Social Determinants of Chronic Child Malnutrition in Peru: Comparison of a National Sample to a Sample from the Rural Andes from the Peru 2006-2008 Measure DHS Project.

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Abstract

Introduction. This study explored social determinants of chronic child malnutrition on national level and in very poor ruralities in the Andean region in Peru.

Methods. Two samples were studied, a national sample, (n = 1426) and a rural subsample, (n = 171). The samples consisted of women age 15-49 and their firstborn children 3-60 months of age. Data were provided by the Demographic and Health Survey ENDES Continua 2004-2006 (DHS 2004-2006). The variable for child malnutrition was composed by anthropometric measures of height and age, and 2 standard deviations below the WHO growth standard indicated chronic malnutrition or stunting. The influence of a range of variables on child stunting were tested through bivariate and logistic regression analyses performed in SPSS.

Results. For the national sample, the traditional socioeconomic indicators were found to be significantly associated with child stunting. Especially wealth, education and occupation were strong predictors even after controlling for possible confounding variables like age, altitude, and ethnicity. For the rural subsample, none of the classical socioeconomic measures were statistically significantly related to child stunting, indicating that other factors play a greater role in reducing child malnutrition. Altitude was a strong predictor for both samples.

Discussion. The diverging results comparing national and rural sample indicate that the widely used measures of income/wealth, education and occupation are not successful at explaining differences in health in very poor ruralities. Rather structural, natural, and cultural structures not addressed in the survey might play more important roles in producing differences in child growth. The results from this study support findings from other studies on social determinants of health in remote and extremely poor areas.

Conclusion. The differing results between the national and rural sample show that one must be careful in generalising findings concerning determinants of health from national to regional levels.

Keywords: child stunting, poor ruralities, social determinants of health, socioeconomic status.

Samandrag

Introduksjon. Denne studien undersøkte sosiale determinantar for kronisk underernæring i born nasjonalt og i svært fattige område i Andesregionen i Peru.
Metode. Studiet brukte to utval, eit nasjonalt (n = 1426), og eit underutval sett saman av fem av dei statistisk sett fattigaste statane i dei rurale Andesområda i Peru (n = 171). Utvala bestod av kvinner i alderen 15-49 år og det fyrstefødde barnet deira i alderen 3-60 månader. Studiet nytta data frå den nasjonale undersøkinga ENDES Continua 2004-2006 innsamla av Demographic and Health Survey (DHS 2004-2006). Variabelen for kronisk underernæring var sett saman av antropometriske mål for høgde og alder, og 2 standardavvik under Verdas Helseorganisasjon sine vekststandardar indikerte kronisk underernæring. Effekten av ei rekkje uavhengige variablar på underernæring vart testa i bivariate og logistiske regresjonsanalysar i SPSS.
Resultat. Logistisk regresjonsanalysar i det nasjonale utvalet viste at dei tradisjonelle sosioøkonomiske indikatorane var statistisk signifikante når testa mot underernæring. Både økonomi, yrke og utdanning var sterke prediktorar sjølv når underliggjande variablar som alder, høgde over havet, og etnisitet vart kontrollert for. I det rurale underutvalet vart det ikkje funne statistisk signifikans for dei klassiske sosioøkonomiske faktorane. Dette indikerer at i dette området er det andre faktorar som har større betyding for reduseringa av kronisk underernæring i born. Høgde over havet var ein sterk prediktor for begge utval.
Diskusjon. Dei avvikande resultata som vart funne når ein samanliknar dei to utvala indikerer at dei mykje brukte måla inntekt/formue, utdanning og yrke ikkje er like meiningsfulle i forsøket på å forklare skilnader i underernæring i svært fattige område som på nasjonalt nivå. Strukturelle, geografiske, og kulturelle forhold som ikkje er teke opp i undersøkinga kan spele større roller i veksten til born i området undersøkt her. Denne studia støttar opp under andre funn som har undersøkt effekten av sosiale determinantar for helse i svært fattige og rurale området i verda.
Konklusjon. Dei ulike resultat for det nasjonale og rurale utvalet viser at ein må vere varsam med å generalisere funn angåande determinantar for helse frå nasjonalt til regionalt nivå.

Nøkkelord: kronisk underernæring, born, sosiale determinantar, sosioøkonomisk status, rurale og fattige område.

1.0 INTRODUCTION

1.1 Study aims

This study addressed the effects of mothers' demographic, social, and socioeconomic factors on their children's nutritional status. The study had an explorative approach, aiming at identifying important social determinants of chronic child malnutrition in the specific context of very poor ruralities in Peru.

1.2 Background

Low- and middle income countries worldwide continue to suffer from mal- and under nutrition (Horton, 2008). Children are especially vulnerable to poor nutrition and malnutrition has been found to be one of the major causes of infectious diseases and child mortality (Pelletier, Frongillo, Schroeder, & Habicht, 1995; Black et al., 2008). Not only does poor diet have immediate serious consequences, but it also affects cognitive and social development and thus has negative impacts on health and wellbeing in adult life (Berkman, Lescano, Gilman, Lopez & Black, 2002; Mendez and Adair, 1999). Malnutrition and poverty are inseparably connected and reducing either is central for reducing the other (Fotso, 2006).

According to a report by UNICEF (2006), 27 percent of all children under five years of age in the developing world are undernourished (UNICEF, 2006). UNICEF (2006) defines undernourishment as "the outcome of insufficient food intake (hunger) and repeated infectious diseases" (p. 3). The term is thus used collectively for being "underweight for one's age, short for one's age (stunting), dangerously thin (wasting), and deficient in vitamins and minerals (micronutrient malnutrition)" (UNICEF, 2006, p. 3). An estimated 146 million children suffer daily from malnourishment, and will continue to be disadvantaged throughout their adolescence and adult life if current conditions persist (UNICEF, 2006).

Moving to country level, a report by Sanchez (2008) addressing social conditions in Peru states that chronic malnutrition or stunting, indicated by height for age, affects 25 percent of all children under five years of age in the country, only slightly below the developing nations average (Sanchez, 2008; UNICEF, 2008). Further, children in the Andes region are disproportionately affected in the sense that being indigenous and living in a rural area produces a higher risk of malnutrition. The report states that the prevalence of stunting in Peru averages 13 percent in urban areas and reaches 40 percent in rural areas. Furthermore, "all

regions with chronic malnutrition above 40 percent are clustered in the Andes" (Sanchez, 2008, p. 10). This fact calls on research to identify underlying factors causing poor nutritional conditions to persist and increase in rural and poor regions in Peru.

This thesis is a result of an initiative to explore what factors predict and produce differences in health in very poor ruralities. An extensive body of literature has investigated social determinants of health in industrialised contexts, and a smaller amount of research has explored these factors on national level in developing, non-industrialised countries. Lacking is knowledge about how these mechanisms operate in local, rural contexts (Gwatkin, 2000).

Being defined as poor does not equal having the same health status. A common perception is to view poorer areas within a country as uniformly poor in terms of wealth and with equally poor health conditions. This is a mistake as within a population of poor people, differences in both health and wealth exist. For instance, Mittelmark and Bull (2010) found differences in rest deprivation as well as distribution of household wealth within areas considered as uniformly poor. Also, ongoing research at the Research Centre of Health Promotion and Development show variation in immunisation status of children and antenatal care outcomes within small, poor areas. Recognising and acknowledging this variability opens up for the possibility to identify protective factors and characteristics of the people that are doing well in spite of the hard living circumstances. Through this, efforts to improve the health of the population in general can be achieved. Thus, questions arise: What causes the differences in health in people living in conditions of extreme poverty in remote areas of the world? Do the same factors that produce good or poor health in the western part of the world also act in these poor ruralities? Can national averages be generalised to local or regional level? The Social Determinants of Health in Very Poor Ruralities (SDHVPR)[1] project is an initiative to explore these questions and contribute to the understanding of the association between living conditions and health in extremely poor and remote areas of the world. The presented thesis is a piece adding to the SDHVPR project.

[1] SDHVPR is a project of the International Union of Health Promotion (IUHPE) funded by the Department of Health in the United Kingdom, with research undertaken at the University of Bergen.

2.0 THEORY, CONCEPTUAL FRAMEWORK, AND EMPIRICAL FINDINGS

In this section, the conceptual frameworks applied as basis for the thesis are presented. Further, various theoretical perspectives and constructs related to the relationship between social factors and health are addressed.

2.1 What are Social Determinants of Health?

Health is influenced by an infinite amount of conditions; among them biological and hereditary, psychological and behavioural, environmental, cultural and social factors (Dahlgren & Whitehead, 1991, see fig 1). The World Health Organisation (WHO) defines health in terms of "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946). This definition encompasses a broad view of health which complies with the principles of health promotion. The definition presupposes attention towards health aspects not traditionally considered within a pathogenic conceptualisation of health and recognises the importance of social determinants of health.

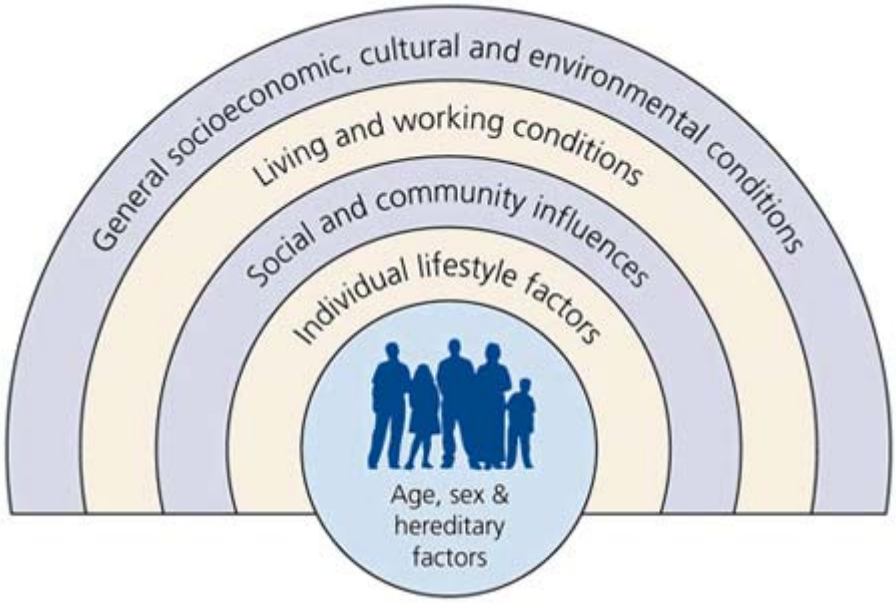

Figure 1. Dahlgren and Whitehead Policies and Strategies to Promote Social Equity in Health (Institute of Futures Studies Stockholm 1991).

WHO has been a forerunner in putting social influences on health on the world health agenda. In 2005 the Commission for Social Determinants of Health (CSDH) was established as a dissemination body of knowledge on social determinants of health, and reduction of social

inequalities in health. The commission produced the report “Closing the gap in a generation” which was published in 2008.

Within the concept of social determinants of health “the full set of social conditions in which people live and work” is comprised (CSDH, 2007, p. 4). This definition exhibits a broad view and a practically infinite amount of factors. As pointed out by the CSDH, though not all determinants are weighted with equal emphasis, the extended frame of determinants is purposely decided so that not valuable and perhaps unexpected determinants of health are lost (CSDH, 2007).

2.2 Health promotion and Social Determinants of Health

Health promotion is based on and guided by certain principles and values. The field emphasises equity in health and social justice through change on various levels in society (WHO, 1986). The Commission on Social Determinants of Health applies “an understanding of health as a social phenomenon, requiring more complex forms of inter-sectoral policy action, and sometimes linked to a broader social justice agenda.” (CSDH, 2007, p. 5). The CSDH points to health equity, distribution of political power, and protection of human rights as directing its work on social determinants of health. As defined by the Commission, health equity is “the absence of unfair and avoidable or remediable differences in health among social groups” (CSDH, 2007, p. 9). Further, the CSDH underscores that governments, be it local or national, carry the main responsibility of ensuring the equity in health among its people. Considering these aspects, research on social determinants of health is at the core of health promotion.

2.3 What theoretical perspectives exist on pathways of SDH?

There are three major theoretical perspectives on how social and socio-economic factors and health are associated. As the CSDH points out, though these perspectives have different directional approaches, they have complementary elements and are not mutually exclusive (CSDH, 2007). Rather they each bring insights contributing to an expanded understanding of a complex field of research.

2.3.1 Social causation perspective

The social causation perspective indicates that health is determined by socioeconomic status through intermediary factors. Evidence supporting this theoretical approach has developed

through longitudinal studies measuring socioeconomic status prior to the occurrence of health problems and through measuring health problems at a later point in time. Results have shown increased likelihood of poor health with lower socioeconomic status (Adler et al, 1994; Chen, Matthews & Boyce, 2002; Chen, 2004; Johnson, Cohen, Dohrenwend, Link and Brook, 1999; Marmot, Ryff, Bumpass, Shipley, & Marks, 1997).

2.3.2 Life course perspective

The life course perspective expands the social causation perspective by emphasising how social determinants of health are linked to timing and development stages in life, both through immediate effects and long-term consequences (CSDH, 2007; Poulton et al., 2002). Chen (2004) suggests that the relationship between SES and health is stronger in certain developmental periods (Chen, 2004). Wilkinson and Marmot (2003) also suggest an accumulative risk effect in which every later transition in life equals an increase in risk to health (Wilkinson & Marmot, 2003).

2.3.3 Social selection perspective

The social causation perspective is challenged through the social selection perspective which argues that health determines socioeconomic status. The background is the difficulty of climbing or maintaining ones position in the social hierarchy when health status is poor or worsened (CSDH, 2007; Smith, 1999). Research is however inconsistent, and studies conclude that one can hardly account on social selection as the "predominant explanation for health inequalities" (CSDH, 2007, p. 11; Smith & Morris, 1994).

2.4 Conceptual Framework

2.4.1 Social Determinants of Health Framework

Considering the existing literature on the topic of social position and health, including nutritional status, the WHO Commission for Social Determinants of Health (2008) developed a conceptual framework for social determinants of health. Figure 2 (p. 11) provides a visual presentation of this framework that has been adopted as the basis for the SDHVPR project and for this individual thesis. The framework is action-oriented. It is not meant to be a theoretical model with no applied value, but a framework that implies action taken on several levels. First, there is a need for orientation towards the area of daily living conditions to improve the circumstances in which "people are born, grow, live, work, and age" (CSDH, 2008, p. 2). Second, changes must be made on political levels to address a re- and more equitable

distribution of power. Third, science must address the scope of the challenges of social determinants of health and build competence and awareness of tackling these (CSDH, 2009). Through some overarching categories, the framework explains the intricate context in which health develops, and the specific relationships between health and factors of socioeconomic and political, social and psychological character. This thesis is largely concentrated around the factors of social position described and defined in the literature and methodology sections.

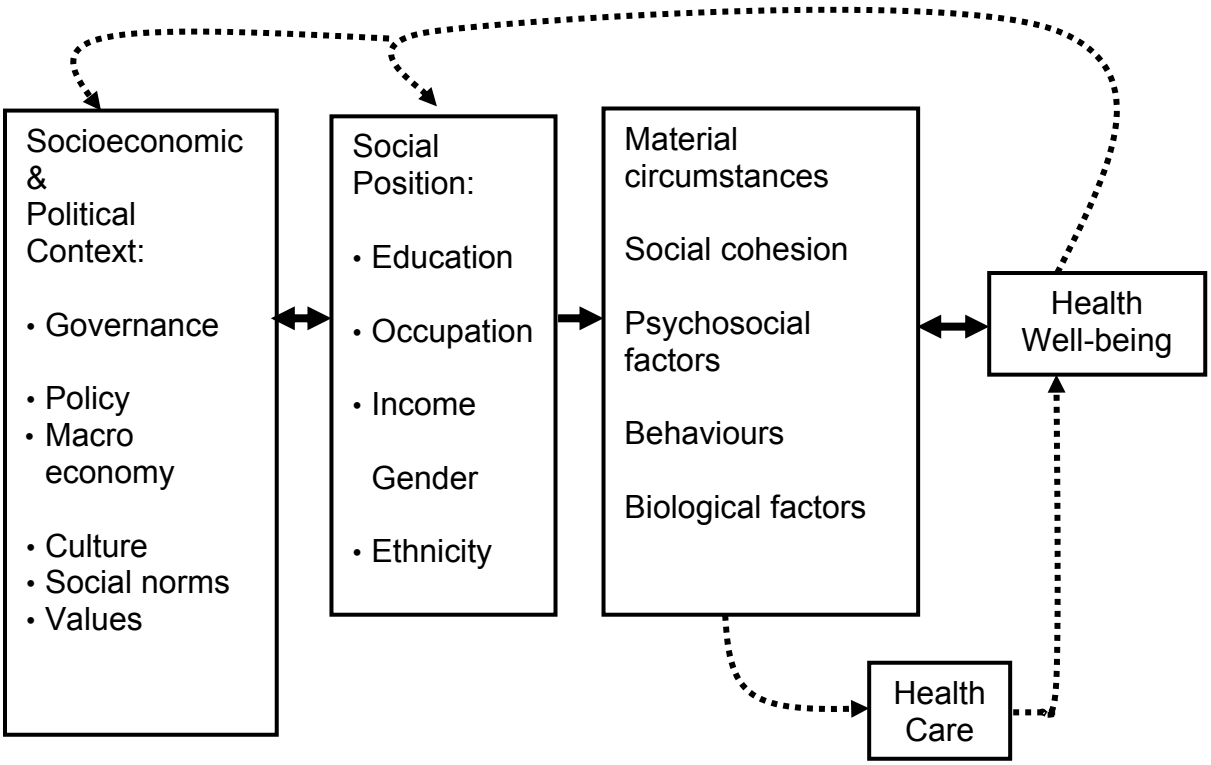

Figure 2 Social determinants conceptual framework, adapted from CSDH (2008), Figure 4.1, page 43.

2.4.2 Sustainable Livelihoods Framework

The framework developed by the CSDH is a general model for addressing social determinants of health. It is developed from a western, developed countries' view and though a useful tool, it is not sufficient as theoretical basis for this thesis. An additional framework, the Sustainable Livelihoods Framework (DfID, 2001), applied by various development researchers and non-governmental organisations, was also applied in this study to account for the fact that in very poor areas people live in a vulnerability that people in industrialised countries do not. Hence they have very different life circumstances regarding what the main predictors of their health are, and how these effectuate various health outcomes. The sustainable livelihoods framework is an integrated framework that goes beyond the "one-factor" studies that have characterised

poverty research, and includes a range of predictors of poverty (Krantz, 2001). According to Ellis (2000) the framework is developed as an "assets-access-activities" model in which the assets are a collection of capitals, access involves the existing opportunities to make use of these capitals, and activities encompass what people engage in through their capitals and opportunities (Ellis, 2000). Together this makes up people's livelihoods. The various capitals are classified according to different dimensions that make up the basis for a sustainable livelihood. As can be noted from Figure 3 (p. 13) the assets or capitals include human, physical, social, financial, natural, cultural, symbolic and political capital. As documented in the World Bank Report, "Voices of the Poor. Can Anyone hear us?" (2000), these capitals are highlighted by the poor themselves as ways of managing the vulnerability they are living in. Interestingly, the aspect of income so widely emphasised in poverty research is not emphasised as the important predictor of their life situation (Narayan, Patel, Schafft, Rademacher, & Koch-Schulte, 2000).

The SDHVPR project and this study acknowledges health as operating at different levels and through various factors, but is mainly concerned with health as an outcome. Thus, the framework was modified to include health as an outcome on equal footing with poverty reduction (depicted as 'increasing well-being, functioning' and 'longevity' in Figure 3). On the predicting side, the capitals were in focus, as it was social factors that influence the health of the individual that were of main interest. In the next section follows a description of the capitals included in the framework.

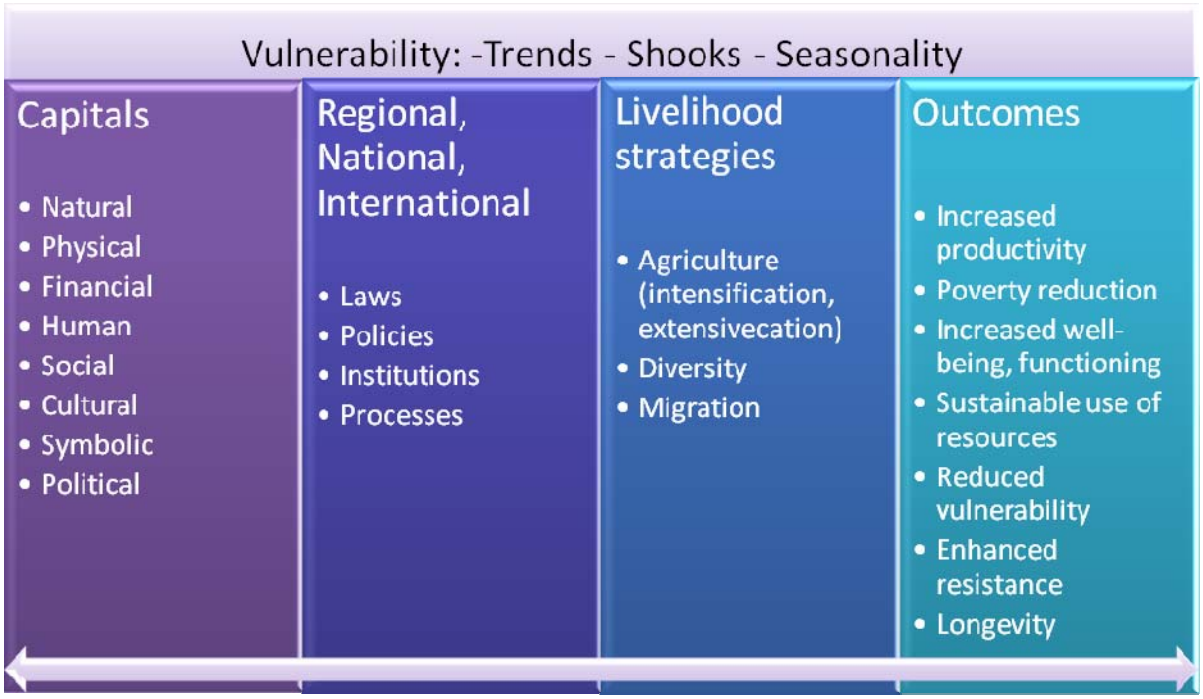

Figure 3. Sustainable livelihood framework with enhanced attention to health. Adapted from Carney, D., with M. Drinkwater, T. Rusinow, K. Neefjes, S. Wanmali, and N. Singh. (1999), Adaption by Maurice Mittelmark.

2.4.2.1 The capitals and their relevance to this study

Natural capital

Natural capital encompasses the natural resources present and available in the living context of an individual or household. Ellis (2000) defines it as "the land, water and biological resources that are utilised by people to generate means of survival" (p. 32). Natural capital thus covers the natural resources both renewable and non-renewable, natural processes in the ecosystem that human survival depends on, and "weather patterns and natural features such as mountains and coastlines" (Black & Hughes, 2001, p. 34). Black and Hughes (2001) further elaborate by including the aesthetic aspects of nature, which are "appreciated for their beauty" (Black and Hughes, 2001, p. 47). The natural capital surrounding us varies from place to place, with season and over time. In a rural sustainable livelihoods context natural capital is of great importance as rural residents to a great extent base their living on natural resources coming directly from their surroundings. The vulnerability-trends-shocks-seasonality dimension of the SL framework is particularly and closely interacting with natural capital in the sense that small changes in the natural resources due to natural disasters, poor harvesting seasons etc. can cause grave difficulties in sustaining one's livelihood.

Physical Capital

Within the SL framework, physical capital is considered to be “the basic infrastructure and producer goods needed to support livelihoods” (DfID, 2001, ¶ 2.3.4). Infrastructure, such as transportation, roads, railways, shelter, clean water and sanitation services, energy supply and communication systems all facilitate more effective manners of sustaining a healthy livelihood. Similarly, producer goods, comprising tools and equipment often owned by individuals, households or groups are important to optimise sustenance. Increasing physical capital involves increasing production capacity in individuals and communities. In poor and often rural contexts this capacity is restricted due to insufficient infrastructure and equipment. Time is spent on walking to a location in stead of calling, fetching water a two hour walk away in stead of from a compound tap.

Financial Capital

Financial capital refers to “the financial resources that people use to achieve their livelihood objectives” (DfID, 2001, ¶ 2.3.5). This involves assets like land, savings and credit, as well as cash transfers provided through state programmes. Level of financial capital is what most often determines level of poverty. In addition to enhancing purchasing power, financial capital can be used to increase other types of capital, i.e. human capital through financing education, or social capital through payment of member fees in organisations. Within the SL approach indirect support for financial capital is emphasised. This involves altering structures and processes involved in financial services, legislation and market development (DfID, 2001).

Human capital

As defined within the SL framework, “Human capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (DfID, 2001, ¶ 2.3.1). Primarily, this involves education and labour capacity at individual and household level (Black & Hughes, 2001). Health is considered an element of this capital, but is as mentioned above removed for the purposes of this study, to enable a focus on how health is influenced by the other elements of human capital as well as by the other capitals.

Human capital has value in itself, but plays an important role in the efficient utilisation of other capitals. The enhancement of human capital can be reached through direct and indirect

support, but its success is dependent on participatory needs assessments and people's willingness to participate (DfID, 2001).

Social Capital

Social capital is a concept that has emerged as central to many social science fields, including that of social inequalities and health (Hawe and Shiell, 2000). According to Portes (1998) Bourdieu was the first to define it through contemporary analysis. He explained it as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance or recognition" (Bourdieu, 1985, ref. in Portes, 1998). Black and Hughes (2001) refer to it as "the patterns and qualities of relationships in a community" (Black & Hughes, 2001, p. 61). Social capital has been abundantly defined, up to the point to which definitions have become conflicting definitions (Robison, Schmid, & Siles, 2002). Criticisms have also emerged arguing for inappropriateness with the use of "capital" in describing human relationships of trust and sympathy established for other purposes than economic gain (Robison et al., 2002). Within the sustainable livelihoods framework social capital involves "the social resources upon which people draw in pursuit of their livelihoods objectives" (DfID, 2001, ¶ 2.3.2). Social capital in this perspective is created through social networks, membership of more formalised groups and relationships of solidarity, trust, reciprocity and exchanges (DfID, 2001).

Cultural capital

A type of capital that has been given increasing interest is cultural capital (Lareau & Weininger, 2003). Bourdieu refers to cultural capital as knowledge, culture and education credentials (Bourdieu, 1986) and Abel (2007) elaborates it further as "the operational skills, linguistic styles, values and norms that one accrues through education and lifelong socialisation. It comprises people's social abilities and competence for action, including their perceptions, values, norms, cognitive and operational skills" (Abel, 2007, p. 2). In relation to health research and inequalities in health, cultural capital involves resources people have that originate in culture and that can be utilised to protect and improve health (Abel, 2007). In this sense, cultural capital is an interesting and important feature in exploring context specific health inequalities.

Symbolic capital

Bourdieu also addresses symbolic capital and claims this to be socially constructed and operating as a way to distinguish between social classes and define prestige (Bourdieu, 1980). According to Flint and Rowlands (2003) symbolic capital is a means of "legitimising particular forms of consumptions, conferring upon the agent a sign of distinction […]" (Flint & Rowlands, 2003, p. 217). Symbolic capital is thus an asset that is linked with the other forms of capital and enforces social hierarchies. It can be reasoned that symbolic capital and the social status attached can contribute to better health due to advantages that are available to people associated with a certain class.

Political capital

Political capital refers to individuals' and communities' access to wider public "institutions of society" (DfID, 2001, ¶ 2.3.2). Political capital is often considered a part of social capital and some choose not to distinguish between these. However, separating them can be appropriate for analysis purposes.

2.4.2.2 Health promotion and Sustainable livelihoods

The sustainable livelihood approach is based on certain core concepts and objectives. Several of these have close ties to health promotion and strengthen the relevance of this study to the health promotion field. It is "people-centred" meaning it aims to place "people at the centre of development, thereby increasing the effectiveness of development assistance" (Segers, Dessein, Nyssen, Mintesinot, & Deckers, 2005, p. 3). Through this aim, the SL framework emphasises participation and locally grounded approaches to development involving the incorporation of a variety of living conditions (DfID, 2001). An important health promotion principle can be identified in this concern with bottom-up strategies in which active participation is valued. Further the SL framework embraces a holistic view of health in which the importance of targeting a wide variety of health predictors and how they interact is stressed. Health promotion is based on the view that health and wellbeing is a result of a wide and complex spectrum of influences at work and in interaction at levels reaching from local to global (WHO, 1986). The SL framework further is a dynamic tool that can assist at effort towards meeting the needs of the people as livelihoods are naturally dynamic and undergoing change at every point in time. Another important aspect of the SL approach is its positive view of people and communities. Strengths and potential are highlighted in stead of limitations and needs (DfID, 2001). Health promotion emphasises a positive view of people and seeks to focus on this through empowerment and development of the potential that people

already possess. Lastly, though stressing the need for close collaboration with and active participation of people at grass root level, the SL approach also recognises the need for action on higher political levels. Structures and regulations on national and regional levels have great impact on local communities. Communication between local, regional and state governments and organisations must be present to assure that sound decisions concerning rural and poor communities are made. This complies with health promotion which emphasises action on all levels and across several sectors in society. Only through keeping in mind the complexity in which people live is it possible to achieve sustainable livelihoods and equity in health.

2.5 Socioeconomic status

According to Morris, Carletto, Hoddinott and Christiaensen (2000), socioeconomic status (SES) is a concept consisting of two components: class and position. "Socioeconomic class refers to social groups that arise from interdependent economic, social and legal relationships among a group of people" (Morris et al., 2000, p. 381). Socioeconomic position is a concept making reference to "the diverse components of economic and social well being that differentiate persons of different social classes, including both resource-based and prestige based measures" (Morris et al., 2000, p. 381). SES is most commonly measured as level of education, occupation and a measure of level of income, wealth or expenditure. According to a wealth of research, socioeconomic status should have a significant position in research on predictors of health (Chen, 2004; Marmot, 2005; Spencer, 2003), and Spencer has characterised it as "among the most important health determinants throughout the life course" (Spencer, 2000).

Recent years have seen a growing interest and focus on the effect of socioeconomic status on health, both in the lowest socioeconomic strata in populations, but increasingly as a mechanism operating across an entire population, creating a gradient in which small increments in socioeconomic position results in small improvements in health (Chen, 2004; Marmot et al., 1997).

Within research on social determinants of health, socioeconomic status (SES) has received tremendous attention, and a wide spectrum of research now exists on how various health outcomes are affected by SES (Chen, 2004; Raphael, 2004; Wilkinson & Marmot, 2003). A growing community of researchers has given great attention to the development of theoretical foundations and studies arguing that health is not merely a result of genetic circumstances, but

also closely tied to environmental and social features (Boadu, 2002; Wilkinson & Marmot, 2003).

2.6 SES and child health

Scientific studies on children's cognitive, physical and emotional development has contributed to particular emphasis on how child health is influenced by social factors (Chen, Matthews, & Boyce, 2002). In concert with elements from the theoretical life course perspective (briefly explained in the theory section), the importance of protecting children from adverse development by improving social living conditions has been stressed. Ample evidence exists indicating a special vulnerability of children living in poverty. Being a child exposed to poor social circumstances is associated to a range of detrimental health conditions including infant mortality, chronic and acute illnesses (Egbuonu & Starfield, 1982; Spencer, 2003). This emphasis is particularly present in studies on social determinants of health in developing countries as increasing efforts in combating child mortality, morbidity and hunger have caught the attention of the international community through global initiatives like the Millennium Development Goals.

2.6.1 Pathways from social determinants to child health

Socioeconomic and social indicators of health applied in research relate to other factors through complex patterns and mechanisms. Hence there is no one way an indicator influence a health outcome. Socioeconomic factors play both direct and indirect roles in the (causal) mechanisms of health. Intervening variables may explain large or small portions of the effect found in a given dual relationship, i.e. education and child stunting (Cleland & Van Ginneken, 1988).

Education may have a direct effect on child health through overall better quality of parenting and increased utilisation of public health care services. Other effects are fewer children and delayed child-bearing (Boyle et al., 2006; Lindeboom, Llena-Nozal, & van der Klaauw et al., 2009). Indirectly education often qualifies an individual for skilled work which oftentimes generates higher income, and in turn can be used to invest in health and tackle unexpected health expenses (Case et al., 2002; Boyle et al., 2006; Lindeboom et al., 2009). This was confirmed by Lindeboom et al. (2009) who found increased levels of schooling to improve household economy (Lindeboom et al., 2009).

Concerning occupation is has been hypothesised that women with husbands involved in higher status occupations, benefit from the prestige traditionally conferred to these professions, including the receipt of gifts and practical support which in turn can contribute to improved health.

In a revision of several studies on the role of parental education on child survival, the broad conclusion could be drawn that about half of the total effect of maternal education was due to economic situation (Cleland & Van Ginneken, 1988). Hence, aspects of economy might possess important positions in explaining the intricate path from social factors to health outcomes.

2.7 SDH and health in the developed world

2.7.1 Education

The literature on social determinants of health gives good evidence of what predicts health in industrialised countries (WHO, 2008). Socioeconomic status as measured by income, education and occupation has been widely used and accepted as large contributors to social inequalities in health. Among the most investigated socioeconomic factors in this respect, is education.

Through the review of 16 studies on the association between education and child health Cochrane, Leslie, and O'Hara (1982), concluded that maternal education was positively associated to child nutritional status (Cochrane, Leslie, & O'Hara, 1982). Walking in these researchers' footsteps, several studies confirmed these correlations, but more importantly added further confidence through more advanced statistical techniques (Moulton, 1997; Jejeebhoy, 1995). Currie and Moretti (2003) found that maternal education improved infant health partly through increased use of prenatal care and reduced smoking (Currie & Moretti, 2003). Though recognizing the pathway to improved health via higher income resulting from education, Currie and Moretti underline the mechanism of changed health behaviour through for example reduced smoking (Currie & Moretti, 2003).

Though a large amount of studies documents the association of education to child health in developed areas, the literature is not completely consistent. Doyle, Harmon, and Walker

(2005) found only weak effects of parental education on the health of their children (Doyle et al., 2005). A study by Lindeboom, et al. (2009) investigated parental education in the United Kingdom and found that a one-year increment in schooling had little effect on the health of the participants' children (Lindeboom et al., 2009).

2.7.2 Occupation

Occupation is another of the classical social determinants of health, and frequently used as a measure of SES (Bravemen et al., 2005; Kunst, Groenhof, & Mackenbach, 1998). Research documents that being unemployed versus employed, type of work and work environment are some of the occupational factors that influence health (Kunst et al., 1998; Wilkinson & Marmot, 2003). Several studies state that unemployment jeopardizes health both in physiological and psychological terms. Further, occupation may work through the pathway of low income and result in poorer abilities of preventing or treating health problems (Wilkinson & Marmot, 2003). Significant associations have been documented between higher mortality and occupational class in a range of European countries (Kunst et al., 1998; Marmot et al., 1997). Poorer health predicts lower occupational position, creating a social gradient (Whitehead & Dahlgren, 2007).

2.7.3 Economic measures

The influence of economic poverty on health is widely studied in developed nations. Research indicates that economic levels predict various health outcomes from childhood to adulthood (Case et al., 2002; Case et al., 2005; Raphael, 2004; Smith, 1999). Duncan, Brooks-Gunn, Klebanov, and Kato (1994) found that cognitive development and behaviour of children were significantly predicted by family income and poverty status even after controlling for family structure and maternal education (Duncan et al., 1994). Confirming a strong association between income and health Kahn, Wise, Kennedy, and Kawachi (2000) found women with lower income to report more depressive symptoms and poorer health compared to women with higher income (Kahn et al., 2000). Further, it was noted that low-income women living in states with high-income inequality had higher risk of reporting poorer mental and physical health, compared to low-income women living in more egalitarian states (Kahn et al., 2000). Lynch and Kaplan (1997) have emphasised the need to address structural changes in form of redistribution of resources in tackling social inequalities in health (Lynch & Kaplan, 1997).

2.8 SDH and health in developing contexts

The predictive power of the classical social determinants of health is well established in the western part of the world (WHO, 2008). Evidence of whether these measures to the same extent can predict health in non-industrialised countries has been lacking, partly due to few routines for the collection of data and a lack of longitudinal data (Chopra, 2005). Recent years have however revealed an increasing interest and body of research including SES measures in health research also in developing contexts (Bicego & Boerma, 1993; Liberatos et al., 1988). This research has indeed documented that a relationship between SES and a variety of health outcomes exists also in countries under development (Fotso, 2006; Hobcraft, McDonald, & Rutstein, 1984; Schellenberg et al., 2003).

Though an emphasis on the effect of social factors on a variety of health outcomes can be observed in developing countries, more research is needed on the specific health outcome of childhood malnutrition (Fotso, 2006). Below follows an overview of what existing research says about commonly studied predictors of child malnutrition in developing countries.

2.8.1 Education and child malnutrition

2.8.1.1 Maternal education and child malnutrition

Of the existing research on childhood malnutrition and its predictors, several studies have documented a positive relationship between mother's education and child nutritional status in developing countries (Bicego & Boerma, 1991; Caldwell, 1979; UNICEF, 2008). This is also the case for the specific nutritional condition of stunting and education (Barrera, 1990; Bicego & Boerma 1991; Hobcraft, 1993; Semba et al., 2008). Studies conducted in Colombia, Thailand and the Dominican Republic found that "children of mothers with no education are at least twice as likely to be stunted" as children of mothers with education even after controlling for economic status (Bicego & Boerma, 1991). Similarly, in a study from Jamaica, the effect of maternal education on child height persisted after controlling for household income, sanitation, sewerage, kitchen facilities and access to community health services (Handa, 1999). Pebley and Goldman (1995) also found higher levels of maternal education to predict lower deficits in child growth (Pebley & Goldman, 1995).

Through multivariate logistic regression analyses, higher levels of maternal and paternal education significantly predicted lower odds of child stunting in both Indonesia and

Bangladesh. These results persisted after adjusting for various demographic measures as well as weekly per capita expenditure (Semba et al., 2008).

Other studies do however argue against the apparently strong impact of maternal education, and claim other factors to have stronger predictive powers on health. Shin (2005) found that though education is a significant predictor of child nutritional status, other variables like regional differences have greater explanatory power (Shin, 2005). Desai and Alva (1998) found in their study of 22 developing countries that after controlling for paternal education, residency and access to piped water and toilet facilities, the association between maternal education and child height for age decreased by two thirds compared to the effects from bivariate associations (Desai & Alva, 1998).

2.8.1.2 Paternal education and child malnutrition

The literature on parental education and child health has exhibited a generally stronger effect of maternal, compared to paternal education on child health status (Lindelow, 2008). Maybe due to this, father's level of education has largely been left out of research on SES and child health in developing countries. Though a substantive amount of research has shown that mother's education influences child health, in many societies and cultures the father or husband is the one taking the final decisions concerning for example household spending which might affect child health (Kuate-Defo & Diallo, 2002). Ricci and Becker (1996) found in their study of children younger than 30 months in the Philippines that father's education was one of the important determinants of child malnutrition (Ricci & Becker, 1996). Fotso (2006) also points to the fact that the distribution of father's education often varies to a greater degree than that of mother's resulting in an increasing chance of finding statistically significant relationships with child nutritional status (Fotso & Kuate-Deto, 2005). Ricci and Becker (1996) found father's education to be an important predictor of child stunting after the child had reached six months of age, and that this factor reached significance earlier in rural compared to urban areas (Ricci & Becker, 1996). Results from the research on the significance of father's education on child health is however inconsistent (Wamani, Tylleskär, Åstrøm, Tumwine, & Peterson, 2004), and on child nutritional status in particular there is a lack of research.

In addition to maternal and paternal education, some studies indicate that the level of education of other persons attached to the household might play significant roles in predicting child health and growth (Alderman, Hentschel, & Sabates, 2003; Handa, 1999).

2.8.2 Occupation and child malnutrition

As with the traditional socioeconomic indicators education and income, occupation is also found to be a significant predictor of health (CSDH, 2008). Some studies have investigated the relationship between parental occupation and child malnutrition. Reyes et al. (2004) found that in rural areas, father's occupation as farmer was related to a greater risk of child stunting (Reyes et al., 2004). For urban areas, having a father with an unstable job was associated with higher risk of child stunting. These results persisted after controlling for potential confounding variables like age, sex of child, literacy of mother and household income. The study indicated different social predictors of child stunting depending on place of residency in rural or urban context (Reyes et al., 2004). Pebley and Goldman (1995) found that children with fathers working in agriculture had a significantly greater likelihood of being stunted compared to those with fathers in other occupations (Pebley & Goldman, 1995).

As with education the research findings on occupation and stunting are not consistent. Kikafunda and colleagues (1998) did not find any statistically significant association between mother's occupation and child stunting in their study of child health predictors in the specific region of north-west Uganda (Kikafunda et al., 1998). Few studies were identified addressing the issue of occupation and child stunting in poor rural areas.

2.8.3 Economic status and child malnutrition

As already outlined, socioeconomic status (SES) is a generally accepted and widely used predictor of health, and the economic dimension of this is widely emphasised. Several measures exist for economic position, but three can be considered principal indicators of economic status: household income, household consumption expenditures, and household wealth (Rutstein & Johnson, 2004).

Household income

Household income is the economic indicator most frequently used by economists and developmental economists (Rutstein & Johnson, 2004). It does however carry with it several

drawbacks making it inappropriate for a host of settings, especially in the Global South. First of all, most people cannot accurately inform about their income. Often this is the case in developing countries where official annual accountings of income do not take place. Also, rural residents are often self-employed and produce for own sustainability and records of income are not kept. Another challenge is that people from all levels of social status are generally hesitant to give out information about their income, often ending in under-reporting. Furthermore, in large areas of the world, income is not a stable factor. Rather it varies from day to day, week to week, according to season, and from year to year. In addition, many work in the informal market and have more than one job. A process of collecting accurate information on household income is highly time consuming and resource straining. The mentioned elements of misclassification bias complicate the accurate measure of economic position through household income (Rutstein & Johnson, 2004).

Much of the criticism of the household income indicator has emerged posterior to research. Though criticized especially when applied in developing settings, household income might in some cases be the only economic indicator available. Hence, several studies exist that have assessed the relationship between income and health in developing countries (Cortez, 2002; Gwatkin, 2000; Houweling, Kunst, & Mackenbach, 2003; Thomas, Strauss, & Henriques, 1987). Comparing mother's and father's income, Cortez (2002) found that mother's income emerged as a stronger predictor of child nutritional status than father's income both in urban and rural regions (Cortez, 2002). Thomas et al. (1987) found household income to make a significant, however small contribution to child survival and child height (Thomas et al., 1987).

Household expenditure

Another economic measure seen in poverty and health research is household expenditure (Zere & MacIntyre, 2003). This measure is intended to assess the capacity of a household to meet its basic needs (UN, 2010). This measure also has severe limitations. Simply measuring expenditure does not indicate whether these resources are financed by savings, loans or selling off possessions, that is negative or positive savings. A report on poverty by the UN (UN, 2010) exemplifies this through a poor household forced to sell their land to manage medical expenses. This elevates the household's registered expenditure, but jeopardises its sustainability (UN, 2010). Many of the limitations mentioned for household income are also

true for household expenditure. As for income, expenditure varies according to season and at a random basis (Rutstein & Johnson, 2004). It is also difficult to assess total household expenditure accurately as data often is based on the interview of one person in the household, and expenditures are seldom done exclusively by this person (Rutstein & Johnson, 2004). Challenges related to selection of time period, and number and types of expenditure have to be considered. Friedman (1957) puts it this way: "Since health outcomes and behaviours are probably more related to "permanent income" than current income, both measures of current income and current expenditures will not properly represent underlying differentials in health" (Friedman, 1957, ref. in Rutstein and Johnson, 2004).

No measure is perfect and economic position is difficult to assess correctly and completely. Researchers make compromises continuously and often have to settle with available and practical measures. Though not perfect, household expenditure has been utilised as indicator of economic status in several studies. In South Africa, Zere and McIntyre (2003) found a statistically significant relationship between stunting and underweight, and levels of household income proxied by per capita household expenditure. No equivalent relationship could be identified between wasting and expenditure. In Guatemala, Immink and Payongayong (1999) found that higher per capita food expenditures as well as the availability for household consumption of self-produced maize and/or beans, reduced the chance of stunting in children under five with 80 percent. The authors propose that a raise in household incomes and per capita food expenditures in poor ruralities may lower under-five child stunting (Immink & Payongayong, 1999).

Wealth and Wealth Index

Household wealth is a third approach to measuring economic status. Compared to the two previously discussed measures it represents a more stable status and can easier be measured with respect to time and consideration to respondent. As an indicator for economic status wealth is considered "an underlying unobserved variable" (Rutstein & Johnson, 2004). This is the approach adopted by Demographic and Health Surveys and involves identifying indicator variables associated with a "household's relative position in the distribution of the underlying wealth factor" (Rutstein & Johnson, 2004). This results in a wealth index, a composite measure of selected assets indicating the living standard of a household. Assets range from

items like television, radio and refrigerator, to type of house construction material and livestock owned.

Research shows that the DHS household Wealth Index proves to be of the better measures for economic status and a better predictor of health compared to income (Bourne & McGrowder, 2009; Houweling et al., 2003). Comparing the performance of household consumption expenditure and Wealth Index, the Wealth Index was found to better explain differences in educational attainment and enrolment (Filmer & Pritchett, 2001).

Though a promising economic measure, issues come to the surface regarding accuracy in determining differences in wealth. How should goods and services provided publicly be dealt with? Furthermore, indicators included in the Wealth Index have both indirect and direct effects on various outcome measures. Moreover, how can differences in needs be accounted for as these definitely vary from household to household depending on size and age distribution (Rutstein & Johnson, 2004)?

As seen in this discussion of economic measures, all indicators are criticised. The use of wealth and the Wealth Index has gained a growing recognition within poverty and health research as an alternative to income and expenditure (Mwageni et al., 2005). Hence, a growing amount of studies exists focussing on the influence of wealth on child health in developing countries (Mosley & Chen, 1984; Mwageni et al., 2005). Studies including wealth and the specific health outcome of child malnutrition also exist, though they are few. Using the Wealth Index as SES indicator a study by Mwageni et al., (2005) resulted in 1.53 odds ratio of under 5-mortality in poorest compared to least poor quintiles in rural Tanzania (Mwageni et al., 2005). Pebley and Goldman (1995) looked to determine predictors of adverse child growth in Guatemala and found land distribution to be among important influences (Pebley & Goldman, 1995). Research has documented statistically significant relationships between household wealth and childhood health and stunting (Fotso & Kuate-Defo, 2005; Mosley & Chen, 1984; Ricci & Becker, 1996). In their study of five African countries Fotso and Kuate-Defo (2005) found that based on household Wealth Index measures, children from the poorest SES group were from 1.5 (Burkina Faso) to 3.2 (Cameroon) times more likely to be stunted compared to their counterparts belonging in the richest SES group (Fotso & Kuate-Defo, 2005). Compared to community SES and household

social position, measured by education and occupation, household wealth emerged as the strongest predictor of child nutritional status (Fotso & Kuate-Defo, 2005).

2.8.4 Autonomy and empowerment

Autonomy and empowerment are psychosocial constructs that may influence health either directly or indirectly through other social determinants of health (Caldwell, 1979; Kishor, 1995). Bennett (2002) describes empowerment as "the enhancement of assets and capabilities of diverse individuals and groups to engage, influence and hold accountable the institutions which affect them" (Bennett, 2002, p. 13). Empowerment, a central concept in health promotion, involves facilitating for individuals to take responsibility for their own life and hence health. Researchers argue that increased level of empowerment can enhance various health outcomes (Kishor, 1995; Sethuraman, Lansdown, & Sullivan, 2006). In a study from India empowerment emerged as having more predictive power of reduction in child malnutrition compared to socioeconomic factors (Sethuraman et al., 2006). Kishor (1995) found the odds of infant survival to increase by 25 percent per unit increase in the mother's score on the factor "family structure amenable to empowerment" (Kishor, 1995). The empowerment of women must stretch itself across several aspects as to protect and promote the complete health of their children (Kishor, 1995). The effect of autonomy on child nutritional status could also be dependent on culture, and it is therefore relevant to study this predictor within the specific context of rural Peru.

The concepts of empowerment and autonomy may operate through other factors. However, through which pathways is difficult to determine (Caldwell, 1979). Especially the association of education and autonomy or empowerment has received increased attention in explaining differences in health status. Caldwell (1979) found that through education, mothers are able to make more decisions in the household concerning the health of their children (Caldwell, 1979). Further, in determining the role of empowerment and autonomy to health, one might need to look beyond traditional social measures such as formal education. Jejeebhoy (2006) underscores the role of informal education in increasing levels of empowerment (Jejeebhoy, 2006).

Contradictory to Caldwell, Frost and colleagues (2005) found no statistically significant effects of female autonomy on child nutritional status in Bolivia when investigating this as a

pathway of education to health (Frost, Forste, & Haas 2005). A study of women's land ownership, empowerment and child nutrition in Nepal revealed similar results. When investigating the possible pathway of empowerment in women's land ownership and child malnutrition, the odds ratio remained almost unchanged compared to the pure model of land ownership and child malnutrition, indicating that empowerment does not possess a significant role in predicting child malnutrition (Allendorf, 2007)

2.8.5 Demographic factors and child malnutrition

2.8.5.1 Rural-urban effects

In a study of five African countries on child stunting and SES, being a rural resident predicted more pronounced socioeconomic inequalities in child stunting compared to urban residency (Fotso et al., 2006). Similarly, Ricci and Becker (1996) found the association between household SES and child malnutrition to become present earlier in rural than urban areas (Ricci & Becker, 1996).

2.8.5.2 Ethnicity

Considering the role of ethnicity, several studies have underscored the notion that Peru, Ecuador and Bolivia are high in prevalence of stunting as well as socioeconomic, regional and ethnic inequalities (Larrea & Freire, 2002; Larrea, Montalvo, & Ricaurte, 2005). Larrea and Freire (2002) found that stunting was significantly higher in the Andes region, and particularly among indigenous people (Larrea & Freire, 2002). Larrea et al. (2005) found the strong association between ethnicity and stunting in Ecuador to persist even after controlling for covariates. Also in Peru and Bolivia the statistical significance disappeared when controlling for socioeconomic status and region. This indicates that the ethnic differences in stunting may be due to "differential endowments," (Larrea et al., 2005). The aspect of ethnic and regional effects on stunting needs further analysis (Larrea & Freire, 2002).

2.8.5.3 Relationship to household

Handa (1999) identified mother's position in the household to be a significant predictor of child stunting (Handa, 1999). A child having a mother who is head of household was a protective factor for child growth. Further, after controlling for various covariates like income, child height was positively and significantly predicted by the presence of a father in the household (Handa, 1999).

2.9 Regional and geographic differences

Though the knowledge of the association between SES and child health and stunting is well established both within industrialised settings, and at national levels within developing countries, this does not sufficiently reveal or prove what is hidden within the relationship of various socioeconomic indicators and health status. In the same way that it is naïve to assume the same mechanisms operating in industrialised countries and developing countries, one should show caution in settling with the assumption that national findings can be generalised to all regions within a country. The wide, and in many countries, increasing gap in social equality, strongly indicates that a national average ranging at fairly "well-off" can hide deep and grave social inequalities and injustice, also in health. These inequalities might be culturally and geographically conditioned, meaning that what produces health might not be equal across regions.

What dominates the literature is research on poverty and health from a national perspective. Greatly lacking are studies focussing on very poor regions within countries, aiming at identifying what social factors predict health in these settings. A recent not yet published study by Mittelmark and Bull (2010), found that after controlling for age, wealth and education predicted rest deprivation on national level in Ghana, but not in the poor rural north of the country (Mittelmark & Bull, 2010). The afore mentioned study by Kikafunda et al. (1998) also reveals indications of a reduced significance of traditionally measured occupation on child health in the particular region of north-west Uganda (Kikafunda et al., 1998). Simon et al. (2002) found only marginal predicting effects of women with formal education on child malnutrition within the Fulbe people in rural Mali after controlling for various determinants of health like birth order, child age, household size and seasonality, mother's age, koranic or religious education, financial decision-making power and occupation (Simon et al., 2002). Adding support to this a study from Brazil examining predictors of child survival (and height) found that the impact of various determinants differed according to regions. Maternal education and household income had a larger effect on child survival in the poorer Northeast compared to the South of Brazil. Maternal height exerted greater impact on child survival in rural areas and in the Northeast indicating that the effect of household level factors was modified by regional independent effects (Thomas et al., 1987).

Considering SES in Peru and other middle and low income countries, the classical socioeconomic indicators might not be the most important nor appropriate in determining health. In poor ruralities where informal and seasonal work, insecure jobs, poor if any education and subsistence farming dominate large geographic areas, it is difficult to assess the impact of occupation, income, wealth and education on health. As mentioned in the introduction to socioeconomic status, socioeconomic position concerns "holdings of assets, the income that these assets yield, and the consumption that such income permits" (Morris et al., 2000, p. 381). Income, expenditure, and wealth are frequently observed measures of socioeconomic position in the literature and research on the association between SES and various health outcomes (Morris et al., 2000). The knowledge on the association between SES and health has grown asymmetrically (Alvarez-Dardet, 2000). Most of the literature and findings have been drawn from an industrialised context with measures appropriate for this context. The increased focus on the effect of social determinants of health in the developing world should be considered a positive development. The methodology should however be contested. One must be careful in generalising findings as well as tools and measures from context to context. The application of measures developed in the industrialised part of the world in a developing country or area should be examined critically. Further, data applied in an industrialised setting to measure socioeconomic status are often not available in developing countries. The just mentioned findings from certain geographic areas and regions suggest that there is a need to consider a different approach towards determining social determinants of health in poor and rural regions.

2.10 Research questions

The main objective of this study was to compare the effect of certain social factors on child stunting in a national and rural sample taken from the Peru DHS, 2004-2005. The main social determinants that were included were education, occupation, and wealth. The objective was explored through the following research questions:

What social factors can predict child stunting in children five years and younger nationally in Peru?

What social factors predict child stunting in children five years and younger residing in very poor ruralities in the Andean highlands?

3.0 METHODS

3.1 Participants

The participants in the study were women of childbearing age, 15-49 years old, and their firstborn child.

3.2 Data

The data utilized as the basis for the study were provided by the Measure Demographic and Health Surveys (DHS) project. This programme was established in 1984 by the U.S. Agency for International Development (USAID) which is also its main funder. The objectives of the programme are "to provide data and analysis on the population, health, and nutrition of women and children in developing countries" (DHSa). Since its initiation in 1984, DHS has been involved in the conducting of more than 240 surveys in 84 countries throughout the world (DHSa).

This particular study was based on the National Demographic and Health Survey (DHS) conducted in Peru in the time period 2004 to 2006. The survey consisted of two main questionnaires; the first addressing the entire household, and the second an individual questionnaire directed at women 15-49 years old. In addition, the survey included a module of anthropometric measures and biomarkers which allowed reliable measures of aspects of the physical conditions of the woman (respondent) and her children. A total of 20 440 homes and 19 090 women from all states and geographic regions of Peru were interviewed during the survey period (INEI, 2007).

The data hold a high quality for several reasons. Usually, Demographic and Health Surveys have been conducted over a short period of time, and the intervals between each survey have reached as much as four or five years. This resulted in large periods without information available that could have been valuable to the data set. In this regard, the DHS Peru has a special position as it is the first country in which a new system of timing of the interviews was conducted. Since 2004 "ENDES Continua" was implemented in which interviews continuously are carried out for nine months each year. This is organised by dividing the total desired number of homes to be interviewed over a five year period into five annual parts. This leaves approximately 6600 homes to be surveyed each year (INEI, 2007). The continuous collection of information about health and demography over several consecutive years

facilitates for longitudinal studies of the development of health and life in Peru. In addition, DHS carries out work in several developing countries, facilitating for comparative studies between countries that could enhance the understanding of several aspects of development, poverty and health.

In the ENDES 2005 a module with anthropometric measurement for the woman and her children was included (INEI, 2007). Compared to using self-reported health, this provides a higher reliability with regard to information concerning physical conditions. The anthropometric module was however only conducted with a limited part of the total number of survey participants. This, in turn, reduced the sample sizes in this study, as it was only concerned with women and their children whose nutritional status, measured by height for age, was available.

3.3 Data collection

Although DHS is the developer of the various national surveys, usually a national organ is in charge of the execution. The national institute for statistics and information in Peru, Instituto Nacional de Estadistica e Informatica (INEI), was head of the implementation of the ENDES Continua 2004-2006. The collection of data followed specific procedures over four different phases. First, the sample was selected to ensure representation from all 25 departments in Peru. Adjustments were made to the questionnaire to make it suited for a Peruvian context. This included for example translations into native languages and rephrasing of questions to make them compatible with the specific culture. Secondly, field staff was trained and eligible households and individual participants were identified and interviewed. The third phase was processing of the data collected. This mainly involved editing, coding and verification, and checking for consistency. Ultimately, analysing, writing of final reports and providing the results and data to the public were done (DHSc).

The surveys were carried out through face-to-face interviews collecting information about all members of the household and a large amount of aspects of the home. The same face-to-face interview was done with every eligible woman 15-49 years old in the household. As mentioned, the interviews were conducted over nine months throughout the year.

According to the final report of the ENDES Continua 2004-2006, the survey had an average total response rate of 99.2 percent. The response rates for each of the states included in the

Andes subsample were slightly higher, ranging from 99.2 to 99.7 percent (INEI, 2007). These rates are uncommonly high and contribute to an elevated quality of the data.

3.4 Sample

The study compared a national sample with a rural subsample. The samples were selected based on several criteria. The study aimed at identifying important social factors in mothers that influence or even determine chronic malnutrition in their children 3-60 months in very poor ruralities. First, this resulted in a selection of women of child bearing age, 15-49 years old. Further, as an important objective was to link social position to these women, only usual residents of the interviewed households were considered eligible. Last, only women whose firstborn child was registered with anthropometric measures for height for age were considered eligible for the study. Both samples were conducted on data adjusted by sample weights to account for the stratified sampling design. This selection process resulted in a national sample of 1426 female respondents.

For the subsample, another selection criteria concerned place of residence. An aim was to look at possible differences in determinants of health for the national population and for subpopulations living in very poor and rural areas. Hence, only rural dwellers from the highlands region were included in the subsample as the highlands are characterised by large rural populations and high poverty rates. To explore the significance of extreme poverty in this rural context, the subsample was limited to five of the poorest states (determined by wealth quintiles and items) in the highlands region. These were Ayacucho, Apurímac, Huancavelíca, Huanuco and Puno. Other poor and rural states were excluded from the sample to reach a more uniform sample with regard to culture, geography, and structure that could be important in explaining child growth patterns. The size of the rural weighted subsample ended at 171 respondents.

3.5 Measures

Due to the explorative nature of the study, a range of measures related to demographic and social aspects were considered to be of interest for analysis. Variables were recoded to ensure enough responses in each category, and also to create meaningful categories within the specific local context of the study. Variables were also reverse coded where needed to ensure equal and correct directionality in agreement with the guidelines developed for the SDHVPR project.

3.5.1 Dependent variable

The dependent variable of the study was child nutritional status, measured by child stunting through the anthropometric measure of height for age. This is the available measure in the DHS data for nutritional deficiencies in children, and it is also regarded as the best measure of chronic nutritional deficiency in children under five presently available (Larrea et al., 2005).

Two trained staff members were required for each anthropometric measurement to assure accurate data (DHSd), and procedures for the measuring followed the recommendations laid out by the UN. The measure complied with the international growth standards set by WHO, in which a condition of stunted is determined by z-values less than -2 standard deviations (SDs) below the median height-for-age (DHSd). The standards are developed from measurements of well nourished children in eight countries on different continents. The standard deviation numbers are set based on natural variations in a well nourished population (DHSd). The final height for age variable was coded in two categories: *"Not stunted"* = 0 which was the reference category, and *"Stunted"* = 1.

3.5.2 Demographic and respondent characteristics measures

The demographic measures included in the study were

1. *Respondent's age* through questions about date of birth and "How many years old are you?"
2. *Partner's age* through the question, "How many years old is your partner/husband?"
3. *Region* or *"departamento"* of the respondent documented at the very beginning of the household questionnaire not by a specific question, but through the note "Geographic Identification" in which region, province, district, and community was listed and registered.
4. *Ethnicity* measured by mother tongue with response categories "*Castilian"* (0), *"Quechua"* (1), and *"Aymara"* (2).
5. *Current marital status* with the original response categories *"never married", "married", "living together", "widowed", "divorced"*, and *"not living together"* that were combined into the two broader categories "*married/living together"* (0), and *"not married/not living together/widowed"* (1).
6. *Relationship to household head* with original response categories of *"head", "wife", "daughter", "daughter-in-law", "grand daughter", "mother", "mother-in-law",*

"sister", *"co-spouse"*, *"other relative"*, *"adopted/foster child"*, *"not related"*, and *"household maid"* collapsed into *"wife"* (0), *"head"* (1), *"daughter or daughter-in-law"* (2). Due to few responses in the other categories, these were excluded from analysis.

7. *Who takes care of the child* with original response categories of *"respondent"*, *"partner"*, *"older daughter"*, *"older son"*, *other relatives"*, *"neighbours"*, *"friends"*, *"household maid"*, *"child at school"*, *"care by WAWA-WASI"*, *"institutional childcare"*, and *"other"* combined to *"respondent"* (0), *"partner"* (1), *"other person"* (2).
8. *Altitude in meters* measured in which altitude the respondent lived at the time of the survey.
9. *Number of children under 5* as a continuous measure.
10. *Rural or Urban residence* measured in the same way as state. At the beginning of the questionnaire the household was identified as situated in a *"large city"*, *"small city"*, *"town"*, or in a *"rural area"*.

3.5.3 Educational measures

Two variables measured respondent's education, namely "educational attainment" and "level of literacy". Educational attainment was measured by level of completed school with the following response categories: *"no education"*, *"incomplete primary"*, *"complete primary"*, *"incomplete secondary"*, *"complete secondary"*, and *"higher"*. These categories were recoded into the following four categories: *"complete secondary school or higher education"*= 0, *"complete primary school and/or incomplete secondary school"* = 1, *"incomplete primary school"* = 2, and *"no education"* = 3.

Level of literacy was measured by requesting the respondents to read a simple sentence to assess their reading capabilities. The respondent was then categorised into one of the following: *"cannot read at all"*, *"able to read only parts of sentence"*, *"able to read whole sentence"*, *"no card with required language"*, or *"blind/visual problems"*. These categories were combined into *"Able to read whole sentence"* (0) and *"Cannot read at all, or able to read parts of sentence"* (1).

Partner's educational attainment was assessed through the question: "What was the last level of education that your partner/husband graduated from?" Response options were *"no*

education”, “incomplete primary”, “complete primary”, “incomplete secondary”, “complete secondary”, and *“higher”*. These were collapsed into three categories and coded as follows “*complete secondary school or higher education”* = 0, *“complete primary school and/or incomplete secondary school”*= 1 and *“incomplete primary school or no education”*= 2.

Both respondent’s and partner’s educational attainment was included in the analyses.

Frequency of reading newspaper/magazine: “Do you read a newspaper or magazine almost every day, at least once a week, less than once a week, or not at all?” These response options were collapsed into two categories: *“More than once a week”* = 0 and *“Never or less than once a week”* = 1.

Frequency of listening to radio: Do you listen to the radio almost every day, at least once a week, less than once a week or not at all? The same response options and coding as for the reading variable were applied in analyses.

3.5.4 Occupational variables

Respondent’s occupational status was measured by the question “What is your primary occupation, or class of work?” As this was an open question, a range of responses were give and these were later combined into the following categories: *“not working”, “professional, technical, management”, “clerical”, “sales”, “agriculture self-employed”, “agriculture employee”, “household & domestic”, “services”, “skilled manual”,* and *“unskilled manual”*. For the purpose of the analyses of this study these categories were again combined into *“Professional/service/technical”,* all of which were put in the category *“White collar”* = 0, *“agriculture or manual labour”* = 1, and *“not working”*= 2.

Partner’s occupation was measured in the same way: “What is the occupation of your husband/partner? That is, what class of work is his primary?” And “What was the occupation of your (last) husband/partner? That is, what class of work was his primary?” In the same way as with respondent’s occupation, the given responses were recoded into *“not working/did not work”, “professional, technical, management”, “clerical”, “sales”, “agriculture self-employed”, “agriculture employee”, “household & domestic”, “services”, “skilled manual”, “unskilled manual”* and *“other”*. These were in turn combined into *“Professional/service/technical” collectively named “White collar”* = 0, and *“Agriculture or*

manual labour" = 1. As a very small number of respondents reported their partner not working, this category was excluded from analyses.

3.5.5 DHS Wealth Index

To construct the WI, DHS applied a standard approach. A variety of items or household qualities which might reflect wealth were entered in principal components analysis. The following items were thus included: electricity, kitchen, radio, television, refrigerator, computer, telephone, car, bicycle, motorcycle, water source, source of drinking water, main wall, floor, and roof material, type of cooking fuel, and number of people per room in the house. The items forming the first factor were selected to be included in the WI. Each item was weighted for importance according to factor loading, and the scores were standardized. Households were assigned scores for each asset in the wealth index. These scores depended on whether the household possessed the specific items or not. All individual household asset scores were summarized into one total household score, a procedure which "places individual households on a continuous scale of relative wealth" (DHSg). Individuals were assigned the score of the household of which they were permanent residents. Lastly, the sample was divided into five population quintiles with 20 percent of the sample in each group (DHSf). For the use in this thesis, the wealth quintiles were calculated for each sample separately.

3.5.6 Wealth items

A number of items related to wealth were included in which the response options were *"yes"* = 0, and *"no"* = 1: Does your home have (toilet facility, electricity, radio, television, refrigerator, bicycle, motorcycle/scooter, car/truck, telephone)?

Further wealth related items were:
Goats own: "Do any of the family members in this household own goats?" Response options were *"yes", "no", "don't know"*, and a request to inform about the quantity.

"How many rooms in the house are utilised for sleeping?"

"Without counting bath room, kitchen, hallways, or garage; how many rooms are in use in your house?"

Information about main wall material and main floor material was collected through observation. For main wall material original response categories were *"wood", "rock with mud", "tripley", "mat", "clay", "brick or cement", "rock with cement"*, and *"other"*. These were collapsed into two categories: *"brick/cement/wood"*, coded as 0, and *"clay/rock with mud"*, coded as 1.

For main floor material original response categories were *"dirt or sand", "wood (boarding)", "parquet", "vinyl or laminate", "tiles", "cement or brick"*, and *"other"*. The last six categories were collapsed into *"cement/brick/wood"*, coded as 0, and *"dirt/sand"* was coded as 1.

3.5.7 Respondent's decision latitude

Degree of decision power was measured by the following: "In your home, who has the final say in making the following decisions on (1) own health care, (2) making large household purchases, (3) making household purchases for daily needs, and (4) visits to family and relatives?" Original response formats were kept in the analyses only with a small change in coding: *"Respondent with partner/husband" (0), "respondent with other person" (1), "respondent alone" (2), "partner/husband alone" (3), and "other person alone" (4).*

3.5.8 Positive husband behaviour

Positive husband behaviour was measured by the following items: "in your relationship to your (last) husband (partner): Can you tell me whether he spends (spent) his free time with you, is(was) affectionate towards you, consults (consulted) your opinion regarding different aspects of the household, respects (respected) your wishes, respects (respected) your rights?" The response options were *"frequently"* (0), *"sometimes"* (1), and *"never"* (2).

3.6 Data analysis

The statistical analyses were performed using SPSS for Windows, version 15.0.

The sample and subsamples were selected based on the set of criteria outlined in section 3.4, p. 29. All analyses were conducted on data adjusted by sample weights to account for the stratified sampling design. The following procedure for the statistical analyses was carried out:

1. The data set was screened for outliers and missing data. The variable measuring Positive husband behaviour had a fairly large portion of missing values, and was later run in separate regression analyses.

2. Relevant items were recoded in new categories and reverse coded to ensure similar and correct directionality for scores.
3. Data were analysed through descriptive statistics, including frequency distributions, mean, standard deviation, skewness and kurtosis (tables 1-6 in appendix).
4. Factor analyses were performed to assess the inter-correlation among items considered for inclusion in scales.
5. Scales for some items were attempted constructed, but eventually rejected as the use of single items was found to be more appropriate.
6. Correlations between the dependent variable and the various independent variables were assessed for each subsample separately. Pearson Product-Moment Coefficient was utilised to calculate correlations of continuous variables. For categorical variables cross tabulations and Chi-Square tests for independence were chosen to calculate correlation with the dependent variable.
7. Variables proven to be statistically significantly correlated to the dependent variable at the $p < 0.001$ for the national sample, and $p < 0.05$ for the rural sample were included in various simple and multiple binary logistic regression analyses. The stricter significance level for the national sample was due to the much larger size of this sample.
8. Another aspect of importance was the significance level compared to the odds ratio. Each added variable in a regression analysis reduces the degrees of freedom. As the significance level is more sensitive than the odds ratio to the sample size, it was considered important to assess both values in the discussion. This to assure that valuable information about the effect of important predictors was kept.

3.7 Strategy for multiple logistic regression analyses

The logistic regression analyses were divided into two main types of analyses for each subsample (1) a classical analysis, and (2) alternative analyses.

The classical analysis involved running the classical social determinants of health in a separate analysis for each sample. Controlling for age, the included variables were Wealth Index, respondent and partner's education, and respondent and partner's occupation. The objective of running these exclusively was to compare the effect these factors had on national and local, rural level.

Further, alternative analyses were performed testing additional variables together with or without the classical social determinants. To increase the statistical power and get the most parsimonious model with the most degrees of freedom, a final reduced model including only the statistically significant variables from the initial alternative regression analyses were tested.

3.8 Ethical considerations

Data was collected prior to the initiation of this study and already ethically approved for research purpose. Being large data collecting institutions, DHS and ICF Macro have clear guidelines for ethical behaviour when collecting information from individuals. Informed consent was gained from all participants taking part in the study, and an additional consent was retrieved for the measurement and use of biometric information. The data were provided to the Faculty of Psychology at the University of Bergen and the directors of the Social Determinants of Health in Very Poor Ruralities research project after application and detailed description of the purpose of use. As a part of this research project, I have received permission to use these data in my analyses.

4.0 RESULTS

4.1 Descriptive results

4.1.1 Child nutritional status

Child nutritional status measured by height for age gave different distributions across samples. For the national sample, 22 percent of children were stunted, compared to the subsample in which the frequency of stunting was twice as high with 44.6 percent (Table 1).

4.1.2 Age

In the national sample, the age distribution of the respondents ranged from 15 to 49 years old. This was the range selected for the study as women of childbearing age were of interest and not others. The mean age for the national sample was 30 years. In the rural sample the distribution was very similar with the lowest age being 16, the highest 49 years and with a mean of 30 years (Table 2). Partner's age ranged from 17 to 78 years with a mean of 34 in the national sample. In the subsample, partner's age ranged from 18 to 62, with a mean of 34 (Table 2 in appendix).

4.1.3 Educational attainment

Table 3 shows the distribution of education among the respondents for both samples. In the national sample, almost 73 percent of the respondents had either complete primary or complete secondary or higher education. A proportion of 4.1 percent reported having no education. For the subsample 10 percent reported having no education, and as much as 44 percent reported not having completed primary education. Women having complete primary education and incomplete secondary were 32.8 percent, and only 12.7 percent had complete secondary school and/or higher education.

4.1.4 Partner's education

For the national sample, the majority of the respondent's reported that their partners had completed secondary education or attended higher education. The proportion with no or incomplete education was 19 percent (Table 3). For the rural subsample, a good 30 percent reported their partners having no education or incomplete primary education. Almost 37 percent of the partners had complete primary or incomplete secondary education (Table 3).

4.1.5 Literacy level

In the national sample, close to 84 percent of the respondents were able to read a whole sentence, and 16 percent could not read at all or only parts of the sentence. In the rural sample the percentage of literate respondents was lower with 64 percent being able to read a whole sentence and 34 percent not able to read at all or able to read parts of the sentence (Table 3).

4.1.6 Respondent's occupation

The variable assessing the occupational situation of the respondents was respondent's occupation. In the national sample, 36 percent fell into each of the categories of white collar, and manual or agriculture work. A relatively high percentage of 28 reported not working. For the subsample, the vast majority of the women, 80 percent, reported agricultural or manual work being their main economic activity (Table 3). A little more than 13 percent were in occupations related to professional, service or technical work, known as white collar occupations. The remaining 6 percent reported not working.

4.1.7 Partner's occupation

In the national sample, 57 percent reported that their partner had manual or agricultural work as main occupational activity. Respondents with partners in the white collar sector counted 36 percent. Results for the subsample were similar for partners and respondents. Table 3 shows that more than 80 percent received their main income from agricultural or manual work, whereas only 9 percent were white-collar workers (occupations of professional, technical or service type).

4.1.8 Wealth Index

As described earlier, the Wealth Index was recalculated to reflect population quintiles for each of the samples. The quintile sizes were similar across samples with from 19.9 to 20.1 percent and 19.8 to 20.2 percent of the respondents in each quintile in the national and rural sample respectively (Table 4). Comparing this to the original Wealth Index, one can appreciate the recalculation and adjustment of the Wealth Index to fit the rural sample. Frequencies with the original Wealth Index run in the rural sample noted 45.9 and 47.5 percent falling in the poorer and poorest quintiles respectively, only .7 percent in the richer quintile, and none in the richest. This clearly shows the enormous differences in wealth within the country depending on region. It also underscores the importance of adjusting the Wealth Index to the specific area in which it is applied.

4.1.9 Wealth items

Table 4 shows the distribution of various items related to wealth in the samples. The overall impression for several of these items was that for the national sample, the majority of the respondents reported having the item. The possession of a refrigerator, bicycle, motorcycle and car was less frequently reported, with the majority not having these items. For the subsample, the situation was opposite. Except for radio, which almost 90 percent reported possessing, the vast majority of the respondents reported not having any of the items listed. Most striking was telephone, which 99.8 percent reported not owning.

4.1.10 Frequency of reading newspaper/magazine and listening to radio

Almost 80 percent in the national sample reported that they never or less than once a week read newspaper or magazine whereas the remaining 20 percent reported doing this more than once a week. In the rural sample, only 2.5 percent reported reading newspaper or magazine more than once a week, and the remaining 97 percent reported doing this never or less than once a week.

A percentage of almost 65 in the national sample reported listening to the radio more than once a week. The percentage of rural residents reporting doing this was 56 (Table 3).

4.1.11 Demographics

The distribution of ethnicity, measured by mother tongue, also varied across samples. For the national sample, the majority reported Castilian as their mother tongue, and 15 percent Quechua. In the subsample, well over half of the respondents reported the native indigenous language Quechua as their mother tongue, and 40 percent reported having Castilian as their native language (Table 3). Similar distributions on respondent's relationship to household head were found, with the national sample reporting a slightly lower percentage of being wife of head, and a slightly higher portion being daughter or daughter-in-law (Table 13). More than 80 percent of the national sample reported being married or living with partner, whereas the percentage for the same question was 49.4 in the subsample (Table 3). The population distribution for the states included in the rural sample can be found in table 3. Puno was the state with most respondents, 60 percent. Huancavelica and Huánuco had 47 and 29 percent of the respondents respectively. Ayacucho and Apurímac had similar sample sizes with 19 and 17 percent respectively.

4.1.12 Decision Latitude

Concerning the various measures for decision latitude the overall pattern for the national sample was that the majority of the respondents reported making final decisions either alone or together with partner. For the rural sample the results were similar but not equally consistent. Decisions on own health care was distributed between respondent alone (35 percent), respondent together with partner (29 percent) and partner alone (30 percent). For large household purchases, 49 percent reported making this decision together with partner, and 25 percent reported that partner made this decision alone. Daily household purchases were made by respondent alone for 44 percent of the cases, and together with partner for 34 percent. Visits to family and relatives was a decision mainly made together with partner (52 percent) (Table 5 in appendix).

4.1.13 Positive Husband Behaviour

For every indicator of positive husband behaviour, more than 50 percent in the national sample reported that their husband or partner showed this behaviour frequently. For the rural sample the same pattern was seen, but with slightly lower frequencies (Table 6 in appendix).

4.2 Bivariate analyses

4.2.1 Educational variables

The relationship between educational measures and child stunting was assessed through Chi-square tests for independence. Tables 7a shows the results for respondent and partner educational attainment. For the national sample, respondent's educational attainment, partner's educational attainment and respondent's level of literacy were negatively related to child stunting with statistical significance at the .001 level, indicating that higher educational attainment was associated with lower levels of stunting. In addition, both frequency of reading newspaper or magazine, and frequency of listening to radio were found to be statistically significantly related to child stunting ($X^2 = 26.553$, $p < .001$, $X^2 = 8.911$, $p < .01$) with higher frequency of reading or listening to radio giving lower scores on child stunting. For the subsample, none of the items measuring education were statistically significantly related to child stunting.

4.2.2 Occupational variables

Chi-square tests for independence were performed to test the role of occupational status. For the national sample both respondent's and partner's occupation was statistically significantly related to child stunting at the 0.001 level with higher scores in the low status occupations giving higher scores on child stunting (Table 7a). For the rural subsample, neither respondent's nor partner's occupation was statistically significantly related to child stunting (Table 7a).

4.2.3 Wealth Index

For the national sample, Wealth Index was positively and statistically significantly related to child stunting at the $p < 0.001$ level. Statistical significance could not be noted for the relationship between child stunting and Wealth Index in the rural sample (Table 7a).

4.2.4 Wealth

In addition to a Wealth Index factor score, a number of single items related to wealth were included in the correlation analyses. Chi-square tests for independence were performed, testing the strength of correlation between the selected wealth items and child stunting. All items, except ”Has Bicycle” were found to have a statistically significant relationship to child stunting in the national sample, with possession of item being related to lower chance of child stunting. None of the correlations were statistically significant for the subsample (Table 7a).

4.2.5 Decision latitude

Chi-square tests for independence were run testing for the correlation between the four items measuring decision latitude, and child stunting. As can be seen in table 7b (in appendix), all of the items were found statistically significant and positively related to child stunting in the national sample. For the subsample, none of the items proved to be statistically significantly related to child stunting.

4.2.6 Positive Husband Behaviour.

Chi-square tests for independence were again performed to determine the possible correlation between five items measuring positive husband behaviour and child stunting. The items “Husband consults respondent” and “Husband respects your rights” were statistically significant at $p < .05$ level with higher frequencies of positive husband behaviour producing lower levels of child stunting. None of the remaining items were significant in relation to child stunting. For the subsample, there was not found statistically significant relations between any of the items and child nutritional status (Table 7b in appendix).

4.2.8 Demographics.

The correlation between child stunting and each of the variables ethnicity, relationship to household head and current marital status were investigated through chi-square tests for independence. As can be seen in table 15 results varied across samples. Ethnicity and relationship to household head were the items found to be positively and statistically significantly related to child stunting for the national sample. For the rural subsample, none of the items correlated statistically significantly to child stunting (Table 7a).

Chi-square tests of independence were performed to assess the relationship between altitude and child nutritional status. In both samples statistically significant relationships were found with higher altitude related to higher risks of stunting. In the national sample the association

was statistically significant at the $p < .001$ level. In the rural sample, the association was weaker with significance at the $p < .05$ level (Table 7a).

Pearson's product-moment coefficient was used to determine the relationship between the continuous variable respondent's age and child stunting. A statistically significant correlation was found for both the national and the rural sample $p < .01$ (sig. 2-tailed .111), and $p < .05$. (sig. 2-tailed .169) respectively. The associations were positive, with higher age correlated to higher scores of child stunting. (Table 8a in appendix).

To assess the relationship between partner's age and child stunting, the same approach as with respondent's age was used. Also here, a statistically significant correlation resulted for both samples, $p < .01$ (sig. 2-tailed .000) and $p < .05$. (sig. 2-tailed .021) for the national and rural sample respectively. The associations were both positive with higher age related to higher scores on child stunting (Table 8a in appendix).

For the national sample, number of members in the household was statistically significantly related to child stunting at the $p < 0.05$ level (2-tailed) with more members increasing levels of child stunting. The variable was not significant in the subsample.

A statistically significant and positive association between number of children under five years in the household and child stunting was noted for the national sample, $p < 0.01$ (2-tailed). No significant relationship was found between these variables in the subsample.

None of the other continuous variables (*goats owned, number of rooms in the household, number of rooms for sleeping*) were statistically significantly related to child stunting for either sample (Table 8a in appendix).

4.3 Binary Logistic Regression Analyses.

Various binary logistic regression analyses were performed in both samples to explore the relationship between child stunting and a number of independent predictors already analysed through descriptive analyses. As outlined under point 3.7 p. 35 in the methods section, two main types of regression analyses were performed: First the classical model, and then the alternative models. Age was controlled for in all analyses for both samples.

4.3.1 Peru National Sample (n = 1426).

As several variables were identified as significantly correlated to stunting, various models were tested in logistic regression.

4.3.1.1 Regressions with Classical Social Determinants of Health.

The classical model was run in binary logistic regression with the traditional social determinants of health. The analysis included respondent's and partner's age, respondent's education, partner's education, respondent's occupation, partner's occupation, and Wealth Index. The model was statistically significant, $X^2 = 231.117$, $p < .001$. The explanation power was between 17 percent (Cox and Snell R square) and 27 percent (Nagelkerke R square), and correctly classified cases were 80 percent. Two of the predictors were found to be statistically significant in the model (respondent's occupation and Wealth Index). Controlling for all other factors, Wealth Index had the strongest predictive power with an odds ratio of 3.919 and 5.311 for the poorer and poorest quintiles respectively compared to the richest. This indicated that respondents falling into these categories were approximately 4 and 5 times more likely to have a stunted first child compared to those falling into the richest category. Not working was also statistically significant in predicting child stunting, but this represented a protective factor against child stunting with an odds ratio of 0.588. A child of a mother who was not working was .6 times as likely to be stunted compared to a child of a mother in a white-collar occupation (Table 9). Worth mentioning is the relatively large effect sizes for both respondent's and partner's education. In previous analyses where age was excluded, both respondent's and partner's education emerged as strong and significant predictors. The insignificant effect of education in the present analysis (where age is included) can be explained by a close correlation between age and education, even if age is not correlated to child stunting, and also to a loss of degrees of freedom by adding a new variable to the equation (see section 3.6, point 8, p.39) . Hence, though not reaching statistically significance in the present analysis, the large odds ratios indicated a possibly important role played by the education variables.

To consider the most parsimonious model possible and determine the actual predictive power of the two statistically significant predictors in the previous model, Wealth Index and respondent's occupation were run in a second, separate logistic regression analysis, still controlling for age. The model was statistically significant, $X^2 = 218.994$, $p < .001$. The complete model explained between 16 (Cox & Snell R Square) and 26 percent (Nagelkerke R

Square) of the variance, and correctly classified 80.3 percent of the cases. Wealth Index still made a strong and statistically significant contribution to the model. Being in the poor and poorest quintiles gave an increased likelihood of being stunted by 6.5 and 9.4 times respectively compared to being in the richest quintile. Respondent's occupation was no longer statistically significant in predicting child stunting (table 10 in appendix).

4.3.1.2 Regressions with variables from bivariate analyses – the alternative model.
Multiple logistic regression analysis was carried out to determine the impact of various independent variables on child stunting in the national sample. Two alternative models were tested. In the first model, a group of 12 variables were included (Respondent's and partner's age, respondent's educational attainment, partner's educational attainment, respondent's literacy level, frequency of reading newspaper or magazine, respondent's occupation, partner's occupation, Wealth Index, relationship to household head, ethnicity and altitude). In addition to age, the variables considered for the analysis were those noted as statistically significant at the $p < 0.001$ level in the bivariate analyses. The full model was statistically significant, $X^2 = 257.606$, $p < .001$. The explained variance was between 19 percent (Cox and Snell R square) and 29.8 percent (Nagelkerke R square). Correctly classified cases were 81 percent. Of the variables included, four made a statistically significant contribution to the model. Wealth Index was by far the strongest predictor with $p < .001$ in the poorest quintile. Respondents falling into the categories poorer and poorest, recorded odds ratios of 3.6 and 5.2 respectively, indicating approximately 3 and 5 times greater likelihood of children being stunted compared to the richest quintile of the population. Altitude was also a strong predictor of stunting with children living 3001-6000 meters above sea level having increased likelihoods of 2 times of being stunted compared to those living from 0-2000 meters above sea level. In the last two significant predictors, respondent's occupation and relationship to household head, protective categories were noted. Similarly to the Classical model, respondents not working were .7 times less likely to have a stunted first child compared to respondents in white-collar occupations. Further, being the head of the household gave a .13 time decreased likelihood of having a stunted first child compared to being the wife of the household head (Table 11 in appendix).

As with the Classical model (table 10), the odds ratios for respondent's and partner's educational attainment should be mentioned. For respondent's educational attainment these were 1.7 and 1.9 for reporting incomplete and no education respectively, indicating increased

likelihoods of having a stunted first child compared to those reporting having completed secondary or started higher education. Similarly, partner's educational attainment noted odds ratios of 1.6 for no education/incomplete primary education. Though these factors could not be identified as statistically significant predictors, they are worth considering as they were just below statistical significance, and the effect sizes were large. The same observations of insignificant results for education once age was added were noted. Once again this can be attributed to a strong correlation between age and education, and to the reduction of degrees of freedom by adding a new variable to the equation.

A second logistic regression analysis was performed to assess the independent impact of the four statistically significant contributors in the just described analysis, still controlling for age. The full model was statistically significant, $X^2 = 241.740$, $p < .001$, and explained between 18 (Cox & Snell R Square) and 28 percent (Nagelkerke R Square) of the variance. The model as a whole correctly classified 80 percent of the cases. All variables but respondent's occupation were still noted as significant contributors in explaining the variance in child nutritional status, with almost unchanged odds ratios. Wealth Index was still noted as the strongest predictor, with a marked increase in odds ratio. Increased likelihoods of being stunted by 5.5 and 8.2 were noted for children falling in the poorer and poorest quintiles compared to the richest (Table 12).

To compare the impact of Wealth Index as a predictor of child stunting with a range of wealth items, a second alternative multiple logistic regression analysis was conducted (Table 13 in appendix). This replaced Wealth Index with wealth items noted as significant at $p < .001$ level in bivariate analyses (Toilet facility available, the possession of electricity, television, refrigerator, telephone, and main wall and floor material). The model was statistically significant, $X^2 = 261.085$, $p < .001$. The model as a whole explained between 19 percent (Cox and Snell R square) and 30 percent (Nagelkerke R square), and correctly classified 80.7 percent of the cases. Five of the variables made a statistically significant contribution to the model (Partner's educational attainment, electricity, main wall material, relationship to household head, and altitude). The strongest predictors of child stunting was wall material and electricity noting odds ratios of 2 and 1.9 respectively. Children living in houses made primarily of mud or a mix of mud and rocks were 2 times more likely to be stunted compared to children living in houses made of cement, brick, or wood. Equally, living in households with no electricity increased the likelihood of being stunted by 1.9 times compared to children

living in households with electricity. Altitude was also statistically significant with 1.7 times greater likelihood of being stunted when living from 3001-6000 meters above sea level compared to living from 0-2000 meters above sea level. For partner's educational attainment the odds ratio was noted as 1.7 for those with no education compared to secondary or higher education. Relationship to household head was the last statistically significant variable in the model and recorded an odds ratio of .147, indicating that being head of household decreased the likelihood of having a stunted child by almost .15 times compared to being wife of head of household. This was consistent with the findings on relationship to household head in the previous analyses (Table 13 in appendix). As in the foregoing analyses, respondent's educational attainment was found to have large odds ratio values and be just on the verge of statistical significance. This is not surprising, as in the same analysis where age was excluded, respondent's educational attainment was noted as one of the strongest predictors. As mentioned for the previous analyses, a possible explanation for the disappearing of significance could be a strong correlation between respondent's educational attainment and age, in addition to the loss of degrees of freedom by adding a new variable to the equation. Hence, the large effect sizes in the present analysis should not be ignored, and respondent's educational attainment should not be rejected as a possibly important influence on child stunting. In addition, it is likely that in this analysis partner's educational attainment represents part of the variance that respondent's education formerly represented (in analyses where age was not included), and therefore increases in strength as a predictor (see Polit & Beck, 2004, p.519

A second multiple logistic regression analysis was performed including only the variables proven to be statistically significant in the previous analysis. Partner's educational attainment, having electricity, main wall material, relationship to household head, and altitude were thus included. In addition age was controlled for. According to the Omnibus test of model coefficients, the complete model was statistically significant, $X^2 = 265.552$, $p < .001$. It explained between 18 percent (Cox & Snell R Square) and 28 percent (Nagelkerke R Square) of the variance and correctly classified 80.5 percent of all cases. All items were found to be making a statistically significant contribution to the model. The strongest predictor was electricity which indicated that residing in a household with no electricity increased the likelihood of being stunted by 2.6 times compared to a child living in a house with electricity. The odds ratio related to partner's educational attainment was strengthened compared to the precious analysis. Compared to partners with higher education, being in the categories of

complete primary or incomplete secondary education, and no education or incomplete primary education increased the likelihoods of being stunted by of 2.1 and 2.3 times respectively. Residing in a household in which the walls are made of mud or mud with rock also increased the likelihood of child stunting by 2 times compared to living in a house primarily made of cement, brick or wood. Being head of the household was still significant and protective of stunting, but not as strong as previously observed. The category of daughter or daughter-in-law also emerged as significant and protective compared to being the wife of the household. Lastly, higher altitude was noted as a risk factor for child stunting with an odds ratio of 2.2 for children living above the altitude of 3000 meters compared to those living at an altitude from 0 to 2000 meters above sea level (Table 14).

4.3.1.3 Simple Binary Logistic Regression Analysis

Positive Husband Behaviour

Simple logistic regression analysis was performed to assess the impact on child stunting by the variables measuring positive husband behaviour. Five variables were included in the analysis (free time, consults, affectionate, respects, husband respects your rights). The model was statistically significant, $X^2 = 31.483$, $p < .001$. The explained variance was between 2.8 percent (Cox and Snell R square) and 4.3 percent (Nagelkerke R square). 78.1 percent of the cases were correctly classified. Three of the five variables made a statistically significant contribution to the model. Respondents reporting that the husband consults them sometimes were almost 1.6 times more likely to have a stunted child compared to respondents who are frequently consulted by their husbands. Never being consulted did not show a statistical significance in the model. Further, women reporting sometimes experiencing respect from their husbands were almost .3 times less likely to have a stunted child compared to women reporting experiencing respect frequently. Never being respected was also statistically significant and protective, however weak with an odds ratio of 0.048 (Table 15 in appendix). Respondents reporting that their husband respected their rights sometime were 3 times more likely to have a stunted child compared to those experiencing this frequently. No statistically significant relationship was found between never experiencing that your husband respects your rights and child stunting (Table 15 in appendix).

Decision Latitude

Similarly to Positive Husband Behaviour, the group of autonomy related variables were run in a separate logistic regression analysis. Four variables were included based on previous chi-

square tests (final say on own health care, final say on making large household purchases, final say on making household purchases for daily needs, and final say on making visits to family and friends). The model was statistically significant, $X^2 = 64.275$, $p < .001$. The explained variance in child stunting was between 4 percent (Cox and Snell R square) and 7 percent (Nagelkerke R square), and 79 percent of the cases were classified correctly. Three of the variables made statistically significant contributions to the model. First, respondents reporting making the final decision on own health care alone were .6 times less likely to have a stunted child compared to those making the decision together with partner or husband. Further, respondents reporting that someone else had the final say in daily household purchases were .2 times less likely to have a stunted child compared to respondents making the decision together with husband or partner. Women reporting that their husband made the final decision alone on visits to family and friends had an increased likelihood of 1.7 times of having a stunted child compared to if respondent and husband made the decision together (Table 16 in appendix).

4.3.2 Peru Regional Sierra Rural Subsample (n = 171).

Multiple Logistic regression analysis was performed to test the explanatory power of the variables noted as statistically significant at the $p < 0.05$ level in bivariate analyses, on the likelihood that the respondent's first child would be stunted. Three independent variables were included in the model (respondent's age, partner's age, and altitude). The model was statistically significant, $X^2 = 10.375$, $p < .05$. The explained variance of nutritional status of the full model was between 6.7 percent (Cox and Snell R square) and 8.9 percent (Nagelkerke R square), and the model was able to correctly classify 59.8 percent of the cases. However, only altitude made a statistically significant contribution to the model with an odds ratio of 4.362 in the category of highest altitude. This indicated that residing above 3000 meters above sea level produced an increased risk of child stunting of four times compared to living from 0 to 1000 meters above sea level (Table 17).

4.3.2.1 Regressions with Classical Social Determinants of Health.

In addition to the just described analysis, a classical model was tested including the classical social determinants of health. This was done to see whether the education, occupation, and wealth were significant in predicting child health also in poor and remote environments. Respondent's and partner's age were controlled for in an analysis which included respondent

and partner's educational attainment, respondent and partner's occupation, and wealth index. The model was not statistically significant, $X^2 = 16.144$, $p = .305$. The full model explained between 10 percent (Cox Snell R Square) and 13.7 percent (Nagelkerke R square) of the variance in nutritional status. Sixty-three percent of the cases were correctly classified. None of the variables were noted as statistically significant in predicting child stunting (Table 9, p. 48). The odds ratios for wealth and respondent's educational attainment were relatively large, but the variables did not reach significance

4.3.2.2 Simple Logistic Regression Analysis

Positive Husband Behaviour

In concert with the exploratory nature of the study, simple logistic regression analysis was performed for the group of variables measuring positive husband behaviour. The impact of each variable was assessed on the likelihood that the respondent's first child would be stunted. The variables included in this model were Free Time, Consults, Affectionate, Respects, and Husband respects you rights. The full model was not statistically significant according to the Omnibus Tests of Model Coefficients, $X^2 = 6.283$, $p = .791$, indicating that the model was not able to distinguish between respondents whose children were stunted and those who were not stunted. The explanation power of the model was between 4.3 percent (Cox and Snell R square) and 5.8 percent (Nagelkerke R squared), and it correctly classified 60 percent of the cases (Table 18 in appendix).

Decision Latitude

To explore the impact of autonomy related factors, a group of variables assessing the degree of respondent's decision latitude were investigated through logistic regression analysis. Four independent variables were included (final say on own health care, final say on making large household purchases, final say on making household purchases for daily needs, and final say on making visits to family and relatives). The model was not statistically significant, $X^2 = 14.860$, $p = .462$. The explained variance was between 8.4 percent (Cox and Snell R square) and 11.3 percent (Nagelkerke R square), and 65.6 percent of the cases were correctly classified. Of the variables included, none proved to make a statistically significant contribution to the model (Table 19 in appendix).

5.0 DISCUSSION

The discussion part will first look at methodological issues in the study, and then move on to addressing the findings.

5.1 Methodological issues

5.1.1 Cross-sectional study

The design of the study was cross sectional, and conclusions about causality cannot be drawn. A study aiming at determining causality would require the analysing of at least three waves of data in structural equations. As there is only one wave of data, this is not possible. Further, as has been underlined, the study is explorative, and causal conclusions are not necessarily the main aim of the research. Rather, identifying what factors are related to child stunting in very poor and remote areas compared to national findings were priority. In addition, it can be argued that the search for causal relationships is actually an oversimplification of complex social and cultural phenomena that adds little to the understanding of mechanisms like the one studied here. In the end, the mechanisms' underlying patterns might be reciprocal in which factors and conditions affect, reinforce and weaken each other.

5.1.2 Self-report

Self-report is a returning methodological issue in survey studies (van Herk, Poortinga, & Verhallen, 2004). DHS data hold high quality as the DHS institution has extensive experience in survey development and data collection. The data that are basis for this study were collected through face-to-face interviews by trained staff. The data collector can however only facilitate a reliable survey to a certain degree. It cannot completely prevent respondents from under or over reporting or giving false responses which are potential validity issues related to survey studies. Avoiding response sets is difficult, especially for sensitive topics (van Herk, Poortinga, & Verhallen, 2004). Few of the variables analysed in this study are however particularly sensitive, and there is not ample reason to consider this as a major methodological issue. For the collection of the type of data used in this study, there are no better alternatives to survey and self report. As Turkkan (2000) puts it: "Even if there were high-tech ways to develop independent measures, health risks are greatest in geographic areas where the resources for health care and health research are the lowest" (Turkkan, 2000, p. 49). When necessary precautions concerning survey instruments and response sets are taken, the limitations of the methodology must be accepted.

5.1.3 Sample size

In regression analysis, a certain number of respondents are needed in relation to the number of variables, for the analysis to have 'sufficient' statistical power. More precisely, it is the number of parameters to be estimated (B coefficient) that is important. For example, a model with four variables will estimate four B coefficients. However if one of the variables is categorised into three categories, one category will be designated as the reference and B coefficients will be estimated for the other two categories. In such a case a total of five B coefficients (parameters) would be estimated.

There is no fast rule for a minimum n to parameter ratio and there is no universally accepted definition of what is sufficient statistical power. However, the ideal is to have as large an n as possible and as few parameters to estimate as possible. Tabachnik and Fidell (2009) suggest an often cited guideline of N > 50 + 8 x number of predictor variables (or more precisely, parameters), and this guideline is met in the regression analyses in this thesis. However, caution is needed in comparing the analyses computed with the relatively large national sample and relatively small rural sample. Similar magnitude odds ratios are less likely to be statistically significant in the rural than in the national analyses, due to the sample size difference.

5.1.4 Comments on variables

For the national sample, the regression models explained between 18 percent and 30 percent for both the Wealth Index and wealth item analyses. As can be noted, the explained variance is at the level of what is normal for studies within this field. It is however possible that the inclusion of other variables might have increased the explanation power. Social capital which was noted as important within the sustainable livelihoods framework is left out of the DHS survey, and variables addressing the aspects of social support and social network within rural communities might be potential indirect contributors to child nutritional status.

5.2 Results Discussion

The study found that nationally, the odds of having a stunted first child were significantly higher with lower levels of two of the classical social determinants of health, namely wealth and occupation. Concerning wealth, being in the two poorer wealth quintiles noted increasing odds of having a stunted child compared to belonging to the richest quintile. The poorer and

poorest quintiles had odds of 6.8 and 9.4 respectively. These odds ratios were slightly weakened, but remained significant when controlling for other variables in further analyses. In the analysis exploring wealth items, absence of electricity and wall material were noted as statistically significant predictors of child stunting with odds ratios of 2.56 and 2 respectively compared to reference categories. Respondent's occupation was noted as statistically significant in all regression analyses. Further, altitude was noted as one of the strongest predictors of child stunting in all regression analyses with odds ratios of up to 2.2 in the reduced models. The odds ratios of stunting among children with mothers and fathers who had low levels of education were generally high for all regression analyses, but statistically significance could not be stated. The results for the rural subsample were quite different. In the bivariate analyses the only variables significantly related to child stunting were respondent's and partner's age as well as altitude. Only altitude remained statistically significant in the regression analysis with an odds ratio of 4.362 of being stunted when residing above 3000 meters above sea level compared to residing at 0-2000 meters above sea level.

An abundance of research exists documenting a strong relationship between social factors and health, including nutritional status. The main findings in this study points to aspects of development and health research that have largely been ignored, namely a clear difference in factors predicting stunting between national and local levels. This study underscores the point that generalisation from national to local level does not suffice. Accepting this, other concerns come to the surface. Why are the differences so marked comparing national level with the rural sub-region of the Andean area? What causes the so widely applied social determinants to fail in explaining the differences in child stunting in the rural area? The discussion part of this thesis illuminates the questions rising from the results.

5.2.1 Why are the classical social determinants of health not related to child stunting in the rural sample?

Education, occupation and economic situation are noted as strong predictors for child stunting in the national sample. This is a sensible result. At first thought, it is less sensible that this does not hold true in poor rural areas. However, several explanations can be posed to give reasoning for the diverging results.

First, the subsample is drawn from poor areas that might have small variations in education, occupation and wealth across the population. Dividing this population into categories or equally large quintiles will not necessarily result in quintiles representing people with different socioeconomic levels. The population is diverse, but concerning the characteristics of education, occupation and wealth, it is not unlikely that it to some extent is uniform. The categories and quintiles will therefore be less powerful as tools for explaining variations in child health.

One should however be careful in generalising a rural area as uniformly poor both in educational and economic aspects. Variations might very well exist both in type of occupation, level of education and economic position. In remote areas, which the subsample of this study falls under, limitations on structural levels might hinder people from reaching potentials they have. In spite of advantages in education, occupation and economy that some might have, child nutrition is perhaps not better for this group due to poor infra structure, lack of health services, natural resource limitations etc (Andrzejewski, Reed, & White, 2009).

Another aspect to consider is the magnitude of the odds ratios for respondents with incomplete primary education in the national compared to the rural sample. Referring to logistic regression model 1 and 10 (table 9) they are both large, though in the rural sample, education is not statistically significant. This is due in part to the fact that the samples are different, and in large part to the relatively small rural sample size. For wealth, the picture is clearer, with large differences in the magnitude of the odds ratios; for the poorest quintile in Table 9 for example, the odds ratio is 4.0 for the national sample and 0.9 for the rural sample. The variation in the statistical significance of these two odds ratios is not due mostly to sample size differences, but to the differential effect of being in the poorest wealth quintile compared to the richest wealth quintile in the national compared to the rural samples.

5.2.2 Why is education related to child stunting in the national sample and not in the rural sample?

5.2.2.1 Formal and informal education

Education might be an important factor affecting health, but the way it is measured can conceal its effects. The most frequently seen measures of education are number of years of formal education, level of formal education completion, and literacy level. These approaches to education can serve effectively in areas were formal education is widespread and well

established. In very poor ruralities, like that of some areas in the Andean region, formal education indicators do not serve equally well. In these areas skills and knowledge are often gained in other ways, namely through informal education (Moulton et al., 2000).

Further, the quality of education often varies significantly within countries, and poor rural areas are often disadvantaged also when it comes to education (Larrea, Montalvo, & Ricaurte, 2005). However important education is for the improvement of health and nutrition, it will not emerge as a strong predictor of stunting if the general quality of the education is poor. In a World Bank report from 2000 recording the opinions and perceptions of poor people's own living situation, critique of education quality was an aspect that emerged: "Poor people realize that education offers an escape from poverty—but only if the economic environment in the society at large and the quality of education improve" (Narayan et al., 2000, p. 5).

5.2.2.2 Underestimation of maternal education effect due to anthropometric measures of living children only

According to Desai and Alva (1998), another aspect of the effect of education on nutritional status can be mentioned. The anthropometric data used in nutritional studies, including this, are only documented for living children. Considering the effect of maternal education on child survival it can be argued that the effect of maternal education on child nutrition is underestimated as children who have died due to their malnourishment are not included in the analyses. This is however a highly hypothetical question and a general limitation of the field, and not a shortcoming specific to this study.

5.2.3 Why is occupation related to child stunting in the national sample and not in the rural sample?

In the logistic regression models in the subsample occupation was not significantly related to child stunting. As mentioned earlier, this might be due to the irrelevance of the classical SDH in rural and poorer places. Another explanation concerns the broad categories of the occupation variable. Though the economic activity in the Andean zone is dominated by agriculture and manual labour it might be the case that the categories applied in this study were too wide. Possible individual effects of specific occupations (on child stunting) might be hidden within the categories.

5.2.4 *Why is not working a protective factor for child stunting in the national sample?*

For three of the regression models in the national sample, mother's occupation was noted as significantly related to child stunting after controlling for other relevant variables. The significance was shown to concern mothers reporting not working, and the category was protective. What can explain the protective characteristic of a mother not working? An aspect could be that the mother spends more time with her child and hence strengthens its healthy development. The results originate in the national sample, and it might be the case that a larger proportion of the women reporting not working live in economically wealthy relationships and don't need to work to support their children. The statistical power in the tested models is however not very high and no firm conclusions can be drawn.

5.2.5 Why is wealth related to child stunting in the national sample and not in the rural sample?

It can be argued that dividing a population that to a large degree is uniform in terms of wealth into quintiles gives poor measures for variations in health. This study did however not use national wealth scores in the rural sample, but recalculated the wealth index for the subsample, giving quintiles of approximately equal size of 20 percent each. The concentration of poverty in the subsample can still cause wealth to be insufficiently variable and hence not stand out as a predictor of stunting.

From the findings it seems that in wealthier areas, the traditional socioeconomic measures are important predictors of health. For rural and poorer contexts differences in wealth might not account for variations in health because other factors related to structural, geographic and cultural conditions might play more important roles in these settings (Bull & Mittelmark 2010).

Wealth can also have different meanings depending on context. The items included in the Wealth Index of the DHS might not be equally applicable in all settings, and the absence of important items might prevent wealth from demonstrating its significant impact. Of the important livestock especially in the high altitude Andean mountains, are llama and alpaca. These were not included in the DHS wealth index. Nationally, this should not be a severe limit, but for the particular region of the subsample, it is.

The natural and geographical features of the area also might have a greater impact on food consumed, compared to wealth. A population of mainly subsistence farmers is dependent on the crops they can cultivate. In the Andean region, the climate is hard due to the high altitude, and the natural features of steep, rocky mountains make cultivating the land challenging. Some types of food grow well, while others are virtually impossible to grow. The limitations of cultivatable crops can possibly be part of explaining insufficient diets.

During a field visit to Huancavelica, one of the poorest regions in the Andes in Peru and part of the regional subsample, I was informed by several local people that one of the challenges to nutrition in this region is not the lack of protein and vitamin rich food. Many households have available milk, eggs and meat, but sell or exchange these in order to get larger quantities of less nutritious, but filling products, like rice and pasta. This can on the one hand indicate a lack of knowledge of what food is needed for a healthy diet. As Panez, Silva, and Panez (2007) emphasise, there is a lack of culture for, or conscience about differing nutritional values in food (Panez et al., 2007). Food culture does not necessarily vary with wealth, and child stunting hence might not be dependent on wealth. On the other hand, the force by poverty to jeopardize the quality of the diet in order to feed everyone might also assist in the explanation.

5.2.6 Why is Positive Husband Behaviour not related to child stunting in the rural sample?

Experiencing these behaviours frequently can be thought to contribute to a harmonic household and family which could potentially facilitate better health and nutrition. However, none of the variables encompassed within Positive Husband Behaviour were noted as significantly related to child stunting. This is not necessarily a puzzling result. The diet of the household and the resulting nutritional status of the children might depend, as this analysis indicates, on other factors. The behaviour of the husband towards his wife measured in this survey is not necessarily important for child nutritional status. It might be the case that how a father acts towards his children in terms of care and providing food is detached from his behaviour towards his wife.

5.2.6 What can explain why sometimes experiencing positive husband behaviour increases risk of child stunting when never experiencing positive husband behaviour doesn't?

The results for Positive Husband Behaviour can seem puzzling with regard to which categories that are risk categories according to significance level. In this type of explorative study one should however not restrict oneself to only focusing on significance values. The overall patterns might be equally, if not more, important. Looking at Husband respects your rights, the never category is not far from being statistically significant at the .05 level with a value of .052 and an odds ratio of 5.6. This indicates that never or sometimes experiencing that husband respects your rights is a risk factor of child stunting compared to the reference category of frequently experiencing this. It might be the case that in a larger sample, significant results would emerge. However, the inconsistent results make it difficult to draw any firm conclusions about the role of positive husband behaviour on child stunting. The results might be subject to inappropriate categories, the sensitive nature of the topic, or complex cultural aspects not accounted for.

5.2.7 Why is women's decision latitude not related to child stunting in the rural sample?

It has been hypothesised that higher levels of child health problems and mortality are related to lower levels of female autonomy (Ghuman, 2003; Santow, 1995). This might however be culturally dependent as the construct of autonomy is not straightforward, and should be considered within the context in which it is studied. According to Devine, Camfield, and Gough (2006), "Autonomy is a universal psychological need but its expression is always contextual" (Devine et al., 2006, p. 105).

Further, an aspect to consider in the light of the results is the cultural scripts of Machismo and Marianismo. The Latin American culture has been, and still is, dominated by these traditions (Tiano, 2005). Machismo refers to the role of the man as on the one hand the provider with responsibility for one's family, and on the other hand possessing characteristics of oppressiveness, dominance and aggressiveness (Heaton et al., 2005). Marianismo refers to the biblical character of Maria and encompasses expectations of the woman as the pure, innocent, stoic woman who has her place and responsibility in the house, taking care of domestic chores and the children (Heaton et al., 2005; Tiano, 2005). The mentality and practice of these cultural dimensions have been found to be more widespread in rural than urban areas (Bull, 1998). This implies that women in rural, more traditional areas might be less autonomous, complying with the expectations of their social roles as the self-sacrificing care taker and nurturer. In relation to the non-significant results between autonomy and child nutritional status, a possible explanation might emerge from these cultural aspects. A mother complying

with her household domestic chores, but without high levels of autonomy, could contribute to the absence of significant associations between increased levels of autonomy and child nutritional status.

5.2.8 Why is being a daughter or daughter-in-law protective of child stunting?

Being a daughter or a daughter-in-law of the household head was noted as protective of child stunting in the national sample. This is an interesting finding, and might be explained by the advantage of drawing knowledge and experience from older members of the household. Several adult persons might mean more capacity of taking care of the children. The finding might also be culture and context specific and require further exploration through qualitative research. It is also important to keep in mind that the associations are relatively weak, and only found in two of the six regression models. Hence, no conclusions about the protective effect of being a daughter or daughter-in-law in a household can be drawn from this single study.

5.2.9 What can explain the different risk categories for child stunting in women's decision latitude in the national sample?

The different risk levels attached to the various response categories for women's decision latitude can hardly be laid as basis for any conclusions about how decision latitude influences child stunting in Peru. The inconsistent results call for more research on the role of autonomy as well as the culturally related perceptions of autonomy.

5.2.10 Why is altitude a strong predictor in both samples?

Altitude emerges as a strong predictor of child stunting in both the national and the rural sample. This indicates that residing at higher altitudes generally is disadvantageous. Considering the proportion of the population that falls into the poorer and poorest wealth quintiles nationally, a large part resides in the higher altitudes in the Andean region. Household wealth cannot however explain the increased likelihood of child stunting in the higher altitudes as the statistical power persists after adjusting for wealth in the national sample. Rather, explanations concerning structural, natural and cultural dimensions should also here be considered. The fact that altitude also seems to be a strong predictor of child stunting in the subsample can originate in some of the same conditions as for the national sample. Rather small differences in altitude might mean large differences in the possibilities

of cultivating, developing infrastructure and expand public services. All are aspects important for the nutritional status of children.

5.2.11 What can explain variations in child stunting in the rural subsample?

5.2.11.1 Feeding practice

Research has documented a positive effect on child nutritional status produced by behavioural factors and caring feeding practices (Nti & Lartey, 2007). These findings persisted after controlling for standard socioeconomic factors (Zeitlin et al., 1990). Birch and Fisher (1995) have identified three types of feeding practices: responsive, controlling and laissez-faire (Birch & Fisher, 1995). Of the three types, laissez-faire is the one that has been most frequently observed in areas where levels of child malnourishment are high (Engle et al., 2000). Compared to the responsive and controlling feeding practices which are interactive, attentive, encouraging and consistent, the laissez-faire style is characterised by little encouragement to eating and expectations of the child being able to eat on its own at a very young age (Engle et al., 2000). The aspect of laissez-faire feeding practice is relevant in this study as research has documented this feeding style as widespread in Latin America (Engle et al., 2000). One study from Nicaragua showed that a mother with intentions of encouraging and helping her child to eat more was associated with improved nutritional status, even after adjusting for maternal education and household wealth (Engle et al., 1996). A study undertaken in the rural Sierra region of Peru found laissez-faire to be the dominating manner of feeding. In 70 percent of the cases no encouragement or responsive feeding was observed (Bentley, Black, & Hurtado, 1991). Though these findings are insufficient in explaining child stunting, they highlight aspects of the complexity underlying child malnutrition.

5.2.11.2 Food security

According to Quisumbing, Brown, Feldstein, Haddad, and Peña (1995) food security is dependent on three pillars: Food availability/adequate food production, economic access to available food, and nutritional security encompassing the nutritious food as well as non-food resources as child care, health care, clean water and sanitation (Quisumbing et al., 1995). The lack of, or insufficient provision of any of these will severely jeopardize child nutritional status. In poor remote areas like that studied in this thesis, the availability of food might be limited. Non-food resources like child health care services are scarce. The distance between communities and the geographical features of the area makes the travelling to the available

health services difficult. Clean water and sanitation systems are not well developed. These facts call for structural changes on national and local governmental level to be undertaken.

Summing up, the results of this study indicate important notions on the regional differences that are hidden in studies based on national samples. In this regard, the results might be puzzling, contradicting an ample amount of research documenting the strong relationship between socioeconomic status and health, also in developing countries. It is an area of research where little is yet known, and which must be given further attention within research. The results do however not stand alone, but add to an emerging body of research finding that the traditional socioeconomic measures cannot explain variations in health in very poor ruralities (Mittelmark & Bull, 2010**;** Myntti, 1993; Wolfe & Behrman, 1983). Neither education nor wealth or autonomy can foster healthy children if the food that is needed is not available.

Further, culture and tradition are aspects that should be taken into consideration when aiming at understanding mechanisms of health problems. The prevailing diets in an area can result in better or worse nutritional conditions. It is not given that the social factors often associated with improved health, like education, wealth, occupation, and autonomy have equally strong effect everywhere.

5.3 Recommendations for further research

The results found in this study call for further research, looking into why the traditional social determinants of health have little power in very poor ruralities. What are appropriate measures for education, occupation and economic position in the poor rural areas? Further, to combat child malnutrition, efforts aiming at identifying which factors significantly predict stunting in the poor rural areas should be undertaken. Studies examining structural as well as individual factors might illuminate more of the complexity of predictors of child stunting. Further research should involve qualitative studies to allow for deeper insights into the areas of resilience in a harsh environment, the role of social capital and support and cultural characteristics, as well as cultural assumptions regarding nutrition in the area.

Considering the critical points raised concerning causality in social health research, cause and effect studies most likely will not give a clear answer to what causes child stunting. However, exploring causality surface as an objective that might contribute to the wider understanding of

the complex phenomenon of poverty and health, and longitudinal studies should, in addition to the other recommendations, be considered for future research.

5.4 Practical Implications

This study indicates that it does not suffice to target only the classical social determinants of health if one aims at reducing chronic child malnutrition. Other aspects of life and milieu come into play in producing growth patterns in poor ruralities in the Andes. The work of NGOs and government run programmes aiming at improving the health of people should be carefully developed and suited for cultural and local specific contexts. Local health promotion initiatives involving participatory needs assessments might yield valuable information that more effectively can improve child stunting. It is important to underline that one explorative study cannot alone be used as basis for change, but should be added to the body of knowledge on the topic.

6.0 CONCLUSIONS

This study investigated the effect of social factors on child stunting in Peru, with particular emphasis on very poor ruralities. The findings of the study suggested important differences in predictors of child stunting depending on area. On national level, the classical social determinants of health proved to be strong predicting forces of child stunting, whereas in the rural subsample of five Andean states, none of these were shown to significantly influence level of child stunting. Altitude also emerged as a significant influence of child stunting on national level with residing at higher altitudes increasing the risk of having a stunted child compared to residing at lower altitudes. Regionally, altitude was not noted as an equally strong predictor of child stunting. The study underscores the dubiousness of generalising findings based on national analyses to local and regional levels. It also calls for further research undertaking efforts to develop tools and measures fit for the regional, cultural and structural conditions present in very poor ruralities. Due to the complex nature of social phenomena, both quantitative and qualitative methods are called for in this respect. To reduce child stunting where child stunting is most prevalent, particular attention must be given to what risk and protective factors impact on child nutrition in these areas.

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Appendix

Frequencies

Bivariate analyses

Logistic Regression Analyses

Appendix

Table 1.
Frequency distribution of child stunting for national and rural sample

	National sample n = 1426		Rural sample n = 171	
Height for age	Frequency	Percent	Frequency	Percent
Not stunted	1138	79.8	98	57.0
Stunted	288	20.2	74	43.0
Total	1426	100.0	171	100.0

Table 2.
Age distribution of respondents and their partners in national and rural sample. Peru DHS 2004-2006.

	National n = 1426				Rural n = 171			
	N	Minimum	Maximum	Mean	N	Minimum	Maximum	Mean
Respondent's age								
Current age	1426	15	49	30	171	16	49	30
Partner's age								
Current age	1232	17	78	34	150	18	62	34

Table 3. Frequency distribution of demographic and respondent characteristics measures.
Peru DHS, 2004-2006.

		National sample n=1426		Rural sample n=171	
		Frequency	(%)	Frequency	(%)
Respondent's educational attainment					
Valid	Complete secondary/higher	612	(43.0)	25	(14.7)
	Complete primary/incomplete secondary	425	(29.8)	58	(33.8)
	Incomplete primary	330	(23.1)	72	(42.2)
	No education	59	(4.1)	16	(9.3)
	Total	1426	(100.0)	171	(100.0)
Missing	System				
Total					
Partner's educational attainment					
Valid	Complete secondary/higher	721	(53.8)	47	(29.5)
	Complete primary/incomplete secondary	348	(25.9)	61	(38.1)
	Incomplete primary/no education	271	(20.3)	52	(32.3)
	Total	1340	(100.0)	160	(100.0)
Missing	System	86		11	
Total		1426		171	
Literacy					
Valid	Able to read whole sentence	1187	(83.5)	109	(63.5)
	Cannot read at all or able to read only parts of sentence	234	(16.5)	62	(36.5)
	Total	1421	(100.0)	171	(100.0)
Missing	System	4			
Total		1426			
Frequency of reading newspaper or magazine					
Valid	More than once a week	289	(20.3)	4	(2.6)
	Never or less than once a week	1136	(79.7)	166	(97.4)
	Total	1425	(100.0)	170	(100.0)
Missing	System	1		1	
Total		1426		171	
Frequency of listening to radio					
Valid	More than once a week	924	(64.8)	97	(56.4)
	Never or less than once a week	502	(35.2)	75	(43.6)
	Total	1426	(100.0)	171	(100.0)
Respondents occupation					
Valid	White-collar	509	(35.7)	19	(10.9)
	Agriculture, manual	516	(36.2)	143	(83.6)
	Not working	400	(28.1)	9	(5.5)
	Total	1425	(100.0)	171	(100.0)
System	Missing	1			
Total		1426			
Partner's occupation					
Valid	White-collar	519	(38.9)	17	(10.5)
	Agriculture, manual	817	(61.1)	143	(89.5)
	Total	1336	(100.0)	160	(100.0)
Missing	System	89		11	
Total		1426		171	
Ethnicity					
Valid	Castilian	1214	(85.5)	62	(36.2)
	Quechua	184	(12.9)	88	(51.7)
	Aymara	22	(1.6)	20	(12.0)

	Total	1420	(100.0)	170	(100.0)
Missing	System	6		1	
Total		1426		171	
Current marital status					
Valid	Married/living together	1232	(86.4)	86	(49.9)
	Never married/not living together/widowed	194	(13.6)	86	(50.1)
	Total	1426	(100.0)	171	(100.0)
Relationship to household head					
Valid	Wife	964	(67.9)	130	(77.2)
	Head	82	(5.8)	9	(5.3)
	Daughter/daughter-in-law	375	(26.4)	30	(17.5)
	Total	1421	(100.0)	169	(100.0)
Missing	System	5		3	
Total		1426		171	
Altitude					
Valid	0-2000 meters above sea level	850	(59.6)	16	(9.5)
	2001-3000 meters above sea level	197	(13.8)	12	(6.9)
	3001-6000 meters above sea level	379	(26.6)	143	(83.6)
	Total	1426	(100.0)	171	(100.0)

Table 4. Frequency distribution of household wealth variables. National and rural sample.

		National sample n=1426		Rural sample n=171	
		Frequency	(%)	Frequency	(%)
Wealth Index					
Valid	Richest	283	(19.9)	34	(19.8)
	Richer	286	(20.1)	34	(20.1)
	Middle	286	(20.0)	34	(19.8)
	Poorer	285	(20.0)	35	(20.2)
	Poorest	286	(20.0)	34	(20.1)
	Total	1426	(100.0)	171	(100.0)
Wealth Items					
Toilet facility available					
Valid	Yes	1101	(77.2)	76	(44.5)
	No	324	(22.8)	95	(55.5)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			
Has electricity					
Valid	Yes	968	(67.9)	69	(40.5)
	No	457	(32.1)	102	(59.5)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			
Has radio					
Valid	Yes	1243	(87.2)	153	(89.2)
	No	182	(12.8)	18	(10.8)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			
Has television					
Valid	Yes	895	(62.9)	47	(27.5)
	No	527	(37.1)	124	(72.5)
	Total	1422	(100.0)	171	(100.0)
Missing	System	3			
Total		1426			
Has refrigerator					
Valid	Yes	408	(28.7)	1	(0.7)
	No	1014	(71.3)	170	(99.3)
	Total	1422	(100.0)	171	(100.0)
Missing	System	3			
Total		1426			
Has bicycle					
Valid	Yes	331	(23.2)	68	(39.8)
	No	1094	(76.8)	103	(60.2)
	Total	1426	(100.0)	171	(100.0)
Has motorcycle/scooter					
Valid	Yes	36	(2.5)	2	(1.0)
	No	1390	(97.5)	170	(99.0)
	Total	1426	(100.0)	171	(100.0)
Has car/truck					
Valid	Yes	95	(6.7)	3	(1.6)
	No	1328	(93.3)	169	(98.4)
	Total	1423	(100.0)	171	(100.0)
Missing	System	3			

Total		1426			
Has telephone					
Valid	Yes	301	(21.2)	0	(0.2)
	No	1121	(78.8)	171	(99.8)
	Total	1422	(100.0)	171	(100.0)
Missing	System	3			
Total		1426			
Main floor material					
Valid	Cement, brick, wood	794	(55.7)	24	(13.8)
	Dirt, sand	631	(44.3)	148	(86.2)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			
Main wall material					
Valid	Brick, cement, wood	758	(53.2)	14	(8.3)
	Mud, rock with mud	667	(46.8)	157	(91.7)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			

Table 5. Frequency distribution of decision latitude. National and rural sample.
Peru DHS, 2004-2006.

		National sample n=1426		Rural sample n=171	
		Frequency	(%)	Frequency	(%)
Final say on own health care					
Valid	Respondent and partner/husband	332	(23.3)	49	(28.7)
	Respondent and other person	10	(0.7)	1	(0.4)
	Respondent alone	681	(47.8)	60	(35.2)
	Husband alone	332	(23.3)	51	(30.0)
	Someone else	70	(4.9)	10	(5.7)
	Total	1425	(100.0)	171	(100.0)
Missing	System	1			
Total		1426			
Final say on making large household purchases					
Valid	Respondent and partner/husband	622	(43.7)	84	(49.2)
	Respondent and other person	33	(2.3)	1	(0.7)
	Respondent alone	297	(20.9)	26	(15.4)
	Husband alone	321	(22.6)	44	(25.5)
	Other person	151	(10.6)	16	(9.2)
	Total	1424	(100.0)	171	(100.0)
Missing	System	1		0	
Total		1426		171	
Final say on household purchases for daily needs					
Valid	Respondent and partner/husband	377	(26.5)	58	(34.0)
	Respondent and other person	32	(2.3)	1	(0.7)
	Respondent alone	693	(48.7)	76	(44.6)
	Husband alone	155	(10.9)	19	(10.9)
	Other person	166	(11.6)	17	(9.7)
	Total	1423	(100.0)	171	(100.0)
Missing	System	3			
Total		1426			
Final say on visits to family and relatives					
Valid	Respondent and partner/husband	717	(51.5)	89	(52.3)
	Respondent and other person	38	(2.7)	2	(1.2)
	Respondent alone	342	(24.5)	31	(18.5)
	Husband alone	209	(15.0)	38	(22.2)
	Other person	87	(6.2)	10	(5.8)
	Total	1393	(100.0)	170	(100.0)
Missing	System	33		1	
Total		1426		171	

Table 6. Frequency distribution of Positive Husband Behaviour.
National and rural sample. Peru DHS, 2004-2006.

		National sample n=1426		Rural sample n=171	
		Frequency	(%)	Frequency	(%)
Husband spends free time with you					
Valid	Frequently	744	(67.6)	96	(67.6)
	Sometimes	323	(29.3)	44	(30.8)
	Never	33	(3.0)	2	(1.5)
	Total	1100	(100.0)	142	(100.0)
Missing	System	326		30	
Total		1426		171	
Husband consults you					
Valid	Frequently	779	(70.9)	105	(73.9)
	Sometimes	288	(26.2)	34	(24.1)
	Never	32	(2.9)	3	(2.0)
	Total	1100	(100.0)	142	(100.0)
Missing	System	326		30	
Total		1426		171	
Husband is affectionate					
Valid	Frequently	770	(70.0)	96	(68.1)
	Sometimes	309	(28.1)	43	(30.5)
	Never	20	(1.8)	2	(1.4)
	Total	1100	(100.0)	142	(100.0)
Missing	System	326		30	
Total		1426		171	
Husband respects you					
Valid	Frequently	829	(75.4)	105	(73.9)
	Sometimes	248	(22.5)	34	(23.8)
	Never	23	(2.1)	3	(2.3)
	Total	1100	(100.0)	142	(100.0)
Missing	System	326		30	
Total		1426		171	
Husband respects your rights					
Valid	Frequently	824	(74.9)	102	(72.2)
	Sometimes	250	(22.7)	36	(25.3)
	Never	26	(2.3)	4	(2.5)
	Total	1100	(100.0)	142	(100.0)
Missing	System	326		30	
Total		1426		171	

Table 7a.
Selected bivariate associations with child stunting (stunted versus not stunted).
National sample (n=1426) and rural subsample (n=171) consisting of rural residents in five regions of the Andean Highlands. Peru DHS, 2004-2006.

	Full national sample			Rural subsample		
	n	Chi Square	df	n	Chi Square	df
Maternal/Respondent factors						
Educational attainment	1427	174.898***	3	171	7.762	3
Occupation	1426	131.558***	2	172	1.714	2
Literacy level	1423	98.612***	3	171	2.124	1
Frequency of reading newspaper/magazine	1425	26.553***	1	170	0.538	1
Frequency of listening to radio	1426	8.911**	1	172	1.344	1
Ethnicity	1421	122.342***	2	170	4.703	2
Current marital status	1425	0.381	1	171	2.124	1
Who takes care of the child	1424	7.984**	1	169	4.424	2
Relationship to household head	1420	29.439***	2	169	4.424	2
Partner factors						
Educational attainment	1338	122.512***	2	160	3.441	2
Occupation	1336	64.616***	1	161	0.041	1
Household factors						
Wealth index	1426	217.948***	4	172	5.261	4
Toilet facility available	1425	65.747***	1	171	0.202	1
Has electricity	1424	162.725***	1	170	0.264	1
Has radio	1425	6.823**	1	172	0.165	1
Has television	1422	153.667***	1	171	0.000[2]	1
Has refrigerator	1422	84.514***	1	172	0.760	1
Has bicycle	1426	0.835	1	171	0.106	1
Has motorcycle/scooter	1426	6.952**	1	171	0.044*	1
Has car/truck	1422	8.742**	1	172	0.696	1
Has telephone	1422	56.440***	1	No one had a telephone		
Main floor material	1425	119.964***	1	171	3.571	1
Main wall material	1424	122.394***	1	172	2.899	1
Cluster altitude in meters	1425	111.211***	2	171	6.667*	2

*** = correlation is significant at the 0.001 level (2-tailed).
** = correlation is significant at the 0.01 level (2-tailed).
* = correlation is significant at the 0.05 level (2-tailed).

[2] The difference between observed and expected values was < .000.

Table 7b. All bivariate associatons with child stunting (stunted vs not stunted).
National (n=1426) and rural sample (n=171) consisting of rural residents in five highlands regions in the Andes.
regions of the Andean Highlands. Peru DHS, 2004-2006.

	National sample			Rural subsample		
	n	Chi Square	df	n	Chi Square	df
Maternal/Respondent factors						
Educational attainment	1427	174.898***	3	171	7.762	3
Occupation	1426	131.558***	2	172	1.714	2
Literacy level	1423	98.612***	3	171	2.124	1
Frequency of reading newspaper/magazine	1425	26.553***	1	170	0.538	1
Frequency of listening to radio	1426	8.911**	1	172	1.344	1
Decision latitude						
Final say on own health care	1425	46.266***	4	172	2.473	4
Final say on making large household purchases	1425	28.475***	4	171	5.445	4
Final say on making purchases for daily needs	1424	26.894***	4	171	4.617	4
Final say on visits to family and relatives	1391	30.199***	4	171	6.561	4
Positive Husband Behaviour						
Husband spends his free time with you	1101	4.363	2	142	0.484	2
Husband consults you	1100	7.444*	2	142	0.120	2
Husband is affectionate	1099	3.685	2	142	2.514	2
Husband respects you	1100	2.652	2	142	0.317	2
Husband respects your rights	1100	8.073*	2	142	0.345	2
Ethnicity	1421	122.342***	2	170	4.703	2
Current marital status	1425	0.381	1	171	2.124	1
Who takes care of the child	1424	7.984**	1	169	4.424	2
Relationship to household head	1420	29.439***	2	169	4.424	2
Partner factors						
Educational attainment	1338	122.512***	2	160	3.441	2
Occupation	1336	64.616***	1	161	0.041	1
Household factors						
Wealth index	1426	217.948***	4	172	5.261	4
Toilet facility available	1425	65.747***	1	171	0.202	1
Has electricity	1424	162.725***	1	170	0.264	1
Has radio	1425	6.823**	1	172	0.165	1
Has television	1422	153.667***	1	171	0.000[3]	1
Has refrigerator	1422	84.514***	1	172	0.760	1
Has bicycle	1426	0.835	1	171	0.106	1
Has motorcycle/scooter	1426	6.952**	1	171	0.044*	1
Has car/truck	1422	8.742**	1	172	0.696	1
Has telephone	1422	56.440***	1	No one had a telephone		
Main floor material	1425	119.964***	1	171	3.571	1
Main wall material	1424	122.394***	1	172	2.899	1
Cluster altitude in meters	1425	111.211***	2	171	6.667*	2

*** = correlation is significant at the 0.001 level (2-tailed).

** = correlation is significant at the 0.01 level (2-tailed).

* = correlation is significant at the 0.05 level (2-tailed).

[3] The difference between observed and expected values was < .000.

Table 8a.
Bivariate analyses with continuous variables and child stunting.
National sample n=1426. Peru DHS, 2004-2006.

Pearson's Product Moment Coefficient

	Child stunting	Respondent's age	Partner's age	# of household members	# of children≤ 5 years	# of rooms in household	# of rooms for sleeping	Goats own
Child stunting								
Pearson Correlation	1.000	0.111**	0.117**	0.060*	0.091**	0.012	0.021	-0.002
Sig. (2-tailed)		0.000	0.000	0.024	0.001	0.649	0.438	0.953
N	1426	1426	1232	1426	1426	1426	1426	1426
Respondent's age								
Pearson Correlation	0.111**	1.000	0.769**	0.098**	-0.85**	0.014	0.013	0.008
Sig. (2-tailed)	0.000		0.000	0.000	0.001	0.604	0.623	0.762
N	1426	1426	1232	1426	1426	1426	1426	1426
Partner's age								
Pearson Correlation	0.117**	0.769**	1.000	0.117**	-0.086**	-0.004	0.026	-0.005
Sig. (2-tailed)	0.000	0.000		0.000	0.002	0.895	0.359	0.859
N	1232	1232	1232	1232	1232	1232	1232	1232
# of household members								
Pearson Correlation	0.060*	0.098**	0,117**	1.000	0.516**	-0.046	-0.044	-0.001
Sig. (2-tailed)	0.024	0.000	0.000		0.000	0.085	0.093	0.980
N	1426	1426	1232	1426	1426	1426	1426	1426
# of children 5 and under								
Pearson Correlation	0.091**	-0.085**	-0086**	0.516**	1.000	0.009	-0.001	-0.029
Sig. (2-tailed)	0.001	0.001	0.002	0.000		0.725	0.977	0.270
N	1426	1426	1232	1426	1426	1426	1426	1426
# of rooms in household								
Pearson Correlation	0.012	0.014	-0.004	-0.046	0.009	1.000	0.814**	-0.014
Sig. (2-tailed)	0.649	0.604	0.895	0.085	0.725		0.000	0.585
N	1426	1426	1232	1426	1426	1426	1426	1426
# of rooms for sleeping								
Pearson Correlation	0.021	0.013	0.026	-0.044	-0.001	0.814**	1.000	0.034
Sig. (2-tailed)	0.438	0.623	0.359	0.093	0.977	0.000		0.202
N	1426	1426	1232	1426	1426	1426	1426	1426
Goats own								
Pearson Correlation	-0.002	0.008	-0.005	-0.001	-0.029	-0.014	0.034	1.000
Sig. (2-tailed)	0.953	0.762	0.859	0.980	0.270	0.585	0.202	
N	1426	1426	1232	1426	1426	1426	1426	1426

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 8b.
Bivariate analyses with continuous variables and child stunting.
Rural sample. Peru DHS, 2004-2006.

Pearson's Product-Moment Coefficient

	Child stunting	Respondent's age	Partner's age	# of household members	# of children ≤ 5	# of rooms in household	# of rooms for sleeping	Goats own
Child stunting								
Pearson Correlation	1.000	0.169*	0.186*	0.079	0.012	0.084	0.091	0.110
Sig. (2-tailed)		0.027	0.022	0.302	0.880	0.273	0.238	0.152
N	171	171	150	171	171	171	171	171
Respondent's age								
Pearson Correlation	0.169*	1.000	0.850**	0.316**	0.010	0.091	0.063	0.066
Sig. (2-tailed)	0.027		0.000	0.000	0.900	0.235	0.410	0.390
N	171	171	150	171	171	171	171	171
Partner's age								
Pearson Correlation	0.186*	0.850**	1.000	0.403**	0.010	0.088	0.047	0.069
Sig. (2-tailed)	0.022	0.000		0.000	0.905	0.286	0.565	0.403
N	150	150	150	150	150	150	150	150
# of household members								
Pearson Correlation	0.079	0.316**	0.403**	1.000	0.421**	0.032	0.089	0.148
Sig. (2-tailed)	0.302	0.000	0.000		0.000	0.680	0.245	0.054
N	171	171	150	171	171	171	171	171
# of children 5 and under								
Pearson Correlation	0.012	0.010	0.010	0.421**	1.000	0.015	0.055	0.134
Sig. (2-tailed)	0.880	0.900	0.905	0.000		0.848	0.472	0.080
N	171	171	150	171	171	171	171	171
# of rooms in the household								
Pearson Correlation	0.084	0.091	0.088	0.032	0.015	1.000	0.880**	-0.032
Sig. (2-tailed)	0.273	0.235	0.286	0.680	0.848		0.000	0.681
N	171	171	150	171	171	171	171	171
# of rooms for sleeping								
Pearson Correlation	0.091	0.063	0.047	0.089	0.055	0.880	1.000	-0.045
Sig. (2-tailed)	0.238	0.410	0.565	0.245	0.472	0.000		0.562
N	171	171	150	171	171	171	171	171
Goats own								
Pearson Correlation	0.110	0.066	0.069	0.148	0.134	-0.032	-0.045	1.000
Sig. (2-tailed)	0.152	0.390	0.403	0.054	0.080	0.681	0.562	
N	171	171	150	171	171	171	171	171

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 9. Models 1 and 10.
Logistic Regression models with social determinants of health predicting child stunting. Classical models.
Peru DHS, 2004-2006

Coefficients	Model 1. National sample n = 1426					Model 10. Rural sample n = 171				
	B	S.E.	Wald	Sig.	O.R.	B	S.E.	Wald	Sig.	O.R.
Respondent's age										
Current age	0.027	0.017	2.554	0.110	1.027	-0.008	0.044	0.034	0.854	0.992
Partner's age										
Current age	0.006	0.014	0.156	0.693	1.006	0.042	0.037	1.276	0.259	1.043
Respondent's educational attainment										
Ref: Complete secondary/higher education										
Complete primary/incomplete secondary	0.491	0.284	2.991	0.084	1.634	0.307	0.688	0.200	0.655	1.360
Incomplete primary	0.566	0.318	3.182	0.074	1.762	0.706	0.719	0.964	0.326	2.026
No education	0.754	0.418	3.251	0.071	2.125	-0.376	0.927	0.165	0.685	0.686
Partner's educational attainment										
Ref: Complete secondary/higher education										
Complete primary/incomplete secondary	0.342	0.225	2.306	0.129	1.407	0.183	0.483	0.144	0.705	1.201
Incomplete primary	0.434	0.254	2.926	0.087	1.543	0.161	0.599	0.072	0.788	1.175
Respondent's occupation										
Ref: White-collar										
Manual, agriculture	0.326	0.248	1.720	0.190	1.385	0.082	0.664	0.015	0.902	1.085
Not working	-0.531	0.260	4.173	0.041	0.588	-1.228	1.111	1.223	0.269	0.293
Partner's occupation										
Ref: White-collar										
Manual, agriculture	-0.293	0.245	1.423	0.233	0.746	-0.592	0.746	0.630	0.427	0.553
Wealth Index										
Ref: Richest										
Richer	-0.476	0.427	1.240	0.266	0.622	0.462	0.594	0.605	0.437	1.587
Middle	0.658	0.379	3.014	0.083	1.931	-0.135	0.596	0.051	0.821	0.874
Poorer	1.366	0.405	11.376	0.001	3.919	-0.150	0.597	0.063	0.802	0.861
Poorest	1.670	0.424	15.514	0.000	5.311	0.739	0.614	1.450	0.229	2.094

Ref. = Reference category
Degrees of freedom (df) for the national data model = 1412, 14, and df for the rural model = 157, 14.

Model 1 was statistically significant, $X^2 = 231.117$, $p < .001$. The model explained between 17.1 % (Cox Snell R Square) and 27 % (Nagelkerke R square) of the variance, and 80 % percent of the cases were correctly classified.
Model 10 was not statistically significant, $X^2 = 16,144$, $p = .305$. The explanation power was between 10.2% (Cox and Snell R square) and 13.7% (Nagelkerke R square). Correctly classified cases were 63.0%.

Table 10. Model 2.
Reduced logistic regression with classical social determinants of health predicting child stunting.
National sample n=1426. Peru DHS, 2004-2006.

Coefficients		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R.	
							Lower	Upper
Respondent's age								
	Current age	0.030	0.016	3.396	0.065	1.031	0.998	1.065
Partner's age								
	Current age	0.012	0.014	0.770	0.380	1.012	0.985	1.039
Respondent's occupation								
Ref:	White collar							
	Manual, agriculture	0.352	0.237	2.206	0.138	1.422	0.894	2.262
	Not working	-0.477	0.256	3.470	0.063	0.621	0.376	1.025
Wealth Index								
Ref:	Richest							
	Richer	-0.282	0.416	0.460	0.498	0.754	0.333	1.705
	Middle	1.016	0.334	9.252	0.002	2.763	1.435	5.319
	Poorer	1.880	0.335	31.435	0.000	6.552	3.396	12.641
	Poorest	2.241	0.345	42.130	0.000	9.403	4.779	18.500

Ref. = Reference category
Df = 1418,8.
The model was statistically significant, $X^2 = 218.994$, $p < .001$. The model explained between 16.3 % (Cox Snell R Square) and 25.6% (Nagelkerke R Square) of the variance, and 80.3% of the cases were correctly classified.

Table 11. Model 3.
Logistic Regression Analysis predicting child stunting. Alternative model 1.
Peru National Sample n = 1426. Peru DHS, 2004-2006.

		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R.	
							Lower	Upper
Respondent's age								
	Current age	0.018	0.018	1.007	0.316	1.018	0.983	1.054
Partner's age								
	Current age	0.011	0.015	0.598	0.440	1.012	0.983	1.041
Respondent's educational attainment								
Ref.	Complete secondary or higher							
	Complete primary or incomplete secondary	0.565	0.292	3.728	0.054	1.759	0.991	3.120
	Incomplete primary	0.513	0.341	2.261	0.133	1.670	0.856	3.257
	No education	0.623	0.478	1.696	0.193	1.865	0.730	4.763
Partner's educational attainment								
Ref.	Complete secondary or higher							
	Complete primary or incomplete secondary	0.383	0.235	2.659	0.103	1.466	0.926	2.322
	No education or incomplete primary	0.457	0.264	2.993	0.084	1.579	0.941	2.648
Level of literacy								
Ref.	Able to read whole sentence							
	Cannot read at all or able to read only parts of sentence	0.039	0.243	0.026	0.873	1.040	0.646	1.673
Frequency of reading newspaper or magazine								
Ref.	Once a week or more							
	Never or less than once a week	-0.392	0.284	1.904	0.168	0.676	0.388	1.179
Respondent's occupation								
Ref.	White-collar							
	Manual, agriculture	0.027	0.269	0.010	0.921	1.027	0.606	1.740
	Not working	-0.523	0.264	3.921	0.048	0.593	0.353	0.995
Partner's occupation								
Ref.	White-collar							
	Manual, agriculture	-0.296	0.253	1.367	0.242	0.744	0.453	1.222
Wealth Index								
Ref.	Richest							
	Richer	-0.444	0.433	1.051	0.305	0.641	0.274	1.499
	Middle	0.631	0.394	2.560	0.110	1.879	0.868	4.068
	Poorer	1.300	0.426	9.291	0.002	3.668	1.590	8.459
	Poorest	1.654	0.443	13.915	0.000	5.228	2.192	12.468
Relationship to household head								
Ref.	Wife							
	Head	-1.980	0.932	4.509	0.034	0.138	0.022	0.859
	Daughter or daughter-in-law	-0.397	0.279	2.031	0.154	0.672	0.389	1.161
Ethnicity								
Ref.	Castilian (Spanish)							

	Quechua	0.229	0.241	0.899	0.343	1.257	0.783	2.016
	Aymara	-0.279	0.561	0.247	0.619	0.757	0.252	2.271
Altitude								
Ref.	0-2000 meters above sea level							
	2001-3000 meters above sea level	0.359	0.246	2.126	0.145	1.432	0.884	2.320
	3001-6000 meters above sea level	0.674	0.220	9.351	0.002	1.962	1.274	3.022

Ref. = Reference category
Df = 1404,22.

The full model was statistically significant, $X^2 = 257.606$, $p < .001$. The explained variance was between 19% (Cox and Snell R square) and 29.8% (Nagelkerke R square). Correctly classified cases were 81.6%.

Table 12. Model 4. Reduced Logistic Regression Analysis with Social determinants of health. Alternative model. National sample n = 1426, Peru DHS, 2004.2006.

Coefficients		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R.	
							Lower	Upper
Respondent's age								
	Current age	0.023	0.017	1.814	0.178	1.023	0.990	1.058
Partner's age								
	Current age	0.014	0.014	1.022	0.312	1.014	0.987	1.043
Respondent's occupation								
Ref.	White-collar							
	Manual, agriculture	0.057	0.250	0.052	0.820	1.059	0.648	1.728
	Not working	-0.477	0.259	3.403	0.065	0.620	0.374	1.030
Wealth index								
Ref.	Richest							
	Richer	-0.319	0.419	0.578	0.447	0.727	0.320	1.653
	Middle	0.885	0.344	6.602	0.010	2.422	1.234	4.757
	Poorer	1.703	0.345	24.309	0.000	5.488	2.789	10.798
	Poorest	2.101	0.355	34.999	0.000	8.172	4.074	16.390
Relationship to household head								
Ref.	Wife							
	Head	-2.027	0.929	4.763	0.029	0.132	0.021	0.813
	Daughter or daughter-in-law	-0.449	0.275	2.661	0.103	0.639	0.373	1.095
Altitude								
Ref.	0-2000 meters above sea level							
	2001-3000 meters above sea level	0.319	0.240	1.766	0.184	1.375	0.860	2.200
	3001-6000 meters above sea level	0.682	0.194	12.395	0.000	1.977	1.353	2.889

Ref. = Reference category

Df = 1414,12.

The full model was statistically significant, X2 = 241.740, p < .001, and explained between 17.9% (Cox & Snell R Square) and 28% (Nagelkerke R Square) of the variance. The model correctly classified 80.7 % of the cases.

Table 13. Model 5. Alternative logistic regression model with wealth items and child stunting. Alternative model 2. National Sample n = 1794, Peru DHS 2004-2006.

		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R.	
							Lower	Upper
Respondent's age								
	Current age	0.013	0.018	0.579	0.447	1.014	0.979	1.049
Partner's age								
	Current age	0.015	0.015	0.976	0.323	1.015	0.986	1.045
Respondent's educational attainment								
Ref.	Complete secondary/higher							
	Complete primary/incomplete secondary	0.510	0.286	3.181	0.074	1.666	0.951	2.918
	Incomplete primary	0.549	0.336	2.676	0.102	1.732	0.897	3.346
	No education	0.678	0.473	2.056	0.152	1.969	0.780	4.973
Partner's educational attainment								
Ref.	Complete secondary/higher							
	Complete primary/incomplete secondary	0.463	0.234	3.910	0.048	1.588	1.004	2.512
	No education/incomplete primary	0.509	0.264	3.714	0.054	1.664	0.991	2.793
Literacy level								
Ref.	Able to read whole sentence							
	Cannot read at all or able to read parts of sentence	-0.042	0.246	0.030	0.863	0.959	0.592	1.552
Frequency of reading newspaper or magazine								
Ref.	Once a week or more							
	Never or less than once a week	-0.399	0.284	1.967	0.161	0.671	0.384	1.172
Respondent's occupation								
Ref.	White collar							
	Manual, agriculture	0.188	0.266	0.496	0.481	1.206	0.716	2.033
	Not working	-0.441	0.268	2.706	0.100	0.644	0.381	1.088
Partner's occupation								
Ref.	White collar							
	Manual, agriculture	-0.103	0.251	0.169	0.681	0.902	0.552	1.474
Toilet facility available								
Ref.	Yes							
	No	0.214	0.186	1.326	0.249	1.239	0.861	1.783
Has electricity								
Ref.	Yes							
	No	0.663	0.219	9.191	0.002	1.941	1.264	2.980
Has television								
Ref.	Yes							
	No	0.216	0.230	0.886	0.347	1.241	0.791	1.948
Has refrigerator								
Ref.	Yes							
	No	0.490	0.346	2.009	0.156	1.633	0.829	3.217
Has telephone								
Ref.	Yes							
	No	-0.098	0.395	0.062	0.804	0.906	0.418	1.967
Main floor material								
Ref.	Cement, wood.							
	Sand, dirt	-0.202	0.231	0.768	0.381	0.817	0.519	1.284
Main wall material								
Ref.	Cement, brick, wood							
	Mud or mud with rock	0.729	0.231	9.972	0.002	2.073	1.318	3.258

Relationship to household head								
Ref.	Wife							
	Head	-1.920	0.933	4.231	0.040	0.147	0.024	0.913
	Daughter or daughter-in-law	-0.452	0.280	2.613	0.106	0.636	0.368	1.101
Ethnicity								
Ref.	Castilian (Spanish)							
	Quechua	0.133	0.248	0.286	0.593	1.142	0.703	1.855
	Aymara	-0.239	0.565	0.179	0.672	0.787	0.260	2.383
Altitude								
Ref.	0-2000 meters above sea level							
	2001-3000 meters above sea level	0.058	0.268	0.046	0.830	1.059	0.626	1.792
	3001-6000 meters above sea level	0.518	0.241	4.610	0.032	1.678	1.046	2.692

Ref. = Reference category

Df = 1401,25.

The model was statistically significant, X2 = 261.085, p <.001. The model as a whole explained between 19% (Cox and Snell R square) and 30% (Nagelkerke R square), and correctly classified 80.7% of the cases.

Table 14. Model 6.
Reduced Logistic Regression Analysis with alternative social determinants of health.
Alternative model. National sample n = 1426, Peru DHS, 2004-2006.

Coefficients		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R. Lower	Upper
Respondent's age								
	Current age	0.019	0.017	1.246	0.264	1.019	0.986	1.053
Partner's age								
	Current age	0.009	0.014	0.421	0.516	1.009	0.981	1.038
Partner's educational attainment								
Ref.	Complete secondary/higher							
	Complete primary/incomplete secondary	0.750	0.200	13.998	0.000	2.116	1.429	3.134
	No education/incomplete primary	0.835	0.217	14.830	0.000	2.304	1.507	3.525
Has electricity								
Ref.	Yes							
	No	0.944	0.175	29.240	0.000	2.569	1.825	3.617
Main wall material								
Ref.	Cement, brick, wood							
	Mud or mud with rock	0.693	0.202	11.748	0.001	2.000	1.345	2.972
Relationship to household head								
Ref.	Wife							
	Head	-1.962	0.930	4.453	0.035	0.141	0.023	0.870
	Daughter or daughter-in-law	-0.559	0.271	4.266	0.039	0.572	0.336	0.972
Altitude								
Ref.	0-2000 meters above sea level							
	2001-3000 meters above sea level	0.192	0.252	0.580	0.446	1.211	0.740	1.984
	3001-6000 meters above sea level	0.798	0.200	15.911	0.000	2.220	1.500	3.285

Ref. = Reference category
Df = 1416,10.

The model was statistically significant, X^2 = 265,552, p<.001. It explained between 18 % (Cox & Snell R Square) and 28,3% (Nagelkerke R Square) of the variance and correctly classified 80,5 % of all cases.

Table 15. Model 7.
Logistic Regression Analysis with Positive Husband Behaviour predicting child stunting
Peru National Sample n = 1794. Peru DHS, 2004-2006.

Coefficients		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R. Lower	Upper
Husband spends his free time with you								
Ref.	Frequently							
	Sometimes	-0.003	0.206	0.000	0.987	0.997	0.665	1.492
	Never	-0.693	0.607	1.303	0.254	0.500	0.152	1.644
Husband consults you								
Ref.	Frequently							
	Sometimes	0.458	0.211	4.715	0.030	1.581	1.046	2.390
	Never	0.537	0.546	0.968	0.325	1.711	0.587	4.988
Husband is affectionate with you								
Ref.	Frequently							
	Sometimes	0.196	0.204	0.920	0.337	1.216	0.815	1.814
	Never	-0.343	0.711	0.233	0.629	0.710	0.176	2.857
Husband respects you								
Ref.	Frequently							
	Sometimes	-1.243	0.331	14.113	0.000	0.289	0.151	0.552
	Never	-3.028	1.143	7.019	0.008	0.048	0.005	0.455
Husband respects your rights								
Ref.	Frequently							
	Sometimes	1.130	0.316	12.799	0.000	3.097	1.667	5.753
	Never	1.732	0.892	3.769	0.052	5.654	0.984	32.508
	Constant	-1.430	0.098	213.221	0.000	0.239		

Ref. = Reference category
Df = 1415,11.

The model was statistically significant, $X^2 = 31{,}483$, $p < .001$. The explained variance was between 2.8% (Cox and Snell R square) and 4.3% (Nagelkerke R square). 78.1% of the cases were correctly classified.

Table 16. Model 8.
Logistic Regression Analysis with decision latitude predicting child stunting
Peru National Sample n = 1426. Peru DHS, 2004-2006.

		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R.	
Coefficients							Lower	Upper
Final say on own health care								
Ref.	Respondent and husband/partner							
	Respondent and other person	0.112	1.197	0.009	0.926	1.118	0.107	11.677
	Respondent alone	-0.520	0.194	7.192	0.007	0.595	0.407	0.869
	Husband/partner alone	0.198	0.206	0.923	0.337	1.219	0.814	1.828
	Other person alone	0.432	0.558	0.600	0.439	1.540	0.516	4.595
Final say on making large household purchases								
Ref.	Respondent and husband/partner							
	Respondent and other person	-0.114	0.955	0.014	0.905	0.892	0.137	5.798
	Respondent alone	0.101	0.235	0.185	0.667	1.106	0.697	1.755
	Husband/partner alone	0.269	0.220	1.490	0.222	1.308	0.850	2.014
	Other person alone	-0.099	0.635	0.024	0.876	0.905	0.261	3.141
Final say on making household purchases for daily needs								
Ref.	Respondent and husband/partner							
	Respondent and other person	-1.295	0.990	1.712	0.191	0.274	0.039	1.906
	Respondent alone	-0.147	0.192	0.588	0.443	0.863	0.593	1.257
	Husband/partner alone	-0.199	0.295	0.457	0.499	0.819	0.460	1.460
	Other person alone	-1.355	0.608	4.961	0.026	0.258	0.078	0.850
Final say on making visits to family and relatives								
Ref.	Respondent and husband/partner							
	Respondent and other person	0.384	0.755	0.258	0.611	1.468	0.334	6.451
	Respondent alone	0.107	0.209	0.263	0.608	1.113	0.739	1.676
	Husband/partner alone	0.551	0.221	6.232	0.013	1.736	1.126	2.676
	Other person alone	0.664	0.591	1.260	0.262	1.942	0.610	6.184

Ref. = Reference category
Df = 1410,16.
The model was statistically significant, $X^2 = 64{,}275$, $p < .001$. The explained variance was between 4% (Cox and Snell R square) and 7% (Nagelkerke R square), and 79% of the cases were correctly classified.

Table 17. Model 9.
Logistic regression analysis predicting child stunting
Peru Regional Sierra Rural Sample n=171. Peru DHS, 2004-2006.

		B	S.E.	Wald	Sig.	O.R.
Coefficients						
Respondent's age						
	Current age	0.004	0.041	0.009	0.923	1.000
Partner's age						
	Current age	0.039	0.036	1.181	0.276	1.040
Altitude						
Ref.	0-2000 MASL					
	2001-3000 MASL	1.251	1.019	1.507	0.220	3.492
	3001-6000 MASL	1.473	0.734	4.022	0.045	4.362

Ref. = Reference category
Df = 167, 4.

The model was statistically significant, X^2 =10.375, p<.05. The explained variance was between 6.7% (Cox and Snell R Square) and 8.9% (Nagelkerke R square). The model correctly classified 59.8% of the cases.

Table 18. Model 12.
Logistic Regression Analysis with Positive Husband Behaviour predicting Child Stunting. Peru Regional Sierra Rural Sample n = 171.
Peru DHS, 2004-2006.

Coefficients		B	S.E.	Wald	df	Sig.	O.R.	95,0% C.I.for O.R. Lower	Upper
Positive Husband Behaviour Free Time									
Ref.	Frequently								
	Sometimes	-0.088	0.566	0.024	1.000	0.876	0.916	0,302	2,774
	Never	-0.453	2.217	0.042	1.000	0.838	0.636	0,008	49,023
Husband consults you									
Ref.	Frequently								
	Sometimes	-0.068	0.555	0.015	1.000	0.903	0.935	0,315	2,776
	Never	0.285	3.049	0.009	1.000	0.926	1.330	0,003	524,157
Husband is affectionate									
Ref.	Frequently								
	Sometimes	0.897	0.531	2.857	1.000	0.091	2.453	0,867	6,944
	Never	2.402	3.097	0.601	1.000	0.438	11.046	0,026	4783,628
Husband respects you									
Ref.	Frequently								
	Sometimes	-0.409	0.888	0.212	1.000	0.645	0.664	0,116	3,789
	Never	-21.571	37026.660	0.000	1.000	1.000	0.000	0,000	.
Husband respects your rights									
Ref.	Frequently								
	Sometimes	0.133	0.878	0.023	1.000	0.880	1.142	0,204	6,389
	Never	19.679	37026.660	0.000	1.000	1.000	351888417.7690	0,000	.

Ref. = Reference category
Df = 161, 10.
The full model was not statistically significant, $X^2 = 6.283$, p = .791. It explained between 4.3% (Cox and Snell R square) and 5.8 % (Nagelkerke R squared) of the variance, and correctly classified 60% of the cases.

Table 19. Model 12.
Logistic Regression Analysis with Decision Latitude predicting Child Stunting
Peru Regional Sierra Rural Sample n = 171. Peru DHS, 2004-2006.

Coefficients		B	S.E.	Wald	Sig.	O.R.	95,0% C.I.for O.R. Lower	Upper
Final say on own health care								
Ref.	Respondent and husband/partner							
	Respondent and other person	22.323	42198.555	0.000	1.000	4951412823.3916	0.000	.
	Respondent alone	-0.020	0.445	0.002	0.963	0.980	0.410	2,343
	Husband/partner alone	-0.500	0.472	1.121	0.290	0.607	0.241	1,530
	Other person alone	1.689	1.578	1.144	0.285	5.411	0.245	119,344
Final say on making large household purchases								
Ref.	Respondent and husband/partner							
	Respondent and other person	21.930	32175.998	0.000	0.999	3343590369.4837	0.000	.
	Respondent alone	0.138	0.586	0.056	0.814	1.148	0.364	3,624
	Husband/partner alone	0.364	0.508	0.512	0.474	1.439	0.531	3,895
	Other person alone	-2.765	2.316	1.425	0.233	0.063	0.001	5,898
Final say on making household purchases for daily needs								
Ref.	Respondent and husband/partner							
	Respondent alone	0.452	0.422	1.151	0.283	1.572	0.688	3,592
	Husband/partner alone	-0.185	0.705	0.069	0.794	0.831	0.209	3,311
	Other person alone	1.821	1.920	0.899	0.343	6.177	0.143	266,249
Final say on making visits to family and relatives								
Ref.	Respondent and husband/partner							
	Respondent and other person	-1.146	2.223	0.266	0.606	0.318	0.004	24,776
	Respondent alone	-0.879	0.575	2.338	0.126	0.415	0.135	1,281
	Husband/partner alone	0.236	0.481	0.240	0.624	1.266	0.493	3,248
	Other person alone	-2.009	1.619	1.540	0.215	0.134	0.006	3,204

Ref. = Reference category
Df = 156, 15.
The model was not statistically significant, X^2 = 14,860, p = .462. The explained variance was between 8.4% (Cox and Snell R square) and 11.3% (Nagelkerke R square), and 65,6% of the cases were correctly classified.