the highest agreement with the Wealth Index (although nonetheless a low level of agreement, with weighted Kappa value approximately 0.3 and only 27.4% classified into the same category) was the satisfaction with living space indicator. This finding is reasonable, given the presence of many items in the index that directly measure living conditions. This indicator includes, for instance, the type of latrine used by the household, type of flooring, the number of sleeping rooms, and the number of household members per sleeping room.

One study finding that is difficult to interpret is the limited agreement among the subjective SES measures. While no particularly high agreement was expected between the satisfaction with living space and the two other measures, as they may capture different aspects of SES, the agreement between "having sufficient income to meet needs" and "making ends meet" in the household had a weighted Kappa value of only

0.3, indicating only poor, slight, or fair agreement, depending on the classification of Kappa adopted.

In the results for unadjusted logistic regression, only the Wealth Index and the "making ends meet" indicator were significantly associated with undernutrition. When measured using the "making ends meet" indicator, having lower SES was associated with higher odds of undernutrition. When measured using the Wealth Index, "poorer" (second quintile) respondents had lower odds of undernutrition than those in the highest category. Additional analyses revealed that this "poorer" quintile included a significantly larger percentage of rural families. Families in rural households in the "poorer" quintile may be able to provide adequate nutrition to children from home-grown foods or other local products, and thus may not face substantial nutrition disparities. It is also possible that rural households are misclassified as poor or poorer due to a limited ability of the Wealth Index to capture rural household wealth (Rutstain, 2008). Since this phenomenon was not observed for any of the subjective measures, it may be assumed that this misclassification is not an issue for the subjective indicators of SES.

In the adjusted analysis, the strongest association was found for households in the "little difficulty/fairly easy" category for "making ends meet," compared to the "easy/very easy" category (OR 4.67, CI 1.10-19.86). Since there was also a marginally significant association between being in the "little difficulty/fairly easy" category and undernutrition, it can be concluded that based on the analysis of odds ratios, the "making ends meet" indicator had the strongest relationship with undernutrition, compared to the other three SES measures examined in this study. The statistically significant association between the "poorer" category of the Wealth Index, and child undernutrition found in

unadjusted analysis persisted in the adjusted results.

The results for having "enough money to meet needs" and satisfaction with living space were not statistically significant in either unadjusted or adjusted analysis. This result suggests that any relationship between these indicators and children's nutritional status may be limited, although it is also possible that this result may be due to limited statistical power.

Regarding the performance of the models, all of the adjusted models were highly significant ($p<0.01$). In the unadjusted models, the lowest p-values for Wald's test were obtained for models with Wealth Index ($p=0.013$) and "making ends meet in the household" indicator ($p=0.109$).

The highest pseudo R^2 indices in adjusted models were produced by the Wealth Index variable, with McFadden R^2 reaching 0.120 for the model with Wealth Index, and 0.112 for the model with "making ends meet" variable. Pseudo R^2 indices in logistic regression cannot be interpreted as a percent of variance explained by the predictors in the model (Shtatland, Kleinman, & Cain, 2002). McFadden's R^2 can be interpreted as a proportional reduction in the minus 2 log likelihood statistic, and is often called the likelihood ratio index. It can be used to estimate the level of improvement over the intercept model by the model with the independent variables included (Hu, Shao, & Palta, 2006; Shtatland et al., 2002). The relatively high McFadden R^2 , provides some evidence that making ends meet indicator may be better suited to predict child undernutrition than the other indicators examined in this study. The evidence is underscored by the theoretical argument that the making ends meet indicator may be a more appropriate measure of a recent socio-economic status than the Wealth Index for understanding child

nutrition outcomes, with less measurement error.

Unemployed mothers had approximately twice the odds of having undernourished children compared to employed mothers in all four models. Employment of the mother may increase household income, which may in turn lead to better nutritional status of the child. Also, maternal income is more likely to be controlled by the mother herself, and spent directly to improve children's nutritional status (Mekonnen, Jones, & Tefera, 2005).

Undernutrition differed significantly among the regions of Armenia. In the models using subjective indicators of SES, households in Armavir, Kotayk, and Syunik had lower odds of child undernutrition compared to those in Yerevan. Households in Shirak had less favorable nutritional status compared to those in Yerevan in all four models. Shirak is the region devastated by a massive earthquake in 1988, from which the economy and society have not fully recovered. Residents in Shirak have poorer socio-economic status compared to those living in most of the other Armenian regions (IFAD, 2011). The geographical differences in malnutrition rates might be explained by the underlying socio-economic compositions of the regions, as well as by varying environmental and structural factors (Pongou et al., 2006).

Each additional year of education for fathers was associated with lower odds of malnutrition in the models using the Wealth Index, "making ends meet" in the household, and satisfaction with living space, although the association was marginally significant in the latter two models. The findings for education are consistent with other studies (Cochrane et al., 1982; Semba et al., 2008; Vella et al., 1992). More education for husbands or partners may result in better family living conditions, better nutrition, and

other benefits that can positively influence the nutritional status of children in Armenian families.

Region, maternal employment, and paternal education were shown to have highly significant associations with undernutrition in almost all of the estimated models using objective and subjective SES measures, and therefore can be assumed to be important independent socio-economic determinants of nutritional outcomes for Armenian children. Policies addressing inequality in child health outcomes should not only target the "economically poor," but also consider those who are disadvantaged in other categories of social capital (Houweling & Kunst, 2010) . Separate social factors may not simply indicate a common underlying construct such as poverty, but may be independent factors; acting together, they may have a cumulative effect on health outcomes in children (Bauman, Silver, & Stein, 2006). Identifying and targeting children who suffer from cumulative disadvantages determined by not one but several of such factors might be particularly useful in Armenia.

The major limitation of the study is the relatively small number of stunted, wasted and underweight children, which necessitated the combination of children with any of the outcomes into an "undernourished" category to increase statistical power. Each of these indicators represents different aspects of malnutrition, and thus might have produced different associations with the SES measures if used separately. On the other hand, grouping them into one category may have helped to identify children with generally unfavorable nutritional conditions, thus enhancing detection of true associations between SES indicators and undernutrition. Even after grouping the malnutrition variables, small sample sizes resulting in some of the cells for bivariate and multivariate analysis may

have limited the statistical power of the analysis.

4.7 Implications for Policy, Practice, and Research

The measurement of SES in former Soviet countries undergoing a vast socio-economic transition can be a challenging task. The common scales validated in more developed, as well as more impoverished countries might be equally inapplicable for these countries given their specific background. Subjective SES measurements help us to understand how SES is perceived and experienced by respondents, and perhaps to capture the aspects of people's socio-economic position in society that objective measures cannot provide. They also might be more "international," more applicable to any setting, since they simply reflect a person's assessment of her or his status in society. The study findings suggest that it would be useful to include a variety of SES measures in health surveys to assess a variety of SES dimensions, and to assess associations of both objective and subjective SES measures with population health outcomes. The inclusion of subjective SES measures is all the more justified given their relative simplicity compared to a Wealth Index, and the limited additional cost associated with data collection.

The results suggest that a particularly useful composite objective SES measure would be country specific, and would include other SES indicators such as employment, education, and perhaps some kind of a regional-level environment/poverty index. The use of an appropriate SES index might be crucial for the correct evaluation of health disparities, and for the development of evidence-based policies to address these disparities in Armenia.

Table 4.1. Household assets used to construct the Wealth Index (Gwatkin et al., 2007).

Asset variable	DHS 2000	DHS 2005
Electricity	+	+
Radio	+	+
Television*	+	+
Refrigerator	+	+
Washing machine	-	+
Vacuum cleaner	-	+
Computer	-	+
Camera	-	+
Watch	-	+
Bicycle	+	+
Motorcycle, scooter	+	+
Car, truck	+	+
Telephone*	+	+
Source of water	+	+
Type of latrine	+	+
Type of flooring	+	+
Type of cooking fuel	+	+
Agricultural land	+	+
Farm animals	-	+
Horse cart	-	+
Boat	-	+

Table 4.1. (continued)

Bank account	-	+
Household had a vacation	-	+
Number of sleeping rooms	-	+
Number of members per sleeping room	-	+

Data Source: Demographic and Health Survey, Armenia, 2005.

* - In 2000 the respondents were asked about telephone and TV in general, while in 2005 the ownership of black and white TV and color TV, as well as cell phones versus land phones were assessed separately.
Notes: + = participants were asked about the asset; - = participants were not asked about the asset.

Table 4.2. Selected characteristics of children under 5, and their mothers and fathers.

	%/ mean	Weighted n/ SE
Wealth quintile (%)		1,255
Poorest	19.9	249
Poorer	20.5	257
Middle	20.2	253
Richer	20.7	260
Richest	18.7	234
Having enough money to meet needs (%)		1,243
Not at all	13.5	167
A little	38.1	474
Moderately	40.9	508
Mostly	6.1	76
Completely	1.4	17
Making ends meet in a household (%)		1,255
Great difficulty	39.0	489
Some difficulty	30.6	384
A little difficulty	17.9	225
Fairly easy	8.5	107
Easy	3.3	41

Table 4.2. (continued)

Very easy	0.7	9
Satisfaction with living space (%)		1,243
Very dissatisfied	5.7	71
Dissatisfied	19.0	236
Neither satisfied nor dissatisfied	30.8	383
Satisfied	41.6	517
Very satisfied	2.9	36
Marital status (%)		1,235
Married	97.2	1,200
Not married	2.8	35
Employment status (%)		1,242
Employed	13.2	164
Unemployed	86.8	1,078
Residence (%)		1,255
Urban	58.0	728
Rural	42.0	527
Region (%)		1,255
Aragatsotn	5.9	74
Ararat	9.1	114

Table 4.2. (continued)

Armavir	9.4	118
Gegharkunik	8.6	107
Lori	7.0	88
Kotayk	8.9	112
Shirak	5.6	71
Syunik	4.8	60
Vayots Dzor	1.2	15
Tavush	5.8	72
Yerevan	33.8	424
Child gender (%)		1,255
Female	45.9	576
Male	54.1	679
Maternal BMI categorical		1,172
Normal	94.4	1,106
Below 18.5 (%)	5.6	66
Education years (mother) (mean)	9.3	0.2
Education years (partner) (mean)	9.3	0.1
Mother’s age at birth	24.8	0.2
Birth weight (kilos)	3.2	0.0
Child age in months (mean)	28.0	0.6

Table 4.2. (continued)

Breastfeeding in months (mean)	9.2	0.3
Stunting (%)		1,255
Normal	81.8	1,027
Stunted	18.2	228
Wasting (%)		1,255
Normal	95.1	1193
Wasted	4.9	62
Underweight (%)		1,255
Normal	96.1	1,206
Underweight	3.9	49
Undernutrition (combined) (%)		1,255
Normal	77.2	968
Undernourished	22.8	286

Data Source: Demographic and Health Survey, Armenia, 2005.

Table 4.3. Percent agreement of subjective SES measures with the Wealth Index.

	Same cell (%)	1 cell shift (%)	2 cell shift (%)	3 cell shift (%)	4 cell shift (%)	Kappa/ Weighted Kappa	SE
Having enough money to meet needs	26.2 (318)	41.7 (507)	25.8 (314)	6.0 (73)	0.2 (2)	0.058*/0.162	0.015
Ability to make ends meet	22.7 (280)	37.6 (463)	26.8 (330)	10.8 (133)	2.0 (26)	0.021/0.120	0.014
Satisfaction with living space	27.4 (333)	48.2 (585)	19.3 (235)	4.9 (60)	0.2 (2)	0.079*/0.237	0.015

* - Kappa statistic is statistically significant

Data Source: Demographic and Health Survey, Armenia, 2005.

Table 4.4. The likelihood of child undernutrition associated with wealth quintiles and subjective SES measures: results of unadjusted logistic regression.

Parameter	Odds Ratio (OR)	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintiles			
Poorest vs highest	1.05	0.52	2.12
Poorer vs highest	0.45	0.21	0.96
Middle vs highest	0.82	0.41	1.62
Richer vs highest	1.17	0.53	2.57
Having enough money to meet needs			
Not at all/little vs mostly/completely	2.19	0.91	5.29
Moderately vs mostly/completely	2.12	0.87	5.17
Making ends meet in the household			
Great difficulty/some difficulty vs easy/very easy	3.74	1.03	13.50
A little difficulty/fairly easy vs easy/very easy	4.03	1.10	14.78
Satisfaction with living space			
Very dissatisfied/dissatisfied vs very satisfied/satisfied	0.97	0.55	1.71
Neither satisfied nor dissatisfied vs very satisfied/satisfied	1.07	0.60	1.90

Data Source: Demographic and Health Survey, Armenia, 2005.

Table 4.5. The likelihood of child undernutrition associated with wealth quintiles and other maternal and child characteristics: results of adjusted logistic regression.*

Parameter	Odds Ratio (OR)	95% Confidence Interval for OR	
		Lower	Upper
Wealth quintile			
Poorest vs highest	0.73	0.31	1.74
Poorer vs highest	0.33	0.14	0.75
Middle vs highest	0.53	0.25	1.15
Richer vs highest	0.68	0.30	1.51
Unemployed vs employed (mother)	2.00	1.07	3.74
Rural residence vs urban	1.01	0.63	1.63
Regions vs Yerevan			
Aragatsotn	0.73	0.28	1.93
Ararat	1.12	0.49	2.59
Armavir	0.43	0.17	1.09
Gegharkunik	1.15	0.51	2.59
Lori	0.81	0.38	1.72
Kotayk	0.53	0.26	1.08
Shirak	3.10	1.43	6.71
Syunik	0.48	0.21	1.08
Vayots Dzor	1.69	0.62	4.62
Tavush	0.57	0.24	1.37
Mother’s education in years	0.93	0.85	1.02

Table 4.5. (continued)

Father's or partner's education in years	0.91	0.83	0.98
Number of household members	0.92	0.81	1.04
Mother's age at the time of child's birth	0.99	0.95	1.03
Low BMI category vs Normal	0.26	0.09	0.77
Breastfeeding in months	1.04	1.01	1.06
Child age in months	0.99	0.98	1.00
Birth weight in kilos	0.46	0.30	0.71
Female children vs male	0.82	0.55	1.23

Model summary: p(Wald F)=0.000, Cox and Snell R^2=0.120, Nagelkerke R^2=0.183, McFadden R^2=0.120

Data Source: Demographic and Health Survey, Armenia, 2005.

*- All covariates are included in the table

Table 4.6. The likelihood of child undernutrition associated with having enough money to meet needs and other maternal and child characteristics: results of adjusted logistic regression.*

Parameter	Odds Ratio (OR)	95% Confidence Interval for OR	
		Lower	Upper
Enough money to meet needs			
Not at all/little vs mostly/completely	1.71	0.67	4.39
Moderately vs mostly/completely	1.54	0.56	4.22
Unemployed vs employed (mother)	1.92	1.00	3.69
Rural residence vs urban	0.99	0.67	1.47
Regions vs Yerevan			
Aragatsotn	0.61	0.22	1.70
Ararat	0.85	0.38	1.89
Armavir	0.34	0.14	0.86
Gegharkunik	0.86	0.37	1.98
Lori	0.61	0.29	1.32
Kotayk	0.42	0.21	0.85
Shirak	2.34	1.15	4.78
Syunik	0.40	0.18	0.86
Vayots Dzor	1.18	0.47	3.00
Tavush	0.45	0.20	0.99
Mother’s education in years	0.93	0.84	1.03
Father’s or partner’s education in years	0.93	0.85	1.01

Table 4.6. (continued)

Number of household members	0.91	0.80	1.04
Mother's age at the time of child's birth	0.99	0.95	1.03
Low BMI vs Normal	0.27	0.09	0.77
Breastfeeding in months	1.03	1.01	1.06
Child age in months	0.99	0.98	1.00
Birth weight in kilos	0.46	0.30	0.69
Female children vs male	0.83	0.55	1.25
Model summary: p(Wald F)=0.000, Cox and Snell R^2=0.108, Nagelkerke R^2=0.164, McFadden R^2=0.107			

Data Source: Demographic and Health Survey, Armenia, 2005.

*- All covariates are included in the table

Table 4.7. The likelihood of child undernutrition associated with perceived ability to make ends meet and other maternal and child health characteristics: results of adjusted logistic regression.*

Parameter	Odds Ratio (OR)	95% Confidence Interval for OR	
		Lower	Upper
Perceived ability to make ends meet			
Great difficulty/some difficulty vs easy/very easy	3.94	1.00	15.59
A little difficulty/fairly easy vs easy/very easy	4.67	1.10	19.86
Unemployed vs employed (mother)	2.05	1.09	3.88
Rural residence vs urban	1.01	0.68	1.50
Regions vs Yerevan			
Aragatsotn	0.57	0.20	1.59
Ararat	0.79	0.34	1.86
Armavir	0.35	0.14	0.88
Gegharkunik	0.91	0.39	2.11
Lori	0.59	0.27	1.29
Kotayk	0.41	0.20	0.82
Shirak	2.22	1.08	4.55
Syunik	0.38	0.17	0.85
Vayots Dzor	1.20	0.48	3.02
Tavush	0.46	0.21	1.02
Mother’s education in years	0.93	0.84	1.02
Father’s or partner’s education in years	0.92	0.85	1.00

Table 4.7. (continued)

Number of household members	0.92	0.80	1.05
Mother's age at the time of child's birth	0.99	0.95	1.03
Low BMI category vs Normal	0.27	0.09	0.79
Breastfeeding in months	1.04	1.01	1.06
Child age in months	0.99	0.98	1.00
Birth weight in kilos	0.45	0.30	0.68
Female children vs male	0.87	0.58	1.32
Model summary: p(Wald F)=0.000, Cox and Snell R^2=0.113, Nagelkerke R^2=0.172, McFadden R^2=0.112			

Data Source: Demographic and Health Survey, Armenia, 2005.

*- All covariates are included in the table

Table 4.8. The likelihood of child undernutrition associated with satisfaction with living space and other maternal and child characteristics: results of adjusted logistic regression.*

Parameter	Odds Ratio (OR)	95% Confidence Interval for OR	
		Lower	Upper
Satisfaction with living space			
Very dissatisfied/dissatisfied vs very satisfied/satisfied	1.02	0.59	1.79
Neither satisfied nor dissatisfied vs very satisfied/satisfied	1.19	0.69	2.07
Unemployed vs employed (mother)	1.97	1.03	3.76
Rural residence vs urban	0.98	0.67	1.45
Regions vs Yerevan			
Aragatsotn	0.60	0.21	1.66
Ararat	0.84	0.37	1.92
Armavir	0.35	0.14	0.88
Gegharkunik	0.91	0.39	2.13
Lori	0.63	0.30	1.35
Kotayk	0.44	0.22	0.88
Shirak	2.41	1.17	4.95
Syunik	0.42	0.19	0.93
Vayots Dzor	1.24	0.49	3.17
Tavush	0.47	0.21	1.05
Mother’s education in years	0.93	0.84	1.02

Table 4.8. (continued)

Father's or partner's education in years	0.92	0.85	1.00
Number of household members	0.92	0.80	1.05
Mother's age at the time of child's birth	0.99	0.95	1.03
Low BMI category vs Normal	0.27	0.09	0.78
Breastfeeding in months	1.03	1.01	1.06
Child age in months	0.99	0.98	1.00
Birth weight in kilos	0.46	0.30	0.70
Female children vs male	0.82	0.55	1.24

Model summary: p(Wald F)=0.000, Cox and Snell R^2=0.107, Nagelkerke R^2=0.162, McFadden R^2=0.105

Data Source: Demographic and Health Survey, Armenia, 2005.

*- All covariates are included in the table

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