

**Parental migration, care-giving practices and left-behind children's
nutritional health in rural China:
A mixed-methods approach**

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List of Abbreviations

- LBC: left-behind children
- Non-LBC: non-left-behind children
- CHNS: China Health and Nutrition Survey
- HAZ: height-for-age Z-scores
- WAZ: weight-for-age Z-scores
- BMIZ: body-mass-index Z-scores
- WHZ: weight-for-height Z-scores
- UNICEF: United Nations Children's Fund
- LBW: low-birth weight
- SDQ: Strengths and Difficulties Questionnaire
- HRQoL: health-related quality of life
- CASP: Critical Appraisal Skills Programme
- PSM: propensity score matching
- IV: instrumental variables
- GCM: Growth Curve Model
- MCAR: Missing Complete At Random
- MAR: Missing At Random
- MNAR: Missing Not At Random
- MI: Multiple imputation
- IOTF: International Obesity Task Force
- WHO: World Health Organization
- LMS: Lambda-Mu-Sigma
- NCHS: National Centre for Health Statistics
- MGRS: Multicentre Growth Reference Study
- DRI: Dietary reference intakes
- FCT: Food Composition Table
- OR: odds ratios
- CI: confidence intervals
- OLS: ordinary least squares
- AMDR: Acceptable Macronutrient Distribution Ranges
- MICE: Multiple Imputation using Chained Equations

SD: standard deviations

SE: standard errors

NCMS: New Cooperative Medical Scheme

NBSC: National Bureau of Statistics of China

RMB: Renminbi (the official currency of People's Republic of China)

GBP: Pound Sterling

USD: The United States Dollar

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The University of Manchester

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Parental migration, care-giving practices and left-behind children's nutritional health in rural China: A mixed-methods approach

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Abstract

China's rural-urban migration has resulted in 61 million children living apart from their parent(s) in rural communities. Previous studies have failed to examine the long-term effects of parental migration on left-behind children's nutritional health, and have not examined the gender differences (of parents and children) in those associations. This research uses a mixed-methods design that incorporates quantitative and qualitative techniques to explore links between parental migration, care-giving arrangements and left-behind children's nutritional health in rural China.

The quantitative analyses draw on a longitudinal dataset – the China Health and Nutrition Survey (CHNS) (1997, 2000, 2004, 2006, and 2009) to examine the relationships between children's nutritional outcomes and different patterns of parental migration including being left behind in different stages of childhood, and being left behind by the father or the mother. The qualitative component consists of analyses of interviews with 32 caregivers (21 grandparents, 9 mothers, and 2 uncles/aunts), and children's diaries (26 children aged 6-12, 21 left-behind children and 5 non-left-behind children) to explore the care-giving practices for left-behind children from the perspectives of a group of children and their caregivers in rural northern central China.

Results of the quantitative analyses show negative associations between parental migration, especially maternal migration, and left-behind children's nutritional outcomes indicated by anthropometric measures and macronutrient intakes, and this is particularly true for boys left behind during early life in rural China. The qualitative findings highlight the importance of socio-cultural factors, since there seems to be a paradox of intergenerational obligations for boys in a culture where sons are more valued than daughters. This is because parents migrate to save for their sons' adult lives, reducing the remittances sent to support their sons who stay behind. There is less pressure to save for daughters' adult lives and so more potential for remittances to support their nutrition.

The research also recognizes the importance of grandparents as carers, and their experiences and beliefs about healthy eating for children. Grandparents, particularly on the paternal side, are expected to fulfil social obligations to care for left-behind grandchildren even without immediate financial returns. Inadequate financial support from the migrant parents of left-behind boys in rural China, in particular boys cared for by paternal grandparents, may result in greater risk of poor nutrition during the early childhood. This potentially renders such left-behind boys vulnerable to developmental delays. These findings are important for policy-makers to develop effective interventions to improve left-behind children's nutritional well-being in rural China.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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Publications from thesis

Some aspects of this thesis have been presented, published or sent for publication during the conduct of this study, and are listed below. All are the original work of the author.

Peer-reviewed journals

Zhang N., Bécares L., Chandola T. & Callery P. (2015). Intergenerational differences in beliefs about healthy eating among carers of left-behind children in rural China: A qualitative study. *Appetite*, 95, 484-491, doi: 10.1016/j.appet.2015.08.024.

Zhang N., Bécares L. & Chandola T. (2015). Does the timing of parental migration matter for child growth? A life course study on left-behind children in rural China. *BMC Public Health*, 15, 966, doi: 10.1186/s12889-015-2296-y

Zhang N., Bécares L. & Chandola T. (2015). A multilevel analysis of the relationship between parental migration and left-behind children's macronutrient intakes in rural China, *Public Health Nutrition*, doi: 10.1017/S1368980015003341. *[selected as the Nutrition Society Paper of the Month for December 2015]*

Zhang N., Chandola T., Bécares L. & Callery P. (forthcoming 2016). Parental migration, intergenerational obligations and the paradox for left-behind boys in rural China (accepted), *Asian Population Studies*

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Presentations

Zhang N., Bécares L. & Chandola T. Parental migration and left-behind children's physical growth in rural China: A life course study. Society for Longitudinal and Life Course Studies (SLLS) Annual Conference, 18th -21st October 2015, Dublin, Ireland. Oral presentation

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Zhang N., Bécares L., Chandola T. & Callery P. Rural-urban migration and left-behind children's nutritional health in China: A mixed-methods approach, 12th June 2014, Postgraduate Research Showcase Conference, The University of Manchester. Poster presentation

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Chapter 1 Introduction

China has been undergoing unprecedented rural-urban migration, which has resulted in a substantial number of children living apart from their parents in rural areas. This thesis focuses on the influence of parental migration on children's nutritional health in rural China. This first chapter presents some general background on China's rural-urban migration, the phenomenon of left-behind children in rural China, and the importance of nutrition in child development, especially during the early years of life. The remainder of the chapter proposes potential links between parental migration and the nutritional health of children left behind, towards a modified conceptual framework for the causes of childhood malnutrition, with a special focus on parental migration and care-giving practices for left-behind children. Finally, the rationale of the research is provided, together with an overall outline of the thesis.

1.1 Rural-urban migration in China

Rural-urban migration in China

Rural-urban migration flows are a consequence of economic development (Vendryes 2011). China has been undergoing the largest-scale internal migration in human history since the reform and opening up of the late 1970s (Hu 2012a), with a massive surplus of rural labourers transferring to cities. At the national level, in about 15% of all rural families at least one member will migrate to an urban area (Zhang 2004). The population of migrant workers was around 262.61 million in 2012, up by 3.9% compared to 2011 (National Bureau of Statistics of China 2014c).

Economic incentives motivate millions of China's rural population to join this unprecedented internal migration (Jia and Tian 2010; Janson 2014). The relaxation of institutional constraints such as the household registration system, known as *hukou*, is one external factor making rural-urban movement possible in the Chinese context. *Hukou* acts like an internal passport system (Ma 2010), placing strong constraints on individual migration throughout the country, especially from rural to urban areas (Vendryes 2011). Under the *hukou* system, Chinese people are officially segregated into 'urban residents' born in urban areas and 'rural residents or peasants' born in rural areas. These two categories provide key status markers in contemporary China, and entail different state welfare entitlements (Xiang 2007; Gong et al. 2012). Although gradual and partial relaxation of *hukou* constraints has entitled rural people greater freedom to migrate, they still encounter obstacles to obtaining permanent urban *hukou* status, which is associated with many exclusive benefits including government-provided housing, medical care, employment, children's education, and improved living security (Chan and Buckingham 2008).

Massive internal migration, mostly of young adults aged 25 to 49 (Hu et al. 2008; Wong et al. 2007), has fundamentally altered the Chinese demographic landscape. Due to financial constraints and the transient nature of work in urban communities (Gao et al. 2010), migrant workers have to leave their children, especially those of school age, in their rural hometowns (Ye and Pan 2011), creating a unique social group in contemporary China – 'left-behind children'.

Left-behind children in rural China

The concept of left-behind children was first used to refer to children left in their home country when their parents left to seek job opportunities abroad (Beh and Ye 2012). However, the concept has evolved to apply to the large-scale internal migration in China, and now incorporates children left behind by parents who migrate within China, from rural to urban areas. Xiang (2007) has argued that the emergence of the left-behind population in rural China cannot be conceptualised merely as a rational ‘household strategy’, and that to a large extent it is rather an outcome of institutional arrangements and unequal social relations (Xiang 2007).

Based on the 2005 by-census of 1% of the population, the All-China Women’s Federation estimated that the total population of rural left-behind children (under 18 years old) was around 58 million. Over 40 million of these were under 14 years of age, and the largest group (around 34.85%) was formed of primary school-aged children (All-China Women's Federation 2008). The most recent survey, based on the Sixth National Population Census of the People’s Republic of China of 2010, estimated that the overall population of left-behind children in rural China was around 61 million in that year (accounting for 37.7% of total rural children and 21.88% of all children in China) (All-China Women's Federation 2013), representing an increase by 2.42 million during the five years between 2005 and 2010. The largest group among rural left-behind children was preschool children (from 0 to 5 years old), accounting for 38.37% of all left-behind children, and the second largest group was primary school-aged children (from 6 to 11 years old), accounting for 32.01%. The majority of left-behind children are geographically distributed in the western and central areas of China. It has been reported that 43.64% of total rural left-behind children live in one of five provinces: Sichuan, Henan, Anhui, Guangdong, and Hunan (All-China Women's Federation 2013).

The large number of left-behind children in rural China has attracted increased academic attention in recent years, with several studies exploring the impacts of parental migration in this context (e.g., Duan and Zhou 2005; Ye and Pan 2011; Ye 2011; Ye and Murray 2005; Lee 2011; Guo 2012; Gao et al. 2010). The studies published to date have not been able to use a universally accepted definition of left-behind children (Lu 2011), as several issues have hindered any consensus. First,

there are discrepancies in the period of separation of left-behind children from their migrant parent(s), ranging from at least six months (Duan and Zhou 2005;He et al. 2012) to over a year (Fan et al. 2010;Lin and Yuan 2007). It is likely that the duration of separation may affect the magnitude of the impacts of parental migration on left-behind children's well-being because the exposure effect may be cumulative over the children's life course (Spallek et al. 2011); for example, the longer the parent(s) (in particular, the mother) is away, the worse the potential effect on the psychological well-being of the left behind children (Huang et al. 2015;Fan et al. 2010). Second, there seems to be a lack of agreement regarding the oldest age of left-behind children (e.g.,Ye and Murray 2005;Lin 2003;Jia et al. 2010;Li et al. 2015), with possible limits suggested at 14, 16 and 18 years old. The effects of parental migration on children's well-being may vary with children's age. It is likely that being exposed to parental migration during early childhood can be more detrimental for children's well-being than exposure in the later stages of childhood, because younger children may be more vulnerable to family disruption (Fan et al. 2010). Third, despite the acknowledged importance of left-behind children (LBC)'s well-being (e.g., Lu 2011;Ye and Pan 2011;Luo et al. 2008;Tan et al. 2010), in-depth information on relevant care-giving arrangements is still limited. It is well documented that care-giving practices are important to children's nutritional status, especially caregivers' nutritional knowledge (United Nations Children's Fund 1990;Engle et al. 1999). Evidence suggests that non-parent caregivers (mainly grandparents) of LBC tend to have relatively poor nutritional knowledge and behaviour compared to parent caregivers (Tan et al. 2010). It is important to take into account of care-giving practices in exploring the association between parental migration and the well-being of children who are left behind.

In this thesis, LBC are defined as children younger than 18 years of age with rural household registration (*hukou*) living in rural areas when one or both of their parents migrate(s) to urban areas for job opportunities. Compared with previous concepts, this definition is relatively broad, as it is not restricted to a specific age group or specific separation period, and does not depend on who takes the care-giving role in the migrant-sending families. It represents an improvement on existing definitions because it allows an examination of nutritional outcomes in different patterns of parental migration, which may develop over time.

China's rural-urban migration has transformed labour patterns in urban areas as well as social traditions in rural areas. It has been estimated that internal-migrant workers contributed 24% of China's GDP in 2005 (Yan and Li 2007). However, the children left behind in rural areas may have paid a high price for these macroeconomic benefits (Ye and Pan 2011). A growing number of studies have found a negative association between parental migration and LBC's development, in terms of their psychological well-being (e.g., He et al. 2012; Wang et al. 2015; Fan et al. 2010; Jia and Tian 2010; Su et al. 2013; Wen et al. 2015; Wu et al. 2015) and educational attainment (e.g., Lee 2011; He 2008; Zhao and Glewwe 2010; Knight et al. 2010; Hu 2012a; Lu 2012; Wang 2007; Wen and Lin 2012). In addition to psychological well-being and cognitive development, nutritional health is an important aspect of child development, but has received less attention in existing studies in this area. This thesis therefore focuses on the nutritional aspect of LBC's development.

1.2 The importance of nutrition in child development

Children's growth is considered an important public health indicator for monitoring nutritional status among children both at individual and population levels. It is believed that poor nutritional health, regardless of its aetiological origins, always affects growth to some extent (De Onis and Habicht 1996).

Although individuals may also be malnourished in terms of micronutrients¹, the term 'malnutrition' usually refers to macronutrient² malnutrition (Macallan 2005). Malnutrition can refer either to under-nutrition or over-nutrition, and is usually measured by three indices: stunting (low height-for-age), underweight (low weight-for-age), and wasting (low weight-for-height), reflecting distinct biological processes (Seetharaman et al. 2007). Malnutrition weakens the immune response and can aggravate the effects of infection (Pelletier and Frongillo 2003). Therefore, children who are malnourished tend to be more susceptible to severe diarrhoea and other infectious diseases like pneumonia and malaria (De Onis and Blössner 2003; Man et al. 1998; Victora et al. 1994; Macallan 2005; Schaible and Stefan 2007). It is generally accepted that children who are underweight or stunted tend to be at greater risk of

¹ Micronutrients are nutrients needed only in minuscule amounts, which enable the body to produce enzymes, hormones and other substances essential for proper growth and development.

² Macronutrients are nutrients that provide calories or energy and are required in large amounts to maintain body functions and carry out the activities of daily life. They appear in three broad classes: proteins, carbohydrates and fats.

childhood morbidity and mortality (Pelletier et al. 1993;WHO 1995). In addition, a large body of studies has demonstrated that malnutrition, in particular stunting in early childhood, is associated with developmental delay, including cognitive deficits and poor academic performance, often leading to reduced work capacity in adulthood (Grantham-McGregor et al. 2007;Mendez and Adair 1999;World Health Organization 1999;United Nations Children's Fund 1998;Jukes et al. 2002;Walker et al. 2007). Recent evidence from five prospective cohort studies in low-income and middle-income countries (Brazil, Guatemala, India, the Philippines, and South Africa) indicates that low birth weight (LBW) and/or under-nutrition at age two are associated with shorter adult height, lower educational attainment, and reduced economic productivity during adulthood (Victora et al. 2008).

Childhood malnutrition can have long-term effects on adult health. For example, stunting entails a high risk of adult obesity (McCarthy 1997). Popkin (2001) has suggested that one third of all adult coronary heart disease cases and one tenth of adult diabetes and stroke cases in China in 1995 could be attributed to malnutrition in childhood. Overweight and obesity were found to be a major contributor (around 25.5%) to the direct medical costs of obesity-related chronic diseases (e.g., coronary heart diseases, diabetes, hypertension, and stroke) in China in 2003 – a heavy economic burden in China (Zhao et al. 2008).

Although the exact mechanisms by which malnutrition affects growth and development are still not clear (Grantham-McGregor and Ani 2001), protein-energy malnutrition in early childhood is associated with poor cognitive and motor development. The magnitude of the association is, to a large extent, dependent on the severity and duration of malnutrition and its timing during the course of childhood (Black 2003). In other words, moderate protein-energy malnutrition of long-term duration leads to worse consequences than transient severe malnutrition.

The period of early life course from conception to a child's second birthday, approximately 1000 days, is considered to be the time when nutrition has the greatest effect on a child's health, growth, and development (Shekar et al. 2006). Malnutrition during this period can adversely affect adult health and well-being by reducing the body's ability to adapt to inadequate nutrients, and cause irreversible changes in physiology and metabolism in accordance with the so-called 'fetal

original hypothesis' (Barker 1997;Barker et al. 2002;Gluckman et al. 2008). Victora et al. (2008) suggested that height-for-age at age two was a better measure of adult human capital than other measures of nutrition.

It is acknowledged that improving nutrition in early childhood in developing regions is a long-term economic investment and driver of economic growth. Direct evidence comes from a nutrition intervention in Guatemala, where nutritional improvement in early childhood, from ages 0 to 2 years (not from 2 to 3 years), led to substantial increases in the males' wage rates 25 years later (Hoddinott et al. 2008). Millennium Development Goals (MGDs) focus on early childhood up to the age of 5 as a key period for reducing childhood malnutrition to alleviate poverty and hunger in developing countries. Whichever time points of the life course are used, the early years of life still present the best opportunity to promote optimal growth and cognitive development with possible long-term outcomes for economic development.

1.3 Potential links between migration and child nutrition

The ways in which migration influences children's nutritional health are complex and multi-factorial. Theoretically, migration is largely a household strategy to maximize economic welfare at the household level (Stark and Bloom 1985). There is evidence that remittances from migrant parents benefit the family members who stay behind by relieving poverty, increasing education, and more generally boosting economic growth (Mines 1981;Grindle 1988;Massey et al. 1987;McKenzie and Sasin 2007). Over 75% of Chinese migrants send remittances to their original families and the proportion reaches 90% for migrants whose children are left behind (Cai 2007;CYRC 2006). It was estimated that in 2005 nearly USD 30 billion was sent from urban to rural areas in China (Gong et al. 2008;Akay et al. 2014). Improved economic status makes it possible for left-behind children to access healthcare services, and makes it easier for them to enjoy a healthier environment and more nutritious food. In addition to economic gains, migration often brings about social remittances in terms of useful information or knowledge and new life perspectives, thereby broadening one's horizons (Toyota et al. 2007;Levitt 1998), which can influence left-behind children through their interactions with parents and carers (Graham et al. 2012).

However, one important negative aspect of migration is family dissolution, and this may have serious adverse effects on the psychological and emotional well-being of LBC (Shi 2011). These adverse effects may vary based on factors such as which parent is absent (i.e., the mother only, the father only, or both parents), and the age of children when the parent(s) left. Biblarz and Raftery (1999) found that maternal absence tended to be most detrimental to children's well-being as the mother could contribute more to the children's rearing than the father. With regard to the child's age, the negative impact of parental absence may be stronger for younger children because they are more vulnerable to parenting deficits (Ermisch and Francesconi 2001). Liu et al. (2009) found that Chinese children left behind at a younger age tend to have more symptoms of anxiety and depression. The 'one-child policy' in China, a radical approach to limiting population growth (Cameron et al. 2013), has been identified as a risk factor for internalizing disorders such as depression and anxiety (Meng et al. 2011). LBC who are their households' only children are more likely to experience psychological problems, as they may be subjected to particularly high expectations by their parents in terms of life goals (Wang and Guo 2010). These psychological symptoms may potentially affect dietary attitudes and behaviours such as eating disorders, as well as contributing to unhealthy behavioural problems like smoking, which may jeopardise LBC's health (Martyn-Nemeth et al. 2009; Hampl and Betts 1999; Hanson and Chen 2007; Dallongeville et al. 1998; Fryer et al. 1997).

LBC often live with non-parent carers in extended families when both parents migrate. Qualitative observations have consistently demonstrated that LBC often develop behaviours at two extremes: they are either withdrawn, or excessively aggressive (Li 2004; Zhao 2004). This is possibly due to the fact that grandparents as carers are more likely either to overindulge the children or to fail to fulfil their emotional needs (Ye and Pan 2011). Some LBC usually have to undertake agricultural work or farm work, which may also influence the developmental process (Lu 2011). There is empirical evidence demonstrating that migration of a household member increases the amount of the time spent on farm work and domestic work by LBC, especially left-behind girls (Chang et al. 2011a). Grandparents as primary carers usually pay little attention to children's diets; indeed, children may need to take care of the carers if they are elderly and in poor health (Ye and Pan 2011). In

summary, increased workload, poor dietary intake and unmet emotional needs can be potentially detrimental to LBC's nutritional health.

1.4 Conceptual framework on child nutrition

In tracing potential links between migration and child nutrition, it is useful to depict and analyse hypothesised causal associations in complicated health conditions determined by social and biological factors, such as malnutrition (Weiser et al. 2011;United Nations Children's Fund 2008;Victora et al. 1997). The conceptual framework of child malnutrition developed by the United Nations Children's Fund (UNICEF) (United Nations Children's Fund 1990;United Nations Children's Fund 1998) was adapted for the purposes of incorporating parental migration status in the outline of pathways to LBC's nutritional well-being (Figure 1.1).

This adapted framework provides some guidance on which factors should be considered to examine the impact of parental migration on children's nutritional status. It outlines multiple causes of children's nutrition operating at various levels (individual level, household level, community level, and provincial level) in society. Nutritional status is the outcome of a complex combination of interrelated causes (United Nations Children's Fund 1990;United Nations Children's Fund 1998). It lays out the immediate (most proximate), underlying, and basic (most distant) causes of child malnutrition. All underlying factors can be classified into two interrelated categories: the underlying biological and behavioural causes, and the underlying social and economic causes.

Basic causes include policy, social-cultural, physical, and economic contextual factors operating at community or provincial level. Care-giving practices, household food security, and health services and environment are the three underlying factors determining children's dietary intakes and health as immediate causes, and consequently, child growth and development. The present framework then includes child-specific characteristics as one dimension of underlying causes (not included in UNICEF original framework) (United Nations Children's Fund 1998;United Nations Children's Fund 1990). Child attributes mainly relate to age, gender, and whether or not a child is the only child in his/her family, which can affect distribution of family resources (Bredenkamp 2009).

Migration status is not explicitly referred to in the original framework, but can be implicitly included under underlying social and economic causes, as it could influence household income, and in turn affect accessibility to food, healthcare services, and a healthy environment. In China, internal migration is economically driven, as migrants have lower economic status compared to those families without migrants (Guo 2012). The remittances sent back from migrant parent(s) can positively affect the socioeconomic status of migrant households, which may improve food security and accessibility to health services and/or environment. Moreover, living arrangements for children could be changed or rearranged due to parental absence. Underlying biological and behavioural causes mainly include immunization or preventive care, family size which may influence intra-household food distribution, and characteristics of parents which may capture genetic influences on children's health.

All underlying causes can, in turn, affect immediate causes (dietary intake, infectious disease), and then influence children's nutritional status. It should be noted that most of the factors are correlated. The proposed theoretical framework is not a rigorous model, but rather an attempt at a comprehensive framework to identify many confounding factors involved in child nutrition. However, it is unlikely to capture all such factors implicated in the association between LBC and nutritional status. For example, many rural populations in contemporary China are increasingly exposed to health risks such as environmental pollution and food safety issues (Zhang et al. 2010;Gong et al. 2012). These factors are not captured in this framework.

The proposed framework provides guidance for the mixed-methods research design of this thesis. The quantitative component aims to explore the association between parental migration and LBC's nutritional health by drawing on an on-going longitudinal dataset – the China Health and Nutrition Survey (CHNS). Care-giving practices play an important role in children's nutritional health, especially carers' nutritional knowledge (United Nations Children's Fund 1990;Engle et al. 1999), which is not available from the CHNS. The qualitative component will be designed to explore the care-giving practices for LBC from the perspectives of children and their caregivers in the context of rural China. The quantitative and qualitative components can provide a comprehensive understanding of the links between parental migration and LBC's nutritional health in rural China.

1.5 Research aims and outline of thesis

The research aims to investigate the associations between parental migration and children's nutritional outcomes in rural China by using a mixed-method study design. The remainder of the thesis is structured as follows:

Chapter 2 provides a detailed literature review on the impact of migration on LBC's physical health and psychological well-being in the global and Chinese contexts. Emphasis is placed on the associations between parental migration and LBC's nutritional outcomes, and on care-giving practices of LBC in rural China. Limitations and research gaps will be identified and then research questions will be proposed.

Chapter 3 provides the rationale for the mixed-methods research design, including details on the quantitative and qualitative methods.

Chapter 4 provides a general picture of patterns and distribution of under- and over-nutrition among rural children in China.

Chapters 5 to 8 present four papers which address specific issues with regard to LBC's nutritional status and care-giving practices for LBC in rural China. The first quantitative paper (Chapter 5) employs a life-course approach and growth curve models to explore the long-term associations between being left behind due to parental migration and LBC's physical growth. The second quantitative paper (Chapter 6) presents multilevel modelling analyses to estimate the associations between parental migration (by the father or by the mother) and LBC's macronutrient intakes (protein, fat, and carbohydrates) in rural China. The third and fourth papers (Chapter 7 and Chapter 8, respectively) are of a qualitative nature, drawing on in-depth interviews with caregivers and children's diaries to explore the care-giving practices for LBC in a rural township in northern central China.

Chapter 9, the final chapter, draws together the findings and discusses limitations of the research as well as implications for future work.

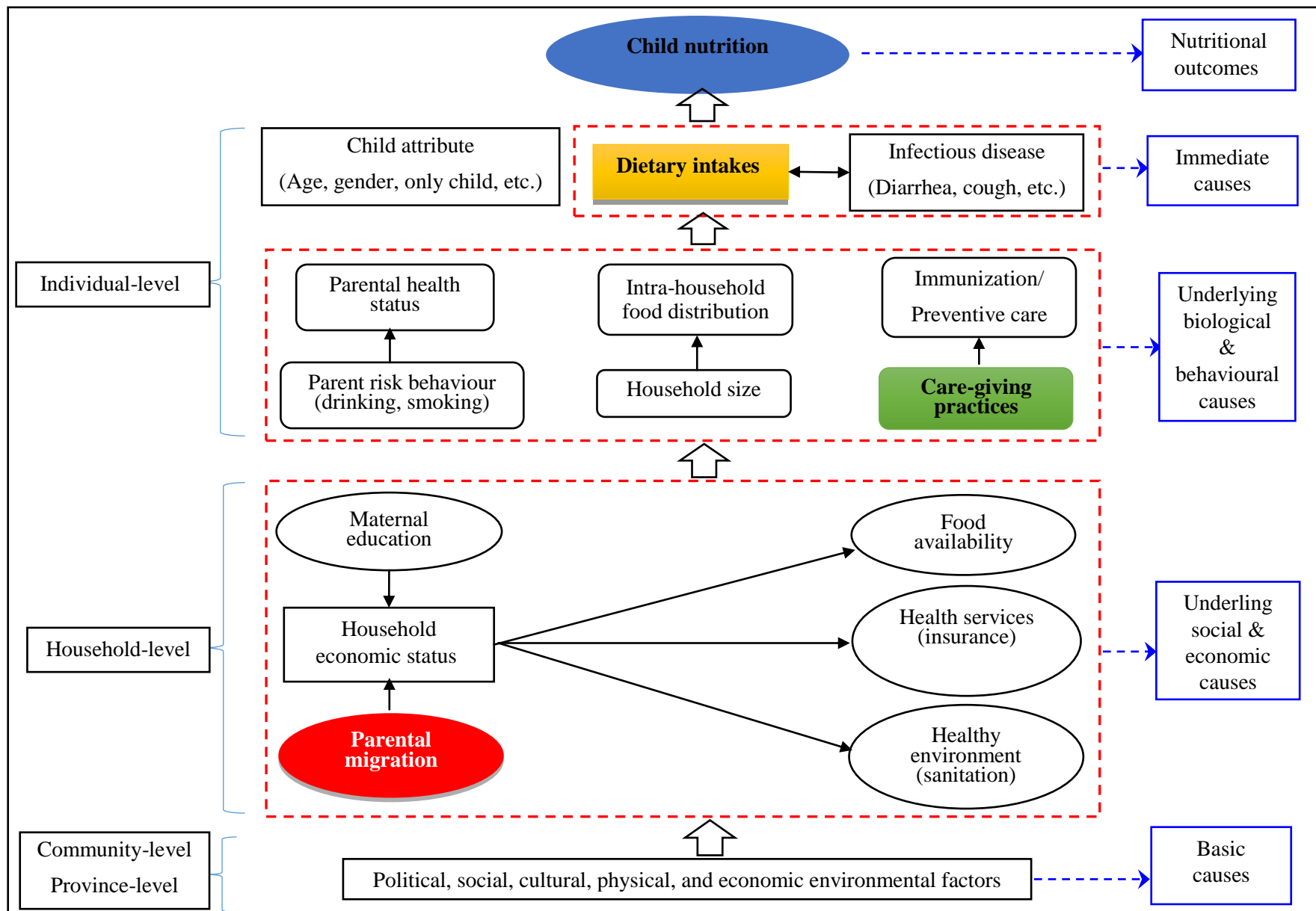


Figure 1-1 Conceptual framework for left-behind children's nutrition (modified from UNICEF framework)

Chapter 2 Literature review

This chapter provides a broad overview of the effect of migration on left-behind children's nutritional health and psychological well-being across international settings and in the Chinese setting. Based on a systematic search of relevant databases, a detailed review is presented of the associations between parental migration and the nutritional outcomes of children who are left behind, and the care-giving practices for left-behind children in rural China. This chapter critically reviews key articles based on their methodological merits and substantive findings. Limitations and knowledge gaps of current evidence are identified at the end of this chapter. This chapter concludes with a short summary of the research questions and the proposed mixed-methods study design.

2.1 Migration and left-behind children's development

Globally, migration has become a key component in household strategies across the developing world. It is well documented that migration has an important influence on the development (e.g., physical health, psychological well-being, and educational attainments) of children who stay behind in residence of origin (e.g., Démurger 2015; Creighton et al. 2011; Stillman et al. 2012; Mazzucato 2014; Jordan and Graham 2012; Lu 2012).

This research draws on health literature on psychological well-being and physical health (mainly nutritional outcomes). As discussed in Chapter 1, left-behind children (LBC) are children who stay behind when their parents migrate nationally or internationally, and who live with one parent and/or other caregivers.

2.1.1 The global context

This section will review studies on the effect of migration on children's nutritional health and psychological well-being in the global context. The next section will focus on the Chinese context.

Nutritional health

It is widely accepted that parental migration has important effects on the nutritional outcomes of children who remain behind. Regardless of whether it is internal or transnational, such migration can influence LBC through a range of different channels. The conventional wisdom is that remittances can relax household budget constraints in relation to food and consumption choices. However, parental migration may also reduce the time available for child care and change the time-use patterns of children who stay behind, especially when it is the mothers, as the primary care providers, who take up migration work (Zezza et al. 2011). Migrant parents may also transmit social remittances in form of ideas and practices gained through migration to household members who remain in the residence of origin, which may include health behaviours and food choices/consumption (Levitt 1998). In short, parental migration may affect the nutritional outcomes of children who remain behind in both positive and negative ways. Therefore, assessing the effect of parental migration on LBC's nutrition is actually an empirical question.

A growing number of studies have examined the effect of transnational migration on the nutritional health of children who stay behind in their countries of origin (e.g., Mexico, Tanga, El Salvador, Pakistan) (e.g., Creighton et al. 2011; Damon and Kristiansen 2014; Stillman et al. 2012; Mansuri 2006).

As an example, Mexico has a long history of migration to the United States, and migration remains a common livelihood strategy for many households in Mexico. Given Mexico's obesity epidemic, the impact of international migration on the risk of child obesity has gained in popularity as an academic subject. Creighton and colleagues (2011) found that children (aged 3-15 years) in households exposed to migrant networks (family members and/or extended relations) in the US were more likely to become overweight or obese compared to children without a relationship to migrant networks. A recent study (Damon and Kristiansen 2014), employing natural disasters as an identification strategy for migration to address inherent selection bias in the migration decision, found that international migration of a male or female family member (parents or siblings) from Mexico to the US increased the risk of obesity in older boys (aged 12-18) in urban areas, although it decreased the likelihood of obesity in girls. Male migration appeared to increase the chances of obesity in younger boys (aged 4-11) in rural areas. Although Damon and Kristiansen (2014) did not differentiate parents from other family members, they suggested that gender differences in the impact of international migration might be due to increased strenuous activities (for example, household work) for girls rather than boys after migration. These results may imply that the effect of migration on child obesity can be mediated by the gender of the child as well as the gender of the migrant parent.

Hamilton and Choi (2015) extended the idea from household migration to community migration and examined the impacts of community-level migration on children's health. Their results indicated that remittances (financial remittances) and return migration (social remittances meaning ideas and practices transmitted by migrants from the host to the home countries) at community level could lead to decreased risk of low-birth weight (LBW) and increased risk of macrosomia (heavy birth weight). Conversely, out-migration at community level was associated with increased risk of LBW and lower risk of macrosomia.

Some studies from elsewhere show a positive effect of migration on nutritional outcomes in terms of the height growth of children who stay behind. In the case of Guatemala, Carletto et al. (2011) used a differences-in-differences approach to examine the impact of international migration to the US on height-for-age Z-scores (HAZ) and stunting prevalence of children under 6 years of age. The results suggested that international migration increased left-behind children's HAZ and reduced the prevalence of stunting by 6% compared with children living in households without a migrant. Azzarri and Zezza (2011) found that in Tajikistan migration appears to increase the HAZ of young children under 5 years of age. Another study, in El Salvador (De Brauw 2011), suggested that in a time of food price crisis, the HAZ of children under 3 years of age from households with international migrants tended to decrease less than those of children from households without international migrants. This implies that migrant households are able to withstand food price shocks better than non-migrant households. Mansuri (2006) reported a positive impact of migration on growth outcomes (measured by HAZ) in Pakistan where son preferences were prevalent, especially for young girls aged between 6 months to 3 years. This may suggest that the effect of parental migration on young children's nutritional health can vary according to children's gender.

Stillman and colleagues (2012) used evidence from a lottery program for migration from Tonga to New Zealand to assess the impacts of migration on multiple nutritional measures among migrant children (as opposed to children who are left behind in their original countries), compared to children whose families remained in Tonga. They found that migration increased the height and reduced the stunting prevalence of children younger than 2 years old, while it increased the body-mass-index Z-scores (BMIZ) and the obesity prevalence of children aged 3-5 years. They also suggested that the obesity effect of migration might be due to dietary change. Drawing on the same dataset, Gibson (2011) found no significant effect of migration on multiple nutritional measures including BMIZ, HAZ and weight-for-age Z-scores (WAZ) among children aged under 18 years who were left behind in Tonga, as compared to children from households containing no migrants to New Zealand. Although using policy experiments is a promising approach to estimate the causal effects of migration on nutritional outcomes among children who stay behind, such data are rarely available, and can be expensive to collect (McKenzie and Yang 2012).

Antón (2010) analysed the impact of remittances on the nutritional status of children younger than 5 years old in Ecuador using an instrumental-variables (IV) approach. The results showed a significant and positive effect on weight-for-height Z-scores (WHZ) and WAZ but no significant impact on HAZ.

So far, the effect of migration on nutritional outcomes among children who remain in their residence of origin is inconclusive. One noticeable discrepancy among the existing studies is the use of different measurements of nutritional outcomes. For example, some Mexico-based studies find a positive effect of migration on over nutrition (e.g., obesity and macrosomia) among children who stay behind (Creighton et al. 2011; Damon and Kristiansen 2014). Studies in other contexts (e.g., Guatemala, Tajikistan, and Pakistan) focused on children's improved nutritional status in terms of height growth (Carletto et al. 2011; Azzarri and Zezza 2011; Mansuri 2006). Even among reports using the same nutritional indicators, there are still differences regarding the nutritional effect of migration on children who stay behind across different contexts (e.g., Stillman et al. 2012; Mansuri 2006; Antón 2010).

The channels through which migration can affect children's nutrition are complex, and neither LBC nor other family members do not necessarily benefit (Démurger 2015). The large heterogeneity in estimates could be due to differences in research designs, temporal dynamics or spatial variations worldwide. The effect of parental migration on children's nutritional well-being is essentially an empirical question and there are several factors that should be taken into account: the gender of migrant parents and LBC, the age of LBC, wider contextual factors (e.g., food prices, and food environment), and social remittances (which can be difficult to measure in practice).

Psychological well-being

Most studies across different contexts have consistently suggested that parental migration negatively affects LBC's psychological well-being (Mazzucato 2014). For example, a cross-sectional survey in four Southeast-Asian countries found a negative effect of parental migration on the psychological well-being of children left behind (Graham and Jordan 2011), especially by migrant mothers (Jordan and Graham 2012). A cross-country comparison study of three African countries (Ghana, Angola, and Nigeria) found worse psychological well-being among children who were left

behind in Angola, but no significant associations in Ghana or Nigeria (Mazzucato et al. 2014). This may suggest that broader characteristics other than parental migration *per se* – for example social norms about family and political stability – contribute to decreased well-being. Parreñas (2005) reviewed research evidence on children of migrants in the Philippines, and noted that many studies found an increased incidence of psychological problems among children who were left behind by migrant parents, in particular by mothers. This may suggest that the gender of the parent can play a key role in LBC’s psychological well-being.

Regarding the gender of LBC, a recent nationally representative household survey in Moldova found that parental migration was significantly associated with conduct problems, but not with poorer emotional symptoms, as measured by caregiver-reported Strengths and Difficulties Questionnaire (SDQ) scores. Associations were statistically significant for left-behind boys, but not for left-behind girls (Vanore et al. 2015). One possible explanation for these differential results could be the different genders’ different means of emotional expression during parental migration: boys may be more likely than girls to isolate themselves because of the perception that any expression of personal emotion may make them appear weak (UNICEF 2008). The gender of the child is thus an important factor to be considered when examining the effect of parental migration on children’s psychological well-being.

Therefore, although there is a large volume of evidence in support of the negative effects of parental migration on LBC’s psychological well-being, it is worth noting that these effects can be mediated by specific factors, and can vary according to the gender of the child, the gender of the migrant parent, and care-giving arrangements in different socio-cultural contexts (Mazzucato et al. 2014; Jordan and Graham 2012; Vanore et al. 2015). For example, close ties with extended family may play an important role in the coping process of LBC after parental migration, helping to ease LBC’s psychological distress through a transition (Robila 2014).

In summary, the effect of parental migration on LBC’s well-being (e.g., nutritional health and psychological well-being) can vary from country to country, and can depend on social-cultural contexts, which highlights the importance of considering characteristics at both macro (national and regional) and micro (household and individual) level.

2.1.2 The Chinese context

This section focuses on the Chinese context and provides a comprehensive picture of the impact of parental migration on LBC's development in China, including their psychological well-being and physical health. Studies on nutritional outcomes are the main focus, and key papers will be critically reviewed in the next section.

The studies reviewed in the previous section focus on LBC in transnational families. Although the physical and legal barriers involved in rural-urban migration in China present key differences to international migration, the split family structure is comparable between the two types of migration.

It is important to note that there are differences between China's internal migration and migration in other countries, which make China a special case. First, China's internal labour migration since its reform and opening up in the late 1970s (Hu 2012a) has been more significant in terms of numbers than any other migration in human history. Second, unlike other countries' internal labour migration, China's internal movement has been subject to its *hukou* system. The system is associated with many exclusive benefits for residents living in urban locations, including government-provided housing, medical care, employment, children's education, and improved living security, which are not available for people living in rural areas, or for migrant workers and their families (Chan and Buckingham 2008). Finally, China's one-child policy may lead to a smaller family size compared to other countries with a history of migration. On the whole it appears inappropriate to compare China and other countries on migration without taking into account the above factors.

Parental migration and child development

In recent years, a growing number of studies in China have suggested that children who are left behind suffer from greater psychological distress than children from non-migrant families (e.g., He et al. 2012; Wang et al. 2015; Fan et al. 2010; Jia and Tian 2010; Su et al. 2013; Wen et al. 2015; Wu et al. 2015), and that this is especially true among children left behind at a younger age and who experience parental absence of long duration (Fan et al. 2010).

The gender of migrant parents may be relevant for the development of behavioural problems among adolescents: it has been argued for example that maternal migration

increases the risk of smoking among adolescents (Gao et al. 2013). A higher level of psychological distress has been argued to lead to poorer general health status among LBC, as measured by health-related quality of life (HRQoL), compared to their non-left-behind peers (Jia et al. 2010). A cross-sectional survey conducted in six mid-western provinces (LBC: N=608; non-LBC: N=755) in rural China found that LBC aged 2-18 years had lower HRQoL scores, including on physical, emotional, and social functioning aspects, than their non-left-behind peers; longer working times of migrant mothers and less frequent visits were also associated with lower HRQoL among left-behind children (Huang et al. 2015).

A longitudinal study using the CHNS 1991 – 2009 found that LBC were significantly more likely to become ill or develop chronic conditions than children living with their parents (Li et al. 2015). However, this analysis may have overestimated the sample of LBC because the concept of LBC was broader than my definition in this thesis, referring to any child whose parent(s) were not living with him or her regardless of any reason, which may be due to seeking employment, divorce, separation, and/or death. A large survey across 28 provinces in China suggested that LBC were more susceptible to development of cardiovascular disease in later life after experiencing increased levels of childhood loneliness, dissatisfaction and anxiety (Lu et al. 2014).

In summary, the above studies suggest that LBC appear to experience lower psychological well-being and increased behavioural and health problems compared to their counterparts from intact families. However, most studies using a cross-sectional design fail to examine the long-term effects of parental migration on children's health. In addition, it has been argued that the effect of parental migration on children's health may differ according to the gender of the LBC and the migrant parent(s). This is an important consideration given the distinct gender roles of both adults and children in rural China where sons are more culturally valued and tend to receive more resources than daughters (Burgess and Zhuang 2000; Ebenstein and Leung 2010).

Given that the focus of this research is the nutritional aspect of child development, a comprehensive review of literature on the association between parental migration and LBC's nutritional status will be presented below.

2.2 Search strategy

There are two main review questions here:

- (1) Does parental migration affect LBC's nutritional health in rural China?
- (2) What are the care-giving practices for LBC in rural China?

The literature review below aims to assess the studies conducted to date that have aimed to address these two questions.

2.2.1 Review strategy

There are two main types of literature review: systematic reviews and narrative reviews. Systematic reviews are rigorous syntheses of primary studies that employ explicit and reproducible methodologies to critically appraise and synthesize the highest quality research on a specific topic (Greenhalgh 2010; Carney and Geddes 2002). Methodological flaws can occur due to a lack of transparency and objectivity in narrative reviews, which may lead to biased conclusions (Mulrow 1987). This is the main reason why systematic review 'purists' have been dismissive of narrative reviews (Dijkers 2009). However, it has also been argued that narrative reviews tend to be more suitable for gaining a broader perspective on a research topic, and may better describe cutting-edge developments in under-researched areas (Cook et al. 1997; Bangert-Drowns 1995).

This review addresses has two major questions. The first asks whether parental migration affects children's nutritional health in rural China, which can be considered a specific topic, where a systematic review is more appropriate than a narrative review. The second review question relates to care-giving practices of LBC, and is broader; and to my knowledge there are few existing studies on this topic. A narrative review is therefore preferred in order to explore the issues and context. This study employs narrative literature reviews using systematic searches of relevant databases for both review questions.

2.2.2 Search literature

Ten English electronic databases, including Ovid, Web of Knowledge, Scopus, PsycINFO, CINAHL, EBSCO, Embase, British Nursing Index, Proquest Dissertations & Theses, and EThOS were searched. The period between 1978 and 2015 was

chosen because China's Economic Reform and Opening-up Policy was initiated in 1978, which promoted China's internal migration. The search was extended by tracking references from relevant studies. Languages were limited to English and Chinese. The key words used were:

- 'rural-urban migration', or 'internal migration', or 'parental migration' or 'labour migration',
- and 'left-behind children',
- and 'nutrition*' or 'physical growth' or 'growth' or 'anthropometr*' or 'stunt*' or 'wasting' or 'malnutrition' or 'under nutrition' or 'underweight' or 'overweight' or 'over nutrition', or 'nutrition* intake' or 'diet*' or 'nutrient' or 'macronutrient', or 'care-giving' or 'caring' or 'childcare',
- and 'China'.

All the key words were located in the title and abstract. The author screened the eligibility of the publications based first on the title and abstract, and if necessary on the full text. In addition, the reference lists of all selected articles and published reviews were screened for potentially relevant publications. Google Scholar was also included to search for 'grey literature' that was not available through the aforementioned databases.

2.2.3 Considerations of quality checking

The use of appropriate appraisal tools can be helpful to assess the quality of key studies. The Critical Appraisal Skills Programme (CASP) tools (CASP 2014) were used in this research. The CASP tools provide specific appraisal checklists for cohort studies, case-control studies and qualitative research. However, there is no CASP checklist for cross-sectional designs and so the cohort study checklist was adapted to assess cross-sectional studies by ignoring questions about follow-up. Each checklist considers three aspects – validity, results and relevance – to produce a comprehensive picture of one particular study.

When assessing the quality of individual studies, the main questions were as follows:

- Whether the study had a clearly focused question;
- Whether the study methods were appropriate;

- Whether the sample recruitment was appropriate (e.g. sampling, sample size, and generalization);
- Whether missing data were considered and handled appropriately;
- Whether confounding variables were appropriately identified and controlled (e.g., for regression analysis);
- Whether the study dealt with selection bias (for longitudinal studies);
- Whether the researcher justified explicitly the setting chosen for data collection, data collection methods, and any method modifications during the study (for qualitative research);
- Whether the relationship between researcher and participants was adequately considered (e.g., reflexivity about the researchers' own role) (for qualitative research);
- Whether ethical issues were taken into consideration (e.g., informed consent, confidentiality, ethical approval) (for qualitative research).

2.3 Quantitative research review

2.3.1 Cross-sectional evidence

A growing number of cross-sectional studies suggest that LBC in rural China are more likely to undergo restricted growth (e.g., stunting and underweight) than non-LBC from intact families (Wei et al. 2011;Duan et al. 2009;Mou et al. 2009;Luo et al. 2008;Chen et al. 2011). However, one survey conducted in rural South China found that there were no significant differences in height between LBC and non-LBC aged 10-18, although LBC tended to be more likely to have unhealthy weight (e.g., overweight and obesity) than their non-LBC peers (Gao et al. 2010). One limitation to this study was that all the demographic and behavioural data were self-reported by the participants, thus potentially being subject to bias. Moreover, the analysis focused on relatively narrow age ranges, and failed to capture the effects of parental migration on children's nutritional health as they grew over time.

A study drawing on a large national survey conducted in 25 provinces across China, using propensity score matching (PSM), examined the causal effects of paternal migration on the nutritional status of rural children aged 10-15 years (N=2417) (Xu and Xie 2015). LBC were defined as children with rural *hukou* living in rural areas with at least one parent who had migrated to urban areas. LBC and non-LBC were

matched on a number of covariates – individual-level (age and gender), family-level (parental education, whether or not a child was born in a hospital or clinic, whether or not a child ever attended a kindergarten, whether or not a child had at least one brother or sister and one living parental or maternal grandparent), and county-level socioeconomic and demographic characteristics – in order to reduce heterogeneity among the two groups of children. The PSM analysis suggested that parental migration did not benefit LBC’s physical growth in terms of their height and weight status, or to improve children’s diets, as measured by the number of food types eaten last month.

A cross-sectional study in southern China (Luo et al. 2008) adopted a two-stage stratified cluster and random sampling strategy and a case-control design, selecting non-LBC aged under 7 years (control group) (N=774) based on similar baseline characteristics (e.g., residence, age, gender, birth weight and feeding types) for comparison with LBC (N=774) left behind by peasant parent(s) working away from home for at least three months up to the survey date. The homogeneity between the two groups, helped to some extent to produce more valid estimates of health disparities between LBC and non-LBC. The results showed that LBC were more prone to lower intakes of protein-source foods, including fish, eggs and meat, than non-LBC. No significant differences between the two groups were found in the prevalence of underweight and growth retardation.

2.3.2 Limitations of cross-sectional evidence

Although they provide interesting findings, these studies are based on cross-sectional data and focus on relatively narrow age ranges, failing to capture the effects of parental migration on children’s nutritional status as they grow. They also confound age and cohort effects, and are prone to selection bias due to lack of adequate control for individual-level heterogeneity (Singer and Willett 2003). In addition, most existing surveys seem to use narrow geographical regions despite regional variations in children’s nutrition, or are restricted to specific age groups; generalization of findings can therefore be problematic. Some studies also fail to adequately report their sampling protocols, making it difficult to gauge external validity. It is important to interpret the findings with caution for generalization and generalize them to other regions and/or age-groups.

First, disparities in children's nutritional health exist not only between rural and urban areas (Liu et al. 2012; Shen et al. 1996) but also across different regions of China (Morgan 2000; Wei et al. 2011). For example, rural children are generally undernourished with poorer growth than urban children (Li et al. 2005). Furthermore, the prevalence of malnutrition in middle and western China is significantly higher than in eastern areas (Liu et al. 2008).

Second, the sample of children in these studies could vary due to different definitions of left-behind children in terms of age and duration of separation from parent(s).

Third, in different stages of development children take on different characteristics in every aspect, such as physical growth, psychological well-being and emotional needs (Berk 2008). Therefore, it is important to distinguish between different stages of childhood.

2.3.3 Longitudinal evidence

Existing longitudinal studies report conflicting associations between parental migration and children's nutritional health. A longitudinal analysis of the CHNS 2006 and 2009 (Lu et al. 2015) found no significant differences in the likelihoods of being underweight or overweight between LBC and non-LBC aged 6-18 years in China. This analysis included urban children. It tended to underestimate the LBC population (including only children who were left behind by both parents) but overestimate the non-LBC population (including children living with one or both of their parents), as compared to previous studies. One further limitation was that the analysis did not take account of clustering of the data structure, in which repeated measurements of weight were nested within children who in turn were nested within neighbourhoods.

A longitudinal analysis of the CHNS 1997 – 2006 adopted individual (children)-level fixed-effects models accounting for time-invariant factors such as family health endowment. This study also allowed error terms to be correlated at the village level and controlled for a set of individual, household and village characteristics including food prices. The results showed that that parental migration had little impact on children's overweight status, while it did increase the probability of underweight by 6.3% for older children aged 7-12 years but not for younger children aged 2-6 years (de Brauw and Mu 2011). In a later study examining the same dataset, Mu and de

Brau (2015) investigated the impact of parental migration on nutritional status of young children aged under 5 at baseline with two rounds of follow-up using HAZ and WAZ. Estimation using a fixed-effects model with an instrumental variable (interaction between wage growth in provincial capital cities and initial village network) showed that parental migration did not significantly affect young children's HAZ and BMIZ, but did improve their WAZ. These effects still remained after taking account of sample attrition by using inverse-probability-of-attrition weights. One limitation of the study could be seen in the weak instrumental variables. It can be a challenge to find a valid instrument. A quality instrumental variable needs to follow certain assumptions, including being associated with treatment or exposure and being unrelated to the confounders and outcome (Greenland 2000;Newhouse and McClellan 1998). If these assumptions do not hold, an instrumental variable analysis can yield a biased estimate of the exposure effect (Greenland 2000;Angrist et al. 1996). The analysis used the interaction between wage growth in provincial capital cities and an initial village network as an instrumental variable. However, this might be associated with contextual confounders (for example, food prices, urbanization), which could affect the outcome variable, i.e., children's nutritional intakes.

A longitudinal analysis of the CHNS (2000, 2004, and 2006) found a negative effect of maternal migration on the HAZ of children aged between 6 to 18 (Chen 2009). However, the author used ordinary least squares (OLS) regressions, an inappropriate statistical technique that ignores clustering when dealing with a longitudinal data structure (Ugrinowitsch et al. 2004). In addition, despite the fact that Chen (2009) distinguished the status of parental migration, the categories did not appear mutually exclusive, so that the group of children living without their mothers could include those with both parents absent. The study was thus likely to overestimate the effect of maternal migration on children's health. By drawing on the CHNS (2000, 2004, and 2006), Guo (2012) employed generalized linear mixed models clustered at household and individual levels to estimate the associations of different left-behind patterns (by the father only, by the mother only, and by both parents) with rural children's overweight status, as measured by BMI, after adjustment for household clustering effects: rural children aged 2-18 years, regardless of left-behind patterns, did not appear to differ significantly in their likelihoods of being underweight from their peers in intact families. However, one limitation of this analysis is that it failed

to carry out subgroup analysis by gender, as it is possible that the nutrition effect of parental migration may differ between boys and girls. Moreover, the analysis pooled children aged 2-18 years old as a whole group, thus becoming unable to fully capture the effects of parental migration on children's nutritional status, which may vary with age.

The studies reviewed so far focus on the associations of parental migration with children's nutritional status rather than dietary intakes; relating to the latter association, only one longitudinal analysis of the CHNS (2000, 2004, 2006 and 2009) (Ning and Chang 2013) could be found. The results suggest that migration of both parents tended to increase the likelihoods of protein-and-energy intake deficiency for children aged 6-17, while no significant associations were found for children left behind by one parent. However, these findings should be treated with caution: firstly, the proportion of parental migration rates in the same village of the previous wave was used as an instrumental variable to reduce selection bias. Arguably, this is a weak instrumental variable because it can be associated with the contextual confounders (for example, food prices and urbanization), thus affecting the outcome variable – children's nutritional status and leading to bias the estimated effect of parental migration on children's nutrient deficiency. Secondly, children's nutrient intakes are commonly influenced by energy requirements, which depend on the basal metabolic rate that are affected by height and weight (James and Schofield 1990). These factors were not controlled for in the analysis. In addition, the study failed to take account of the multilevel data structure of the CHNS, whereby multiple repeated measures were nested within children nested in villages. The approach ignored the fact that children from the same village or neighbourhood are likely to share similar food environments and eating behaviours that may not be shared with children who live in other villages and do not share the same environment. Moreover, the study did not distinguish between paternal migration and maternal migration. Another possible weakness was that nutrient deficiency was poorly defined and potentially overestimated: the authors used recommended nutrient intakes, which represent an optimal intakes that exceed the requirements of 97% to 98% of the population, instead of estimated averaged intakes which meet the requirements of 50% of healthy individuals (Barr et al. 2002). Finally, the analysis did not

distinguish gender differences in parental migration on LBC. This is an important limitation, given the distinct gender roles of both adults and children in rural China.

2.3.4 Limitations of longitudinal evidence

This thesis draws heavily on life course epidemiology that aims to examine long-term effects on chronic disease risk of physical and social exposures during the early years of life including gestation, childhood, adolescence, young adulthood and later adult life (Kuh and Ben-Shlomo 1997). It recognises the importance of time and timing in understanding associations between exposures and outcomes within an individual life course and across generations (Lynch and Smith 2005). Within life course epidemiology framework, two theoretical models are proposed. One is critical period model that emphasizes the timing of exposure, such that an exposure during a critical period of development in the life course has long-lasting effects on health outcomes in later life (Kuh et al. 2003). The other one is accumulation of risk models, which focus on the combination of exposures and its accumulative effect on health in later life. These are two important hypotheses in life course epidemiology to explore potential processes through which exposures acting across different stages of life can, singly or in combination, influence disease risk (Lynch and Smith 2005).

One limitation of existing longitudinal studies is the lack of consideration given to life-course effects; that is, they fail to distinguish between effects of parental migration at different critical periods of children's life course (for example, during pre-school years), and do not investigate whether the effects of parental migration accumulate over children's life course, if they are left behind in separate spells as they grow up (Spallek et al. 2011). It may be hypothesized that being left behind at a younger age (for example, when under 6 years of age before starting school) may have a stronger adverse effect on children's subsequent growth than being left behind at later stages of childhood – the so-called 'critical period hypothesis' (Barker 1998). On the other hand, the effects of being left behind on children's nutritional health may accumulate throughout their life course, as argued by the accumulation hypothesis (Kuh et al. 2003). According to the accumulation hypothesis, being left behind by migrant parents in early and later childhood can have a cumulative effect on children's growth and development, and can therefore be more harmful than the effect of any one critical period of being left behind.

Another limitation of previous longitudinal studies is their failure to distinguish between left-behind patterns (by the father only, by the mother only, or by both parents). This is important not only because of the maternal role as a traditional childcare provider within households in China, but also because of gender differences in the use of household economic resources, such as remittances. For example, mothers tend to purchase higher quality food in the absence of migrant fathers, which has important implications for the nutritional well-being of children as they develop (Kennedy and Haddad 1994; Case and Paxson 2001; Maitra 2004). It has been argued that the effects of parental migration on nutritional intakes may differ between boys and girls due to gender differences in energy and nutrient needs (Brown 2007). Another important reason is gender discrimination in favour of boys in intra-household allocation in rural China (Burgess and Zhuang 2000). Therefore, parental migration could be more detrimental to the nutritional intakes of girls than that of boys.

Another common methodological pitfall of previous longitudinal studies is the conducting of complete cases analyses on key variables under the assumption that data are Missing Completely At Random (MCAR) (Ning and Chang 2013; de Brauw and Mu 2011; Lu et al. 2015), whereby the probability of missingness is independent of any characteristics of the subjects (He 2010). This missingness assumption, however, may often not hold, leading to biased estimations. For example, the missingness or attrition can be age-related because older children who go to boarding school or to college may drop out (Popkin et al. 2010).

Another limitation is failure to control for potential confounders. The issue of confounding has generally been addressed by controlling for a set of individual and household characteristics in previous studies or using fixed effects at the individual or household level. The problem, however, is that few studies (de Brauw and Mu 2011; Ning and Chang 2013; Mu and De Brauw 2015) control for wider contextual factors including physical, social, cultural, and economic environmental risk factors, such as food prices, that can affect children's nutritional status (Evans and Kantrowitz 2002; Gong et al. 2012). Furthermore, some studies (Ning and Chang 2013; Lu et al. 2015; Mu and De Brauw 2015) fail to take account of multilevel data structure in which multiple repeated measures are nested within children nested in villages, which may lead to biased estimates.

The above limitations can contribute to conflicting results among the empirical studies reviewed so far. There are, however, some other considerations. For example, the definitions of LBC are ambiguous, failing to clarify age and household registration status or differentiate the reasons for parental absence. Additionally, the indicators for child nutrition tend to be inconsistent and the growth references used to calculate indices for nutrition are different and thus incomparable. In summary, the heterogeneity in estimates of the effect of parental migration on children's nutrition can be due to differences in research design as well as different temporal and spatial dynamics across China.

2.4 Qualitative research review

2.4.1 Care-giving practices for left-behind children

Due to financial constraints and the transient nature of work in urban communities (Gao et al. 2010), most migrant workers tend to leave their children in rural areas. Children being placed in the care of relatives, especially grandparents, is common in the developing world, and it is often a cultural norm for extended families to play an active role in child rearing (Ma 2010). Grandparents' care of LBC gives parents the opportunity to migrate to increase their own income; they can then send remittances home in reciprocation for their children's care (Agree et al. 2002). This form of intergenerational exchange has been called the 'intergenerational contract' (Croll 2006) or 'time-for-money' exchange and can be observed in several Asian countries (Cong and Silverstein 2011; Cong and Silverstein 2008; Frankenberg et al. 2002; Shi 1993).

The most common form of migration is both parents (experienced by 46.74% of the 61 million LBC), followed by father only (36.39%) and mother only (16.87%) (All-China Women's Federation 2013). About 32.67% of children with both parents away are left in the care of grandparents with a low level of education (All-China Women's Federation 2013). Around 10.7% were living with other relatives, mostly commonly uncles and aunts (Fan et al. 2010), and 3.37% (about 2.05 million) were living on their own (All-China Women's Federation 2013).

The literature search identified five studies on care-giving practices related to nutrition and diets of LBC in rural China (Table 2.2). One mixed-method study was carried out on a sample of 400 LBC aged 6-18 years, 128 guardians of LBC, and 200

non-LBC from five mid-southern provinces (Anhui, Henan, Hunan, Jiangxi, and Sichuan) in rural China (Ye and Pan 2011). The findings showed that caregivers of LBC included grandparents, stay-behind mothers, stay-behind fathers, relatives (uncles or aunts), and self-care. Grandparents often tended to pay less attention to LBC's diets due to limited economic resources and traditional parenting concepts. Parental migration often increased workload and labour burden for LBC, including farm work and household chores, especially for left-behind girls. The findings implied that LBC in the care of grandparents, in particular left-behind girls, were often at increased risk of nutritional problems in the given context. However, this survey did not provide in-depth information about how the care-giving was organized from the perspectives of the caregivers and the children themselves. Moreover, the study did not mention ethical concerns or the reflexivity of the researchers' role.

A small-scale qualitative longitudinal exploration (Lu 2011) in Inner Mongolia, using a purposive sample of 35 LBC and 35 non-LBC aged 7-13 of years, caregivers, and migrant parents, suggested that being left behind was a dynamic process involving migrant parents making complex assessments of children's well-being and negotiations with (potential) caregivers. In other words, care-giving arrangements for LBC were subject to change during parents' absence. LBC's standard of living was reported to be lower than when their parents were at home. Children left in the care of grandparents were worse off in terms of food and cleanliness, and undertook increased housework than children looked after by other carers. Lu's study (2011) suggested a dynamic change in care-giving arrangements for LBC in Inner Mongolia before and after parental migration. This finding may not translate to other socio-cultural contexts due to the different ethnicities, food culture, and socio-economic diversity across China.

Another mixed-methods study (272 children aged 6-18 years, comprising 161 LBC and 111 non-LBC) explored the daily lives of LBC and non-LBC and how caregivers managed care-giving practices for LBC in rural sites of four mid-northern provinces in China (He 2008). Descriptive statistics were used to obtain percentages or frequencies from survey data. The data analysis method was not specified. The results suggested that LBC who had mothers as guardians experienced better care, and that grandparents' care-giving practices had 'the most serious problems' due to

their old age, low education, and ‘over-indulgence’ of LBC. LBC who were cared for by grandparents had worse nutrition and an increased labour burden including farm work and household chores. Fewer LBC, especially those cared for by grandparents, were satisfied with their meals than non-LBC. Non-LBC’s carers paid more attention to preparing meals for their children than LBC’s carers. These findings suggested that non-LBC were better off in terms of diet and nutrition than LBC cared for by grandparents. Neither ethical concerns related to the question of researching with children nor reflexivity of role of the researcher was mentioned.

A large cross-sectional survey in seven provinces in rural China used structured questionnaires to interview 1691 non-parent caregivers mainly grandparents for LBC under 7 years of age, and 1670 parent caregivers (Tan et al. 2010). The results suggested that rates of awareness of nutritional knowledge, positive attitude towards nutrition behaviours, and the optimal behaviour relating to children’s nutrition among non-parent caregivers were significantly lower than among parent caregivers. The survey employed a case-control study design: LBC and non-LBC were matched by residence, gender, close age, and similar birth weight in order to reduce heterogeneity between the two groups. Another cross-sectional case-control survey with 1548 rural children under 7 years of age in Hunan province (Luo et al. 2008) found that the mean daily intake of protein-source foods including fish, eggs and meat, was significantly lower for LBC care for by grandparents than for non-LBC.

The above two studies are based on a quantitative study design, which limits the opportunity for participants to identify issues unforeseen by the researcher and to produce rich information for a more detailed understanding of a complex phenomenon, such as care-giving practices which are complex and not easy to quantify or measure (Jones and Sumner 2009). Qualitative research can produce rich data that provide a better understanding of the intra-household dynamics and/or social processes behind the numbers (Jones and Sumner 2009)

2.4.2 Limitations of previous studies

Several researchers have suggested that carers play an important role in LBC’s nutrition when their parents are away (Lu 2011;Ye and Pan 2011;Luo et al. 2008;Tan et al. 2010). Most studies on LBC in rural China have employed a quantitative study design based on large-scale surveys using pre-set questionnaires or structured

interview schedules (Tan et al. 2010;Ye and Pan 2011;Lin 2003;Ye and Murray 2005;Gao et al. 2010;Duan et al. 2009;Luo et al. 2008). A qualitative approach can produce rich and in-depth information and allow a more detailed understanding of the complexity of care-giving practices for LBC in rural China (Creswell 2006).

Few studies have consulted LBC directly (Lu 2011;He 2008), leading to an inadequate understanding of children's own views of care-giving practices. It has been argued that adults may not always be appropriate agents to give valid accounts of children's social worlds, due to the different natures of childhood and adulthood (Dixon-Woods et al. 1999;Beresford 1997). Engaging with children enables us to hear their own narratives rather than their experiences as mediated through adults' voices (Hill 2006).

It is to be expected that care-giving practices, as they are influenced by socio-cultural norms, may differ across regions in China. Previous qualitative studies have focused on different regions, from Inner Mongolia (Lu 2011) to mid-southern China (Ye and Pan 2011). Geographical differences are often related to socio-cultural and socio-economic disparities, which may influence the research process and findings.

2.5 Summary

This research aims to answer the research questions: how parental migration is associated with the nutritional outcomes (i.e., anthropometric measures, and nutritional intakes) of children who are left behind, whether these associations differ according to being left behind at different stages of childhood, and whether these associations differ according to the gender of LBC and migrant parents in rural China.

In order to address some of the limitations observed in the studies described, the research uses a mixed-methods study design. The quantitative component uses five rounds (1997, 2000, 2004, 2006, and 2009) of the CHNS datasets to explore how parental migration influences children's nutritional health across space and over time. This thesis does not only compare the nutritional statuses of LBC and non-LBC, but also distinguishes the different effects of different migration patterns (by the mother or by the father) on LBC, as compared with children from intact families. Child development can also vary significantly in different periods of life: for example, growth is dramatic in the first two years of life, and then slows down until

adolescence (Tassoni 2007). This thesis therefore looks at different age groups of children. Most importantly, the study attempts to control for a rich set of confounding factors at various levels (e.g., individual/household levels, and neighbour level) in order to generate more robust results. In particular, this work takes into account care-giving arrangements for LBC in extended families, something which has often been neglected in previous longitudinal studies.

Care-giving practices are crucial to children's nutritional status (United Nations Children's Fund 1990; United Nations Children's Fund 1998; Engle et al. 1999). It is anticipated that carers can play a very important role in LBC's nutrition when their parents are away. Unfortunately, information about carers is not available from the CHNS dataset. Some longitudinal studies (de Brauw and Mu 2011; de Brauw and Mu 2012) have controlled for whether or not LBC are living with a grandparent, but it is possible that the living arrangements of LBC are subject to change and that carers do not necessarily remain the same throughout the time parents are away (Lu 2011). Most of the existing studies regarding LBC in rural China have been quantitative large-scale surveys using pre-set questionnaires or interview schedules (Ye and Pan 2011; Lin 2003; Ye and Murray 2005; Gao et al. 2010; Duan et al. 2009). This limits the opportunity for participants to identify issues unforeseen by the researcher and to produce rich information for a more detailed understanding of a complex phenomenon (Creswell 2006).

Qualitative study designs are appropriate to answer research questions starting with a *how* or a *what* (Creswell 2006), including '*What is going on in left-behind children's extended families?*' and '*How are care-giving practices are organized?*' Thus, a qualitative study will be conducted to generate rich and in-depth data on care-giving arrangements for LBC. The overall aim of the qualitative study is to gain a better understanding of care-giving practices for LBC from the perspectives of caregivers and children themselves. The qualitative study is a complementary and integrated part of this thesis, which will be discussed in more detail in the methodology chapter. In the subsequent chapters, this thesis aims to address the limitations that have been identified in the review of quantitative and qualitative research.

Table 2-1 Quantitative studies examining the associations between parental migration and children’s nutritional health in rural China (N=8)

Author, Year, Journal	Study design	Data set	Participants (N) and settings	Exposure	Confounders/ covariates	Statistical methods	Outcome/results	Missing data
Lu <i>et al.</i> (2014) International Journal of Social Welfare	Longitudinal	CHNS 2006, 2009	Children aged 6-18 (N=2048) in rural and urban areas from 9 provinces	Being left behind if both parents had migrated compared to rural children living with one or both of their parents	Age, gender, household income, family size, number of children within each household, wave dummies, residency status (urban or rural)	Multi-logit regression	Overweight and underweight: sex-and age-adjusted BMI by International Obesity Task Force (IOTF) cut-offs ¹ ; LBC were less likely to be underweight or overweight than normal weight as compare to rural children; not statistically significant at the significance level of 0.05	Complete case analysis
Mu & De Brauw, (2015) Journal of Population Economics	Longitudinal	CHNS 1997, 2000, 2004, 2006	Followed rural children aged under 5 years in 1997, 2000, and 2004 up to two rounds of survey: children aged 0-9 (N=491 for HAZ, 511 for WAZ, 455 for BMIZ) from 9 provinces	Being left behind whose parent(s) left home to seek employment for work	Individual (age, gender), household (household head’s schooling, household asset per capita, No. of working men and women, elderly aged 60 and above), and village (average income per capita, food prices) characteristics, province and wave dummies	OLS, individual fixed effects, and instrumental variables (IV, interaction term between wage growth in provincial capital cities and initial village network) estimations	HAZ, WAZ and BMIZ by WHO 2007 standards ² : IV results showed parental migration did not affect HAZ and BMIZ but improved WAZ at the 0.05 significance level. The results did not change after taking account of attrition.	Using inverse-probability-of-attrition weights
Ning & Chang, (2013)	Longitudinal	CHNS 2000, 2004,	Rural children aged 6-17 (N=5787), LBC	Being left behind by one parent	Age, gender, child’s education, birth order, single child, household	IV (proportion of the parental migration	Energy and protein intake deficiency and fat over-intake compared to Chinese dietary	Complete case analysis

Author, Year, Journal	Study design	Data set	Participants (N) and settings	Exposure	Confounders/covariates	Statistical methods	Outcome/results	Missing data
Agricultural Economics		2006, 2009	with one migrant parent (N=592), with two migrant parents (N=330), non-LBC (N=4865) from 9 provinces	and by both parents	size, if there is elderly aged 60 or above in the household, food price, household net income, distance from local food market, province and wave dummies	rates in the village of the previous wave) approach to reduce migrant selection bias; Trivariate probit model	reference intakes (DRI): both parents' migration tended to increase the likelihoods of protein at the 5% level, one parent's migration was associated with a lower risk of the fat over-intake for children aged 6-17 at a 1% level	
Guo, (2012) Doctoral thesis	Longitudinal	CHNS 2000, 2004, 2006	Rural children aged 2-18 (N=4835) including children living in alternative families (do not live with two parents); LBC (N=572) from 9 provinces	Being left behind by father, by mother, or by both (reference: children living with two parents)	Gender, age, household assets, parental education, household structure (siblings, adults, and grandparents), wave dummies, regional dummies	General linear mixed modelling (GLMM): the random intercept were clustered at the household and individual levels	Underweight was measured by the BMI fifth percentiles by the US standards ³ : LBC regardless of their left-behind patterns, did not appear to differ in the likelihoods of being underweight compared to children from intact families.	Missing At Random (MAR)
De Brauw & Mu, (2011) Food Policy	Longitudinal	CHNS 1997, 2000, 2004, 2006	Rural children aged 2-12 (982 children with 2263 observations) from 9 provinces	Out migration(any member of household has migrated): whether a migrant is a parent or	Age, gender, household size, the number of siblings, whether a grandparent lives in the household, whether there is a health facility in the village, the percentage of other households in	Fixed effect models by allowing error terms to be correlated at the village level	Underweight and overweight was based on BMI by IOTF cut-offs ^{1,4}): parental migration did increase older children's (aged 7-12) probability of being underweight by 6.3% at the 5% level but not for younger children aged 2-6; parental	Complete case analysis

Author, Year, Journal	Study design	Data set	Participants (N) and settings	Exposure	Confounders/covariates	Statistical methods	Outcome/results	Missing data
				non-parent member	the village has tap water, food prices (rice, flour and pork), province and wave dummies		migration did not appear to affect both younger (aged 2-6) and older (aged 7-12) children's overweight.	
Xu & Xie, (2015) European Sociological Review	Cross-sectional survey	China Family Panel Studies 2010	Children aged 10-15 (N=2417) from 25 provinces	Being left behind referring to children who possess rural <i>hukou</i> and by at least one parent who has migrated to an urban residence	Matching LBC with non-LBC on a number of covariates including individual (age, gender), family (parental education, whether a child was born in a hospital or clinic, and whether a child ever attended a kindergarten, whether a child has at least one brother or sister and one living parental or maternal grandparent), and country-level (percentage of agricultural population and its squared term, and geographic region) socioeconomic and demographic characteristics	Propensity score matching	Height (cm), weight (kg) and number of food types eaten last month: being left behind did not seem to affect children's physical growth and nutrition intakes.	Complete cases analysis

Author, Year, Journal	Study design	Data set	Participants (N) and settings	Exposure	Confounders/ covariates	Statistical methods	Outcome/results	Missing data
Gao <i>et al.</i> (2010) BMC Public Health	Cross-sectional survey	Survey 2007-2008	Rural school children aged 10-18 (N=2986, 1536 for boys and 1450 for girls, response rate=92.6%) from Fuyang Township, Guangdong, Southern China	Being left behind at their original residence with one or both parents migrating into other places for work and not living together with children for at least 6 months	Age, ethnicity, school type (regular or vocational school), whether living in a boarding school, parental education level, whether living with grandparents, housing type, whether having computer access at home	Multiple logistic regression and linear regression stratified by gender	Height (cm), overweight and obesity were defined according to Chinese BMI cut off points; being stunted was based on WHO cut-off points: being left behind tended to increase the risk of overweight for boys and the effect was marginally significant (p=0.069); left-behind girls are more vulnerable to obesity without statistical significance.	Response rate=92.6 %
Luo <i>et al.</i> (2008) Public Health Report	Case-control study	Cross-sectional	Rural children under 7 year of age (N=1548, 774 pairs) from 102 villages in Hunan province	Being left behind by parent(s) who had been peasants and were working out of home for at least 3 months up to the survey date	Children in a control group were matched with LBC on variables including residential area, gender, close age (with age gap less than two or three months), similar birth weight and birth situation.	A <i>t</i> test was used to examine differences in continuous variables; A chi-square test was used to examine differences in categorical variables between two groups	Height/length (cm) and weight (g) were used to construct HAZ and WAZ according to National Centre for Health Statistics/ WHO references: no significant differences in WAZ and HAZ between LBC and non-LBC groups; no significant differences in proportion of underweight and growth retardation between two groups at the level of 0.05.	Not reported

1. Cole TJ, Flegal KM, Nicholls D, Jackson AA. 2007. Body mass index cut-offs to define thinness in children and adolescents: international survey. *BMJ*, 335: 194-202.
2. de Onis M, A.W. Onyango, E. Borghi, A. Siyam, C. Nishida, and J. Siekmann. 2007. Development of a WHO Reference for School-aged Children and Adolescents. *Bulletin of the World Health Organization*, 85; 660-667
3. Must, Aviva, Gerard E. Dallal, and William H. Dietz. 1991. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness¹⁴. *American Journal of Clinical Nutrition*, 53(4):839-46
4. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*, 320: 1240-3

CHNS, China Health and Nutrition Survey; IOTF, International Obesity Task Force; OLS, ordinary least squares; DRI, dietary reference intakes; LBC, left-behind children; BMI, body-mass-index; HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores; IV: instrumental variables

Table 2-2 Studies on care-giving practices for left-behind children in rural China (N=5)

Author, Year, Journal	Research question/aim	Study design	Participants and settings	Data collection methods	Data analysis and findings/outcomes/themes	Reflexivity
Ye & Pan, (2011) The Journal of Peasant Studies	To explore the impacts of rural parents' migration on the care-giving and nurturing of LBC	Mixed methods	400 LBC aged 6-18 (207 boys and 193 girls), 200 non-LBC and 128 guardians of LBC in 10 rural communities in mid-south China including Anhui, Henan, Hunan, Jiangxi, and Sichuan	A household questionnaire survey mixed with qualitative approach including case studies, key informant interviews, a record of daily routines, semi-structural interviews, workshops, and role play sessions.	<ol style="list-style-type: none"> (1) Descriptive analysis of survey data to obtain frequency or percentage; qualitative data analysis was not specified; (2) Caregiver arrangements: grandparents, stay-behind mother, stay-behind father, relatives (uncle or aunt), and self-care; (3) Basic daily care: mainly involves food and clothing; grandparents usually hold an indifferent attitude to children's diets due to limited economic conditions and traditional parenting concepts; unable to provide meals on time due to farm work; (4) Increased workload and labour burden including farm work (weeding, ploughing, planting, fertilizing, harvesting, etc.) and household chores (cooking and washing) for LBC, especially for left-behind girls; (5) Increased risk of injuries and accidents; (6) Loose parent-child contact; suffer from psychological pressures 	Not reported
Lu, (2011) Doctoral thesis	To explore the experiences and the process of being left behind and changes in care-giving arrangements	Qualitative longitudinal approach for 3 stages	A purposive sample of 35 LBC (both parents migrating to work for at least 6 months) and 35 non-LBC (living with one or both parents) aged 7-13 in Northern China—Inner	Semi-structural interviews, participant observation, visual methods, qualitative longitudinal methods, and	<ol style="list-style-type: none"> (1) Being left behind is a dynamic process involving parents making complex assessments of children's well-being and negotiations with carers and potential cares, rather than an event; (2) LBC's standard of living was reported to be lower than when their parent were at home, and children looked after by 	Ethical concerns; self-reflectivity; data collection and data analysis

Author, Year, Journal	Research question/aim	Study design	Participants and settings	Data collection methods	Data analysis and findings/outcomes/themes	Reflexivity
	from perspectives of children, their guardians, parents and teachers		Mongolia; 12 guardians, 13 parents and 5 teachers; 12 LBC and 1 non-LBC formed case studies and participated in in-depth interviews	case studies	<p>grandparents were worse off in terms of food, cleanliness and increased housework than children looked after by other carers;</p> <p>(3) LBC were reported to suffer from emotional problems;</p> <p>(4) Negative effects of parental migration can be cumulative to LBC.</p>	process; triangulation involving the use of multiple research methods
Tan <i>et al.</i> (2010) Public Health Nutrition	To explore and compare nutrition knowledge, attitudes and behaviours of non-parent and parent caregivers of children under 7 years of age in rural China	Cross-sectional survey	Multistage stratified cluster and random sampling were adopted; 1691 non-parent caregivers and 1670 parent caregivers from 7 provinces including Jiangxi, Sichuan, Hunan, Hubei, Guizhou, Henan and Anhui	Face-to-face interviews by using structured questionnaires involving socio-demographic characteristics, nutrition knowledge, attitudes and behaviours about children's nutrition	<p>(1) Descriptive analyses and multivariate logistic regression;</p> <p>(2) Non-parent caregivers tended to have relatively poorer nutrition knowledge, attitudes and behaviours compared to parent caregivers;</p> <p>(3) The awareness rate of nutritional knowledge, the rate of positive attitudes towards nutrition behaviours and the rate of optimal behaviours about children's nutrition among non-parent caregivers were significantly lower than parent caregivers.</p>	No applicable
Luo <i>et al.</i> (2008) Public Health Reports	To examine the lack of care and the nutritional status of LBC aged under 7 years of age in rural China	Case-control cross-sectional survey	Rural LBC (whose parent(s) were peasants and working out of home for at least 3 months up to the survey date) and non-LBC younger than	Face-to-face interviews with children's parents or guardians by using self-developed questionnaire and	<p>(1) A t test was used to examine the differences in dietary intake between LBC and non-LBC groups;</p> <p>(2) The mean daily intake of meat, fish, and eggs for LBC were significantly lower than non-LBC at the significance level of 0.05.</p>	Not applicable

Author, Year, Journal	Research question/aim	Study design	Participants and settings	Data collection methods	Data analysis and findings/outcomes/themes	Reflexivity
			7 year of age (N=1548, 774 pairs) from 102 villages in Hunan province	simplified food-frequency questionnaire		
He. (2008) Doctoral thesis	To explore daily lives of LBC and non-LBC and how caregivers manage care-giving practices for LBC during the absence of their parents	Mixed methods	236 rural families and 272 children aged 6-18 (161 LBC, 111 non-LBC) in 10 villages of four provinces mid-northern China including Shandong, Henan, Hebei and Shanxi.	A questionnaire survey, and qualitative methods including case study, in-depth interviews, focus groups, key informant interviews, etc.	<ul style="list-style-type: none"> (1) Descriptive analyses of survey data to obtain percentage or frequency; qualitative data analysis methods were not specified. (2) LBC who had mothers as guardians provide the best care, and the grandparents' supervision had the most serious problems due to grandparents' old age, low education and over-indulgence; (3) LBC's nutrition was relatively poor if they were taken care of by grandparents due to increased labour burden (farm work and household chores); (4) Non-LBC's caregivers paid more attention to preparing meals for the children than those of LBC; (5) Fewer LBC, especially those cared for by grandparents satisfied with their meals than non-LBC. 	Ethical considerations were not reported; reflexivity was not considered

LBC, left-behind children; non-LBC, non-left-behind children

Chapter 3 Methodology

This chapter presents the rationale of the mixed-methods research design, including an overview of the quantitative and qualitative methods. The first section of this chapter provides the rationale of mixed-methods research, and highlights theoretical and practical concerns of designing such a study, including paradigm stance and the timing of integration between qualitative and quantitative approaches. The second section concerns quantitative methods, including study hypotheses, dataset, target population, nutritional outcomes, exposures, confounding factors, and statistical methods. The final section focuses on qualitative methods including the rationale of using qualitative research, research setting, sampling and recruitment, ethical concerns, data collection, and data analysis methods.

3.1 Mixed methodology

The research presented in this thesis used a mixed methods study design. The quantitative component looked at five rounds (1997, 2000, 2004, 2006, and 2009) of the China Health and Nutrition Survey (CHNS) dataset to estimate the association between parental migration and children's nutritional health across regions and over time. The qualitative component was intended to gain insights into care-giving practices from the perspectives of caregivers and children themselves in rural sites in northern-central China. The aim was to assist in explaining and interpreting some of the results of the quantitative component.

3.1.1 Mixed methods

Mixed methods research has been considered the third methodological approach alongside qualitative and quantitative research (Denscombe 2008; Borrego et al. 2009; Tashakkori and Teddlie 2002). It draws on the strengths of both qualitative and quantitative approaches by integrating both elements in a single study (Bazeley 2009; Creswell et al. 2003). The central premise of mixed-methods research is that incorporating both quantitative and qualitative methods can provide a broader and more credible understanding of research problems than either approach alone (Tashakkori and Teddlie 2010; Johnson et al. 2007; Robins and Ware 2008). In addition, mixed methods can expand the impact and enhance the flexibility of a research design (Sandelowski 2000), to triangulate, complement, or expand the contribution of a single approach (Johnstone 2004).

Despite its growing popularity in the research community, mixed-methods research is not free from criticisms (Hossain 2012). When constituting a methodology in social inquiry, it is necessary to clarify philosophical assumptions (Greene 2006) concerning reality (ontology), and knowledge of that reality (epistemology) (Guba 1990; Sale and Brazil 2004). Mixed methods research, as a methodology (Creswell and Plano Clark 2007; Tashakkori and Creswell 2007; Greene 2008), is no exception. The tension that mixed-methods researchers face is in the potential incompatibility of the ontological and epistemological assumptions that underlie quantitative and qualitative research – that has been termed as ‘the paradigm war’ (Tashakkori and Teddlie 2006).

However, theoretical concerns have been marginalized to a large degree due to the emergence of pragmatism (Morgan 2007;Denscombe 2007), the philosophical position underlying mixed-methods research (Denscombe 2007), which emphasizes problem solving, practical consequences, and research questions over methods in a single study (Creswell and Plano Clark 2007;Morgan 2007;Zimmermann 2006).

3.1.2 Rationale for mixed methods

First, consistent with the pragmatist approach, different research questions are formulated in accordance with knowledge gaps identified in a literature review. There is a need to explore not only the associations (i.e., here, whether and to what extent parental migration affects left-behind children's nutritional status); but also the processes (i.e., how the associations work). The literature review has suggested that care-giving practices are crucial to children's nutritional status (United Nations Children's Fund 1990;United Nations Children's Fund 1998). It is anticipated that carers can play an important role in LBC's nutritional health in the absence of their parents. Unfortunately, information about care-giving practices is not available from the CHNS. Therefore, mixed-methods research is adopted to address different research questions reflecting the various dimensions of the research problem.

Second, quantitative data may not be able to adequately capture some of the important confounding factors of care-giving practices for LBC and omitted variables could affect quantitative results. For example, although some longitudinal studies (de Brauw and Mu 2011;de Brauw and Mu 2012) have controlled for whether or not LBC live with a grandparent, it has been argued that the living arrangements of LBC are in fact subject to change (Lu 2011). Most importantly, care-giving practices *per se* are complex, and are not easy to quantify or measure (Jones and Sumner 2009). Quantitative measurements are disadvantaged in 'capturing complexity of family life in the sense of an on-going stream of behaviour over a long period of time that interweaves the perceptions of individuals with behaviours in relationships' (Wampler and Halverson 1993 p.189). Therefore, additional qualitative research can produce rich data that provide a better understanding of the intra-household dynamics and/or social processes behind the numbers (Jones and Sumner 2009).

Third, increased attention has been given to applying mixed-methods approaches in research on children's well-being and development studies (Leung and Shek 2011; Jones and Sumner 2009). Quantitative data can test the associations between two or more phenomena (e.g., here, parental migration and LBC's nutritional status) through advanced statistical analytical techniques; however, it cannot, in the majority of cases, explain why the associations exist (Lin 1998). Qualitative methods are better able to identify the underlying explanations of the associations observed (Harding and Seefeldt 2013).

Qualitative research is also advantageous in its subjectivity and reflexivity, as it can take account of the influences of the researcher and incorporate the voices of marginal groups such as children, who have lower social status and voice, in interpretation of phenomena of interest (Brannen 2005; Ribbens and Edwards 1998). Existing studies looking at LBC in China often involve only carers, and not the children themselves (Cai and Wang 2010; Tan et al. 2010). The present research approached children directly and encouraged LBC as well as carers to speak for themselves, seeking detailed and in-depth data on their experiences, perceptions, beliefs, and behaviours (Brannen 2005). This approach aims to allow the tracing of possible mechanisms or links as to why and how parental migration may affect LBC's nutrition. This could in turn allow the formulation of hypotheses for subsequent testing using quantitative methods.

This thesis therefore presents a mixed-methods approach that aims to seek complementarities (Sale et al. 2002; Johnson and Onwuegbuzie 2004); for example, possible explanations of quantitative results are sought in the in-depth data produced in the qualitative component. Another purpose is expansion, the aim being to expand the breadth of the research by using different methods to investigate different dimensions of the research questions (Johnson and Onwuegbuzie 2004). Both the quantitative and qualitative elements in this research aim to gain insights into the phenomenon of LBC and their development and well-being in rural China.

3.1.3 Considerations

There are some theoretical and practical considerations that ought to be taken into account when designing this mixed-methods research: paradigm stance,

methodological principle, and the timing of the integration between the qualitative and quantitative approaches.

Paradigm stance

It has been suggested that different paradigms should be applied to different research questions within one single study (Kuzel and Like 1991). Clarification of philosophical and methodological positions is needed to address practical issues such as the processes and stages of combining qualitative and quantitative components in a single project (Johnson et al. 2007). However, mixed-methods researchers can neglect epistemological and ontological issues when employing pragmatism (Bryman 2007). In practice, they often fail to disclose their rationales for using mixed methods and tend to shy away from mentioning paradigm incompatibility (Wiggins 2011). Pragmatism is almost an ‘anti-philosophical philosophy’, which advocates an emphasis on the research rather than on philosophical concerns (Robson 2011). Olsen (2004) argues that the realist position, which is plural regarding methodologies as well as theories, is the one that best fits a mixed-methods research design, which accepts a pluralist theoretical stance in order to allow for different methods seeking insights into different facets of the same social phenomenon (Carter and New 2005).

This assumes that there is an objective reality (ontology) ‘out there’ (Leung and Shek 2011), which can be explored and known through sensory observations (epistemology) (Slife and Williams 1995). That is, the hypotheses built upon the reality can be tested and verified through inferential statistics. For example, one hypothesis in the quantitative component is that parental migration is negatively associated with rural children’s nutritional status. It is assumed that sophisticated statistical techniques can produce valid estimates that are close to ‘the truth,’ or at least to a part of ‘the truth’ that a researcher can observe at a particular moment. However, reality may not be fully observed except through the lenses of the researcher’s own constructions. This point may support the interpretivist or constructivist paradigm in suggesting that there are multiple realities (Schwandt 1994a) that are constructed in the mind of the individual, in contrast to positivism’s single objective external reality (Hansen 2004).

If the association between parental migration and poorer nutritional status, for example, is confirmed by the quantitative results, does this mean that parental migration necessarily leads to children's poorer nutritional status? It may not. One important argument concerns that inferences based on aggregate data at group level may not apply to the individuals (Piantadosi et al. 1988). Moreover, any association found in this study cannot be assumed necessarily to indicate causation.

Another point relates to the lack of quantitative data on care-giving practices for LBC. This means that the data may only capture part of the objective truth. Furthermore, care-giving practices are a result of complex interactions among different stakeholders, including LBC, their carers, and their migrant parent(s) (Lu 2011; Pan et al. 2013), constituting a 'care triangle' (Graham et al. 2012) (Figure 3.1). This social process involves different views, beliefs, and/or concepts of care-giving from the perspectives of children and their carers. None of the parties face and experience social and the physical realities in the same way (Hossain 2012). Thus, the idea of 'an objective reality' is challenged, as we may have no proper tools to measure it. In other words, there is no firm hypothesis predetermined at the beginning. It is essential to take an inductive approach and seek to understand the issue from the perspectives of those involved when our theoretical understanding is not sufficient to generate hypotheses.

Methodological principles

It can be important to link the different paradigms underpinning the quantitative and qualitative approaches to the specific questions that they seek to answer. The primary quantitative research question here seeks to examine the association between parental migration and children's nutritional health. The qualitative research question seeks to gain an in-depth understanding of how care-giving for LBC is organized from the perspectives of the children themselves and of their caregivers, in order to establish at least a partial understanding of the association examined in the quantitative element. Therefore, the quantitative and qualitative elements are complementary, as they aim to approach the same problem from different angles.

Timing of integration

It has been argued that the integration of quantitative and qualitative components may not always be intended in certain mixed-methods research (Bryman 2007). For

example, when a mixed-methods study is designed to tackle distinct research questions in each component, it may not be valuable to explore connections between the two elements (Hammond 2005; Bryman 2006). However, a lack of integration may to some extent suggest that researchers are not making the most of their data (Bryman 2007). Added values can always be achieved by combining qualitative and quantitative findings to suggest convergence or divergence; therefore, integrating qualitative and quantitative approaches should be considered whenever possible (Abowitz and Toole 2009).

The quantitative and qualitative aspects in this thesis were combined in the following phases: (1) research design; (2) recruitment; (3) interpretation.

Firstly, in the research design phase, a simplified theoretical framework was devised based on the literature review (Figure 3.2). This assumed that parental migration (along with other rich sets of factors not illustrated here) might affect children's nutritional status, and that this influence was indirect, acting through care-giving practices as a 'mediating factor'; however, the data on care-giving practices were unknown, just like a 'black box' in a system. Therefore, this thesis addresses two general research questions: (1) whether or not parental migration is associated with LBC's nutritional status, and (2) how the process of care-giving practices for LBC is organized. Although these two research questions are distinct, they are also interrelated. Both qualitative and quantitative methods are therefore used concurrently to explain the various dimensions of the research problem.

Secondly, the recruitment phase in the qualitative component also integrated quantitative and qualitative research. The quantitative study used an existing secondary longitudinal dataset – the CHNS. The recruitment site for the qualitative study was located in one of the survey regions of the CHNS, which enabled contextual information to be drawn on from the wider study, helping to achieve a better handle on the interpretations of underlying statistical associations (Brannen 2005). However, for both ethical and practical reasons, it was not feasible to trace and recruit participants who also participated in the CHNS. This study therefore applied a non-nested design for data collection, where the qualitative data were not collected from the same participants as the quantitative data. Seeking in-depth data from the same participants has in any case been argued to be impractical and

unnecessary (e.g., Zuckerman and Sgourev 2006; Schrank 2008; Fernandez-Mateo 2009). One strength of the data collection approach employed in the present study is its flexibility (Small 2011).

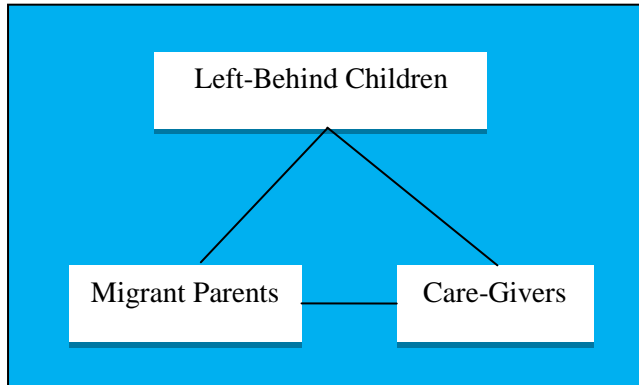


Figure 3-1 The care triangle

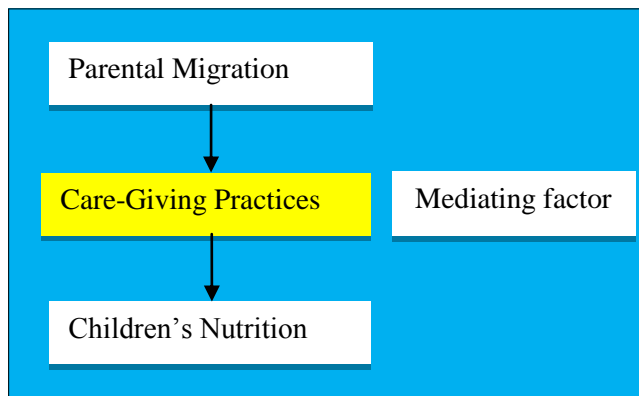


Figure 3-2 The simplified theoretical framework

Third, quantitative and qualitative data were integrated at the stage of data interpretation. Qualitative in-depth data may provide a better understanding of or explanations for associations derived from quantitative findings, although such interpretations may not be safely generalized due to the small sample sizes (Harding and Seefeldt 2013). It should be noted that the quantitative component and the qualitative component in this thesis are parallel and iterative. The qualitative study of this research was designed to: (1) explain the role of care-giving practices in the association between parental migration and childhood nutritional health in a specific socio-cultural context; and (2) potentially generate some further hypotheses to be tested in the quantitative component and future studies. Such hypotheses might link to the following research questions, for example: Are there gender differences of LBC in the associations between parental migration and the nutritional outcomes of children who are left behind? Does it matter for children's nutritional health when

they are left in the care of maternal grandparents or paternal grandparents? These questions can be answered quantitatively. However, exploring the reasons for such differences can benefit from qualitative analysis.

3.2 Quantitative methods

3.2.1 Study aims, objectives, and hypotheses

The overall aim of this study was to examine the relationship between parental migration and children's nutritional status (e.g., physical growth and macronutrient intakes) in rural China. The detailed study objectives and hypotheses, based on the literature described above, were as follows:

Objective 1 To investigate the long-term association between parental migration and children's physical growth in terms of height growth and weight gain in rural China.

Hypothesis 1 Young children whose parents migrate are more likely to suffer from slower growth rates than children from intact families when they grow up.

Objective 2 To examine the associations between parental migration patterns (by the father or by the mother) and children's macronutrient intakes in rural China.

Hypothesis 2 Among LBC, those children who are left behind by the father only are more likely to have higher intakes of macronutrients, while children who are left behind by the mother only, or by both parents, are more likely to have lower nutritional intakes, compared to children from intact families.

Objective 3 To investigate whether the associations between parental migration and children's nutritional outcomes identified in Objectives 1 and 2 differ according to the gender of children in rural China.

Hypothesis 3 Among LBC, girls are likely to be worse off in nutritional outcomes than boys, given the context of rural China where boys are more valued than girls.

3.2.2 Data sources

The China Health and Nutrition Survey (CHNS) is an on-going open cohort, international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition

and Food Safety at the Chinese Center for Disease Control and Prevention, which aims to analyse how the social and economic transformation of Chinese society affects the health and nutritional status of its population. The project was designed to examine, across space and time, the ways in which economic and social change affect a range of health behaviours in China (Popkin et al. 2010). Ethical approval was provided by the Internal Review Board of University of North Carolina at Chapel Hill and The Chinese Center for Disease Control and Prevention.

The CHNS collected longitudinal data on anthropometric measurements, health indicators, and a wide range of household and individual economic, demographic, and social characteristics. It began in 1989 and followed up with the participants subsequently in 1991, 1993, 1997, 2000, 2004, 2006, and 2009.

The CHNS employed a multistage, random-clustered sampling process to establish a sample of about 4,400 households with a total of about 19,000 participants from over 200 communities or neighbourhoods in nine provinces³. These were: Liaoning and Heilongjiang, which are located in north-eastern China; Jiangsu, and Shandong, two relatively economically developed provinces, which are northern coastal provinces; Henan, Hubei and Hunan, which are located in central China; and Guangxi and Guizhou, two relatively economically deprived provinces, which are mountainous southern provinces (see Figure 3.4). Four counties were randomly selected from an income-stratified sample in each province generated from a weighted sampling scheme. The smaller sampling units, such as villages or towns, are then randomly drawn from each county.

These nine provinces contain approximately 56% of China's population (Yan et al. 2012). Although the CHNS is not a nationally representative sample, and sampling weights are not available (Popkin et al. 2010), the counties within the selected provinces were chosen to represent a range of income levels, and provinces vary substantially in geography, economic development, public resources, and health indicators.

³ In 1997 Liaoning was left out and Heilongjiang was included as replacement. In later waves, both provinces were included. Nine provinces are covered from 2000 onwards.



Figure 3-3 China map and the CHNS survey provinces

Source: CHNS website http://www.cpc.unc.edu/projects/china/about/proj_desc/chinamap

Fieldwork site is highlighted by a yellow circle.

3.2.3 Target population and attrition

This study drew on data from the five waves of the CHNS, collected in 1997, 2000, 2004, 2006, and 2009. Throughout the work ‘rural children’ refers to children whose household registration type (*hukou*) is classified as ‘rural’ in the CHNS dataset.

The main issue with the longitudinal dataset is attrition. There are several major causes of loss to follow-up in this study. Firstly, considerable attrition may exist between waves, as younger children may miss the earlier waves and older ones drop out in later surveys. Secondly, school children who were in boarding schools, and who entered colleges and universities may miss certain rounds of survey. Thirdly, because participants aged ≥ 16 years may migrate themselves in order to find employment, and they cannot be followed up (Popkin et al. 2010). In addition, a new province (Heilongjiang) was added in 1997 when one province (Liaoning) was unable to participate for natural disaster, political and administrative concerns (Popkin et al. 2010).

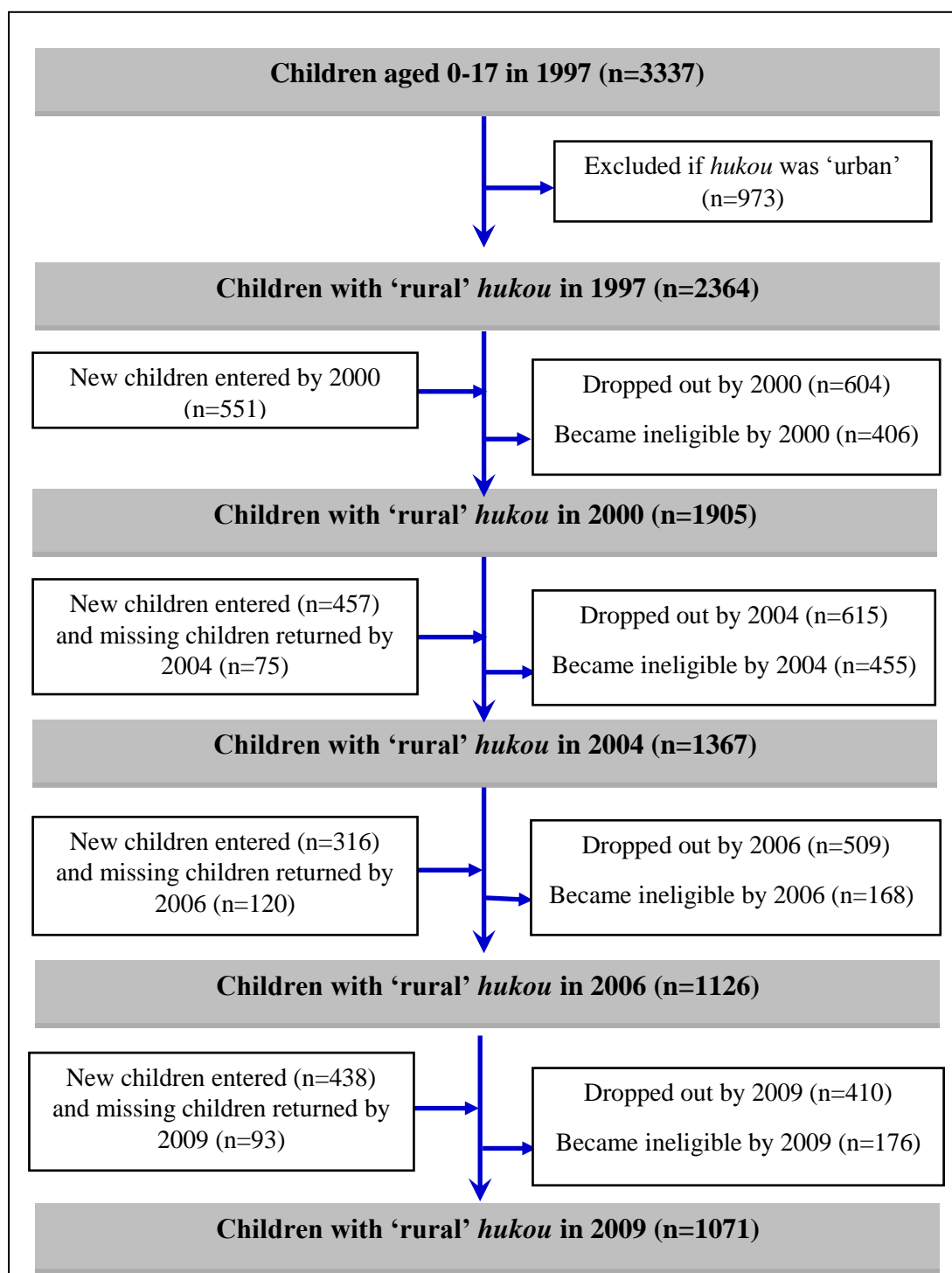


Figure 3-4 The flowchart depicting selection of participants in the CHNS from 1997

hukou: status of household registration as either 'rural' or 'urban'
to 2009 (N=7833)

Figure 3.5 depicts the sample selection of child participants in the CHNS from 1997 to 2009. There were 4126 children aged 0-17 years involved in the study, with 7833

observations. A substantial number of children dropped out or became ineligible as they turned 18 or older from the survey at each wave.

3.2.4 Nutritional outcomes

Anthropometric measures

Anthropometric measures (e.g., weight and height) are commonly used to assess nutritional status for children and adolescents, with growth standard and/or growth reference used for assessing growth, nutritional status, and well-being (WHO 1995; Wang et al. 2006). The most commonly used anthropometric indices are weight-for-height, height-for-age, and weight-for-age. These indices can be expressed in terms of Z-scores, sometimes called ‘standard scores’, and percentiles. One advantage of Z-scores as a dimensionless quantity is that, based on the distribution of the reference population (median and standard deviation), they can be compared across ages, sexes, and anthropometric measures (Wang and Chen 2012).

Z-scores are derived from the following formula (WHO 1995), taking height-for-age Z-scores (*HAZ*) as an example:

$$HAZ = \left(\frac{Height - Median}{\sigma} \right)$$

where *Height* refers to the observed height of an individual child in the population of interest, and σ is the standard deviation (SD) of the height variation from the median height (indicated as *Median*) of the reference population specific to age and sex.

The WHO has recommended growth standards/references for international use to assess children’s growth and nutritional status (Wang and Chen 2012). The last version, which was published in 2006, was developed by the Multicentre Growth Reference Study (MGRS), which recruited affluent, breast-fed, and healthy infants and young children whose mothers did not smoke during or after pregnancy from widely diverse ethnic backgrounds and cultural settings, including Brazil, Ghana, India, Norway, Oman, and the US (WHO 2009).

The WHO growth standards confirm that the effect of ethnic differences on the growth of infants and young children or preschool students (birth to five years) in populations is small, with only about 3% of the total variation in growth contributed by race/country. Although some studies argue that ethnic differences may exist due

to genetic variance, in the light of practicality these differences are not considered large enough to invalidate the general use of the WHO growth standards in all populations (WHO 2009).

A WHO growth reference for school-aged children and adolescents aged 5 to 19 years was later constructed by merging data from the 1977 National Center for Health Statistics (NCHS)/WHO growth reference (1-24 years) with data from the WHO Child Growth Standards under 5 years of age (de Onis et al. 2007). This reference was mainly based on the US dataset (Hamill et al. 1977), unlike the multicentre data designed for WHO Growth Standards for preschool children. Thus, genetic influences on inter-individual variation cannot not be ruled out (Butte and Garza 2006).

Given the ethnic variations in physical growth, it is essential to develop local growth standards. China has developed its own growth charts for children aged 0 to 18 years based on two national studies (Zong and Li 2013) using smoothing techniques of the Cole's Lambda-Mu-Sigma (LMS) method (Cole and Green 1992), which is used to obtain smoothed centile curves. The first was the Fourth National Survey on Growth and Development of Children under 7 years of age, which was conducted in 9 major cities across China (two municipalities including Beijing and Shanghai, seven provincial capital cities including Harbin, Xi'an, Nanjing, Wuhan, Guangzhou, Fuzhou, and Kunming) in 2005 across China (Li 2008). The second was the Fifth Chinese National Surveillance on Students' Constitution and Health, carried out on Chinese school students aged 6-20 in 2005, covering 31 provinces in mainland China (Ji 2007).

As the growth charts of height and weight are based on national survey data they are recommended as national standards for use in paediatric clinics and public health services (Zong and Li 2013). Comparison of the Chinese growth references with the WHO standards demonstrates ethnic differences in human growth (Zong and Li 2013). For example, for boys under 15 years of age and girls under 13, height by the Chinese reference is taller than by the WHO standard, but from these ages onwards, Chinese children tend to fall behind.

Anthropometric measures of interest

There are two main sets of anthropometric measurements in this research. The first set is formed of Z-scores: height-for-age Z-scores (HAZ), weight-for-age Z-scores (WAZ), and body-mass-index Z-scores (BMIZ). Z-scores are used to compare children's nutritional status across age and gender (Wang and Chen 2012). HAZ are an indicator of chronic malnutrition and cumulative long-term health status, whereas weight-for-height Z-scores (WHZ) indicate more recent short-term deprivation. WAZ, to some extent, confound the two (both short-term and cumulative nutrition), and are mainly affected by acute socio-economic factors (Stevens et al. 2012). Z-scores were constructed using the Chinese growth reference (Zong and Li 2013). Children whose HAZ or WAZ are below -2 (i.e., more than 2 SDs below the reference children's median height and weight, respectively), are classified as stunted or underweight, respectively. BMIZ below -2 and over 1 are defined as thinness (distinguished from underweight as measured by WAZ) and overweight (including obesity), respectively.

Another set of anthropometrics comprises height and weight. Compared with anthropometric Z-scores, height and weight are more straightforward to interpret. In addition, the use of height and weight allows monitoring of individual growth changes and growth rates in a secular trend.

Macronutrient intakes

Another indicator of nutritional outcome is macronutrient intakes, including carbohydrates, fat, and protein. Trained fieldworkers collected detailed individual-level diet data via 24-hour recall for three consecutive days, and household-level food consumption using a weighing technique over the same three-day period. Individual dietary intakes were obtained by asking each household member to report all food consumed at home and away from home. Information regarding young children younger 12 years of age was reported by caregivers. Interviewers used information on household food consumption to cross-check the individual diet recall data. When significant discrepancies were found, the household and the individuals in question were revisited and asked once more about their food consumption to resolve these discrepancies. Individual diet data were then used to calculate the nutrient values in terms of caloric intakes, protein intakes, fat intakes, and carbohydrate intakes based on the Food Composition Table (FCT) for China. The

dietary assessment approach of the CHNS has been shown to reduce the effects of measurement error and accurately capture usual energy intake (Paeratakul et al. 1998).

3.2.5 Exposures and covariates

Drawing on the conceptual framework for children's nutritional status (Figure 1.1), this research considers a set of confounding factors, as follows.

Left-behind status

The status of being left behind was operationalized using the household roster: from 1997 onwards, if one household member in a previous round of the CHNS was no longer residing in the same household in the current survey, the respondent was asked for the reasons for his/her absence (Appendix 26). Children under 18 years old whose parent(s) have left the home to seek employment elsewhere are defined as LBC.

The left behind variable is measured as dichotomous. The reference group is non-LBC from intact families, coded as 0, and LBC are coded as 1.

This study not only intends to investigate the association between parental migration and children's nutritional health in rural China, but also intends to distinguish between the impacts of different left-behind patterns (by the father or the mother or both parents) on children's nutrition among left-behind children.

Moreover, this research intends to examine whether being left behind at early childhood (aged below 6 years of age during pre-school years) and later childhood (aged over 6 years of age during school years) for physical growth differ from children from intact families. I created a four-category time-invariant variable to indicate at which stage of childhood years the child was left behind, ranging from ages 0-17: children from intact households who were never left behind and were the reference group; children who were left behind only in early childhood, from ages 0 to 5, but not in later childhood during school years, from ages 6 to 17; children who were left behind in both early and later childhood; and children who were left behind only in later childhood, from ages 6 to 17, but not from ages 0 to 5.

Gender

Gender is controlled because the gender of a child often affects the intra-household allocation, particularly in rural China, where son preference is prevalent (Burgess and Zhuang 2000).

The gender variable is measured as dichotomous, with the answer 'girl' coded as 1, and the answer 'boy' as 0.

Age

The age variable is used here to capture whether younger children are better off in terms of nutritional status than older children, or vice versa. In addition, controlling for age can allow us to address the question of whether the impact of parental migration on children's nutritional health varies by age.

Age is a continuous variable measured in years with 2 decimal precision.

Household size

The number of household members is taken into account because children in a large extended family may receive less attention than a child in a nuclear family. In addition, family size affects the allocation of intra-household resources.

Only child

Only child variable is measured as dichotomous. It is coded as 1 when the child is only child and 0 otherwise.

The presence of other siblings implies competition for intra-household resources and may reduce the amount of resources each child receives. Being an only child can increase HAZ significantly after controlling for community-level fixed effects and individual-level confounders including age, sex, maternal education, maternal height and healthcare variables (Bredenkamp 2009).

Household income

Household income is an important factor in children's nutritional health (United Nations Children's Fund 1998; Black et al. 2008). The CHNS provides detailed per capita income estimates for rural households. Data on household income were collected by trained interviewers using a questionnaire. Gross household income in cash or kind was created for different categories and then expenses are deducted to

generate a net income value. Per capita household income was calculated according to family structure and net income value. All variables of monetary values were adjusted by the price index provided by the CHNS.

Gross household income is used to control for the income effect of parental migration on children's nutritional health. Remittances sent back by migrant parents would be more appropriate than household income to capture the income effect of parental migration. However, the CHNS did not collect this information. Therefore, only household income was employed in this thesis.

Maternal education

The maternal education variable is measured as the number of years of formal education completed by the mother.

Maternal education is included as a covariate because of its strong association with children's health and development. One possible explanation for how maternal education can affect children's health, is that literacy and numeracy skills gained from education enable the mother to obtain health-related knowledge, and therefore influence children's health (Glewwe 1999). One study in China analysed a large sample of adopted children who were genetically unrelated to their foster parents, and indicated that maternal education is an important determinant of the adopted children's health in terms of HAZ after controlling for income, the number of siblings, health environments, and other socioeconomic variables (Chen and Li 2009).

One issue in this thesis is that the mother may be absent due to parental migration. However, the mother could still play an important role in their left-behind children's well-being through regular long-distance communication.

Parental height/weight

The parental height is measured in centimetres, and weight in kilograms.

The height and weight of parents are controlled for two reasons. Firstly, these variables may capture some genetic predispositions (Strauss 1990). Although the exact role of genetics on height is complex and uncertain, there are strong associations in heights in biological families. One recent study using 5 birth cohorts

(7630 mother-child pairs in total) from 5 low-and middle-income countries (Brazil, Guatemala, India, the Philippines, and South Africa), showed that maternal height influences offspring's linear growth over the growing period using multivariate regression models adjusted for household economic status, child gender, birth order, and research sites (Addo et al. 2013). There is evidence that early childhood growth velocity can be specifically affected by maternal or paternal height and body mass index (BMI) at particular stages of childhood (Botton et al. 2010). Parental height and weight can also capture effects related to family background, such as ethnic differences, household diet preferences, and previous favourable or unfavourable environmental influences which cannot be examined using current data.

Healthcare services

The health insurance dummy variable is coded as 1 when the child had health insurance and 0 otherwise.

Access to quality healthcare services is essential to children's health (Thomas et al. 1996). The present study used health insurance to represent the access to healthcare services.

Urbanization score

An urbanization index was created for each community (village or neighbourhood) based on a twelve multidimensional components from the CHNS including population density, transportation infrastructure, traditional and modern markets, sanitation, housing, health infrastructure and some other factors that can distinguish features of urban places (Jones-Smith and Popkin 2010). This score was used to capture physical, social, cultural, and economic environmental risk factors for children's nutritional health (Evans and Kantrowitz 2002;Gong et al. 2012).

Regional variations and time effects

Regional dummy variables were created according to the geographical and socio-economic differences: coastal (Shandong and Jiangsu, the two most economically developed provinces), northeast (Liaoning and Heilongjiang), central inland (Henan, Hubei, and Hunan), and the mountainous south (Guangxi and Guizhou), the most economically deprived region, which was set as the reference region. Regional dummies were controlled to capture unobserved geographical and cultural factors

related to food consumption and food prices, which may influence dietary intakes. Wave dummies were included to capture time effects with 1997 as the reference.

3.2.5 Statistical analysis

Descriptive statistics (frequencies, means, and standard deviations) were calculated to examine the distribution of the variables across the sample. Analyses of variances and *Chi-square* tests were carried out to assess heterogeneity between groups with regard to parental migration and key covariates.

The next analytical step consisted of regression modelling. Hypotheses regarding the associations between parental migration and health outcomes were tested with regression techniques using the CHNS. The type of regression depended on the measurement property of the study outcomes; when the study outcome was continuous, multilevel regression models were constructed. The log likelihood ratio test was used to determine the choice of models among nested models. When the health outcome was categorical, multinomial logistic models were employed to calculate the odds ratios (OR) and their 95% confidence intervals (CIs). The Wald test was used to test statistical significance. All *p*-values were two tailed, and those below 0.05 were considered to indicate statistical significance. Stata 13.1 (StataCorp 2013b) and MLwiN Version 2.28 (Rasbash et al. 2013) were used for statistical analyses.

Dealing with a longitudinal dataset

Longitudinal data have a natural hierarchical or multi-level structure, with repeated observations nested within subjects (Rabe-Hesketh and Skrondal 2012; Olsen et al. 2010). They can be viewed as two-level or clustered data with occasions nested in subjects so that the subjects become the clusters (Rabe-Hesketh and Skrondal 2008). In addition to the correlation produced by repeated measurements with the same subjects, individuals may be further clustered inside larger units, for example, households and neighbourhoods, thus leading to a three-level and even higher-level data structure. These sources of correlation violate the independence assumption of traditional statistical methods including OLS and fixed-effects models (Gibbons et al. 2010).

Multilevel models, known as random-coefficient models or hierarchical models, are valuable for modelling data with a hierarchical structure (Weiss 2005) because they are developed to adjust for this dependency, for example by allowing for different regression coefficients for different classes. This can be reflected in a standard regression model by adding a random intercept to the model in order to take into account dependency. This technique is well suited for use in longitudinal studies where multiple measures are observed over time for one subject, and are thus correlated (Twisk 2013). This approach was applied here in order to account for the hierarchical structure of the CHNS. Due to the relatively small number of children within the same household, I ignored the household level and focused on the village level and child level. Therefore, the models were fitted with repeated measurements at level 1, children at level 2 and villages at level 3 (see Figure 3.6). This corrects the estimated standard errors, thereby dealing with the clustering of observations that occurs within units (Duncan et al. 1998).

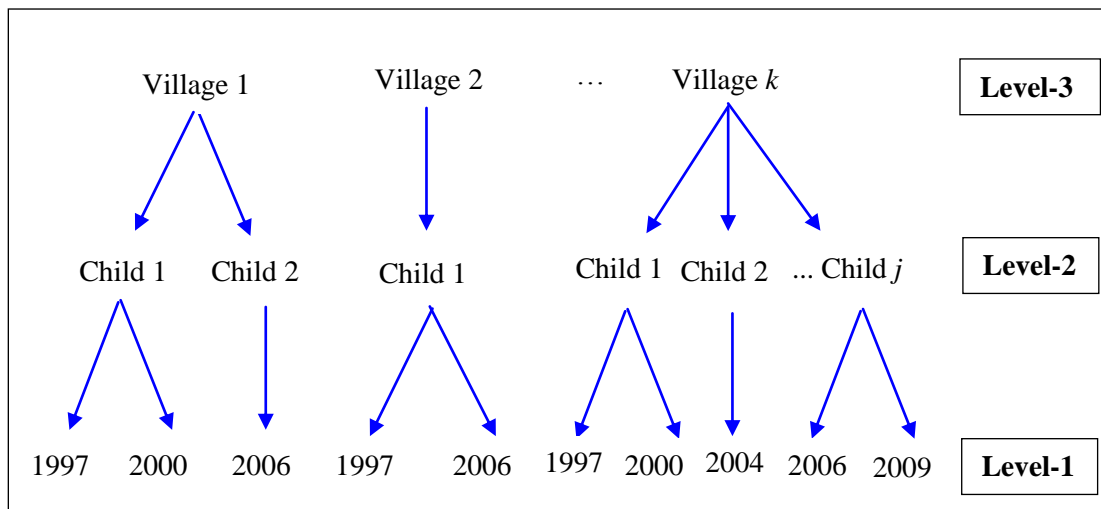


Figure 3-5 Multilevel structure of the CHNS children

Growth curve models

In longitudinal data, each subject is observed at several occasions over time. This data structure makes it possible to study between-person differences in within-person changes (Curran et al. 2010). Growth curve models (GCM) typically refer to statistical methods that model inter-individual variability in intra-individual patterns of change over time (Bollen and Curran 2006; Curran and Bauer 2011; McArdle 2009; Singer and Willett 2003). GCM are a special case of multilevel models with a focus on longitudinal data or panel data (Rabe-Hesketh and Skrondal 2012), which

explicitly model the shape of trajectories of individuals over time, and how these trajectories vary according to covariates of interest.

GCM do not require within-subject observations to be independent of each other, which is a benefit in the case of the CHNS datasets, since the health outcomes for the same child at different time points are more likely to be correlated. Moreover, GCMs are capable of handling unbalanced and incomplete data under the assumption that observations are ‘missing at random’, based on either maximum likelihood or restricted maximum likelihood techniques.

Missing data in longitudinal studies

One of the main methodological issues in longitudinal studies is missing data. Little and Rubin (2014) distinguish three types of ‘missingness’: (1) Missing Completely At Random (MCAR: missingness is independent of both unobserved and observed data); (2) Missing At Random (MAR; missingness depends on observed data, but not on unobserved data, or, in other words, given the observed data, the unobserved data are random); (3) Missing Not At Random (MNAR, which is also called non-ignorable missingness, where missingness is dependent on unobserved data). However, these distinctions between the three types of missingness are rather theoretical and have limited value in practice.

In longitudinal data analysis, there are two types of missingness that should be considered for practical reasons. It is important to investigate whether or not missing data depend on earlier observations of the outcome variable or certain covariates. However, in practice, this distinction is not really necessary and is primarily for educational purposes, because both types of missingness often coexist in longitudinal studies. In a more practical sense, when subjects have missing data at the end of the longitudinal study they are often referred to as drop-outs. In addition, some subjects may also miss certain measurements, and then return to the study during follow-up, which is often referred to as ‘intermittent missing data’ (Twisk 2013). In real-life longitudinal datasets, these two patterns often occur together.

In practice, it is recommended that information about missing data at different time-points be combined, especially when there are only a few (repeated) measurements and the amount of missing data at a particular measurement is rather low (Twisk 2013): the subjects are divided into two groups, one without any missing data over

the longitudinal period (usually at the first measurement), and the other with missing data in one or more measurements. This is how sample attrition and/or missingness were handled in the present research.

Multiple imputations

Multiple imputation (MI) on the dataset was conducted under the assumption that the missing data are MAR, whereby the missingness (i.e., whether the data are missing or not) may depend on observed data, but not on unobserved data (Schafer and Graham 2002). In order to reduce bias, an imputation model should include a wide range of variables, including all the variables in the substantive analysis, variables that predict missingness, and variables likely to be correlated with the process leading to missing data, though these may not be of interest in the substantive analysis (Collins et al. 2001). The number of imputed datasets was determined by the attrition rate, because ‘a rule of thumb’ suggests that the imputations should be at least equal to the percentage of incomplete cases in the dataset (White et al. 2011).

Chapter 6 will describe the MI process in more detail, using the macronutrient models as an example. There may be problems if the sample is confined to complete cases with non-missing values in all outcome and explanatory variables. For example, when the sample was restricted to complete cases with non-missing values in outcome and explanatory variables, the sample size dropped from 4401 to 2171. Such a substantial reduction in sample sizes could lead to invalid estimation of regression results. Therefore, the analyses here were not restricted to complete cases. The multiple imputations used in this thesis are not without limitations. I did not take into account clustering effects in imputation models for computational feasibility, which could lead to poor imputations (Goldstein 2009).

3.3 Qualitative methods

3.3.1 Rationale for the qualitative study design

A qualitative study design was adopted in order to gain insights into the care-giving practices for left-behind children (LBC) from the perspectives of caregivers and children themselves in a rural township from northern central China.

The specific objectives were as follows:

1. To understand how caregivers manage LBC's food, such as food preparation, food items, meal times, etc.;
2. To understand the views of caregivers on healthy eating;
3. To describe LBC's daily dietary and other routines including physical activities, household work, etc.

The rationale for the choice of the qualitative approach was as follows:

- First, a qualitative approach is appropriate for an exploratory research question about how people think and act in a particular social context (Creswell 2007b);
- Second, a qualitative study can produce rich and in-depth information and detailed understanding about the complex phenomenon of care-giving practices for LBC in the context of rural China (Creswell 2006);
- Third, the main aim of this study is to explore and conceptualise the social process of care-giving for LBC, which fits into a grounded theory approach (Robrecht 1995; Chenitz and Swanson 1986);
- Moreover, this study intends to look at how caregivers manage the LBC's daily routine, what is going on within their interaction and how they interact with each other. This follows symbolic interactionism which provides an interpretive perspective for individuals' social and psychological interaction 'in search of portraying and understanding the process of meaning making' (Schwandt 1994b p. 123).

3.3.2 Research site

Location

This study was conducted from September 2013 to February 2014 in a township in Henan Province, which is the most populous, and traditionally one of the largest migrant-sending central areas of the People's Republic of China (All-China Women's Federation 2008; 2013). Henan province, located in the northern central region of mainland China, is a major agricultural province and an important producer of agricultural and side-line products (e.g., grain, wheat, and oil seed output, and animal products) throughout China (The China Perspective 2013). This province ranked the 24th of 31 provinces in per capita gross domestic product (GDP) throughout mainland China in 2013 and its urbanization rate was around 43.8% at the same year (National Bureau of Statistics of China 2014a). Within the research setting where the study was conducted, the annual per capita income of urban residents in 2012, the last year for which data is available, was 19,408 RMB (or 1,940 GBP) and 7,432 RMB (or 740 GBP) for rural residents (Yongcheng Government 2013), lower than the national average (24,565 RMB or 2,450 GBP for urban residents and 7,917 RMB or 790 GBP for rural residents) (National Bureau of Statistics of China 2014c). One practical consideration is that this was my home province. I was familiar with local language and customs, which was essential to facilitate the fieldwork process.

Characteristics of this township

The agricultural township where the study was conducted has a population of 55 thousand (Han Chinese) and includes 30 villages under its administrative jurisdiction. The child participants were initially approached through a primary school. The public primary school was free and available to eligible children of school (primary and secondary school) age from nearby villages. Children who participated in this study were from 7 villages which were geographically close.

There were two coal mines which provided job opportunities for local people. During my fieldwork, I learned that jobs from the coal mine industry are often temporary, labour-intensive and only available to young labours in their 20s or 30s. The permanent job opportunities were limited and people who secured such jobs were financially better off than their village peers.

The township enjoyed a warm temperate climate, featuring four distinct seasons with warm and windy spring, torrid and rainy summers, refreshing autumns and chilly

winters (the lowest temperature mostly below zero degrees Celsius). This study was conducted mainly during autumn and winter. The main crops in this township included wheat, corns, and soybeans. The main staple food was wheat-based products including steamed buns and noodles. Villagers went to local markets to purchase vegetables, animal products, and fruits. Some households had small vegetable gardens in their backyards (see Figure 3.6) and some raised poultry and livestock. However, these were not the main source of food for villagers, who went to local markets to purchase food supplies.



Figure 3-6 A picture of a participant's vegetable garden in the backyard

There was a main local market that runs every 2 or 3 days located in the centre of the township. It usually took villagers around 30 minutes on average by bike to get to the market to purchase food (e.g., noodles, vegetables, animal products, fruits) and other living supplies. The main road from the primary school to the local market was an asphalt road but others that link different villages are dusty roads (see Figure 3.7). Road conditions became poor on bad weather days, especially in winter, which could restrict villagers' activities and communication with facilities outside of their villages.

On good days, I cycled to participants' houses from the town where I lived, which normally took 30-40 minutes. On rainy or snowing days, I walked to approach the participants. This often took much longer, around 1.5 to 2 hours.



Figure 3-7 A picture of a village road to a participant's home

There were buses available around the local market to get to the nearest city centre, which took approximately one hour. The bus fare was 5 RMB per person (or 0.5 GBP) for a one-way journey. However, it was a quite small city centre with limited job opportunities according to the participants, so the majority of migrant workers went interprovincial to big cities like Shanghai, Guangzhou, Shenzhen, and Beijing. They worked in manufacturing, constructing and catering industries. If they returned home, it was mainly in the Chinese New Year and occasionally during harvest season in August.

With regards to the health care services, the New Cooperative Medical Scheme (NCMS) was available for adults and children as a voluntary programme in this township. Under the NCMS, the health care is provided in public health centres through a fee-for-service reimbursement, and the reimbursement rates vary between different types of care and at different health facilities. For example, the claimed

reimbursement rates are higher for care delivered at village/township health centres than at the city/provincial level. Over 90% of study participants were enrolled in the NCMS.

Since 2011, rural people aged 60 or over were eligible to claim pension allowance, which was 60 RMB (or 6 GBP) per month in this township. The pension beneficiaries who participated in this study reported that the small amount of financial subsidies had improved their daily lives and reduced their dependence upon their adult children for financial support.

I made enquiries with local authorities and school teachers from the primary school about social support and related services available for rural families with migrants and LBC. Despite recognizing its necessity and importance, formal social support/services were not in place for LBC in the study setting. LBC relied solely on informal social support provided by a kinship family consisting of a nuclear family and various relatives (e.g., grandparents, aunts, and uncles).

School food

The primary school where I initially approached the children provides lunch (see Figure 3.8) for school staff for free, and occasionally for some students whose caregivers were unable to make them lunch, especially during harvest time. Students were required to pay for their lunch, which cost 3 RMB per head (or 0.3 GBP). I spent one month at this school at the outset of the study, which allowed me to become familiar with the school lunch as well the children.

For school lunch, there was no set menu available. Lunch was provided from 11.45pm-12.30pm. The dining place was located in an old classroom. There were two chefs who were in charge of the school kitchen and preparing for lunch. Normally around 30 to 40 people including staff and students had meals there. The meal usually included one staple food (e.g., steamed buns, steamed rice, and noodles) and one dish of stir-fried vegetables (e.g., Chinese cabbages, radish, potatoes, etc.). There were no drinks, fruits, or desserts available in the school canteen. Steamed rice was served only once a week, less frequently than wheat-products, because this township was one of wheat-growing areas in China. Therefore, wheat and wheat products were more consumed than rice. According to some participants, rice

products were believed to be more nutritious than wheat products due to its scarcity and relatively higher prices.



Figure 3-8 A picture of school lunch including steamed rice on the bottom, stir-fried mixed vegetables and sweet potato vermicelli on the top

3.3.3 Sampling and recruitment

Inclusion and exclusion criteria

Left-behind children aged 6-12 years were eligible to participate. As a reminder, in this thesis LBC were defined as children under 18 years old with rural household registration living with one parent or non-parent carers and whose mother, father, or both, left for work to an urban area. Primary school-aged children were included for two reasons.

- Firstly, children above 6 years of age are generally considered to have the cognitive and language capabilities to be interviewed (Rich 1968; Yarrow 1960; Docherty and Sandelowski 1999). Children as young as 6 years old can demonstrate a basic understanding of the purposes of research and what is expected of them during the research process (Broome 1999). Children often start primary education at 6 or 7 years old in China (Shah et al. 2005a).

- Secondly, it is estimated that LBC of primary school age is the second largest group, accounting for around 32.01% among over 61 million of LBC (All-China Women's Federation 2013). This thesis also included some non-LBC living with both parents who had similar characteristics on age, gender, and residence as LBC.

Child participants were recruited from the rural primary school described in Section 3.3.2. The sample was purposive (a purposive sample, also commonly called a judgemental sample, is one that is selected based on the knowledge of a population and the purpose of the study) in order to achieve maximum variation (Creswell 2006) of age, gender, and family structures (left behind by mother, father, or both parents). Caregivers for eligible children were invited to take part. All participants had to be able to speak Chinese (Mandarin or the local dialect).

Sampling methods

Sampling is a sequential process in grounded theory research, starting with purposive sampling and moving into theoretical sampling when concepts emerge (Draucker et al. 2007). At an initial stage, purposive sampling was used in order to achieve the maximum variation (Creswell 2006) on factors including children's age, gender, and family structure. Despite being tentative and subject to revision in accordance with further evidence (Ayres 2007), these aspects may be of crucial importance to understand care-giving processes for LBC and help maximize differences at the outset.

Further, theoretical sampling was employed whereby participants were chosen for inclusion to expand, confirm, or endeavour to disconfirm a merging theory (Ayres 2007). Sample size is not fixed until saturation occurs (Corbin and Strauss 2007). Saturation is often quoted in qualitative studies and defined as 'data adequacy', which means no new information is obtained (Morse 1995). It has been argued that the idea of saturation offers little practical guidance for estimating sample sizes prior to data collection (Guest et al. 2006). There seems to be no published guidelines or tests of adequacy for estimating the sample size required to reach saturation (Morse 1995; Mason 2010). Creswell (2007a) has recommended that interviews with 20 to 30 participants may be appropriate in grounded theory studies. However, recruitment

would continue until data saturation occurs (i.e., until no new major topics emerge from additional participants).

Initial approach

Recruitment is a crucial and fundamental stage of research. This is particularly so when researching vulnerable groups (Chiang et al. 2001), such as children. When undertaking interviews with children, it is important to gain the cooperation of a wide range of 'gatekeepers', such as parents, school staff, and so on (Cree et al. 2002;Fargas-Malet et al. 2010). It can be quite complex to gain access and seek consent to research LBC because of the potentially more gatekeepers involved, such as their migrant parents as well as caregivers.

The conduct of fieldwork often depends largely on the relationships that the interviewers build with the interviewees. It is through these relationships that all data are collected and data validity is strengthened (Adler and Adler 2002;Kvale 1996). Interpersonal skills are crucial to sustain good field relations (Marshall 2011). It is important to be a patient and thoughtful listener, and to show empathetic understanding of and a profound respect for the viewpoints of participants. There is a particular need to take into account the influences of inter-generational power relations when adult researchers gain access to and conduct research with children (Bushin 2007).

At the outset, I was planning to approach caregivers during the regular school meetings. However, due to the busy farming season and National holiday from September to October, the school meeting was not successfully scheduled. Therefore, I decided to initially approach children first. I went to all classes (6 in total from Grade 1 to 6) before the class began and explained my study in plain language to the children. They were given opportunities to ask any questions about my study. After the short meeting, children who expressed initial interest in this research were provided with a research package including information sheets, consent forms, and my contact information, which were sent to their caregivers. As LBC's parents were currently away from home, sufficient time, at least one week, was allowed for LBC and their carers to communicate this study with migrant parents and decide whether to take part or not.

Reply-slips were required to be sent back by the children to the school if the family was willing to participate in the research. This is a standard school practice when letters are sent home and it is more common and straightforward for families to opt into research than to include stamped-addressed envelopes in rural China. I went to school and check with returned reply-slips regularly. A reminder was sent to caregivers delivered by the children and this reminder emphasized the voluntary nature of participation. Also, letting children deliver the letters may enable them to take responsibility and get involved in the research. It is likely that caregivers were not able to read and write, I provided my contact information in the reply-slips and encouraged the children to read them out to their caregivers. Therefore, the caregivers could have chance to talk to me over phone.

Gaining consent

Prior to interviews, a full verbal explanation was made to children as well as their carers and they were asked to sign the consent form at the beginning of every time. Consents from parents, guardians or other representatives are generally necessary in relation to research with children and adults who lack the capacity to give consent for themselves (Wiles et al. 2007).

Normally consent from parents is required for studies with children. However, given the long-term separation of around two years (Pan et al. 2013), parents have left the children in charge of the carers, who have the responsibility for the children they care for. In order to reflect this change in responsibility over the children, consent for the LBC were obtained from the caregivers. Carers were encouraged to talk with the parents first, and sufficient time was given for this to occur (at least one week). Mobile phone contact is the common communication channel to connect the LBC and their parents (Pan et al. 2013). The carers had the opportunity to contact LBC's parents before they gave consent.

LBC and non-LBC had their own information sheets and consent forms (see Appendices 11-14 for information sheet, Appendices 17-20 for consent form). After giving their assent, children could only participate with consent from their carers or their parents. Given that some caregivers or parents were illiterate, I read the information sheet and consent form for them and invited them to express their consent verbally. Meanwhile, audio-visual documentation of oral consent (video,

audiotape recording, and photography) was used to gain consent from illiterate carers (Benitez et al. 2002).

Only after gaining consent from gatekeepers and assent from children themselves, can the children be included in the study. They were assured that they could withdraw from the study at any stage. However, there are several practical concerns. Firstly, the quality of information offered to children and their caregivers is very important, which may affect the ability to give informed consent (Bogolub and Thomas 2005). LBC in rural China are mainly cared for by their grandparents, many of whom can be poorly educated (All-China Women's Federation 2013). Therefore, the letters used simple Chinese language (e.g. simple words, short sentences, no jargons or acronyms), diagrams, speech bubbles or pictures, and large font. Secondly, as the children were initially recruited through schools, once school teachers have provided access, children might find it difficult to decline to take part (Backett-Milburn and McKie 1999). Moreover, Chinese children may not be accustomed to refuse directly a request from adult (Lu 2011). Hence, it is pivotal to minimize these risks by emphasizing and reassuring children that that they are to entirely free to participate and can withdraw at any time.

Socio-demographic characteristics of the sample

Forty children who showed their interest in my study brought back the reply-slips. And 30 of them (and their caregivers) agreed to take part in this study. Among 30 children, four were excluded for two reasons: two children were found to hold urban household registration during the interview, and the other two children were withdrawn by their caregivers due to farm work commitments. The final sample consisted of 26 children aged between 6-12 years old (Table 3.1): 21 LBC (12 boys and 9 girls) and 5 non-LBC (3 boys and 2 girls); 12 of 21 LBC were left behind by both parents, 3 were left behind only by the mother, and 6 were left behind only by the father. Twenty-four (92%) kept diaries which involved daily routine (e.g., eating, playing, and helping out with caregivers) (see Appendices 7 and 25).

Table 3.2 presents the characteristics of the caregivers. Of the 21 grandparents (17 on the paternal side and 4 on the maternal side), 15 were aged over 60 years old, and 6 were aged over 70. Only two of them went to primary school and the rest had

never attended school. The other caregivers (8 mothers, 1 aunt and 1 uncle, defined as the parent generation) had up to a middle school education.

3.3.4 Ethical concerns

Ethical approval was obtained from the University of Manchester Research Ethics Committee. This study involved child participants, for whom ethical issues can be of greater concern (Kirk 2007). The possible ethical considerations related to informed consent, confidentiality, potential harms, and the issue of power.

Informed consent

The importance of obtaining informed assent from children themselves, instead of only obtaining proxy consent from adult gatekeepers, is increasingly recognized (Tisdall et al. 2008). Some principles should be followed:

- Consent needs to be explicit in terms of verbal agreement or written signature;
- It is important for researchers to explain the research in plain language designed to appeal to children;
- Consent needs to be given voluntarily, without any coercion;
- Both children and their ‘gate-keepers’ can withdraw from the research project at any stage.

Child participants were included after gaining their own assent and informed consent from their caregivers and/or parents either in writing or by verbal audio-recording from illiterate participants.

Confidentiality

Confidentiality can be problematic in researching children. If any child abuse is disclosed, or there is evidence showing that a child is at risk, such as physical abuse and some unusual events described by some children, exceptions must be made to confidentiality issues to make sure appropriate actions can be taken to protect the child. In this case, complete confidentiality cannot be guaranteed and researchers may need to disclose information, to some extent, if they feel that children are ‘at risk’ (Beresford 1997). The limits to confidentiality and the strategies about how the researcher manages disclosure need to be highlighted in an information sheet (Alderson 1995; Beresford 1997; Davis 1998). It was made clear to the caregivers that the confidentiality of children could be breached if a child’s safety was thought to

be at risk but the researcher would discuss this issue with the carers first prior to disclosure.

Potential harm

It has been acknowledged that there is an obligation for adult researchers to make sure that children are not harmed and damaged by participating in research (Morrow and Richards 1996;Morrow 2012). When participants become upset or depressed in the course of an interview, normally support from professional staff, for example a counsellor or social worker is sought. However, this social service may be limited in rural China (Lu 2011). Should the researcher have become aware of the discomfort or distress, a break would be immediately offered, or the interview would be terminated if participants could not carry on. Help from the school teacher would have been sought where necessary.

It should be noted that child abuse may occur. In the UK if any child abuse is disclosed, or there is evidence showing that a child is at risk, such as physical abuse and some unusual events described by some children, certain safeguarding strategies should be in place to protect children's safety. However in rural China, neither social services nor any other agency is responsible for intervening in the case of suspected child abuse, or other child protection issues (Lu 2011). The researcher still has the ethical responsibility to avoid any potential harms being done to the children. Should a child be perceived to be at risk, at the end of the interview, the researcher would have asked the child who he or she thought might be able to make things better for her or him. The researcher would have also discussed with the child's school teachers any concerns she had about the child's safety, and seek advice and support from them. Any action to discuss the situation with a third person, such as the carer or the teacher would have been explained to the child.

Power issues

Power relations are increasingly considered to be critical in ethical practice with children (Tisdall et al. 2008). It is suggested that participatory methods can be helpful, enabling adults to share power with children (Barker and Weller 2003;Nieuwenhuys 2004). At the outset, the researcher interacted with children by taking part in school activities, like playing games or telling stories in order to obtain their understanding and trust. During the interviewing process, it was particularly

suitable for the researcher to use non-verbal behaviours, such as maintaining eye contact and nodding the head, which implied that the interviewer was interested in the child's stories (Fargas-Malet et al. 2010;Cameron 2005).

3.3.5 Data collection

Semi-structural interviews

It is pivotal that the method of data collection is congruent with research questions as well as with methodological orientations (Wimpenny and Gass 2000). Qualitative research relies heavily on interviewing as a major strategy for data collection (Dilley 2004;Knox and Burkard 2009;Starks and Trinidad 2007). Interviewing is a way of accessing people's feelings, perceptions, meanings and constructions of reality (Punch 2005).

There is evidence that interviewing is suitable for a grounded theory study (Kvale 1996). In such a study, the objective of the interview is to elicit the participant's story (Starks and Trinidad 2007). The researcher acts as the listener and asks participants to give accounts of their experiences. Probing questions during interviewing can encourage participants to elaborate in detail so that the researcher can obtain in-depth data.

The interview can take various forms, including standardised interview, semi-standardised (semi-structured) interview and un-standardised interview, in accordance with the rigidity of the presentational structure (Berg 2004). Semi-structured interviews can be a suitable approach for data collection in a grounded theory study given that the flexible interview questions, to a large degree, follow a theoretical direction, particularly as the study processes and themes begin to emerge. Semi-structured interviews are consistent with the principles of symbolic interactionism which underpinned the study, and the grounded theory method (Fielding 1994;Duffy et al. 2004). Semi-structured interviews allow the interviewer to ask key questions in the same way each time and to probe for further information (Arthur and Nazroo 2003). In addition, exemplary semi-structured interviews give participants a sense of where the discussion is going, which in turn builds rapport (Ayres 2007). The interview protocol is often developed using open-ended questions in semi-structured interviews, serving as a guide (Flick 2002), a foundation on which

the interview is built, which allows creativity and flexibility to ensure the full unveiling of participants' stories (Knox and Burkard 2009).

Face-to-face interviews allow the observation not only of verbal but also of nonverbal data (Hiller and DiLuzio 2004), such as facial expressions, body language, and other nonverbal indications that may enrich the meaning of the verbal information (Carr and Worth 2001). In addition, face-to-face interviews allow the researcher time to build rapport, which may enable the interviewee to freely disclose their experiences (Shuy 2003). Additionally, interviewing is an age-appropriate method (Christensen and James 2008; Bushin 2007), and so is suitable for this study.

Face-to-face semi-structured interviews were conducted with caregivers, either individually or together with their partners, and their children. The interviews took the form of informal conversations in which the researcher asked open questions about children's food and diet using a topic guide. Topic guides (see Appendices 1-2 for English and Chinese versions) were developed using open-ended questions based on the central focus about the care-giving practices for LBC. Caregivers were encouraged to elaborate on their answers and to raise additional topics that they considered relevant. Interviews were conducted in Chinese (Mandarin or dialect). Each interview lasted approximately between 1 and 1.5 hours. All interviews were conducted by the researcher in the participants' homes and were audio-recorded with their permission.

In addition to caregivers, children were also invited to take part in face-to-face semi-structured interviews using topic guides about their daily routine (see Appendices 3-4 for LBC and Appendices 5-6 for non-LBC). After gaining their own assent and caregivers' consent, interviews with children were carried out in their homes. Caregivers were allowed to be present during interview if the children felt comfortable. The average duration of interview with children was between 20 minutes and 30 minutes. Interviews were conducted in Chinese and were recorded with the children's and their caregivers' permission.

Diary and journaling

Prior to commencing interviews, children were encouraged to keep diaries about their daily activities, eating, interaction with peers and caregivers, and their feelings for around one week. I explained using plain language to the children how to fill in

the diaries and encouraged them to ask questions and concerns about the diaries. I also was able to get hold of caregivers to ask them to encourage their children to fill in the diaries, but not to influence their content.

It is essential to motivate and encourage the children when they are completing diaries. They were provided pens, and interesting and user-friendly notebooks, which may make children feel more predisposed to completing the diaries (Tinson 2009). In addition, normally I went to school and made quick reminders for the children twice a week, which was useful to let them know that the researcher was still continuing with the project. The next day after distributing the diary books to the children, I came to the school and described to the children again how to complete the diaries, offering time for them to check the diaries by themselves and to ask questions if they were not sure how to proceed.

Diaries were used to establish rapport with children and their caregivers during interview process and as a starting place for interviews between the participants and the researcher (Spratling et al. 2012). Also, the diaries were used to facilitate discussions in further interviews with both children and their caregivers (Lopez-Dicastillo et al. 2013).

3.3.6 Data analysis

The first five interviews were transcribed verbatim and translated into English so that they could be checked and discussed between me and my supervisors to direct further interviews. The rest of the interviews were transcribed verbatim by two local persons with a good knowledge of the dialect outside the research team. All the Chinese transcripts were carefully checked against the audio-recording for quality and content by me, thus ensuring familiarity with the interviews. Data analyses were initially processed in Chinese in order to avoid misunderstanding and minimize the risk of losing participants' original meanings. As the analysis developed, data relating to emerging themes were translated into English to facilitate review and discussion with my supervisors. The translated versions and the original Chinese versions were checked by an independent and bilingual person outside the research team.

Principles and procedures of the constant comparative methods guided data analysis (Charmaz 2006), following transcription and entry into the qualitative analysis

computer program Nvivo 10 (QSR 2012). It has been designed for qualitative researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required.

Concurrent data collection and data analysis occurred with codes and categories being inductively developed from the data. Analysis involved identifying codes and their properties and dimensions, grouping these codes to create categories, systematically comparing and contrasting the codes, and examining the connections between the categories and subcategories. Prior to data analysis, each transcript was read through carefully several times so that I could familiarise myself with the data. During this process, interesting quotes and recurring ideas were noted as part of the initial coding process. The second stage of data analysis was done in Nvivo 10. I re-read and coded each transcript line-by-line. Data were fractured into segments and distinct codes. During this process, joint meetings were scheduled with my supervisors to achieve consensus on possible meanings or categories. Then, relationships between categories were linked on a conceptual level rather than on a descriptive level, concerning conditions, context, action/interactions, and consequences (Corbin and Strauss 2007). During this process, memos were created to record my thoughts about why emerging themes had been identified. Once all interviews had been individually analysed, the identified themes were integrated with subsequent comparative analysis.

An example of coding from one interview was provided in Appendix 27. The main themes from integrated analysis were summarised in Figure 3.10, including ‘migration motives: economic incentives’, ‘care-giving arrangements for LBC’, and ‘intergenerational differences in managing food and diet for children’. They will be discussed in more detail in Chapters 7 and 8.

3.3.7 Rigour and reflexivity

Rigour

Rigour in relation to data collection in the qualitative research may include ethical rigour and procedural rigour (Høye and Severinsson 2007). The former relates to the procedure aiming to ensure the confidentiality and the voluntary nature of participation; the latter refers to precise data collection procedures and self-criticism to reduce bias and incorrect interpretations. For example, in the interviewing process,

there are several factors that can affect rigour, such as the length of interviews, the appropriateness and breadth of topic guide, and the types of questions asked (Tracy 2010).

If the sequence of questions on the topic guides is not arranged in a logical manner according to the dynamics of discussion, this could impede the probing for further detailed information and the acquisition of rich data. In addition, if the length of the interview is longer than originally expected, the participant may become unfocused and bored, and give fewer responses to the last few questions, which might affect the integrity of the interview and the rigour of the research. For ethical considerations, consent should be gained prior to interviews. This, however, may be problematic in in-depth, open-ended, and inductive interviews, as in such interviews neither interviewers nor interviewees can predict what is going to be discussed in advance of the event (Nunokoosing 2005; Cutcliffe and Ramcharan 2002).

With regards to ethical rigour, Chinese children may not be accustomed to directly refuse a request from an adult (Lu 2011). Even though the author gained assents from children themselves, and consents from their carers or parents, there might still be coercion due to cultural background. Thus, ethical rigour might be threatened. At the outset of data collection, I spent one month teaching and playing with children at school to become familiar with each other. Meanwhile, I explained my project in plain language to them and encouraged them to raise any questions or concerns they had about the project. These could potentially enhance ethical rigour. Also, this could make it easier for children to talk openly because they became familiar with me.

Reflexivity

Reflexivity refers to researchers being part of, rather than separate from, the research (Lipson 1991). Hutchinson (1993 p.187) claims 'because grounded theory research requires interpersonal interaction, the researcher is inevitably part of his or her daily observations'. Grounded theory researchers need to take into account their own positions in the interviewing process and perform ongoing self-reflection to ensure that personal biases, worldviews, and assumptions are considered (Suddaby 2006). Therefore, incorporating reflexivity has the potential to strengthen the rigour in grounded theory research (Hall and Callery 2001).

My personal position might influence the recruitment process. I initially approached the LBC and non-LBC through school channels. This could lead to a perception that I was a friend of the school teachers, which could be viewed as some pressure on them to take part.

Interviewing is a useful approach to learning about the world of others, although interpretations may occasionally be elusive (Qu and Dumay 2011). Interviewees may withhold certain information inconsistent with their preferred self-image (Fielding 1994) or only disclose what they think the interviewer wants to hear (Qu and Dumay 2011) in particular, if the children wish to please the adult researchers. Moreover, the assumption that accounts are accurate indicators of participants' inner experiences may be erratic (Lambert and Loisel 2008). I was concerned in this study, although sharing common languages and cultural backgrounds, the personal experiences of the participants, and their preferences, as well as world views, are different, which may lead to different understandings of conversations. This may threaten the trustworthiness of the findings. I was aware of these issues and used a reflexive approach to identify such differences and took them into account when interpreting data.

During data analysis process, one concern about qualitative data analysis in this study is whether all the Chinese transcripts should be translated into English. It has been argued that the Chinese language is quite complex and it is often difficult to achieve equivalence of meaning in English language (Twinn 1998). Therefore, it is important to keep transcripts in Chinese in order to avoid misunderstanding and minimize the risk of losing participants' original meanings. I translated emerging themes into English to facilitate the review and discussion with my supervisors. To ensure trustworthiness, the translated themes and the original transcripts were checked by an independent and bilingual person outside the research team.

Table 3-1 Sample size and characteristics of left-behind children and non-left-behind children (N=26)

	Left-behind children		Non-left-behind children		Total
	Aged 6-9 years	Aged 10-12 years	Aged 6-9 years	Aged 10-12 years	
Gender					
Boy	4	8	0	3	15
Girl	5	4	1	1	11
Left-behind type					
Only mother away	1	2	-	-	3
Only father away	3	3	-	-	6
Both parents away	5	7	-	-	12
Cared for by					
Parent generation	1	4	1	4	10
Grandparent generation	6	5	-	-	9
Both grandparents and parent generation	2	3	-	-	5
Number of children keeping diary					
Yes	9	10	1	4	24
No	-	2	-	-	2
Total	9	12	1	4	26

Table 3-2 Sample size and characteristics of caregivers (N=32)

Characteristics	Paternal grandmother	Paternal grandfather	Maternal grandmother	Maternal grandfather	Mother	Aunt/uncle	Total
Age Range (years)							
30-39	-	-	-	-	5	1	6
40-49	-	-	-	-	4	1	5
50-59	6	-	-	-	-	-	6
60-69	5	3	1	-	-	-	9
>=70	1	2	2	1	-	-	6
Educational attainment							
Illiterate	11	5	2	1	1	-	20
Primary school	1	-	1	-	2	1	5
Middle school	-	-	-	-	6	1	7
High school or higher	-	-	-	-	-	-	-
Number of children cared							
1	1	1	1	-	1	-	4
2	9	2	1	-	7	1	20
3	1	1	-	-	1	-	3
4	1	1	1	1	-	1	5
Total	12	5	3	1	9	2	32

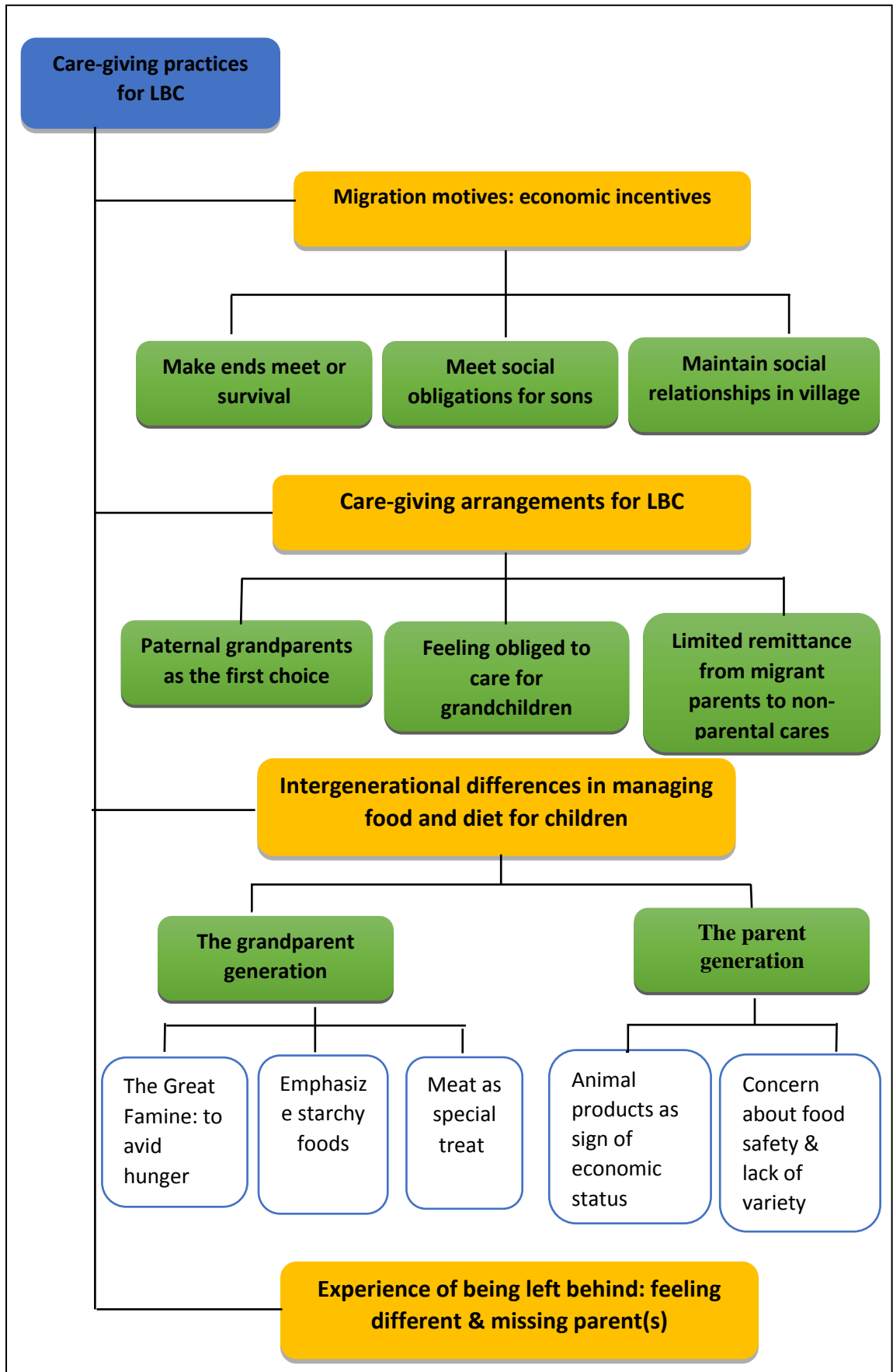


Figure 3-9 Summary of main themes from integrated analysis

Chapter 4 Patterns and distributions of under-and over-nutrition among rural children: Evidence from rural China

This chapter provides a general picture of patterns and distributions of malnutrition among all rural children in China, including left-behind children. The chapter begins with a brief introduction of nutritional problems that children are facing in rural China, where different dimensions of malnutrition, including under-nutrition (e.g., stunting and underweight) and over-nutrition (e.g., overweight and obesity) are prevalent and often coexist. This chapter then explores the spatial and temporal dynamics and other patterns (by gender, age groups, left-behind status, and the degrees of urbanization) of children's nutritional outcomes by looking at the China Health and Nutrition Survey (CHNS).

4.1 Introduction

It is well documented that under-nutrition during early childhood restricts children's physical growth, which may in turn lead to increased risk of dying from infectious disease, or adversely affect cognitive skills, academic achievements, and health and economic capacity in later life (Black et al. 2008; Grantham-McGregor et al. 2007; Black et al. 2013; McDonald et al. 2013; Walker et al. 2007).

One of the factors that can improve nutritional status at the macro level is economic growth (Strauss and Thomas 1998), and China is no exception. The nutritional status of Chinese children has steadily improved since the economic reforms of the late 1970s (Shen et al. 1996; Morgan 2000; Bredenkamp 2006; Wei et al. 2011; Li et al. 2005; Chang et al. 2000). The average height of school-aged children showed a significant upward trend between 1979 and 1995, although there were considerable geographical variations (Morgan 2000). Between 1975 and 1985, the average height of Chinese rural children aged 2-5 years old increased by 2.0 cm, compared to 1.3 cm among urban children of the same age. Between 1987 and 1992, the net increase for rural children was only one fifth that of urban children (0.5 versus 2.5 cm) (Shen et al. 1996). A systematic analysis of 141 low-income and middle income countries between 1985 and 2011 demonstrates a substantial urban-rural differences in children's height and weight: urban children are taller and heavier than their rural counterparts, and the urban-rural gap has increased over time in Asia, including China (Paciorek et al. 2013).

Evidence consistently shows that under-nutrition of children in China has been substantially reduced. For example, data from a nationally representative dataset National Food and Nutrition Surveillance System, NFNSS), show that the prevalence of underweight in rural children under 5 years old declined from 16.5% (national prevalence: 13.7%) to 10.3% (national prevalence: 8.2%) between 1990 and 2000, while the prevalence of stunting dropped from 40.3% (national prevalence: 33.1%) to 25.3% (national prevalence: 20.0%) during the same period (Chen et al. 2011). From 2000 onwards, the prevalence decreased continuously to 4.6% for underweight and 12.6% for stunting in 2009. Based on the same WHO growth reference as used by Chen et al. (2011), Li et al. (2009) analysed the nationally

representative dataset the China National Nutrition and Health Survey (CNNHS) and found that the stunting prevalence for children and adolescents in 2002 was 16.4% in rural China and 5.7% in urban China. One longitudinal study using the CHNS (1991-2002) suggested that the prevalence of malnutrition based on 2000 CDC growth charts declined significantly in China in the 1990s, and a dramatic downward secular trend was observed in almost every aspect of malnutrition including underweight, stunting and wasting (Bredenkamp 2006).

Although a remarkable improvement of childhood nutrition in China has been achieved, there remains considerable under-nutrition, including stunted growth and underweight, among children in poor provinces and regions (Chen et al. 2011;Pei et al. 2014;Zong and Li 2014;Jiang et al. 2015;Dang et al. 2014). Anaemia, which emerges due to inadequacy of micronutrient-rich diets and is sometimes described as ‘hidden hunger’, impairs cognitive and academic performances and remains a major health problem among children and adolescents in rural China, especially in poor areas (Luo et al. 2012;Li et al. 2013;Willows et al. 2011;Luo et al. 2010;Chen et al. 2011). In such cases, children can appear to be well fed or even overweight, but are still lacking in the critical nutrients needed for normal development.

Furthermore, in contemporary China, new and worrisome issues have emerged, such as the coexistence of underweight and obesity (Dearth-Wesley et al. 2007;Poskitt 2009), the increasing prevalence of overweight and obesity, particularly in urban areas and affluent rural areas (Hui and Bell 2003;Wang et al. 1998;Wang et al. 2003;Zong and Li 2014), and related nutritional concerns of left-behind children within rural areas (Wei et al. 2011;Tan et al. 2010;Gao et al. 2010;Luo et al. 2008;de Brauw and Mu 2011).

Rapid social and economic change is transforming China with enormous implications for public health. The prevalence of overweight and obesity in children and adolescents increases with the degree of urbanization in China (Zhang et al. 2014). One possible explanation may be that urbanization is associated with changes in lifestyle and behaviours such as physical inactivity and high-fat and energy-dense diets.

Overweight and obese children have become a public health problem in affluent rural areas (Zong and Li 2014;He et al. 2014;Lyu et al. 2013). Wang et al. (2009)

argued that the relatively high prevalence of overweight among rural children could be a false impression, suggesting that many ‘overweight’ children are actually stunted. This could be described in a separate category as ‘stunting overweight’ (Chang et al. 2006), not really ‘overweight’. Based on this, studies describing the degree of overweight/obesity among rural children in China should be interpreted with caution.

Risk factors of child malnutrition in China

Specific socio-cultural factors should also be considered when examining the risk factors of child malnutrition in the context of China. These include son preferences and China’s one-child policy. Gender differences in HAZ have been found among rural Chinese children aged 6 months to 10 years from households with more than one child by using the CHNS (1991 – 2009): girls from such families are significantly more disadvantaged compared to boys, and boys appear to be better off in terms of HAZ when they have a brother, rather than a sister (Ren et al. 2014). This pattern of gender differences could be due to gender discrimination against girls in rural China, where cultural preferences of sons are prevalent (Song and Burgard 2008). Evidence suggests that the one-child policy in China is associated with increased risk of child obesity as well as related coronary artery diseases (Cheng 2013; Cheng 2005).

Another important risk factor that can influence children’s nutritional health in contemporary China is parental migration, as has been well documented (e.g., de Brauw and Mu 2011; Ning and Chang 2013; Gao et al. 2010; Lu et al. 2015; Mu and De Brauw 2015). In a nationally representative survey conducted in 2009, based on WHO child growth standards, the prevalence of stunting was higher among children under 5 years old who had been left behind by mothers migrating to cities for work than among their rural counterparts living with both parents (17.8% vs. 12.0%). The rates of underweight for the two groups were 6.8% and 4.4%, respectively (Chen et al. 2011). Further nationally representative results for older children are not available, since most studies on this issue have only been carried out for specific age-groups (mostly among children under 5 years of age) (Chang et al. 2006; Zhang et al. 2011; Wang et al. 2009), and in a small number of areas (Shan et al. 2010; Shi et al. 2005; Jia et al. 2012; Gao et al. 2010; Harris et al. 2001; Wang et al. 2009). Thus, it

may be hard to generalize these results to all Chinese children as different age groups can have different growth rates. Regional variations in economic developments within China could affect children's nutrition differentially.

Research aims

The short review above describes a double burden of malnutrition for children in rural China – the coexistence of under-nutrition (e.g., stunted growth, underweight) and over-nutrition (e.g., overweight or obesity) in the same population.

Heterogeneity in the prevalence of childhood malnutrition could be due to differences between study designs, different age groups studied, temporal and spatial dynamics across China, or the various growth references used (Li et al. 2009; Dang et al. 2014). Therefore, reporting national-level prevalence of child malnutrition may obscure important subgroup heterogeneity, in particular across different regions, age groups, and socioeconomic groups.

Despite a number of studies, in particular cross-sectional studies, suggesting an increased prevalence of over-nutrition and decreased prevalence of under-nutrition among children, the limited age ranges of rural children from specific regions, and the relatively short study periods assessed to date, may fail to capture a comprehensive picture of children's nutritional transition in China, which is undergoing a rapid social and economic change.

This chapter aims to provide a comprehensive picture of the socioeconomic and demographic patterning of children's under-and over-nutrition in rural China.

4.2 Methods

4.2.1 Study design and subjects

The present study used data from five waves of the CHNS, collected in 1997, 2000, 2004, 2006, and 2009, which was described in detail in Chapter 3. Children younger than 18 years old who were reported having rural household registration (*hukou*) were included.

Table 4-1 Participation of rural children aged 0-17 years across survey waves from the CHNS, 1997 to 2009

Numbers of observations	Number of children	Participation rate
1	1662	47%
2	1117	32%
3	533	15%
4	178	5%
5	43	1%
Total	3533	100%

Table 4.1 presents the CHNS follow-ups for rural children across the five waves of the study from 1997 to 2009. Among the target population, 1871 children (53%) participated in the study more than once. Approximately half of the rural children (47%) only participated once. Children who participated in three, four, and five waves of the survey were numbered 533 (15%), 178(5%), and 43 (1%), respectively.

4.2.2 Nutritional outcomes

The CHNS recorded height and weight for each individual within the household, as measured by health professionals. There are three main anthropometric measurements for children’s nutritional status: height-for-age Z-scores (HAZ), weight-for-age Z-scores (WAZ), and body-mass-index Z-scores (BMIZ). Z-scores are used to compare children’s nutritional status across age and gender (Wang and Chen 2012). HAZ are an indicator of chronic malnutrition indicating cumulative long-term health status, whereas weight-for-height Z-scores (WHZ) indicate more recent short-term deprivation. WAZ to some extent confound the two (both short-term and cumulative nutrition), and are mainly affected by acute socio-economic factors (Stevens et al. 2012). WHZ were not reported in the present study because the short-term changes reflected by WAZ could be empirically indistinguishable from variations due to the longitudinal study design of the CHNS.

Z scores were constructed using the Chinese growth reference based on Chinese urban children (Zong and Li 2013). Children whose HAZ or WAZ are below -2 (i.e.,

more than 2 standard deviations below the reference children’s median height and weight), are classified as *stunting* or *underweight*, respectively. BMIZ below -2 and over 1 are defined as *thinness* (distinguished from *underweight* measured by WAZ) and *overweight* (including *obesity*). Due to small numbers, *thinness* was collapsed with the *underweight* group.

Chi-square tests show that differences in the prevalence of stunting across overweight, underweight and normal weight status are strongly statistically significant for rural children regardless of age range ($p < 0.001$) (Table 4.3). Of the 5091 children with normal weight, the percentage of stunting is 21.6% and 26.6% of children who are overweight are also stunted. Over 70% of underweight children are stunted. Among children younger than 6 years old, 35.4% of overweight children are stunted. This percentage decreases to 20.5% for school children aged 6-17 years. 76% of underweight children of school age are stunted.

Given the different dimensions and potential overlap of nutritional status (for example, stunting can coexist with underweight or with overweight), a general measure of nutritional status was created – malnutrition – which has six categories (Table 4.2): 1) normal (normal weight and not stunted) as the reference group, 2) stunted only (normal weight and stunted), 3) overweight only (overweight but not stunted), 4) stunted overweight, 5) underweight only (underweight but not stunted), and 6) stunted underweight. Table 4.3 shows sample sizes and distributions of six scenarios of malnutrition among children by age group in China.

Table 4-2 Six scenarios of childhood malnutrition status

Malnutrition	Normal weight	Overweight	Underweight
Not stunted	1. Normal	3. Overweight only	5. Underweight only
Stunted	2. Stunted only	4. Stunted overweight	6. Stunted underweight

Table 4-3 Sample size and percentage of stunting across overweight/underweight status from the CHNS, 1997-2009

Stunting status		Overweight/underweight status			Total
		Normal	Overweight	Underweight	
Aged 0-17 ***	Not stunted	3994 78.45%	679 73.41%	109 26.85%	4782 74.46%
	Stunted	1097 21.55%	246 26.59%	297 73.15%	1640 25.54%
Total		5091 (100%)	925 (100%)	406 (100%)	6422 (100%)
Aged 0-5 ***	Not stunted	694 80.89%	245 64.64%	49 32.45%	988 71.18%
	Stunted	164 19.11%	134 35.36%	102 67.55%	400 28.82%
Total		858 (100%)	379 (100%)	151 (100%)	1388 (100%)
Aged 6-17 ***	Not stunted	3300 77.96%	434 79.49%	60 23.53%	3794 75.37%
	Stunted	933 22.04%	112 20.51%	195 76.47%	1240 24.63%
Total		4233 (100%)	546 (100%)	255 (100%)	5034 (100%)

*** *Chi-square test p-value*<0.001

Due to relatively small sample sizes in some of the malnutrition groups, ‘stunted only’ ‘underweight only’ and ‘stunted underweight’ were further combined into one category named ‘under-nutrition’ (Table 4.4). Accordingly, ‘overweight only’ can be considered as ‘over-nutrition’, and ‘stunted overweight’ a paradox of under-and over-nutrition.

Table 4-4 Sample size and percentage of malnutrition status in four categories for the CHNS children (1997-2009) in rural China

Malnutrition	Normal	Under-nutrition		Paradox	Total
		(stunted underweight)	Over-nutrition (overweight only)	(stunted overweight)	
Aged 0-5	694 (50.00%)	315 (22.69%)	245 (17.65%)	134 (9.65%)	1388
Aged 6-17	3300 (65.55%)	1188 (23.60%)	434 (8.62%)	112 (2.22%)	5034
Total	3994 (62.19%)	1503 (23.40%)	679 (10.57%)	246 (3.83%)	6422

Chi-square test p-value<0.001

4.2.3 Variables

Individual/household-level risk factors

Drawing on the conceptual framework of children’s nutritional status (See Figure 1.1), I considered the following set of socioeconomic variables: maternal education (the number of years of formal education completed by the mother), annual income per capita at the household level; only child (whether or not a child is the only child within a household), child insurance (whether or not a child has health insurance or not), and being left behind (whether or not a child’s mother or father migrate elsewhere for employment). Maternal education was measured as years of schooling. I adopted cut-offs for years of schooling that were based on typical education benchmarks: 0 year (illiterate), 1-5 years (primary school), 6-8 years (middle school), and ≥ 9 years (high school or higher). To control for differential purchasing power across the households, household income per capita was categorised into tertiles (low, medium, and high groups).

In addition, I considered socio-demographic variables including child age, gender, and region of residence to control for unobserved geographic variations in cultural factors related to food consumption and food prices, which may influence nutritional status. An urbanization index was produced for each community (village or neighbourhood)⁴ according to a range of community-level data from the CHNS.

⁴ Each community (village or neighbourhood) is a government-designated administrative district, not a natural population cluster.

Additionally, regional dummy variables were created according to the geographical and socio-economic variation. Detailed information was provided in Chapter 3.

The sample was restricted to complete cases for the nutritional outcomes and predictors considered in the analysis. The sample size of children under 18 years of age was 3533 nested in 2097 households clustered in 163 villages with 6422 observations.

4.3 Results

Tables 4.5 and 4.6 report the prevalence of being stunted, underweight and overweight for rural children younger than 6 years, and for those between 6-17 years in China. Tables 4.7 and 4.8 present six scenarios of childhood malnutrition for young children and school-aged children in rural China. Tables 4.9 and 4.10 show four scenarios of malnutrition: normal nutrition, under-nutrition (stunted and underweight), over-nutrition (overweight only), and the paradox of malnutrition (stunted overweight).

The findings presented in Table 4.5 show that the prevalence of stunting decreased from 35.03% in 1997 to 16.27% in 2009 for young children, while for school-aged children this prevalence declined from 32.69% to 14.45% (Table 4.6). Children of school age experienced a downward trend in underweight prevalence and an upward trend in overweight prevalence. Overweight has become a major public nutritional challenge for rural children regardless of age group. In these data, the prevalence of stunted overweight/underweight among young children was higher than that among school children (Tables 4.7 and 4.8).

There was substantial regional variation in childhood malnutrition in terms of being stunted, underweight and overweight. The mountainous southern areas, the most deprived of the survey regions, had the highest prevalence of childhood stunting (42.86% for children under 6 years and 39.24% for school-aged children) and underweight (15.38% for young children and 8.45% for school-aged children), and the lowest overweight prevalence (23.08% for preschool age and 5.26% for school age) among the four regions as shown in Tables 4.5 and 4.6. The prevalence of being stunted overweight (13%) and stunted underweight (12.09%) among young children remained highest in the southern region (Table 4.7). The coastal areas, the most economically developed in the survey, had the highest prevalence of overweight

children regardless of age group among all the survey regions. For children aged 6-17 years, the prevalence of being stunted overweight (5.02%) was higher in the coastal regions than anywhere else (Table 4.8).

Tables 4.9 and 4.10 show that children from more urbanized villages were more likely to suffer from over-nutrition (i.e., overweight) and less likely to suffer from under-nutrition (i.e., stunted and underweight) compared with children from less urbanized communities. The least urbanized villages had the highest prevalence of being stunted overweight of children among all the villages surveyed, regardless of age group. Stunted overweight was more prevalent in young children under 6 years than among children of school age. Young girls (25.47%) were more likely to suffer from under-nutrition (stunting and underweight) than young boys (20.65%). However, when children grow up school-aged boys (25.17%) tended to have a higher prevalence of under-nutrition than girls of school age (21.79%). Young children from low-income families were more likely to be stunted and overweight at the same time than children from higher-income families. Children from highest-income families tended to have the highest prevalence of over-nutrition and lowest prevalence of under-nutrition, regardless of age group. There was no distinguishable difference in the prevalence of over-nutrition (i.e., overweight) and under-nutrition (i.e., stunted and underweight) between children who were left behind and children from intact families in rural China.

4.4 Conclusions

This chapter explores the patterns and determinants of childhood under- and over-nutrition in rural China. Under-nutrition among children has decreased over time while over-nutrition appears to become a public health concern. Household income seems to be associated with decreased risk of under-nutrition and increased risk of over-nutrition. There are substantial regional disparities (regions of residence and degrees of urbanisation of the village) in childhood over-nutrition and under-nutrition across rural China. These results may suggest that improving household environments as well as living environments from wider context can be important to enhance rural children's nutritional status.

Table 4-5 Sample size and distribution of rural children under 6 years across stunting, underweight and overweight from the CHNS, 1997-2009

Variables	Sample size	Three nutritional outcomes		
		Stunting (reference: not stunting)	Underweight (reference: not underweight)	Overweight (reference: not overweight)
Sample size	1388 (%)	1388(%)	1388(%)	1388(%)
Gender				
Boy	799 (57.56)	218 (27.28)	61 (7.63)	219 (27.41)
Girl	589 (42.44)	182 (30.90)	71 (12.05)	173 (29.37)
Left behind				
No	1145 (82.49)	333 (29.08)	113 (9.87)	328 (28.65)
Yes	243 (17.51)	67 (27.57)	19 (7.82)	64 (26.34)
Household income per capita				
Lowest	456 (32.85)	156 (34.21)	51 (11.18)	133 (29.17)
Middle	441 (31.77)	146 (33.11)	49 (11.11)	128 (29.02)
Highest	491 (35.37)	98 (19.96)	32 (6.52)	131 (26.68)
Maternal education				
Illiterate	80 (5.76)	37 (9.25)	11 (8.33)	24 (6.12)
Primary school	541 (38.98)	184 (46.00)	63 (47.73)	136 (34.69)
Middle school	655 (47.19)	156 (39.00)	51 (38.64)	204 (52.04)
High school or above	112 (8.07)	23 (5.75)	7 (5.30)	28 (7.14)
Urbanization index				
Lowest	470 (33.86)	136 (28.94)	39 (8.30)	137 (29.15)
Middle	415 (29.90)	128 (30.84)	36 (8.67)	106 (25.54)
Highest	503 (36.24)	136 (27.82)	57 (11.33)	149 (29.62)
Region				
South	546 (39.34)	234 (42.86)	84 (15.38)	126 (23.08)
Coastal	156 (11.24)	26 (16.67)	3 (1.92)	60 (38.46)
Northeast	260 (18.73)	30 (11.54)	8 (3.08)	84 (32.31)
Central	426 (30.69)	110 (25.82)	37 (8.69)	122 (28.64)
Wave				
1997	294 (21.18)	103 (35.03)	28 (9.52)	80 (27.21)
2000	276 (19.88)	104 (37.68)	32 (11.59)	75 (27.17)
2004	269 (19.38)	85 (31.60)	25 (9.29)	86 (31.97)
2006	254 (18.30)	60 (23.62)	27 (10.63)	86 (33.86)
2009	295 (21.25)	48 (16.27)	20 (6.78)	65 (22.03)

Table 4-6 Sample size and distribution of rural children aged 6-17 across stunting, underweight and overweight from the CHNS, 1997-2009

Variables	Sample size	Three nutritional outcomes		
		Stunting (reference: not stunting)	Underweight (reference: not underweight)	Overweight (reference: not overweight)
Sample size	5034(%)	5034(%)	5034(%)	5034(%)
Gender				
Boy	2698 (53.60)	714 (26.46)	118 (4.37)	254 (9.41)
Girl	2336 (46.40)	526 (22.52)	109 (4.67)	292 (12.50)
Left behind				
No	4451 (88.42)	1113 (25.01)	198 (4.45)	491 (11.03)
Yes	583 (11.58)	127 (21.78)	29 (4.97)	55 (9.43)
Household income per capita				
Lowest	1685 (33.47)	513 (30.45)	94 (5.58)	170 (10.09)
Middle	1700 (33.77)	475 (27.94)	88 (5.18)	150 (8.82)
Highest	1649 (32.76)	252 (15.28)	45 (2.73)	226 (13.71)
Maternal education				
Illiterate	676 (13.43)	237 (19.11)	50 (22.03)	62 (11.36)
Primary school	1963 (38.99)	540 (43.55)	104 (45.81)	184 (33.70)
Middle school	1936 (38.46)	379 (30.56)	62 (27.31)	242 (44.32)
High school or above	459 (9.12)	84 (6.77)	11 (4.85)	58 (10.62)
Urbanization index				
Lowest	1682 (33.41)	495 (29.43)	62 (3.69)	171 (10.17)
Middle	1717 (34.11)	441 (25.68)	103 (6.00)	153 (8.91)
Highest	1635 (32.48)	304 (18.59)	62 (3.79)	222 (13.58)
Region				
South	1598 (31.74)	627 (39.24)	135 (8.45)	84 (5.26)
Coastal	777 (15.44)	142 (18.28)	7 (0.90)	162 (20.85)
Northeast	907 (18.02)	90 (9.92)	9 (0.99)	128 (14.11)
Central	1752 (34.80)	381 (21.75)	76 (4.34)	172 (9.82)
Wave				
1997	1514 (30.08)	495 (32.69)	86 (5.68)	132 (8.72)
2000	1351 (26.84)	356 (26.35)	65 (4.81)	118 (8.73)
2004	880 (17.48)	175 (19.89)	35 (3.98)	106 (12.05)
2006	680 (13.51)	126 (18.53)	23 (3.38)	90 (13.24)
2009	609 (12.10)	88 (14.45)	18 (2.96)	100 (16.42)

Table 4-7 Sample size and distribution of rural children aged under 6 years across malnutrition in six scenarios from the CHNS, 1997-2009

Variables	Sample sizes	Malnutrition in six scenarios					
		1 Normal	2 Stunting only	3 Overweight only	4 Stunting overweight	5 Underweight only	6 Stunting underweight
Sample size	1388	694	164	245	134	49	102
	<i>n (%)</i>				<i>n (%)</i>		
Gender							
Boy	799 (57.56)	424(53.07)	93(11.64)	134(16.77)	76(9.51)	23(2.88)	49(6.13)
Girl	589 (42.44)	270(45.84)	71(12.05)	111(18.85)	58(9.85)	26(4.41)	53(9.00)
Left behind							
No	1145 (82.49)	569(49.69)	132(11.53)	205(17.90)	113(9.87)	38(3.32)	88(7.69)
Yes	243 (17.51)	125(51.44)	32(13.17)	40(16.46)	21(8.64)	11(4.53)	14(5.76)
Household income per capita							
Lowest	456 (32.85)	207 (29.83)	63 (38.41)	78 (31.84)	51 (38.06)	15 (30.61)	42 (41.18)
Middle	441 (31.77)	206 (29.68)	58 (35.37)	72 (29.39)	50 (37.31)	17 (34.69)	38 (37.25)
Highest	491 (35.37)	281 (40.49)	43 (26.22)	95 (38.78)	33 (24.63)	17 (34.69)	22 (21.57)
Maternal education							
Illiterate	80 (5.76)	31 (4.47)	16 (9.76)	11 (4.49)	11 (8.21)	1 (2.04)	10 (9.80)
Primary school	541 (38.98)	260 (37.46)	78 (47.56)	75 (30.61)	59 (44.03)	22 (44.90)	47 (46.08)
Middle school	655 (47.19)	334 (48.13)	62 (37.80)	141 (57.55)	55 (41.04)	24 (48.98)	39 (38.24)
High school or above	112 (8.07)	69 (9.94)	8 (4.88)	18 (7.35)	9 (6.72)	2 (4.08)	6 (5.88)
Urbanization index							
Lowest	470 (33.86)	240(51.06)	53(11.28)	80(17.02)	54(11.49)	14(2.98)	29(6.17)
Middle	415 (29.90)	209(50.36)	62(14.94)	65(15.66)	39(9.40)	13(3.13)	27(6.51)
Highest	503 (36.24)	245(48.71)	49(9.74)	100(19.88)	41(8.15)	22(4.37)	46(9.15)
Region							
South	546 (39.34)	240(43.96)	97(17.77)	49(8.97)	71(13.00)	23(4.21)	66(12.09)
Coastal	156 (11.24)	85(54.49)	8(5.13)	45(28.85)	15(9.62)	0	3(1.92)
Northeast	260 (18.73)	154(59.23)	11(4.23)	69(26.54)	15(5.77)	7(2.69)	4(1.54)
Central	426 (30.69)	215(50.47)	48(11.27)	82(19.25)	33(7.75)	19(4.46)	29(6.81)
Wave							
1997	294 (21.18)	138(46.94)	46(15.65)	44(14.97)	34(11.56)	9(3.06)	23(7.82)
2000	276 (19.88)	125(45.29)	45(16.30)	41(14.86)	33(11.96)	6(2.17)	26(9.42)
2004	269 (19.38)	121(44.98)	37(13.75)	57(21.19)	27(10.04)	6(2.23)	21(7.81)
2006	254 (18.30)	120(47.24)	18(7.09)	59(23.23)	23(9.06)	15(5.91)	19(7.48)
2009	295 (21.25)	190(64.41)	18(6.10)	44(14.92)	17(5.76)	13(4.41)	13(4.41)

Table 4-8 Sample size and distribution of rural children aged 6-17 years across malnutrition in six scenarios from the CHNS, 1997-2009

Variables	Sample sizes	Malnutrition in six scenarios					
		1 Normal	2 Stunting only	3 Overweight only	4 Stunting overweight	5 Underweight only	6 Stunting underweight
Sample size	5034	3300	933	434	112	60	195
	<i>n (%)</i>				<i>n (%)</i>		
Gender							
Boy	2698 (53.60)	1765(65.42)	545(20.20)	196(7.26)	58(2.15)	23(0.85)	111(4.11)
Girl	2336 (46.40)	1535(65.71)	388(16.61)	238(10.19)	54(2.31)	37(1.58)	84(3.60)
Left behind							
No	4451 (88.42)	2898(65.11)	840(18.87)	387(8.69)	104(2.34)	53(1.19)	169(3.80)
Yes	583 (11.58)	402(68.95)	93(15.95)	47(8.06)	8(1.37)	7(1.20)	26(4.46)
Household income per capita							
Lowest	1685 (33.47)	1018 (30.85)	392 (42.02)	129 (29.72)	41 (36.61)	25 (41.67)	80 (41.03)
Middle	1700 (33.77)	1098 (33.27)	357 (38.26)	109 (25.12)	41 (36.61)	18 (30.00)	77 (39.49)
Highest	1649 (32.76)	1184 (35.88)	184 (19.72)	196 (45.16)	30 (26.79)	17 (28.33)	38 (19.49)
Maternal education							
Illiterate	676 (13.43)	393 (11.91)	170 (18.22)	39 (8.99)	23 (20.54)	7 (11.67)	44 (22.56)
Primary school	1963 (38.99)	1252 (37.94)	412 (44.16)	145 (33.41)	39 (34.82)	26 (43.33)	89 (45.64)
Middle school	1936 (38.46)	1334 (40.42)	285 (30.55)	201 (46.31)	41 (36.61)	22 (36.67)	53 (27.18)
High school or above	459 (9.12)	321 (9.73)	66 (7.07)	49 (11.29)	9 (8.04)	5 (8.33)	9 (4.62)
Urbanization index							
Lowest	1682 (33.41)	1047(62.25)	391(23.25)	116(6.90)	55(3.27)	24(1.43)	49(2.91)
Middle	1717 (34.11)	1134(66.05)	322(18.75)	127(7.40)	26(1.51)	15(0.87)	93(5.42)
Highest	1635 (32.48)	1119(68.44)	220(13.46)	191(11.68)	31(1.90)	21(1.28)	53(3.24)
Region							
South	1598 (31.74)	891(55.76)	481(30.10)	59(3.69)	25(1.56)	21(1.31)	121(7.57)
Coastal	777 (15.44)	509(65.51)	98(12.61)	123(15.83)	39(5.02)	3(0.39)	5(0.64)
Northeast	907 (18.02)	699(77.07)	65(7.17)	111(12.24)	17(1.87)	7(0.77)	8(0.88)
Central	1752 (34.80)	1201(68.55)	289(16.50)	141(8.05)	31(1.77)	29(1.66)	61(3.48)
Wave							
1997	1514 (30.08)	909(60.04)	380(25.10)	90(5.94)	42(2.77)	20(1.32)	73(4.82)
2000	1351 (26.84)	889(65.80)	272(20.13)	89(6.59)	29(2.15)	17(1.26)	55(4.07)
2004	880 (17.48)	602(68.41)	130(14.77)	92(10.45)	14(1.59)	11(1.25)	31(3.52)
2006	680 (13.51)	474(69.71)	90(13.24)	74(10.88)	16(2.35)	6(0.88)	20(2.94)
2009	609 (12.10)	426(69.95)	61(10.02)	89(14.61)	11(1.81)	6(0.99)	16(2.63)

Table 4-9 Sample size and distribution of rural children aged under 6 years across malnutrition in four scenarios from the CHNS, 1997-2009

Variables	Sample sizes	Malnutrition in four scenarios			
		Normal	Under-nutrition (stunting and underweight)	Over-nutrition (Overweight only)	'Paradox' (Stunting overweight)
Sample size	1388	694	315	245	134
	<i>n(%)</i>			<i>n(%)</i>	
Gender					
Boy	799 (57.56)	424(53.07)	165(20.65)	134(16.77)	76(9.51)
Girl	589 (42.44)	270(45.84)	150(25.47)	111(18.85)	58(9.85)
Left behind					
No	1145 (82.49)	569(49.69)	258(22.53)	205(17.90)	113(9.87)
Yes	243 (17.51)	125(51.44)	57(23.46)	40(16.46)	21(8.64)
Household income per capita					
Lowest	456 (32.85)	207 (29.83)	120 (38.10)	78 (31.84)	51 (38.06)
Middle	441 (31.77)	206 (29.68)	113 (35.87)	72 (29.39)	50 (37.31)
Highest	491 (35.37)	281 (40.49)	82 (26.03)	95 (38.78)	33 (24.63)
Maternal education					
Illiterate	80 (5.76)	31 (4.47)	27 (8.57)	11 (4.49)	11 (8.21)
Primary school	541 (38.98)	260 (37.46)	147 (46.67)	75 (30.61)	59 (44.03)
Middle school	655 (47.19)	334 (48.13)	125 (39.68)	141 (57.55)	55 (41.04)
High school or above	112 (8.07)	69 (9.94)	16 (5.08)	18 (7.35)	9 (6.72)
Urbanization score					
Lowest	470 (33.86)	240(51.06)	96(20.43)	80(17.02)	54(11.49)
Middle	415 (29.90)	209(50.36)	102(24.58)	65(15.66)	39(9.40)
Highest	503 (36.24)	245(48.71)	117(23.26)	100(19.88)	41(8.15)
Region					
South	546 (39.34)	240(43.96)	186(34.07)	49(8.97)	71(13.00)
Coastal	156 (11.24)	85(54.49)	11(7.05)	45(28.85)	15(9.62)
Northeast	260 (18.73)	154(59.23)	22(8.46)	69(26.54)	15(5.77)
Central	426 (30.69)	215(50.47)	96(22.54)	82(19.25)	33(7.75)
Wave					
1997	294 (21.18)	138(46.94)	78(26.53)	44(14.97)	34(11.56)
2000	276 (19.88)	125(45.29)	77(27.90)	41(14.86)	33(11.96)
2004	269 (19.38)	121(44.98)	64(23.79)	57(21.19)	27(10.04)
2006	254 (18.30)	120(47.24)	52(20.47)	59(23.23)	23(9.06)
2009	295 (21.25)	190(64.41)	44(14.92)	44(14.92)	17(5.76)

Table 4-10 Sample size and distribution of rural children aged 6-17 years across malnutrition in four scenarios from the CHNS, 1997-2009

Variables	Sample sizes	Malnutrition in four scenarios			
		Normal	Under-nutrition (stunting and underweight)	Over-nutrition (Overweight only)	'Paradox' (Stunting overweight)
Sample size	5034	3300	1188	434	112
	<i>n(%)</i>			<i>n(%)</i>	
Gender					
Boy	2698 (53.60)	1765(65.42)	679(25.17)	196(7.26)	58(2.15)
Girl	2336 (46.40)	1535(65.71)	509(21.79)	238(10.19)	54(2.31)
Left behind					
No	4451 (88.42)	2898(65.11)	1062(23.86)	387(8.69)	104(2.34)
Yes	583 (11.58)	402(68.95)	126(21.61)	47(8.06)	8(1.37)
Household income per capita					
Lowest	1685 (33.47)	1018 (30.85)	497 (41.84)	129 (29.72)	41 (36.61)
Middle	1700 (33.77)	1098 (33.27)	452 (38.05)	109 (25.12)	41 (36.61)
Highest	1649 (32.76)	1184 (35.88)	239 (20.12)	196 (45.16)	30 (26.79)
Maternal education					
Illiterate	676 (13.43)	393 (11.91)	221 (18.60)	39 (8.99)	23 (20.54)
Primary school	1963 (38.99)	1252 (37.94)	527 (44.36)	145 (33.41)	39 (34.82)
Middle school	1936 (38.46)	1334 (40.42)	360 (30.30)	201 (46.31)	41 (36.61)
High school or above	459 (9.12)	321 (9.73)	80 (6.73)	49 (11.29)	9 (8.04)
Urbanization score					
Lowest	1682 (33.41)	1047(62.25)	464(27.59)	116(6.90)	55(3.27)
Middle	1717 (34.11)	1134(66.05)	430(25.04)	127(7.40)	26(1.51)
Highest	1635 (32.48)	1119(68.44)	294(17.98)	191(11.68)	31(1.90)
Region					
South	1598 (31.74)	891(55.76)	623(38.99)	59(3.69)	25(1.56)
Coastal	777 (15.44)	509(65.51)	106(13.64)	123(15.83)	39(5.02)
Northeast	907 (18.02)	699(77.07)	80(8.82)	111(12.24)	17(1.87)
Central	1752 (34.80)	1201(68.55)	379(21.63)	141(8.05)	31(1.77)
Wave					
1997	1514 (30.08)	909(60.04)	473(31.24)	90(5.94)	42(2.77)
2000	1351 (26.84)	889(65.80)	344(25.46)	89(6.59)	29(2.15)
2004	880 (17.48)	602(68.41)	172(19.55)	92(10.45)	14(1.59)
2006	680 (13.51)	474(69.71)	116(17.06)	74(10.88)	16(2.35)
2009	609 (12.10)	426(69.95)	83(13.63)	89(14.61)	11(1.81)

Chapter 5 Does the timing of parental migration matter for child growth? A life course study on left-behind children in rural China

Chapters 5-8 present four papers which address specific issues regarding parental migration, care-giving practices and left-behind children's nutritional health in rural China. This chapter presents the first quantitative paper using a life course approach and growth curve models to examine the long-term associations between being left behind due to parental migration and left-behind children's physical growth including height growth and weight gain. This paper focuses on the physical growth outcomes of children, which is an important public health indicator for monitoring nutritional status among children. The key exposure in this paper is being left behind at different stages of childhood, which allows for testing the accumulation and critical period life course hypotheses.

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Does the timing of parental migration matter for child growth?

A life course study on left-behind children in rural China

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5.1 Abstract

Background

China's unprecedented internal migration has left 61 million rural children living apart from parents. This study investigates how being left behind is associated with children's growth, by examining children's height and weight trajectories by age, testing the accumulation and critical period life course hypotheses.

Methods

Data were drawn from five waves of the China Health and Nutrition Survey (CHNS). Multiple cohorts of children under 6 years old from 1997 to 2009 were examined (N=2,555). Growth curve models investigated whether height and weight trajectories differ for children who were left behind at different stages of the life course: in early childhood (from ages 0 to 5 but not afterwards), in later childhood (from ages 6 to 17 only), and in both early and later childhood (from ages 0 to 5 and from ages 6 to 17), compared to their peers from intact households.

Results

Boys who were left behind at different life stages of childhood differed in height and weight growth compared with boys from intact families. No significant associations were found for girls. As young boys turned into adolescents, those left behind in early childhood tended to have slower height growth and weight gain than their peers from intact households. There was a 2.8 cm difference in the predicted heights of boys who were left behind in early childhood compared to boys from intact households, by the age of 14. Similarly, the difference in weight between the two groups of boys was 5.3 kg by the age of 14.

Conclusions

Being left behind during early childhood, as compared to not being left behind, could lead to slower growth rates of height and weight for boys. The life course approach adopted in this study suggests that early childhood is a critical period of children's growth in later life, especially for boys who are left behind. The gender paradox in

China, where sons are preferred, but being left behind appears to affect boys more than girls, needs further exploration.

Keywords

Internal migration, Left-behind children, Nutritional status, China, Life course

5.2 Background

China's unprecedented internal migration has left around 61 million rural children under 18 years of age living apart from either one or both parents, which accounts for 37.7% of total rural children, and for 21.9% of all children throughout China (All-China Women's Federation 2013). A growing number of cross-sectional studies suggest that left-behind children (LBC) in rural China are more likely to undergo restricted growth (i.e., stunting and underweight) than non-left-behind children (non-LBC) from intact families (Chen et al. 2011; Wei et al. 2011; Duan et al. 2009; Mou et al. 2009; Luo et al. 2008). However, one survey in rural Southern China indicates that there are no differences in height between LBC and non-LBC aged 10-18, although LBC tend to be more likely to be overweight and/or obese than their peers (Gao et al. 2010). Although they provide interesting findings, these studies are based on cross-sectional data and focus on relatively narrow age ranges, failing to capture the effects of parental migration on children's nutritional health as they grow. They also confound age and cohort effects, and are prone to selection bias due to lack of adequate control for individual-level heterogeneity (Singer and Willett 2003).

The limited longitudinal studies on LBC and growth report conflicting associations between parental migration and children's nutritional health. A longitudinal analysis of the China Health and Nutrition Survey (CHNS) indicates that parental migration does not appear to significantly affect children's overweight status, while older children (aged 7-12) of migrant parents are more likely to be underweight, as compared to non-left-behind peers (de Brauw and Mu 2011). In a later study examining the same dataset, Mu and de Brauw (2015) investigate the impact of parental migration on nutritional status of children aged under 5 at baseline who were followed up in terms of height-for-age Z-scores (HAZ) and weight-for-age Z-scores (WAZ) and show that parental migration does not significantly affect young children's HAZ, but it improves their WAZ. Although these studies improve on the cross-sectional limitations of early studies, both use fixed effects models that only

analyse within-child change in height and weight, rather than between-child differences, failing to detect heterogeneity in growth between children according to their left behind status. This is an important limitation, as differences between LBC and children from intact households may increase as they get older.

Another limitation of existing longitudinal studies is the lack of consideration given to life course effects, as they fail to distinguish between the effects of parental migration at a critical period of the children's life course (for example, during pre-school years), and do not investigate whether the effects of parental migration accumulate over the children's life course, if they are left behind during separate spells as they grow up (Spallek et al. 2011). It may be hypothesised that being left behind at a younger age (for example, when under 6 years of age before the children start school) may have a stronger adverse effect on children's subsequent growth than being left behind at later stages of childhood — a so-called 'critical period hypothesis' (Barker 1998). On the other hand, the effects of being left behind on children's nutritional health may accumulate throughout the child's life course, as argued by the accumulation hypothesis (Kuh et al. 2003). According to the accumulation hypothesis, being left behind by migrant parents in early and later childhood can have a cumulative effect on children's growth and development, and can therefore be more detrimental than being left behind during a critical period.

The aim of the present study is to address the previous limitations in the literature and to investigate the associations between being left behind at different stages of childhood and children's nutritional status in terms of physical development in relation to the accumulation and critical period hypotheses in life course epidemiology.

5.3 Methods

5.3.1 Data

The China Health and Nutrition Survey (CHNS) is an ongoing open cohort, international collaborative project between the Carolina Population Centre at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Centre for Disease Control and Prevention. It employs a multistage, random-clustered sampling process to draw a sample of about 4,400 households with a total of about 19,000 participants from over 200

communities or neighbourhoods in nine provinces, with the first round conducted in 1989. Although the CHNS is not a nationally representative sample (Popkin et al. 2010), the counties within selected provinces were chosen to represent a range of income level, and provinces vary substantially in geography, economic development, public resources, and health indicators.

The survey has been approved by the institutional review committees from the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Food Safety, China Centre for Disease Control and Prevention. All participants and/or their parents/guardians provided written informed consent for their participation in the survey.

5.3.2 Target population

This study used data from the five waves of the CHNS, collected in 1997, 2000, 2004, 2006, and 2009. The status of being left behind was operationalised using the household roster: from 1997 onwards, if one household member in a previous round of the CHNS was not residing in the same household in the current survey, the respondent was asked for the reasons for his/her absence. In this study, children under 18 years old whose parent(s) have left the home to seek employment elsewhere are defined as LBC. Children varying in age (between 0 and 6) were recruited in 1997 and then followed up for 12 years up to 2009, by drawing on accelerated longitudinal designs (Collins 2006). This allows us to explore age-outcome trajectories over a broader age span (between 0 and 18) during a relatively shorter study period (from 1997 to 2009). In addition, we also followed up multiple cohorts of the age range between 0 and 6 in 2000, 2004, 2006 and 2009. Multiple cohorts at different waves included not only new-born eligible children, but also a new province that was added from 2000, and villages lost to follow-up returned in later waves (Popkin et al. 2010). Children with non-missing values on outcome variables and key predictors were kept in the analysis, yielding a total sample of 1,231 children with 2,555 observations.

5.3.3 Variables

Child growth is an important public health indicator for monitoring nutritional status and health among children (De Onis and Blössner 2003). Poor nutritional health, regardless of its aetiological origins, can affect growth to some extent (De Onis and

Habicht 1996). Anthropometric measurement (e.g., height and weight) is highly recommended to assess nutritional status for children and adolescents (World Health Organization 1995). The CHNS recorded height and weight for each individual within the household, measured by health professionals. Height and weight were used as outcome variables.

To examine critical period and cumulative effects, we created a four-category time-invariant variable to indicate at which stage of childhood years the child was left behind, ranging from ages 0 to 17: children from intact households who were never left behind and were the reference group; children who were left behind only in early childhood, from ages 0 to 5, but not in later childhood during school years, from ages 6 to 17; children who were left behind in both early and later childhood; and children who were left behind only in later childhood, from ages 6 to 17, but not from ages 0 to 5.

We adjusted for a range of demographic and socioeconomic factors, including age, gender, insurance status (whether a child has insurance or not), only child (whether a child is the only child within a household), household size, annual household income per capita, maternal education (the number of years of formal education completed), and maternal height and weight. We also included wave dummies and province dummies to capture time and geographical effects respectively.

Given the possible recall bias in income data from CHNS, we created a household asset score using principal component analysis on the household items that mainly included having a colour television, washing machine, air conditioner, tap water, and flush toilet. This asset score was used as a measure of socio-economic status for each household at each time point from 1997 to 2009. Compared with household income or expenditure data, asset-based measures of socio-economic status are more reflective of longer-term household wealth or living standards (Filmer and Pritchett 2001; Vyas and Kumaranayake 2006).

5.3.4 Analysis

Growth curve models, which model individual differences in change/growth over time, are appropriate to use with data where repeated measurement occasions are clustered within participants (Singer and Willett 2003) because they take into account the dependence of residuals due to covariance between the levels in the data.

Failure to account for the inter-dependence of residuals can underestimate standard errors, leading to biased estimates. A key advantage of growth curve models is that they can be estimated in the presence of unbalanced and incomplete data under a Missing At Random (MAR) assumption (missingness is not associated with the value of missing variable itself but associated with other observed variables) (Curran et al. 2010). All children whose height or weight was measured on at least one occasion were included in the analysis. Only missing occasions were automatically removed from growth curve models, rather than children with any missing data.

The growth curve models can be expressed by equations at two levels and fitted by using MLwiN Version 2.28 (Rasbash et al. 2013), within multiple occasions (Level 1) nested within children (Level 2) over time. We also run three-level models further accounting for household level (Level 3) as there may be more than one child within the same household. And the household-level clustering effects were found to be relatively small and statistically insignificant. Hence we reported two-level growth curve models in this paper and assumed that the household clustering effects are negligible. Children's age was used as the indicator of time metric. In order to facilitate parameter interpretation, we centred age at the grand mean.

The individual growth model or level (1) submodel takes the following form:

$$H_{ij} = \pi_{0j} + \pi_{1j}Age_{ij} + \pi_{2j}Age_{ij}^2 + \pi_3 D_{ij} + \varepsilon_{ij} \quad (1)$$

Where H_{ij} is the nutritional status in terms of height and weight measured for the j th ($j=1,2,\dots,N$) child at occasion i ($i=1, 2,\dots,T$). Use of a quadratic function, Age_{ij} and Age_{ij}^2 allows for non-linear changes so that the effects of age on H_{ij} can increase or decrease over time. π_{0j} denotes j th child's nutritional status at mean age. π_{1j} captures linear growth rate and π_{2j} captures the curvilinearity of the growth trajectory and are allowed to vary between children, so that the model estimates different growth curves for each child. D_{ij} represents a set of time-varying covariates; its effects on children's nutritional status are denoted as π_3 . ε_{ij} is the Level-1 residuals.

We would expect that the children's nutritional status at mean age is likely to be confounded by background time-invariant predictors that bear on children's

nutritional status, such as only child, and being left behind at different stages of childhood.

The level (2) submodel can be written as:

$$\pi_{0j} = \pi_{00} + \pi_{01}X_j + \pi_{02}M_j + U_{0j} \quad (2.1)$$

where π_{00} indicates the average nutritional status at mean age. X_j represents other time-invariant covariates at the individual level, other than being left behind at different stages, and π_{01} represents its effects on children's nutritional status at the mean age. M_j is a four-category time-invariant variable denoting the stage of childhood when the child was left behind: the reference group is children from intact families who were never left behind; and another three categories refer to children who were left behind in early childhood only, children who were left behind in both early and later childhood, and children who were left behind in later childhood only respectively. π_{02} represents its effects on children's nutritional status at mean age. U_{0j} represents how the j th child's nutritional status at mean age deviates from the average initial level π_{00} .

To examine whether growth rates of nutritional status differ between children left behind at different stages of childhood compared to children from intact families, we estimate the interactions between the left behind stage variables and children's age (linear and quadratic terms).

The Level-2 submodels for growth rates take the following forms:

$$\pi_{1j} = \pi_{10} + \pi_{12}M_j + U_{1j} \quad (2.2)$$

$$\pi_{2j} = \pi_{20} + \pi_{22}M_j + U_{2j} \quad (2.3)$$

Where π_{12} and π_{22} indicate non-linear associations between being left behind at different stages of childhood and growth rates of children's nutritional status. U_{1j} and U_{2j} are individual-specific random effects: U_{1j} and U_{2j} indicating how the linear growth rate and the quadratic growth rate vary in accordance with the average linear growth term π_{10} and the average quadratic growth rate π_{20} respectively at the mean age.

The model assumptions are expressed as:

$$\varepsilon_{ij} \sim N(0, \sigma^2) \quad (3.1)$$

$$\begin{pmatrix} U_{0j} \\ U_{1j} \\ U_{2j} \end{pmatrix} \sim N \left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_0^2 & \sigma_{10} & \sigma_{20} \\ \sigma_{10} & \sigma_1^2 & \sigma_{21} \\ \sigma_{20} & \sigma_{21} & \sigma_2^2 \end{bmatrix} \right\} \quad (3.2)$$

$$\text{Cov}(\varepsilon_{ij}, U_{0j}) = 0, \text{Cov}(\varepsilon_{ij}, U_{1j}) = 0, \text{Cov}(\varepsilon_{ij}, U_{2j}) = 0$$

where Level-1 residuals ε_{ij} are assumed to follow a normal distribution, Level-2 residuals U_{0j} , U_{1j} , and U_{2j} are assumed to follow a multivariate normal distribution, and Level-1 residuals are independent of Level-2 residuals. Equation 3.2 presents variance-covariance matrix among the Level-2 residuals. σ_0^2 , σ_1^2 , and σ_2^2 denote variances for children's nutritional status at mean age, the average linear growth rate, and the average quadratic growth rates, respectively. σ_{10} and σ_{20} indicate covariances for children's nutritional status with linear and quadratic growth rates. σ_{20} represents covariance between linear and quadratic growth rates.

The better fit of the models is associated with lower values in -2 log likelihood statistics. Nested models are compared through deviance statistics (difference in -2 log likelihood) over the difference in degrees of freedom using an ordinary chi-square distribution (Singer and Willett 2003). A significant difference between two nested models indicates that the models with the lowest value have a better fit to the data. Given the sex difference in physical development (Sinclair and Dangerfield 1998), we perform subgroup analyses based on stratification by gender for boys and girls separately.

5.4 Results

Table 5.1 describes the nutritional outcomes in terms of height and weight, and socio-economic characteristics of boys and girls aged 0-17 from 1997 to 2009. In general, boys were more likely than girls to be the only child within a household. Boys were more likely than girls to be left behind in early childhood except in 1997 and 2004. Children's economic status in terms of household income per capita and asset score improved over time, and girls tended to be better off than boys. There were no significant gender differences for height, weight and age.

Table 5.2 presents the coefficients and standard errors of the quadratic growth curve models (with age and age² terms) of height separately for boys and girls. Among boys, Model 1 shows that boys from intact families were 115.7 cm tall on average at the age of 7, and grew about 6.4 cm (6.58-0.14) from age 7 to 8. Being left behind at different stages of childhood was significantly associated with height ($p < 0.01$) and the interactions with the linear and quadratic terms denoting children's age were also significant ($p = 0.01$). Furthermore, the interactions between being left behind and the age terms remained significant even after adjusting for a range of socio-economic and socio-demographic confounders ($p < 0.01$) (Model 2). The predicted heights for boys at different ages from Model 2, Table 5.2 are shown in Figure 5.1. On average, by teenage years, boys who were left behind before the age 6 appeared to grow not as tall as boys who were never left behind. By the age of 14, boys who were never left behind were 153.7 cm tall, on average, while boys who were left behind before the age of 6 were only 150.9 cm tall. Another measure of the difference between the two groups of boys was the average age by which they reached a height of 150 cm—13.1 years for boys who were never left behind and 13.7 years for boys who were left behind in early childhood. Boys who were left behind in later childhood (after the age of 6) also were not as tall as boys who were never left behind by the age of 14, although this difference was not as large as the difference between those left behind at an early age and those never left behind. Boys who were left behind in both early and later childhood periods had the most favourable height growth trajectory. But this group was small ($N = 78$), thus our estimate may be unreliable.

For girls, being left behind was not significantly associated with height, nor were there any significant interactions with age and age square (Table 5.2). The predicted heights for girls (Figure 5.2) suggested girls who were left behind before the age of 6 were shorter, on average, than never left behind girls, by teenage years, although these differences were not significant.

A similar gender difference emerged for the trajectories of weight gain. Being left behind at different stages of childhood was significantly associated with lower weight gain among boys ($p = 0.03$ in Model 2, Table 5.3), but not among girls. Once again, boys who were left behind before the age of 6 had the slowest increase in weight by the age of 14 (36.7kg) compared to boys who were never left behind (42 kg), as shown in Figure 5.3. Boys who were never left behind had a weight of 36 kg,

by the age of 12.2 years, on average, while boys who were left behind in early childhood reached that weight when they turned 13.7 years old, on average. Boys who were left behind in later childhood also had slower weight gain trajectories than boys who were never left behind. Boys who were left behind in both early and later childhood periods had the most favourable weight increase trajectory. But as this was a small group (N=78), our estimate may be unreliable.

5.5 Discussion

The present study aimed to examine the importance of being left-behind on boys' and girls' height and weight growth, and to explore the accumulation and critical period hypotheses to the exposure of parental migration in children's nutritional status in terms of physical development. We found that boys from intact households tended to be better off in terms of height and weight growth compared to boys who were left behind only during early childhood, or only during later childhood, thus finding some support for the critical period hypothesis. There was a 2.8 cm difference in the predicted heights of boys who were left behind in early childhood compared to boys from intact households, by the age of 14. Similarly, the difference in weight between the two groups of boys was 5.3 kg by the age of 14. The accumulation hypothesis was not supported since the adverse effects of being left behind did not increase as the children aged. However, this finding should be treated with caution as the group of boys and girls who were left behind both in early and later childhood was very small (N=78 for boys and N=63 for girls).

Previous longitudinal evidence by drawing on CHNS data shows that parental migration does not affect young children's HAZ (aged under 5 years old at baseline and followed up once up to age 9), but it improves their WAZ (Mu and De Brauw 2015), and that LBC aged 7-12 are more likely to be underweight compared to their non-left-behind peers (de Brauw and Mu 2011). Our study suggests that being left behind in early childhood (from birth to 5 years old) can negatively affect boys' height and weight growth by adolescence. The discrepancy between our results and others' can partially derive from different age ranges of children, and nutritional outcomes. For example, our study targeted at children of a relatively wider age range, from birth to 18 years old, compared to other studies. We used height and weight as nutritional outcomes, rather than adjusted height and weight by age and gender, such

as HAZ and WAZ as they are less straightforward to interpret (Wang and Chen 2012). More importantly, previous studies (de Brauw and Mu 2011; Mu and De Brauw 2015) by using fixed effects models, tended to focus on within-child change of height and weight over relatively shorter time periods, but to neglect between-child differences regarding to their left behind status. These differences between LBC and children from intact households may increase with age with much larger gaps observed by a later stage of childhood (for example, by teenage years). The use of the life course approach in our study allows us to detect that being left behind in early childhood can lead to slower height growth and weight gain for boys by teenage years.

To our knowledge, the present study is the first attempt to employ a life course approach to explore the long-term associations between being left behind due to parental migration and children's nutritional status. A number of studies have consistently indicated that growth restriction in the early years of life often leads to several poor outcomes in adulthood (Grantham-McGregor et al. 2007; Mendez and Adair 1999; World Health Organization 1999; Jukes et al. 2002; McCarthy 1997). Accordingly, life course studies suggest that health inequalities in adulthood, to some extent, begin in the early years of life (Braveman and Barclay 2009; Hallqvist et al. 2004). These two aspects of the literature provide some insights into how being left behind can shape health across the life course. We identified that the pre-school ages, from birth to 5 years, constitute critical periods for the exposure to parental migration in height growth and weight gain for boys. That is, an early life health shock in terms of parental migration can have long-term adverse effects on children's nutritional outcomes.

Although no direct comparisons were made, we were still able to observe gender differences in the effects of being left behind at different stages on height and weight outcomes. For girls, being left behind at any time during childhood did not appear to affect their growth trajectories, while boys who were left behind in the preschool years had the slowest growth trajectories. This suggests that being left behind appears to be more detrimental for boys than girls. This may be partly attributed to the natural selection of physiological traits that increases female survival, which may render greater vulnerability of males to health insults such as parental migration in early life (Wells 2000). Some evidence, however, suggest the effect of parental

migration can be more detrimental for girls than for boys in the Chinese context. Parental migration results in increased physical workload (Ye and Pan 2011;Ye et al. 2005) and time use on farm work and domestic work for left-behind girls aged 7-14, but not for boys of the same age range (Chang et al. 2011a). Moreover, girls are more likely than boys to be disadvantaged in nutrient intakes due to China's 'son preference' norm, especially in rural areas (Ning and Chang 2013). Son preference in rural China contributes to additional height growth advantage for boys, and this effect becomes more pronounced in the teenage years (Song and Burgard 2008). Our study does not directly compare the effect of parental migration among boys and girls. Thus, there seems to a gender paradox in China, where sons are preferred, but being left behind appears to affect them more than girls. This needs further exploration.

The pathways through which migration affects children's growth can be complex and multi-factorial. For example, remittances from migrant parents can enhance LBC's economic status to improve access to healthcare services, healthy living environments, and nutritious food. However, one negative aspect of parental migration is family dissolution, which may expose LBC to adverse effects of psychological and emotional wellbeing (Shi 2011). These psychological symptoms may potentially affect dietary attitudes and cause unhealthy behavioural problems like smoking in adolescence, which could jeopardize LBC's nutritional status (Martyn-Nemeth et al. 2009;Hampl and Betts 1999;Hanson and Chen 2007;Dallongeville et al. 1998;Fryer et al. 1997). Unfortunately, we were not able to distinguish the different mechanisms through which migration affects children's nutritional status. Regardless of possible pathways, it can be useful and important to be able to identify and narrow down the specific ages at which the window of opportunity opens in order to facilitate interventions. Identifying the specific ages of critical period in childhood is a first step to design and deliver adequate interventions.

The limitations of this study mainly relate to data issues given that the CHNS was not originally designed to study internal migration and LBC. First, the study period we looked at is from 1997 to 2009, making use of five waves (1997, 2000, 2004, 2006 and 2009). We identified LBC according to the migration status of parents based on particular time points. However, parental migration status could have changed between waves, for example, old parental return or new parental migration

between two time points, which were not tracked by the CHNS. This could lead to an underestimation of the LBC sample. Furthermore, we might have underestimated the samples of children who were left behind only in later childhood (aged 6 to 17) and those left behind throughout childhood (aged 0 to 5 and aged 6-17). We focused on multiple cohorts (aged 0-6) at each wave but were unable to follow all of them up to age 18 due to the limited time span (from 1997 to 2009). Second, previous studies suggest that being left behind by different parents may have different impacts on children's nutritional status (Chen 2009;Guo 2012;Gao et al. 2010). The present study did not distinguish whether children are left behind by the father, the mother, or by both parents because of the small numbers in these categories. Third, even though we tried to adjust for as many relevant confounders as possible, there are still certain important time-varying factors that were not captured by the CHNS, including remittances from migrant parent(s) (McKenzie and Sasin 2007) as well as the care-giving arrangements for children left behind (United Nations Children's Fund 1998;United Nations Children's Fund 1990;Engle et al. 1999). This is particularly relevant for the children who were left behind at an early age—the families of such children may be much more disadvantaged than other groups of children and we may not have been able to adequately control for such disadvantage in our analyses.

And finally, one main limitation with this, and any longitudinal dataset, is missing data and sample attrition. In the CHNS, older children may not take part in later surveys, and school children who were in boarding schools, and who subsequently entered colleges and universities, may miss certain rounds of survey. Also, children may themselves migrate when aged above 16 years old (Popkin et al. 2010). Sample attrition and missing data could thus lead to biased results. We examined predictors of sample attrition and missingness in our study and found several variables that were related to attrition/missingness (results not shown), such as household income per capita, household size, child age, whether a child is the single child within his/her household, and asset score. These predictors could cause either downward or upward bias in our estimates. For example, it suggested that poorer children were more likely to drop out from subsequent surveys as they might have experienced more difficulties to participate. Given poorer children may have slower growth rates than richer children, so the attrition of poorer children can lead to a downward bias

in our estimate of the effect of being left behind on children's growth rates. We also found that children from larger families were less likely to drop out and a larger family size could be more detrimental to children's growth rates due to restricted resource allocation, so our estimates could have been overestimated. Therefore, we were unable to distinguish the exact direction of bias that was introduced by sample attrition and missingness in our estimates. This is a major limitation of this study. An accelerated longitudinal design enabled us to track age-outcome trajectories over the entire childhood (from ages 0 to 17) during a relatively shorter study period (from 1997 to 2009). However, one danger of an accelerated longitudinal design is that it assumes there are no age-by-cohort interaction effects; or in other words, it assumes that a single growth trajectory can represent all the cohorts (Collins 2006). In fact, such effects may arise due to demographic differences (i.e., age, family background) between cohorts, and perhaps due to effects of history (Miyazaki and Raudenbush 2000). We adjusted for time effects by adding multiple baseline waves to minimize cohort differences associated with historical time in the age-outcome relationship but data pooled from multiple cohorts ignoring demographic differences may lead to biased inferences.

5.6 Conclusion

Being left behind due to parental migration during early childhood, as compared to not being left behind, could lead to slower height growth and weight gain for boys. In contrast to previous findings that suggest contradicting effects of being left behind on children's growth, the life course approach adopted in this study suggests that early childhood is a critical period for children's growth in later life, especially for boys who are left behind. The gender paradox in China, where sons are preferred, but being left behind appears to affect boys more than girls, needs further exploration.

List of abbreviations

LBC, Left-behind children; Non-LBC, non-left-behind children; CHNS, China Health and Nutrition Survey; HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

NZ analysed the data, drafted and revised the paper. TC contributed to the conceptualization of the idea, interpreted the data, revised the paper, and supervised NZ. LB interpreted the results, reviewed drafts of the paper, and supervised NZ. All authors read and approved the final manuscript.

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Table 5-1 Characteristics and health outcomes of children aged 0-17 by gender in rural China from the CHNS, 1997-2009

	Wave					N
	1997	2000	2004	2006	2009	
Boys						
	<i>Proportion (%)</i>					
Only child*	37 (22.0)	55 (22.5)	97 (28.5)	118 (34.7)	188 (50.7)	495
Never left behind	120 (71.4)	157 (64.1)	226 (66.3)	217 (63.8)	249 (67.1)	969
Left behind in early childhood only	4 (2.4)	16 (6.5)	35 (10.3)	47 (13.8)	67 (18.1)	169
Left behind in early and later childhood	5 (3.0)	14 (5.7)	22 (6.5)	19 (5.6)	18 (4.9)	78
Left behind in later childhood only	39 (23.2)	58 (23.7)	58 (17.0)	57 (16.8)	37 (10.0)	249
	<i>Mean (s.d.)</i>					
Height (cm)	93.6 (13.7)	103.2 (17.5)	114.8 (24.6)	117.9 (27.0)	120.3 (30.5)	1465
Weight (kg)	14.3 (3.6)	17.4 (5.6)	22.6 (10.0)	24.4 (12.1)	26.179 (15.0)	1465
Age (years)	3.6 (1.7)	5.1 (2.5)	7.0 (3.7)	7.5 (4.2)	7.6 (4.8)	1465
Household income per capita (RMB)	3100.7 (2735.1)	3508.4 (2741.4)	4594.5 (4088.1)	4938.8 (5103.2)	8471.8 (7968.2)	1465
Asset score	1.2 (0.7)	1.2 (0.8)	1.6 (0.8)	1.7 (0.8)	1.8 (0.8)	1465
Girls						
	<i>Proportion (%)</i>					
Only child*	26 (23.4)	32 (18.4)	61 (23.6)	85 (30.9)	102 (37.5)	306
Never left behind	82 (73.9)	112 (64.4)	166 (64.3)	179 (65.1)	182 (66.9)	721
Left behind in early childhood only	7 (6.3)	8 (4.6)	27 (10.5)	37 (13.5)	38 (14.0)	117
Left behind in early and later childhood	4 (3.6)	10 (5.8)	17 (6.6)	16 (5.8)	16 (5.9)	63
Left behind in later childhood only	18 (16.2)	44 (25.3)	48 (18.6)	43 (15.6)	36 (13.2)	189
	<i>Mean (s.d.)</i>					
Height (cm)	90.5 (14.9)	103.0 (17.2)	112.5 (25.3)	116.8 (26.9)	120.8 (27.2)	1090
Weight (kg)	13.2 (3.7)	16.8 (5.1)	21.4 (9.8)	24.0 (12.4)	25.9 (13.7)	1090
Age (years)	3.3 (1.8)	5.2 (2.4)	6.7 (3.7)	7.4 (4.2)	8.0 (4.7)	1090
Household income per capita (RMB)	3232.9 (2796.2)	3593.2 (3626.2)	4600.4 (4162.2)	5416.7 (5865.4)	7158.6 (6862.7)	1090
Asset score	1.3 (0.7)	1.2 (0.7)	1.6 (0.8)	1.7 (0.8)	1.7 (0.8)	1090

* Whether this child is the only child within a household

Table 5-2 Estimates (standard errors) of height and growth curve models fitted to boys and girls in rural China from the CHNS, 1997-2009

Fixed effects	Boys		Girls	
	Model 1 ^{&}	Model 2 [§]	Model 1 ^{&}	Model 2 [§]
Intercept	115.70 (0.35)	116.68 (0.96)	115.76 (0.41)	117.14 (1.05)
Age (mean centred at age 7)	6.58 (0.06)	6.41 (0.07)	6.67 (0.06)	6.55 (0.07)
Age ²	-0.14 (0.01)	-0.16 (0.01)	-0.19 (0.01)	-0.20 (0.01)
Left-behind stage (reference group never left behind child aged 7):				
Never left behind	0	0	0	0
In early childhood only	2.62 (0.91)	1.99 (0.80)	-0.82 (1.09)	-0.21 (0.93)
In early and later childhood	-1.51 (1.25)	-0.25 (1.05)	-1.94 (1.42)	0.06 (1.17)
In later childhood only	-1.64 (0.79)	-0.40 (0.66)	-2.03 (0.92)	-0.40 (0.76)
<i>Deviance statistics</i>	16.63	7.15	6.10	0.31
<i>P-value for Chi-square (df=3)</i>	<0.01	0.07	0.11	0.96
Interactions (reference group never left behind child aged 7):				
Age×Left-behind stage:				
In early childhood only	0.17 (0.23)	0.01 (0.22)	-0.42 (0.21)	-0.46 (0.20)
In early and later childhood	-0.23 (0.23)	-0.38 (0.23)	0.02 (0.22)	-0.19 (0.23)
In later childhood only	-0.35 (0.14)	-0.36 (0.14)	0.03 (0.15)	-0.08 (0.16)
Age ² ×Left-behind stage:				
In early childhood only	-0.09 (0.04)	-0.10 (0.04)	0.01 (0.04)	0.00 (0.04)
In early and later childhood	0.07 (0.05)	0.08 (0.05)	0.05 (0.05)	0.05 (0.05)
In later childhood only	0.03 (0.03)	0.03 (0.03)	-0.00 (0.03)	-0.00 (0.03)
<i>Deviance statistics</i>	18.31	18.94	5.86	6.79
<i>P-value for Chi-square (df=6)</i>	0.01	<0.01	0.44	0.34
-2 Log likelihood	9357.00	9138.48	6872.58	6681.72

[&] Adjusts for age, age², left-behind stages, and the interaction effects between age×left-behind stage, and age²×left-behind stage.

[§] Additionally adjusts for covariates, e.g., gender, only child, child insurance, maternal education, maternal height, household size, household income per capita, asset score, wave, and province, which are not reported here.

Table 5-3 Estimates (standard errors) of weight and growth curve models fitted to boys and girls in rural China from the CHNS, 1997-2009

Fixed effects	Boys		Girls	
	Model 1 ^{&}	Model 2 [§]	Model 1 ^{&}	Model 2 [§]
Intercept	20.91 (0.18)	21.20 (0.41)	20.76 (0.24)	21.24 (0.50)
Age (mean centred at age 7)	2.46 (0.05)	2.41 (0.05)	2.57 (0.06)	2.48 (0.06)
Age ²	0.08 (0.01)	0.08 (0.01)	0.09 (0.01)	0.08 (0.01)
Left-behind stage (reference group never left behind child aged 7):				
Never left behind	0	0	0	0
In early childhood only	0.71 (0.50)	0.76 (0.47)	0.06 (0.65)	0.10 (0.58)
In early and later childhood	-1.04 (0.65)	-0.49 (0.59)	-0.15 (0.84)	0.40 (0.74)
In later childhood only	-0.89 (0.41)	-0.49 (0.37)	-1.28 (0.55)	-0.81 (0.48)
<i>Deviance statistics</i>	10.26	5.72	5.66	3.51
<i>P-value for Chi-square (df=3)</i>	0.02	0.13	0.13	0.32
Interactions (reference group never left behind child aged 7):				
Age×Left-behind stage:				
In early childhood only	-0.30 (0.20)	-0.30 (0.20)	0.13 (0.19)	0.10 (0.19)
In early and later childhood	-0.01 (0.16)	-0.03 (0.16)	0.08 (0.19)	0.05 (0.18)
In later childhood only	-0.21 (0.10)	-0.16 (0.10)	-0.20 (0.11)	-0.21 (0.11)
Age ² ×Left-behind stage:				
In early childhood only	-0.08 (0.03)	-0.08 (0.03)	0.03 (0.03)	0.02 (0.03)
In early and later childhood	0.04 (0.03)	0.04 (0.03)	-0.02 (0.03)	-0.01 (0.03)
In later childhood only	-0.00 (0.02)	-0.00 (0.02)	0.01 (0.02)	0.02 (0.02)
<i>Deviance statistics</i>	15.97	13.89	6.42	7.15
<i>P-value for Chi-square (df=6)</i>	0.01	0.03	0.38	0.31
-2 Log likelihood	7567.18	7416.62	5709.49	5589.92

[&] Adjusts for age, age², left-behind stages, and the interaction effects between age×left-behind stage, and age²×left-behind stage.

[§] Additionally adjusts for covariates, e.g., gender, only child, child insurance, maternal education, maternal weight, household size, household income per capita, asset score, wave, and province, which are not reported here.

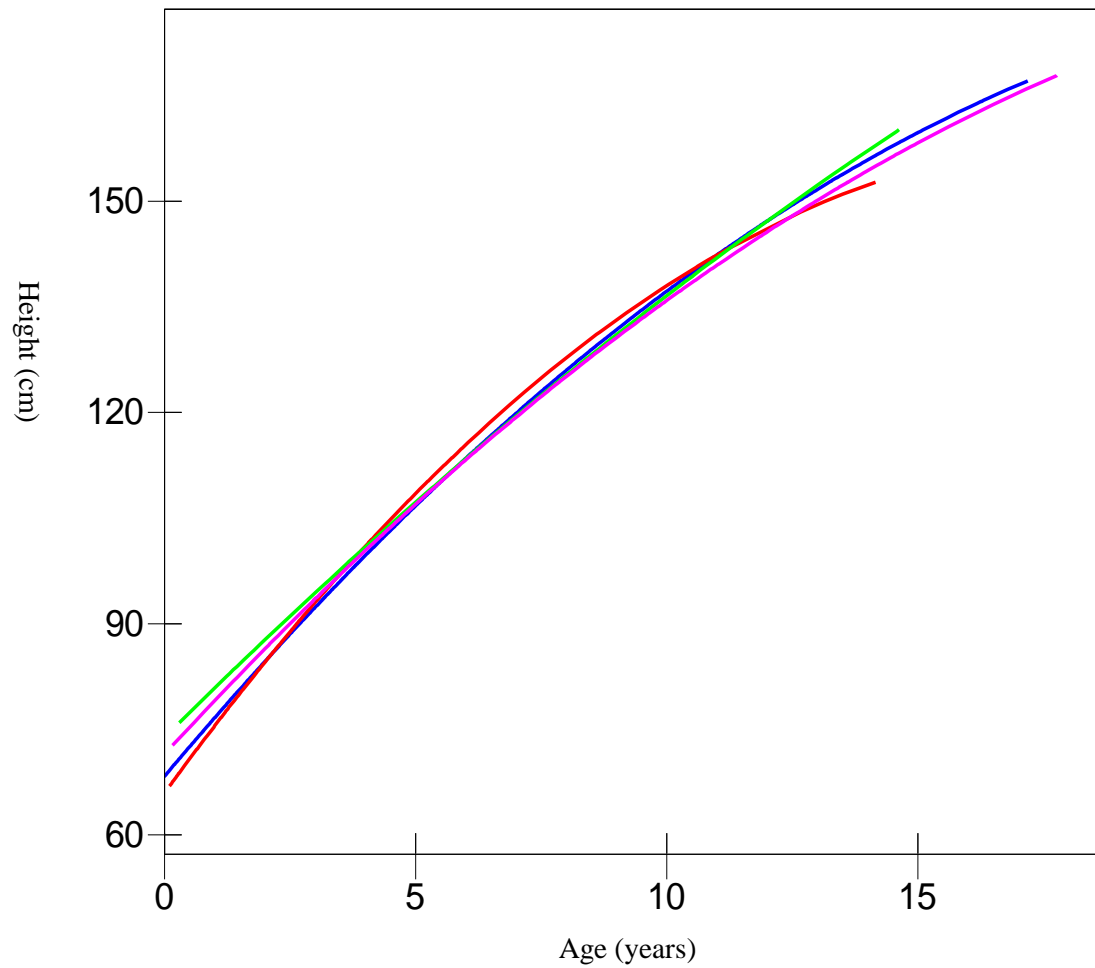
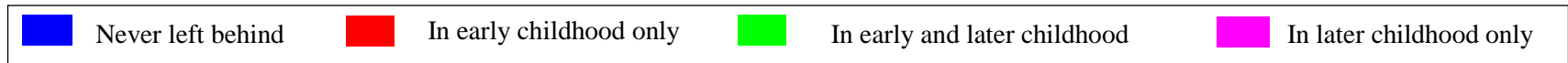


Figure 5-1 Trajectories of height for boys in rural China (estimated from model 2, Table 5.2)

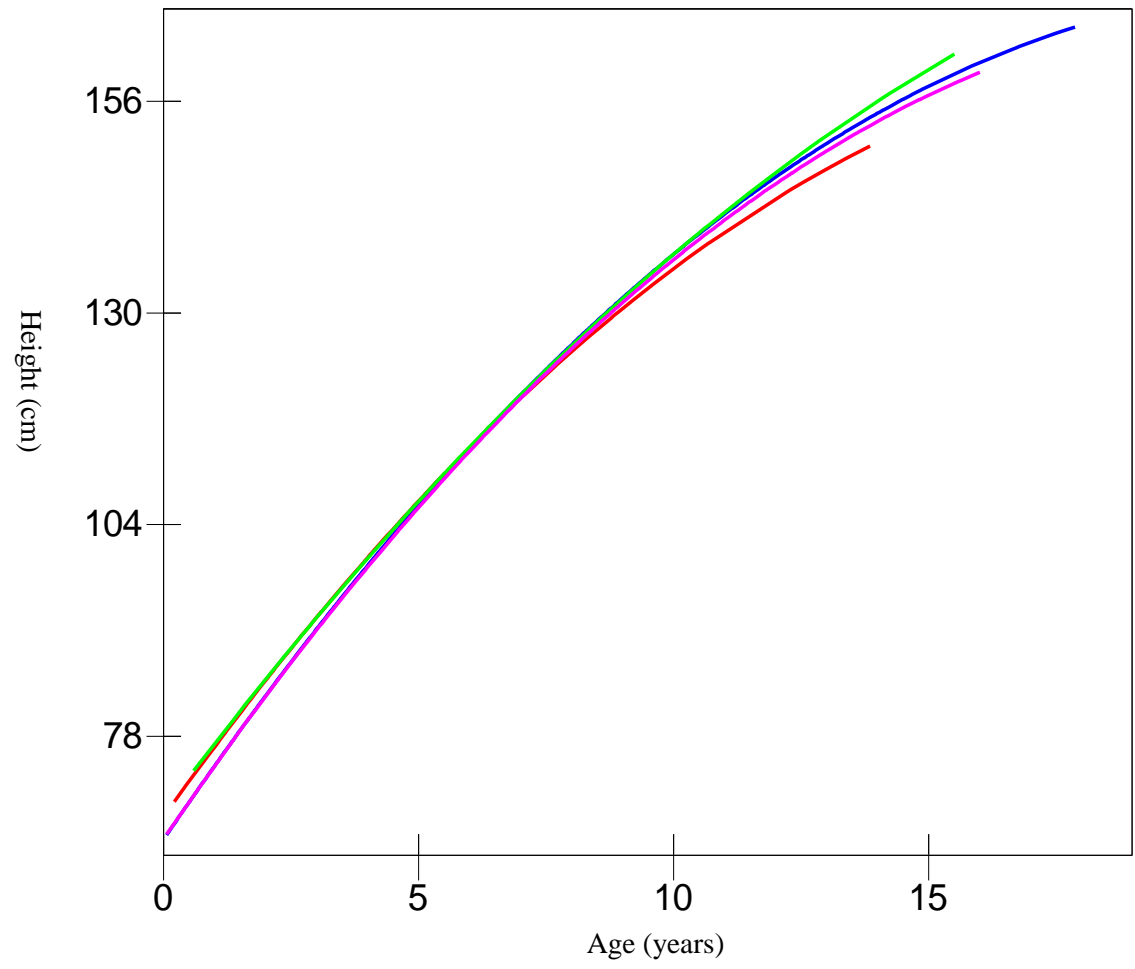


Figure 5-2 Trajectories of height for girls in rural China (estimated from model 2, Table 5.2)

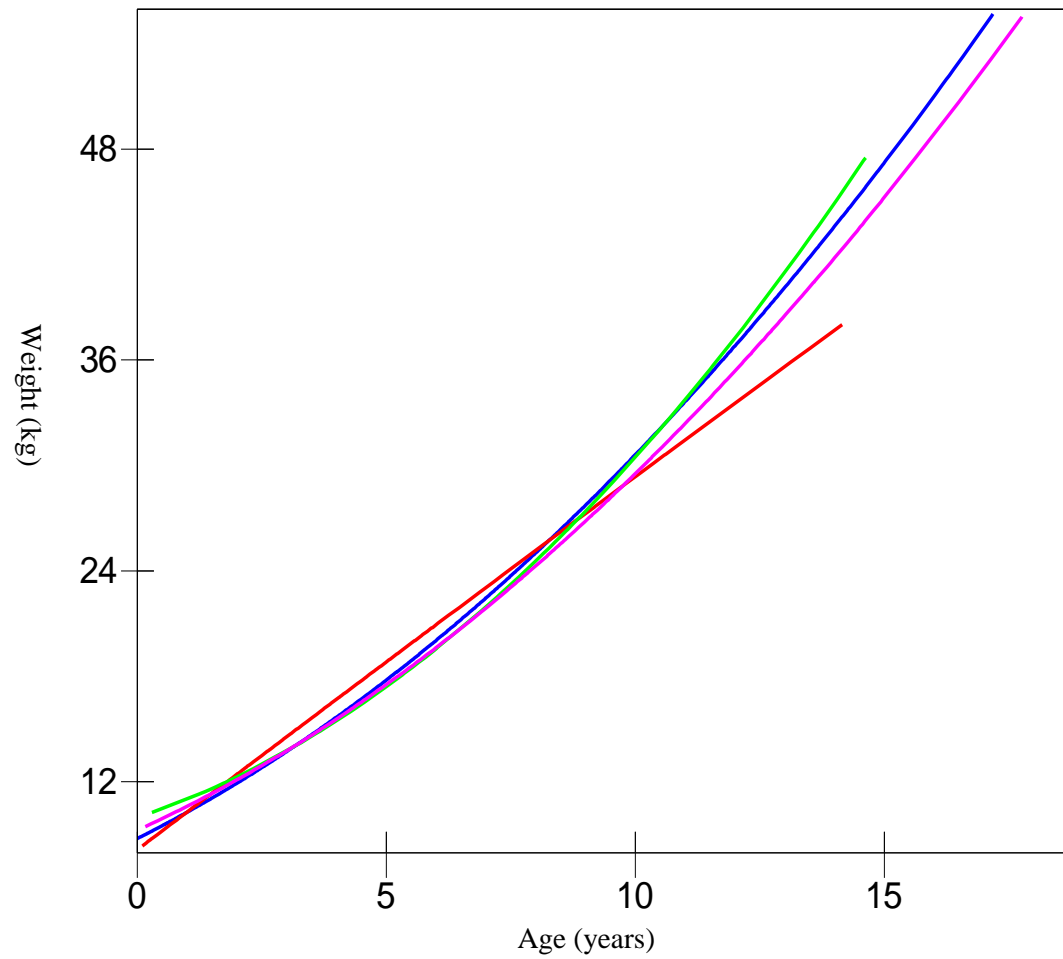


Figure 5-3 Trajectories of weight for boys in rural China (estimated from model 2, Table 5.3)

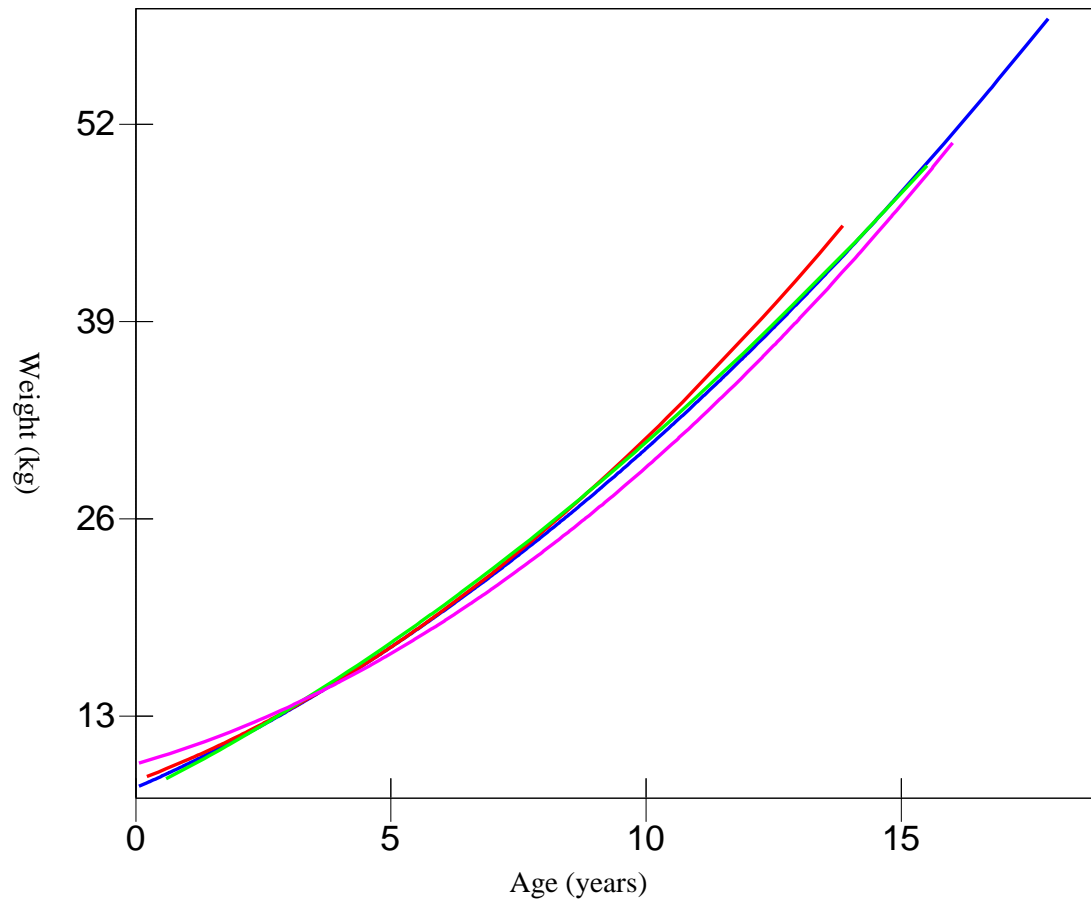


Figure 5-4 Trajectories of weight for girls in rural China (estimated from model 2, Table 5.3)

Chapter 6 Gender differences in parental migration and left-behind children's macronutrient intakes in rural China: A multilevel analysis

Chapters 5-8 present four papers which address specific issues regarding parental migration, care-giving practices and left-behind children's nutritional health in rural China. This chapter presents the second quantitative paper and examines the associations between parental migration and macronutrient intakes (protein, fat and carbohydrates) of children, and whether these associations differ according to the gender of the migrant parents and the gender of left-behind children in rural China. It is important to examine the role of gender, especially in a culture where 'son preferences' are valued.

Chapter 6 has been accepted for publication by the date of submission of the thesis.

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Gender differences in parental migration and left-behind children's macronutrient intakes in rural China: A multilevel analysis

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6.1 Abstract

Objective: China's internal migration has left 61 million children living apart from their parent(s) in rural areas. This study aims to examine whether relative macronutrients (protein, fat and carbohydrate) contributing to total energy intake differ between children left behind by the father or mother, compared with children from intact families.

Design: Drawing on a longitudinal study – the China Health and Nutrition Survey (1997-2009), multilevel modelling analyses (Level-1: occasions; Level-2: children; Level-3: villages) were performed.

Setting: Data were derived from rural communities in nine provinces in China.

Subjects: 975 rural children (555 boys and 420 girls) from 140 villages.

Results: Among boys of school age, being left behind by the father tended to reduce the relative protein intake by 0.70% ($p<0.01$) compared with boys from intact families. Being left behind by at least the mother was more detrimental for young boys under the age of 6 than paternal migration, reducing relative protein intake by 1.14% ($p<0.05$). Parental migration was associated with a significant increase in young boys' relative fat intake by 2.60% ($p<0.05$). No significant associations were found for girls. Results suggest left-behind boys, especially in early life, are subject to a higher-fat and lower-protein diet compared with non-left-behind boys. This may put them at increased risk of being overweight or obese, or of suffering from stunted growth, when they grow up.

Conclusions: Public health policies should recognize the impact of parental migration on boys, especially of maternal migration, and encourage a more balanced diet for children in rural China.

Keywords

Nutritional Intakes, Malnutrition, Left-behind children, Gender, China

6.2 Introduction

China's internal migration has resulted in around 61 million rural children under 18 years of age living apart from either one or both parents (All-China Women's Federation 2013). The majority of these children are left behind by both parents (46.5%), followed by being left behind by the father only (36.4%), and by the mother only (16.9%). A number of studies in rural China have examined the associations between parental migration and children's nutritional health in terms of anthropometric measures including height-for-age Z-scores (HAZ), Weight-for-Age Z-scores (WAZ), Body-Mass-Index (BMI), and dietary intakes (Luo et al. 2008; Ning and Chang 2013), among other outcomes (Chen et al. 2011; Luo et al. 2008; Gao et al. 2010; de Brauw and Mu 2011; Guo 2012; Mu and De Brauw 2015), mostly suggesting a negative association between parental migration and child nutritional outcomes. However, few studies have distinguished between differences in patterns of parental migration (i.e., by the gender of the parent) on children's nutritional status (Gao et al. 2010; Chen 2009; Guo 2012) or on children's dietary intakes (Ning and Chang 2013). The gender of the child may be also important in intra-household allocation, particularly in rural China where 'son preference' is prevalent (Burgess and Zhuang 2000).

One case-control survey conducted in Southern China showed that the average daily intake of protein-source foods including fish, eggs, and meat for left-behind children (LBC) under 7 years of age were significantly lower than that of their non-left-behind peers (Luo et al., 2008). However, this analysis failed to distinguish between the effects of paternal migration and maternal migration on boys and girls separately. This is an important limitation given well-documented gender differences in energy and nutrient needs (Brown 2007). Another study (Ning and Chang 2013) drawing on data from the China Health and Nutrition Survey (2000 to 2009) found that both parents' migration tended to increase the likelihoods of protein and energy deficiency for children aged 6-17, while no significant associations were found for children left behind by one parent. LBC, especially those who were left behind by one parent, appeared to have decreased risk of fat over-consumption. However, the study did not examine whether the association between parental migration and

nutritional deficiency of LBC differs by the gender of the migrant parent or by the gender of the child. This is an important limitation given the distinct gender roles of both adults and children in rural China.

The present study aims to address these limitations by examining the impact of parental migration on rural children's macronutrient intakes and considering the gender of the parents, and of the children. Analysing gender differences is important not only because of the maternal role as a traditional childcare provider within households in China, but also because of gender differences in the use of household financial resources, such as remittances. Mothers tend to purchase higher quality food in the absence of migrant fathers, which has important implications for the nutritional well-being of children as they develop (Kennedy and Haddad 1994; Case and Paxson 2001; Maitra 2004). With regards to the gender of the LBC, we expect that the effect of parental migration on nutritional intakes may differ between boys and girls partly due to gender differences in energy and nutrient needs (Brown 2007), but also because of gender discrimination in favour of boys in intra-household allocation in rural China (Burgess and Zhuang 2000).

Another innovation of the present paper is its focus on relative macronutrient intakes expressed as the percentage (%) of total energy intake contributed by a macronutrient including protein, fat and carbohydrate. This measurement of nutritional outcomes can, in a sense, reflect the food composition and diet quality, in contrast to previous studies using anthropometric measures. The Acceptable Macronutrient Distribution Ranges (AMDR) for carbohydrate, fat, and protein as a general diet evaluation guide, expressed as percentage of total energy intake, is a healthy range of intake of a particular energy source that is associated with a reduced risk of chronic disease while providing adequate amounts of essential nutrients (Hellwig et al. 2006). Intakes outside this range raise the potential for an increased risk of chronic disease shown to be associated with long-term health, and increase the risk of insufficient intakes of essential nutrients (Hellwig et al. 2006).

In order to investigate the associations between left behind patterns (being left behind by the father or by the mother), and children's relative macronutrient intake status, with an emphasis on the gender differences of the parents and of the LBC, this study aims to answer the interrelated research questions:

1. Is parental migration associated with LBC's relative macronutrient intakes (%) in terms of protein, fat, and carbohydrate contributing to total energy intake?
2. Is parental migration associated with LBC's relative macronutrient intakes of being with, above or below the AMDRs for protein, fat, and carbohydrate?
3. Do associations examined in Questions 1 and 2 differ according to the gender of the parents and the gender of the LBC?

6.3 Methods

6.3.1 Study design and subjects

Data were drawn from the China Health and Nutrition Survey (CHNS), an ongoing open-cohort study which employs a multistage, random-clustered sampling process to draw a sample of about 4,400 households with a total of about 19,000 participants from over 200 communities or neighbourhoods in nine provinces, with the first round conducted in 1989. The CHNS covers nine provinces that varied substantially in geography, economic development, public resources, and health indicators. The design, sampling, and response rates are reported elsewhere (Popkin et al. 2010).

We used data from five waves of the CHNS, collected in 1997, 2000, 2004, 2006, and 2009. The status of being left behind was operationalised using the household roster: from 1997 onwards, if one household member in a previous round of the CHNS was not residing in the same household in the current survey, the respondent was asked for the reasons for his/her absence. In this study, children under 18 years old whose parent(s) had left the home to seek employment elsewhere were defined as LBC. Children varying in age (between 0 and 6) were recruited in 1997, 2000, 2004, 2006 and then followed up to 2009, by drawing on accelerated longitudinal designs (Collins 2006). Multiple cohorts at different waves included not only new-born eligible children, but also a new province that was added from 2000, and villages lost to follow-up returned in later waves (Popkin et al. 2010).

The institutional review committees from the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Food Safety, China Centre for Disease Control and Prevention, approved the survey protocols and instruments and

the process for obtaining informed consent for this survey. All participants and/or their parents/guardians provided written informed consents for their participation in the survey.

6.3.2 Dietary variables and covariates

Trained fieldworkers collected detailed individual-level 24-hour recall diet data for three consecutive days, and household-level food consumption using a weighing technique over the same three-day period. Individual dietary intakes were obtained by asking each household member to report all food consumed at home and away from home. Information regarding young children younger than 12 years of age was reported by caregivers. Interviewers used information on household food consumption to cross-check the individual diet recall data. Where significant discrepancies were found, the household and the individual in question were revisited and asked about their food consumption to resolve these discrepancies. Individual diet data were then used to calculate the nutrient values in terms of caloric intakes, protein intakes, fat intakes, and carbohydrate intakes based on the Food Composition Table (FCT) for China. The dietary assessment approach of the CHNS has been shown to reduce the effects of measurement error and accurately capture usual energy intake (Paeratakul et al. 1998).

Relative macronutrient intakes were defined as the percentage (%) of total energy intake contributed by a macronutrient including protein, fat and carbohydrate. Macronutrients can be utilized by the body for energy, with 1 gram of protein and 1 gram of carbohydrate yielding 4 kcal, and 1 gram of fat yielding 9 kcal (Whitney et al. 1998). When needed to meet the body's energy requirements, macronutrients can, to some extent, replace each other. They are not independent of one another as energy fuel source or of the total energy requirement of the individual. For a specific level of energy intake, increasing the proportion of one macronutrient necessitates decreasing the proportion of the one or both of the other macronutrients (Hellwig et al. 2006). Relative macronutrient intakes were compared with AMDRs. The AMDRs for carbohydrate are 45%-65% for children aged 1-17 years; the AMDRs for fat are 30%-40% for children aged 1-3 years, and 25%-35% for children aged 4-18 years; the AMDRs for protein range from 5% to 20% for children aged 1-3 years and 10% to 30% for children aged 4-18 years (Rippe 2011).

Left-behind status

To investigate the different effects of parental migration on macronutrient status, we created a three-category time-variant variable to indicate whether the child was left behind: by the father only; by at least the mother (combining being left behind by the mother only, and by both parents, due to small sample size in each category); or by none of the parents, referring to children from intact families.

Covariates

We controlled for a range of socio-demographic and socio-economic variables, including age, gender, only child (whether a child is the only child within a household), child height and weight, household size, annual household income per capita, and maternal education (the number of years of formal education completed). The gender of a child often affects the intra-household allocation, particularly in rural China where son preference is prevalent (Burgess and Zhuang 2000). Child height and weight were included to control for individuals' energy requirements depending on the basal metabolic rate (BMR), which in turn is influenced by the height and weight of individuals (James and Schofield 1990). The CHNS recorded height and weight for each individual within the household, measured by health professionals.

Controlling for whether the child is the only child within household indicates that the presence of other siblings implies competition for intra-household resources and may reduce the amount of resources each child receives. The number of household members was also taken into account because children in a large extended family may receive less attention than a child in a nuclear family. We adjusted for maternal education, because it can affect children's health given that literacy and numeracy skills gained from education enable the mother to obtain health knowledge, and therefore influence children's health (Glewwe 1999). An urbanization index was created for each community (village or neighbourhood) based on a multidimensional twelve components from the CHNS including population density, transportation infrastructure, traditional and modern markets, sanitation, housing, health infrastructure and related factors that distinguish features of urban places (detail reported elsewhere) (Jones-Smith and Popkin 2010). This score was used to capture

physical, social, cultural, and economic environmental risk factors for children's nutritional health (Evans and Kantrowitz 2002;Gong et al. 2012).

Regional dummies were created according to geographical and socio-economic differences: coastal (Shandong and Jiangsu, the two most economically developed provinces), northeast (Liaoning and Heilongjiang), central inland (Henan, Hubei and Hunan), and the mountainous south (Guangxi and Guizhou). This latter category, capturing the most economically deprived region in China, was set as the reference region. Regional dummies were controlled to capture unobserved geographic and cultural factors related to food consumption and food prices, which may influence dietary intakes. We also included wave dummies to capture time effects with 1997 as reference wave.

6.3.3 Statistical analysis

Multilevel modelling

To account for the hierarchical nature of the CHNS, where multiple occasions (Level-1) are nested within children (Level-2) and clustered in villages (Level-3), multilevel modelling analyses were constructed with Stata 13.1 (StataCorp 2013b). Multinomial logit models were conducted within MLwiN Version 2.28 for categorical outcomes (Rasbash et al. 2013), which allowed us to compare relative macronutrient intakes with AMDRs and examine whether relative macronutrient intake (%) within AMDR (as reference), below the AMDR lower limit, or over AMDR upper limit. The log likelihood ratio test was used to determine the choice of model among nested models for continuous outcomes—relative macronutrient intakes (%). Wald test was used to test statistical significance in multinomial logit regressions for categorical outcomes.

As AMDRs were not available for children younger than one year old, we only included children aged 1-17 in the final analyses. Children with non-missing values on outcome variables and key predictors were kept in the analysis, yielding a total sample of 2171 observations within 975 children (boys: 555, girls: 420) clustered in 140 villages. We first examined the overall effects of being left behind on relative macronutrient intakes among boys and girls (Model 1 and Model 3). Then we decomposed the overall effects of parental migration into two components including being left behind by the father only and being left behind by at least the mother

(Model 2 and Model 4). Given sex differences in energy and nutrient needs (Brown 2007), we performed subgroup analyses based on stratification by sex for boys and girls separately. Children were separated into two age groups: preschool children aged 1-5, and school children aged 6 to 18, because the energy balanced-related behaviours of these two age groups tend to differ (Brown 2007). These analyses were based on complete cases (Figure 6.1).

Multiple imputations

Due to missing data on a few key variables, including on the measures of left-behind status (n=1403), protein intake (n=1840), household income per capita (n=1489), and maternal education (n=1457), we performed multiple imputation on the dataset under the assumption that the data are Missing at Random (MAR), whereby the missingness (i.e., whether the data are missing or not) may depend on observed data, but not on unobserved data (Schafer and Graham 2002). In order to reduce bias, the imputation model should include a wide range of variables including: all the variables in the substantive analysis, variables that predict missingness and variables likely to be correlated with the process leading to missing data, although they may not be of interest in the substantive analysis (Collins et al. 2001). I included all variables used in the substantive models as well as variables likely to predict the attribution of child participants: whether one particular child has a grandparent or not. Multiple Imputation using Chained Equations (MICE) were used to create thirty imputed datasets using the Stata 13.1 'mi impute chained' command (StataCorp 2013a). The number of imputed datasets was determined by the attribute rate around 30% in the present study, which as a rule of thumb suggests that the imputations should be at least equal to the percentage of incomplete cases in the dataset (White et al. 2011). Sensitivity analyses performed on the imputed datasets showed similar results to those from the complete cases analyses as shown in Table 6.7, so in the following sections I only present and discuss results from the complete-case analysis.

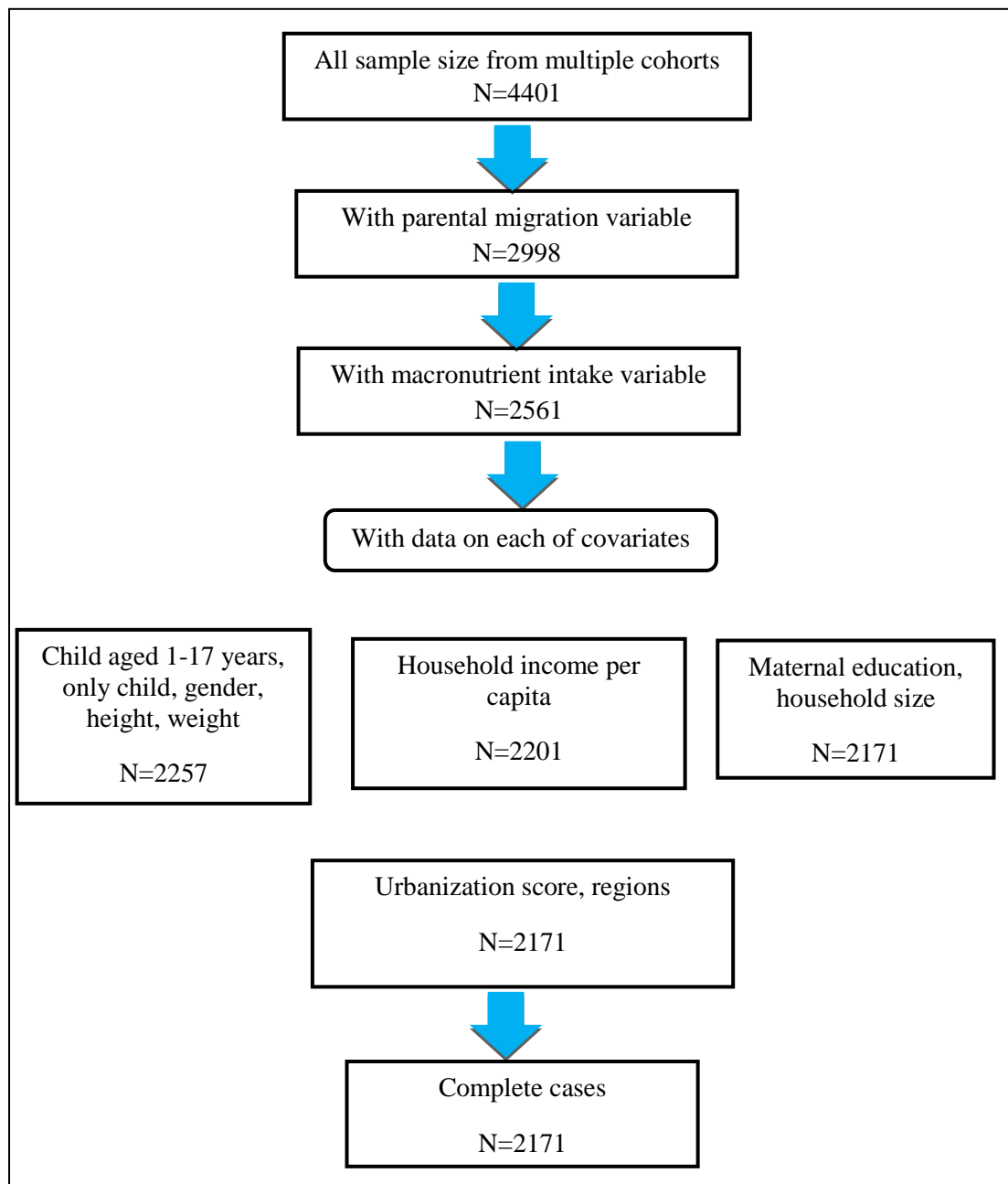


Figure 6-1 Missing data in multilevel modelling on relative macronutrient intakes of rural children from the CHNS, 1997-2009

6.4 Results

Table 6.1 presents the means (and standard deviations) of (relative) macronutrient intakes for the CHNS children aged 1-17 according to left-behind patterns in rural China from 1997 to 2009. Figure 6.2 shows relative macronutrient intakes of preschool and school boys and girls by left-behind patterns in rural China. The mean macronutrient-energy percentage for boys and girls by left-behind patterns were within the AMDRs for protein, fat, and carbohydrate, with relative protein and fat intake approaching the lower limits of AMDRs, and relative carbohydrate intake approaching the AMDR upper limit. Young boys aged 1-5 years who were left behind by at least the mother tended to have the lowest-protein diet as compared to other young boys and girls. Young boys who were left behind by the father only had the highest-protein and highest-fat diet than other children. Left-behind boys and girls of school age tended to have lower protein and lower fat percentage contributing to total energy than children from intact families. Relative carbohydrate intakes, in general, appeared to be higher among LBC than children from intact families. Figure 6.3 shows the proportions of children whose macronutrient intakes were within AMDR, below AMDR lower limit, and above AMDR upper limit, according to left-behind patterns. On average, for protein intake, over 20% of children appeared not meet the recommended protein intake and only a small proportion of children (less than 1%) exceeded AMDR upper limit. Over half of boys and girls who were left behind by the father only appeared to suffer from fat deficiency. Almost half of LBC appeared to consume more carbohydrate than recommended (Figure 6.3).

Multilevel modelling results

Table 6.2 presents the coefficients and standard errors of the multilevel modelling of relative protein intakes for boys and girls of preschool and school age after adjusting for socio-economic and demographic confounders. For preschool boys, being left behind due to parental migration tended to reduce the relative daily protein intake by 0.46 percent (Model 1 for preschool age, Table 6.2), as compared to boys of the same age from intact families, although the association was not statistically significant ($p=0.17$). The effect of being left behind on boys' protein-energy density

became statistically significant when they entered school age (Model 1 for school age, Table 6.2): left-behind school boys, on average, appeared to consume a protein diet lower than non-left-behind boys of the same age by 0.70 percent ($p < 0.01$). Being left behind by at least the mother, tended to be more detrimental to young boys' dietary protein density by reducing 1.14 percent ($p < 0.05$), as compared with preschool boys from intact families. The negative effects of being left behind by at least the mother persisted but became less pronounced when boys grew up to school age (Coefficient: -0.67, SE: 0.37). Being left behind by the father only significantly reduced school boys' protein-energy density by 0.72 percent ($p < 0.01$), as compared to boys of the same age with both parents living at home. There were no significant associations between relative protein intake and parental migration found among preschool girls (Coefficient: -0.18, SE: 0.35) as shown in Model 3 for preschool age and school girls (Coefficient: -0.36, SE: 0.27) in Model 3 for school age from Table 6.2, although the associations showed similar patterns to boys.

Table 6.3 presents the multilevel modelling results of relative fat intake contributing to total energy consumption for boys and girls of preschool and school age, respectively. For preschool boys, being left behind significantly increased the percentage of dietary energy available from fat sources by 2.60 percent ($p < 0.05$) (Model 1 for preschool age, Table 6.3), on average, as compared to boys of the same age from intact families. When decomposing the overall effects of being left behind into two components as shown in Model 2 for school age from Table 6.3, the results suggested that young boys who were left behind by the father only tended to have the highest-fat diet (Coefficient: 2.91, SE: 1.50) than those boys of the same age who were left behind by at least the mother (Coefficient: 2.13, SE: 1.76), on average, as compared to non-left-behind preschool boys from intact families. The positive effects of being left behind on relative fat intake for boys became less pronounced and statistically insignificant when boys entered school age (Model 1 and Model 2 for school age, Table 6.3).

Tables 6.5 and 6.6 summarise the analyses on the associations between the left behind variables and the multinomial outcomes of being under or over the recommended AMDR limits. Only the outcomes of being above or below the recommended AMDR limits for fat and carbohydrates were examined and reported. For the outcome for protein, the sample size of children whose protein intake

exceeded AMDR upper limit was insufficient to achieve modelling convergence. Left-behind boys were more likely to exceed the upper limit of recommended fat intake compared to boys from intact families ($p<0.01$) (Table 6.5). There were no statistically significant associations between left behind status and relative fat intake among preschool- and school-aged girls (Tables 6.3 and 6.5), or between left behind status and relative carbohydrate intake among boys and girls (Tables 6.4 and 6.6).

In addition, household economic status including maternal education, household size and whether the child was the single child within one family appeared to be strong predictors of macronutrient-energy percentage for rural children. For example, increasing maternal schooling tended to improve the relative protein intake of boys and for girls of school age (Table 6.2). For young boys and girls aged 1-5 years old, more maternal schooling was associated with higher fat-energy percentage and lower carbohydrate-energy percentage of their diet composition (Tables 6.3 and 6.4). Interestingly, coming from a relatively larger family tended to decrease young boys' fat-energy percentage ($p<0.05$), while being a single child within the family appeared to significantly increase his relative-energy intake ($p<0.01$) (Table 6.3). Among young girls, household size and being the only child within one family were both negatively associated with relative fat intake, although the associations were not statistically significant. These results suggested that gender discrimination in fat consumption in favour of young boys may exist in rural Chinese families. More interestingly, the urbanization score significantly increased relative macronutrient intakes in terms of protein and carbohydrate, and decreased the relative fat intake among boys and girls ($p<0.05$) in rural China.

Multiple imputation results

In analyses including the imputed data (Table 6.7), results for relative protein intake were consistent with the findings of the complete-case analyses. Being left behind tended to reduce relative protein intake for young boys (Coefficient: -0.36; SE: 0.28). For school boys, the effect of being left behind on relative protein intake appeared to slightly worsen as compared to the complete-case results (Coefficient: -0.72 vs. -0.70), and remained statistically significant ($p<0.001$). For young boys, the positive effect of parental migration on relative fat intake tended to weaken and become statistically insignificant in the imputed analyses. The size of the effect of being left

behind on relative fat intake for young girls tended to increase but still remained statistically insignificant. There were no statistically significant associations between left behind status and relative carbohydrate intake among boys and girls in complete-case analyses as well as imputation analyses, which were not reported here.

6.5 Discussion

The present study aimed to examine the association between parental migration and children's relative macronutrient intakes (i.e., protein, fat, carbohydrates) in rural China, and to explore gender differences of both parents and children in these associations. Being left behind appeared to decrease boys' (but not girls') relative protein intake, and to increase their relative fat intake. Young boys who were left behind, especially by at least the mother, tended to have a lower-protein but higher-fat diet, as compared to boys from intact families. No significant associations between left-behind status and relative macronutrient intakes were observed for girls.

Previous longitudinal evidence (Ning and Chang 2013) has suggested that both parents' migration tends to increase the likelihoods of protein and energy intake deficiency for children aged 6-17, while no significant associations are reported for children who were left behind only by one parent compared to children who are not left-behind. LBC, especially those who were left behind by one parent, appears to have decreased risk of fat over-nutrition (Ning and Chang 2013). However, in this study, the nutrient deficiency was poorly defined and potentially overestimated, as the authors used the recommended nutrient intake which represents an optimal intake of the nutrient that exceeds the requirement of 97% to 98% of the population, instead of using an estimated averaged intake which meets the requirements of 50% of the healthy individuals (Barr et al. 2002), and therefore provides a more conservative estimate of nutrient deficiency among LBC. Moreover, this analysis failed to distinguish gender differences in the associations between parental migration patterns and children's nutritional intakes. After examining gender differences in the present study, we find that parental migration tends to decrease the proportion of energy available from protein, but not from non-protein sources including fat and carbohydrate, among rural boys in China. Protein intakes, especially from animal products, are essential for optimal growth in children and adolescents (Samour and Helm 2005), but are still limited for poor families in the developing world (Neumann

et al. 2002). Left-behind boys, especially those of school age who have relative lower protein intakes are vulnerable to stunted growth, as compared to boys from intact families in rural China. Foods rich in carbohydrate are an essential part of traditional Chinese diet (Newman 2004). Evidence suggests that nutritional intakes of Chinese households have not increased *pari passu* (*equally*) with their household income growth due to rising food prices of protein-source foods, which can off-set the positive effects of income on children's nutritional health (You et al. 2014). This may suggest that protein (especially animal protein) intake is more sensitive to increased household economic status than other sources of energy, including carbohydrates.

We found that young boys who were left behind appeared to have a higher-fat diet as compared to boys from intact families. Left-behind boys were also more likely to exceed the recommended fat intake, as compared to boys from intact families. This may cause certain nutritional problems for left-behind boys in rural China. High-fat intakes during childhood, especially saturated fat, may potentially contribute to future overweight or obese status and chronic heart disease, although the evidence for this is tenuous (Hellwig et al. 2006). Studies show that in the last two decades Chinese children in rural areas have been undergoing a dramatic nutritional transition from a traditional low-fat and high-carbohydrate diet to a high-fat diet, especially among children from relatively affluent families (Cui and Dibley 2012). Our findings suggest that increased socioeconomic status both at household level and urbanization at neighbourhood level appear to increase rural children's relative protein and fat proportion, but reduce the carbohydrate percentage to total energy intake. The prevalence of overweight/obesity has increased among rural children in China (Yu et al. 2012;Lyu et al. 2013), which may lead to a future increase in non-communicable disease among these population (Popkin 2006).

LBC in rural China are often left in the care of close relatives, such as grandparents (All-China Women's Federation 2013). The nutritional knowledge and food preferences of LBC's caregivers can contribute to children's eating habits. Evidence suggests that non-parent caregivers (mainly grandparents) of LBC tend to have relatively poorer nutrient knowledge and behaviours than parent caregivers (Tan et al. 2010). Although malnutrition occurs primarily due to inadequate dietary intake, which is rooted in disadvantaged economic status, evidence shows that the high rates

of malnutrition among children are largely due to a lack of knowledge with respect to healthy dietary intake rather than food shortage (Tan et al. 2010; Chang et al. 2000).

The positive association between parental migration and young boys' fat intake should be interpreted with caution: our descriptive analysis shows that among left-behind boys, over half of them were at risk of fat intake deficiency, while only one fifth of them seemed to over-consume fat. Young children have a higher fat oxidation rather than adults, and low-fat diets can lead to reduced intake of certain micronutrients, including fat-soluble vitamins (Hellwig et al. 2006). This suggests that increased fat composition due to parental migration can be beneficial to the majority of left-behind young boys. However, whether and to what extent parental migration benefits rural children's fat intakes still needs further exploration.

We were able to observe some gender differences in the associations between parental migration and relative macronutrient status. The magnitude of the association of being left behind with protein-energy percentage for boys appeared to be larger than that of girls, and the different left behind patterns (by the father only and by at least the mother) did not appear to affect girls' relative macronutrient intake, as did boys. This may suggest that being left behind can be more detrimental for boys than for girls. One possible explanation may be due to socio-cultural factors, for example, migrant parents of boys tend to save up for sons' adult lives rather than sending financial remittances immediately in the context of rural China (Zhang et al. 2015b). This may imply that less financial resource is spent on left-behind boys that could be important for their growth and development. However, there is evidence that girls are more likely than boys to be disadvantaged in nutrient intakes due to 'son preference' norm in rural China (Ning and Chang 2013). These findings, however, should be interpreted with caution due to relatively small samples who were left behind by at least the mother for boys (N=86) and girls (N=62).

Our findings suggest that maternal migration can be more detrimental to young children's especially young boys' relative protein intake than paternal migration. There are some possible explanations for these patterns: First, migrant women tend to earn less than migrant men in China (Fan 2004), which may affect the amount of remittances sent back to LBC. Second, women in most cultures serve as the direct

caregivers of the children (Adanu and Johnson 2009), including in China (Zhou 2003). Grandparents, the primary non-parent carers of LBC in rural China, may have less healthy dietary behaviours and nutritional knowledge than LBC's parents (Tan et al. 2010;Ye and Pan 2011). Third, gender differences have been reported in the use of household economic resources such as remittances. For example, mothers tend to purchase higher quality food in the absence of migrant fathers (Kennedy and Haddad 1994;Case and Paxson 2001;Maitra 2004). For older children (boys in particular) of school age from 6 to 17 years, being left behind by the father only appears to be more detrimental than being left behind by at least the mother. One possible explanation is that other factors, such as food environment at school and food preference which were not adjusted in this study, can play a role in older children's dietary intakes (Taylor et al. 2005). This is an important topic that requires future research.

Several methodological limitations warrant cautious interpretation of our findings. First, being left behind was identified based on the status of parental migration on particular time points with a minimum of a two-year interval (1997, 2000, 2004, 2006 and 2009). Parental migration status could have changed between these time points. This may have underestimated the numbers of LBC. The numbers of left behind by at least the mother were relatively small, leading to potentially large standard errors. Second, certain omitted time-varying confounders were not adjusted for in the present study, including remittances from migrant parent(s) (McKenzie and Sasin 2007), the care-giving arrangements for LBC, especially caregivers' nutritional knowledge (United Nations Children's Fund 1990;Engle et al. 1999). Third, measurement errors may occur when eliciting dietary data from children. The mother or caregivers reported the data on behalf of young children less than 12 years of age. Diet information was based on individual recall over a 24-hour period, although steps were taken by interviewers to obtain accurate information (Paeratakul et al. 1998).

Another caveat of our study is that we did not consider the energy-related activities which partly determine children's energy and nutrients needs (Millward and Jackson 2004). Information about physical activities of children is available only from 2004 onwards in the CHNS, and data on pre-schoolers are substantially missing. Previous studies using the CHNS data did not find significant association between maternal

employment and the physical activities school children aged 6-18 in China (Nie and Sousa-Poza 2014). Moreover, LBC, especially girls, tend to engage in increased household workloads (Chang et al. 2011a), especially when being cared for by elderly grandparents (Ye and Pan 2011). This suggests that, on average, LBC may need more energy intake as compared to their peers from intact families. Finally, one key limitation in the CHNS, as in any longitudinal dataset, is sample attrition. Although imputed analyses did not make much difference compared to complete cases analyses, sample attrition could still lead to biased results when MAR is violated.

Although we are unable to make definitive statements and causal inferences using the CHNS data, our findings suggest that left-behind boys, especially in early life, tend to have a higher-fat but lower-protein diet compared to their non-left-behind peers, which may put them at increased risk of becoming overweight or obese, as well as suffering from possible stunted growth, when they grow up. These potential nutritional problems for LBC, especially for young boys, have important policy implications. Public health policies should recognize the importance of parental migration, especially maternal migration to ensure a more balanced diet for children in rural China.

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surveys, and the China-Japan Friendship Hospital, Ministry of Health for support for CHNS 2009.

The authors have no financial or personal conflicts of interest to declare.

Table 6-1 Means (standard deviations) of macronutrient intakes and relative macronutrient intakes (%) of boys and girls by left-behind patterns in rural China from the CHNS, 1997-2009

Macronutrient	N	%	Macronutrient intake				Relative macronutrient intake (%)		
			Energy (kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Protein (%)	Fat (%)	Carbohydrate (%)
Boys									
Age groups									
Aged 1-5	551	44.26	1097.01(494.35)	32.48(16.15)	33.15(21.65)	167.20(84.48)	11.95(2.76)	26.65(10.95)	61.39(11.35)
Aged 6-17	694	55.74	1726.80(612.67)	51.26(20.72)	52.36(31.34)	262.58(103.21)	11.93(2.51)	26.84(10.58)	61.24(10.54)
Left-behind patterns									
Non-left-behind	1015	81.53	1436.22(646.46)	42.94(21.36)	43.82(29.62)	217.46(104.95)	12.03(2.67)	26.87(10.69)	61.09(10.87)
By father only	144	11.57	1508.07(638.97)	43.62(19.32)	44.37(26.91)	233.86(113.45)	11.67(2.23)	26.38(11.02)	62.11(11.21)
By at least mother	86	6.91	1487.48(635.48)	41.85(19.65)	43.43(26.28)	232.18(110.92)	11.32(2.48)	26.08(10.88)	62.57(10.75)
Girls									
Age groups									
Aged 1-5	403	43.52	1045.56(406.03)	31.34(14.09)	32.21(21.00)	157.52(65.59)	12.02(2.62)	27.03(10.84)	60.96(11.13)
Aged 6-17	523	56.48	1616.56(1378.82)	45.19(16.71)	53.08(143.53)	239.30(88.25)	11.66(2.49)	26.47(11.44)	61.81(11.41)
Left-behind patterns									
Non-left-behind	747	80.67	1366.13(1206.13)	39.12(17.11)	45.32(121.03)	200.28(87.27)	11.90(2.56)	27.11(11.11)	60.94(11.19)
By father only	117	12.63	1402.62(558.65)	39.65(17.28)	38.50(24.04)	224.29(105.02)	11.41(2.53)	24.61(11.83)	64.03(11.96)
By at least mother	62	6.70	1326.04(428.39)	38.70(16.24)	38.46(21.30)	206.20(69.80)	11.54(2.48)	25.80(10.45)	62.63(10.61)

Table 6-2 Estimates (standard errors) of relative protein intake (%) from multilevel modelling fitted to rural children across gender and age groups from the CHNS, 1997-2009

Fixed effects	Preschool aged 0-5 years				School aged 6-17 years			
	Boys		Girls		Boys		Girls	
	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}
Intercept	5.49 (2.83)	5.26 (2.83)	4.17 (3.02)	4.27 (3.00)	8.73 (1.81)	8.74 (1.81)	11.63(1.99)	11.61(1.98)
Left behind (reference: non-left-behind children)	-0.46 (0.32)		-0.18 (0.35)		-0.70(0.23)**		-0.36(0.27)	
<i>Log likelihood ratio test p-value</i>	0.17		0.61		0.003		0.19	
Left behind types (reference: non-left-behind children)								
By father only	0.02 (0.39)		0.21 (0.42)		-0.72(0.27)**		-0.52(0.31)	
By at least mother	-1.14 (0.45)*		-0.71 (0.50)		-0.67 (0.37)		0.01 (0.43)	
<i>Log likelihood ratio test p-value</i>	0.04		0.27		0.01		0.24	
Covariates								
Age (years)	-0.25 (0.18)	-0.25 (0.18)	-0.42(0.20)*	-0.41(0.20)*	-0.05 (0.08)	0.05 (0.08)	0.12 (0.09)	0.12 (0.09)
Only child (reference: have siblings within the same household)	0.28 (0.26)	0.31 (0.26)	0.30 (0.31)	0.34 (0.31)	0.26 (0.21)	0.26 (0.21)	-0.41(0.26)	-0.42(0.26)
Household income per capita/1000 (RMB)	0.02 (0.03)	0.02 (0.03)	0.001(0.03)	0.005(0.03)	0.03 (0.01)*	0.03 (0.01)*	0.02 (0.02)	0.02 (0.02)
Maternal education (years)	0.11 (0.04)*	0.11(0.04)**	0.08 (0.04)	0.08 (0.04)	0.09 (0.03)**	0.09 (0.03)**	0.11(0.04)**	0.11(0.04)**
Household size	0.18 (0.09)*	0.20 (0.08)*	0.08 (0.09)	0.08 (0.09)	0.05 (0.08)	0.05 (0.08)	-0.10 (0.09)	-0.11 (0.09)
Urbanization score	0.03(0.01)***	0.03(0.01)***	0.04(0.01)***	0.04(0.01)***	0.01 (0.01)	0.01 (0.01)	0.02(0.01)**	0.02 (0.01)*
-2 <i>Log likelihood</i>	-1303.55	-1301.30	-922.75	-921.58	-1558.91	-1558.90	-1183.28	-1182.72

[&] Additionally adjusted for children's height, children's weight, regional dummies, and wave dummies, which were not reported here.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Age was centred on 4 years for preschool aged children and 10 years for school aged children.

Table 6-3 Estimates (standard errors) of relative fat intake (%) from multilevel modelling fitted to rural children across gender and age groups from the CHNS, 1997-2009

Fixed effects	Preschool aged 0-5 years				School aged 6-17 years			
	Boys		Girls		Boys		Girls	
	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}
Intercept	5.21 (10.21)	5.03 (10.94)	7.87 (12.44)	8.08 (12.44)	10.54 (7.69)	10.74 (7.70)	4.79 (9.00)	4.87 (8.97)
Left behind (reference: non-left-behind children)	2.60 (1.23) [*]		1.42 (1.45)		0.35 (0.98)		0.22 (1.21)	
<i>Log likelihood ratio test p-value</i>	0.04		0.33		0.72		0.86	
Left behind types (reference: non-left-behind children)								
By father only	2.91 (1.50)		2.16 (1.75)		-0.02 (1.15)		-1.19 (1.38)	
By at least mother	2.13 (1.76)		0.32 (2.06)		1.13 (1.56)		3.44 (1.94)	
<i>Log likelihood ratio test p-value</i>	0.10		0.47		0.77		0.11	
Covariates								
Age (years)	-0.22 (0.70)	-0.22 (0.70)	-0.43 (0.82)	-0.42 (0.82)	-0.90(0.34) ^{**}	-0.89 (0.34) ^{**}	-1.01(0.41) [*]	-1.05(0.41) [*]
Only child (reference: have siblings within the same household)								
	2.95 (1.02) ^{**}	2.97 (1.02) ^{**}	-0.46 (1.27)	-0.40 (1.27)	-0.23 (0.89)	-0.22 (0.89)	2.84 (1.19) [*]	2.75 (1.19) [*]
Household income per capita/1000 (RMB)	0.18 (0.12)	0.18 (0.11)	0.09 (0.10)	0.09 (0.10)	0.07 (0.06)	0.07 (0.06)	0.15 (0.10)	0.16 (0.10)
Maternal education (years)	0.33 (0.16) [*]	0.34 (0.16) [*]	0.42 (0.18) [*]	0.41 (0.18) [*]	0.07 (0.14)	0.06 (0.14)	0.19 (0.18)	0.18 (0.18)
Household size	-0.86 (0.34) [*]	-0.84 (0.34) [*]	-0.47 (0.38)	-0.47 (0.38)	-0.55 (0.35)	-0.57 (0.35)	-0.68 (0.43)	-0.74 (0.42)
Urbanization score	0.17 (0.04) ^{***}	0.17 (0.04) ^{***}	0.15(0.05) ^{***}	0.15 (0.05) ^{***}	0.20(0.04) ^{***}	0.20 (0.04) ^{***}	0.12 (0.05) [*]	0.12 (0.05) [*]
-2 <i>Log likelihood</i>	-2049.22	-2049.16	-1494.63	-1494.34	-2562.60	-2562.40	-1966.95	-1964.77

[&] Additionally adjusted for children's height, children's weight, regional dummies, and wave dummies, which were not reported here.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Age was centred on 4 years for preschool aged children and 10 years for school aged children.

Table 6-4 Estimates (standard errors) of relative carbohydrate intake (%) from multilevel modelling fitted to rural children across gender and age groups from the CHNS, 1997-2009

Fixed effects	Preschool aged 0-5 years				School aged 6-17 years			
	Boys		Girls		Boys		Girls	
	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}	Model 1 ^{&}	Model 2 ^{&}	Model 3 ^{&}	Model 4 ^{&}
Intercept	89.43(11.25)	89.85(11.25)	86.96(12.38)	86.66(12.37)	79.00 (7.51)	78.74 (7.5)	83.50 (8.81)	83.38 (8.76)
Left behind (reference: non-left-behind children)	-2.10 (1.27)		-1.18 (1.44)		0.57 (0.96)		0.19 (1.18)	
<i>Log likelihood ratio test p-value</i>	0.10		0.42		0.56		0.87	
Left behind types (reference: non-left-behind children)								
By father only	-2.90 (1.54)		-2.15 (1.74)		1.04 (1.12)		1.73 (1.35)	
By at least mother	-0.92 (1.81)		0.29 (2.05)		-0.43 (1.52)		-3.32 (1.89)	
<i>Log likelihood ratio test p-value</i>	0.17		0.43		0.59		0.07	
Covariates								
Age (years)	0.45 (0.72)	0.45 (0.72)	0.76 (0.81)	0.75 (0.81)	0.92 (0.33) ^{**}	0.91 (0.33) ^{**}	0.89 (0.40) [*]	0.93 (0.40) [*]
Only child (reference: have siblings within the same household)	-3.20 (1.05) ^{**}		-3.25 (1.05) ^{**}		-0.01 (0.87)		-2.47 (1.17) [*]	
Household income per capita/1000 (RMB)	-0.19 (0.12)	-0.20 (0.12)	-0.10 (0.10)	-0.10 (0.10)	-0.10 (0.06)	-0.10 (0.06)	-0.16 (0.10)	-0.17 (0.10)
Maternal education (years)	-0.44 (0.17) ^{**}	-0.45 (0.17) ^{**}	-0.48(0.18) ^{**}	-0.48 (0.18) ^{**}	-0.17 (0.13)	-0.16 (0.13)	-0.30 (0.18)	-0.30 (0.18)
Household size	0.67 (0.35)	0.63 (0.35)	0.38 (0.38)	0.37 (0.38)	0.49 (0.34)	0.52 (0.34)	0.79 (0.42)	0.85 (0.41) [*]
Urbanization score	-0.21 (0.04) ^{***}	-0.20 (0.04) ^{***}	-0.19 (0.05) ^{***}	-0.19 (0.05) ^{***}	-0.20 (0.04) ^{***}	-0.20 (0.04) ^{***}	-0.14 (0.05) ^{**}	-0.14 (0.05) ^{**}
<i>-2 Log likelihood</i>	-2063.72	-2063.31	-1492.94	-1492.44	-2545.20	-2544.85	-1954.94	-1952.22

[&] Additionally adjusted for children's height, children's weight, regional dummies, and wave dummies, which were not reported here.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Age was centred on 4 years for preschool aged children and 10 years for school aged children.

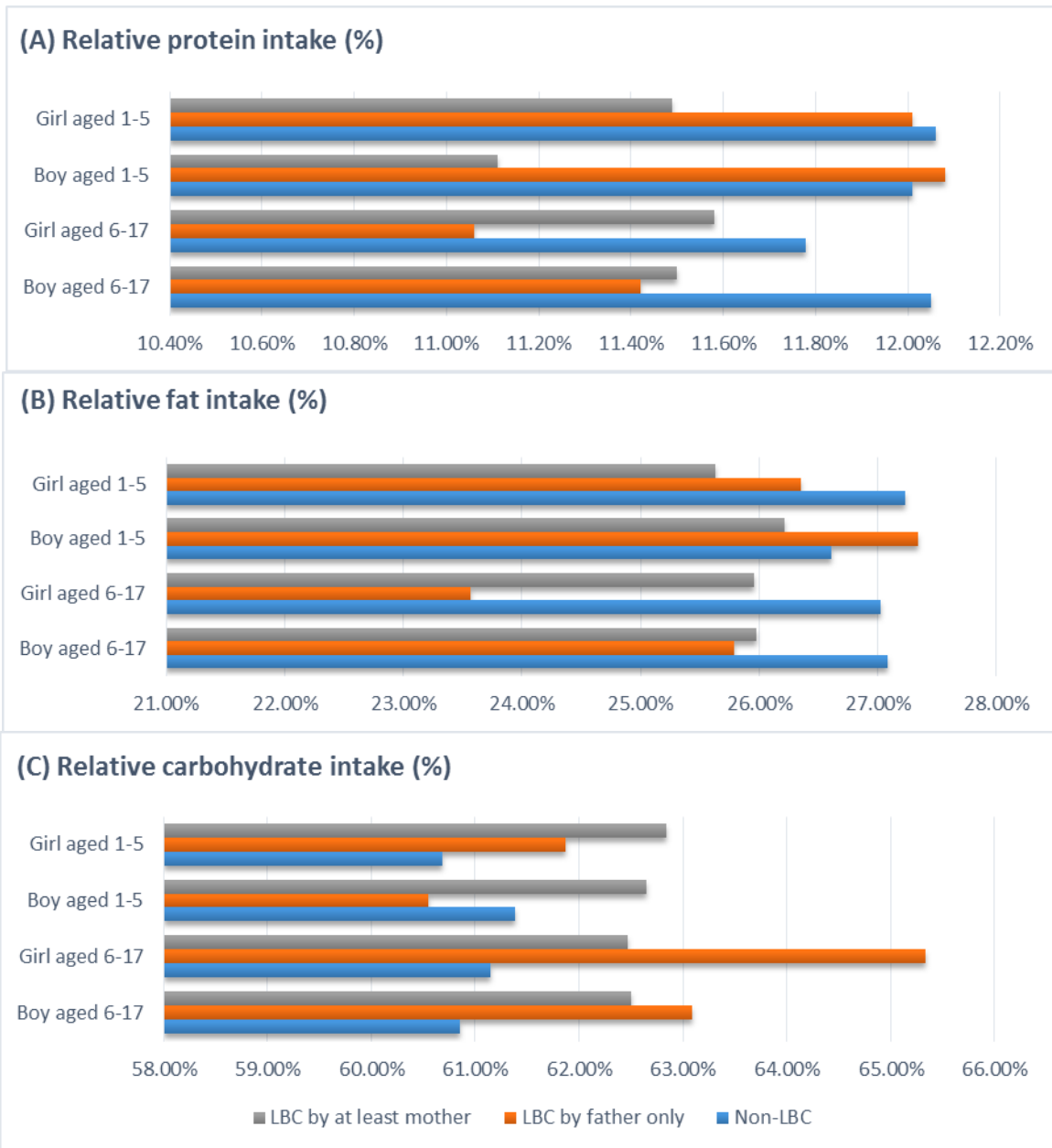


Figure 6-2 Relative macronutrient intakes including (A) protein, (B) fat and (C) carbohydrate of preschool and school boys and girls by left-behind patterns in rural China from CHNS, 1997-2009

LBC: left-behind children

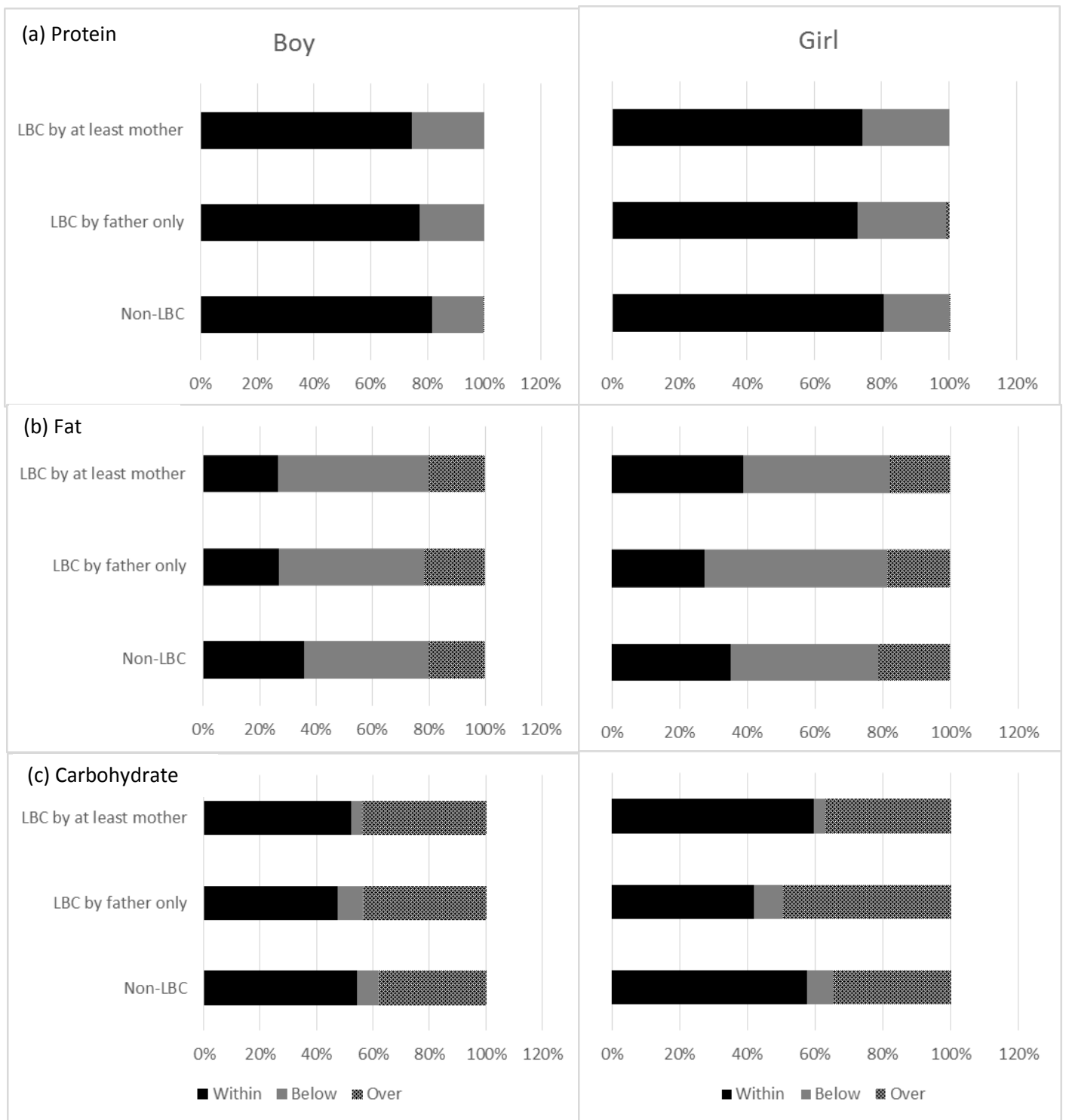


Figure 6-3 Prevalence of rural children with relative macronutrient intakes within, below, and over AMDR ranges for (a) protein, (b) fat, and (c) carbohydrate for boys and girls in rural China from the CHNS, 1997-2009

LBC: left-behind children; AMDR: Acceptable Macronutrient Distribution Ranges

Table 6-5 Selected parameter estimates (standard errors) from a multinomial logit model [using within AMDR as the reference] for two scenarios of relative fat intake (%) including under AMDR lower limit, over AMDR upper limit for boys and girls aged 1-17 year in rural China, with adjustment for clustering at individual and village levels

	Boys				Girls			
	Model 1 ^{&}		Model 2 ^{&}		Model 1 ^{&}		Model 2 ^{&}	
	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit
Fixed effects								
Left behind (reference: non-left-behind children)	0.32(0.17)	0.56(0.20)**			-0.11(0.19)	0.17(0.24)		
<i>Wald test p-value</i>	0.053	0.005			0.55	0.47		
Left behind types (reference: non-left-behind children)								
By father only			0.32(0.20)	0.50(0.24)*			0.13(0.22)	0.33(0.28)
By at least mother			0.33(0.25)	0.69(0.30)*			-0.54(0.30)	-0.09(0.36)
<i>Wald test p-value</i>			0.15	0.013			0.13	0.44

[&] Additionally adjusted for child age, only child, children's height, children's weight, maternal education, household income per capita, urbanization score, household size, regional dummies, and wave dummies, which were not reported here.

Continuous predictors were centred on grand mean.

AMDR: Acceptable Macronutrient Distribution Ranges

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6-6 Selected parameter estimates (standard errors) from a multinomial logit model [using within AMDR as the reference] for two scenarios of relative carbohydrate intake (%) including under AMDR lower limit, over AMDR upper limit for boys and girls aged 1-17 years in rural China, with adjustment for clustering at individual and village levels

	Boys				Girls			
	Model 1 ^{&}		Model 2 ^{&}		Model 1 ^{&}		Model 2 ^{&}	
	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit	Under AMDR lower limit	Over AMDR upper limit
Fixed effects								
Left behind (reference: non-left-behind children)	0.22(0.31)	0.04(0.17)			0.13(0.37)	0.05(0.20)		
<i>Wald test p-value</i>	0.48	0.81			0.72	0.82		
Left behind types (reference: non-left-behind children)								
By father only			0.48(0.34)	0.12(0.20)			0.54(0.41)	0.30(0.23)
By at least mother			-0.50(0.60)	-0.09(0.26)			-0.85(0.76)	-0.40(0.31)
<i>Wald test p-value</i>			0.22	0.75			0.18	0.13

[&] Additionally adjusted for child age, only child, children's height, children's weight, maternal education, household income per capita, urbanization score, household size, regional dummies, and wave dummies, which were not reported here.

Continuous predictors were centred on grand mean.

AMDR: Acceptable Macronutrient Distribution Ranges

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6-7 Estimates (Standard errors) of relative protein (%) and fat (%) intakes from multilevel modelling based on imputed dataset (n=30) for rural children from the CHNS, 1997-2009

	Relative protein intake (%)				Relative fat intake (%)			
	Boys ^{&}		Girls ^{&}		Boys ^{&}		Girls ^{&}	
	Aged 1-5 N=798	Aged 6-17 N=795	Aged 1-5 N=610	Aged 6-17 N=591	Aged 1-5 N=798	Aged 6-17 N=795	Aged 1-5 N=610	Aged 6-17 N=591
Left behind (reference: non-left-behind)	-0.36 (0.28)	-0.72 (0.22)	-0.05 (0.34)	-0.39 (0.25)	1.35 (1.12)	-0.09 (0.91)	2.05 (1.32)	-0.35 (1.12)
<i>P</i> -value	0.20	0.001 ^{***}	0.89	0.12	0.23	0.92	0.12	0.76

[&]Additionally adjusted for children's height, children's weight, children's age, only child, maternal education, household size, urbanization score, regional dummies, and wave dummies, which were not reported here;

* p<0.05, ** p<0.01, *** p<0.001

Chapter 7 Intergenerational obligations for children left behind by parental migration in rural China

Chapters 5-8 present four papers which address specific issues regarding parental migration, care-giving practices and left-behind children's nutritional health in rural China. This chapter is the first qualitative paper using semi-structural in-depth interviews with caregivers of left-behind children to explore their understanding of migration motives and the social process of taking on care-giving roles for left-behind children in a rural township in northern central China. This paper highlights socio-cultural explanations pertaining to economic motives for parental migration in a specific cultural setting, such as making contributions for social events in village life, and fulfilling social obligations for sons' adult lives. Left-behind boys, and in particular boys cared for by paternal grandparents, may be at greater risk than other LBC as they may receive even fewer resources in form of remittances from migrant parents in their early childhood.

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7.1 Abstract

This article draws on in-depth interviews with caregivers of left-behind children (LBC) in rural China, in order to explore their understanding of migration motives and the social process of taking on care-giving roles for LBC. The authors argue that there are underlying socio-cultural explanations pertaining to economic motives for migration; for example, making contributions for social events (weddings and funerals) in village life, and fulfilling social obligations for left-behind sons' futures. Parents migrate to save for sons', but not daughters', adult lives. Grandparents, particularly on the paternal side, are expected to fulfil social obligations to care for left-behind grandchildren, even without immediate financial returns. These suggest that left-behind boys, and in particular boys cared for by paternal grandparents, may be at greater risk than other LBC, as they may receive even fewer resources in the form of remittances from migrant parents in their early childhood.

Keywords: rural-urban migration; left-behind children; China; intergenerational exchange

7.2 Introduction

Migration in developing countries and deprived areas can relieve poverty at the household level and boost economic growth at the national level (Mines 1981;Grindle 1988;Massey et al. 1987;McKenzie and Sasin 2007). Many theories have been developed to explain labour migration from the economic perspective (Lewis 1954;Jorgenson 1961; 1967;Harris and Todaro 1970;Stark and Taylor 1991). Neoclassical economics emphasizes the importance of human capital and considers migration as a rational choice to maximize individual net benefits (Sjaastad 1962;Todaro 1980). However, this has been challenged by the new economics migration theory that views migration as a strategy to maximize the net gains for the entire household rather than for an individual (Adams and Page 2003;De Jong 2000;Stark 1991). Thus, the main difference between the two perspectives of migration is whether decision making is at the individual level or the household level (Massey et al. 1993). Grasmuck and Pessar (1991, p.15) suggest that: ‘It is not individuals but households that mobilise resources and support, receive and allocate remittances, and make decisions about members’. Economists tend to focus on the economic nature of migration and assume *homo economicus* in many economic models. Anthropologists and sociologists, however, argue that economic motives are far from sufficient to predict human movement without accounting for social and cultural contexts that constrain human behaviours (Brettell and Hollifield 2008). The household rather than the individual as a social and economic unit can help understand the interaction of structure and agency in most societies (Wallace 2002;Morgan 1989), which may enable researchers to integrate other socio-cultural factors with economic factors in the study of migration. The household approach can also help interpret the phenomena of temporary migration, split family structures and remittances in migration.

The Chinese context: internal migration and left-behind children

China has provided a good example for studying temporary migration where the world’s largest internal migration is taking place since the reform and opening up that started in the late 1970s (Hu 2012a), with a massive surplus of rural labourers

transferring to cities. At the national level, about 15% of all rural families have at least one member migrating to an urban area (Zhang 2004). The population of migrant workers was around 268.94 million in 2013, up by 11.0% over that of 2010 (National Bureau of Statistics of China 2014c; National Bureau of Statistics of China 2011). The massive internal migration, mostly of young adults aged 25-49 years old (Hu et al. 2008; Wong et al. 2007), has fundamentally altered the Chinese demographic landscape.

The split family structure is common in rural China due to internal migration. The household registration system (known as *Hukou*), which used to act as a strong constraint on individual rural-urban movement throughout China (Vendryes 2011), limits migrant workers' access to urban welfare entitlements (Xiang 2007; Gong et al. 2012). Therefore, migrant workers have to leave their children, especially those of school-age, in their rural hometowns (Ye and Pan 2011), resulting in a social group of 'left-behind children' (LBC) in contemporary China. The most recent survey based on the Sixth National Population Census of the People's Republic of China estimates that the overall population of LBC aged 0-17 in rural China in 2010 was around 61 million (accounting for 37.7% of total rural children and 21.9% of all children in China) (All-China Women's Federation 2013).

In the Chinese context, internal migration has indeed alleviated household poverty in migrants' rural communities of origin (Zhu and Luo 2010; Huang and Zhan 2008). Economic motives for migration are often highlighted (Ye et al. 2013; Fan 2007), and seemingly, taken for granted without examination of the underlying explanations. The focus on household economic gains can neglect non-economic sociocultural dimensions that underlie decision-making for migration (Fan 2007). For example, narrative data from migrant workers suggest that, unlike their previous generation, 'new generation' migrants born after 1980s participate in rural-urban outflow for gaining new experiences and broadening horizons apart from economic motives (Hu 2012b).

Care-giving arrangements for left-behind children in China

Migration is a complex decision-making process at the household level (Stark and Bloom 1985; Agesa and Kim 2001). It concerns not only those who intend to migrate

but also those who stay behind. A migrant's decision making often involves considerations for other family members (Rowland 1994). In particular for migrant parents, care-giving arrangements for their left-behind children may become a major concern. In China, both parent migration accounts for around 46.7% of the 61 million LBC. Over one in five of LBC aged 6-11 share a household with a parent plus grandparents, while one third live with grandparents only (All-China Women's Federation 2013). Grandparents therefore play a key childcare role in multigenerational as well as 'skipped generation' households (Burnette et al. 2013).

Kinship care of children, especially by grandparents, is a common arrangement in the developing world, and it can be a cultural norm for extended families to play an active role in child rearing (Ma 2010). Adult children may be motivated to take up migrant work to improve the household's economic status when their own parents are available to look after young children. Those who are left behind in the extended family can constitute 'a reliable and effective support system' (Chang et al. 2011b). This is consistent with the group/mutual aid model, in which each household member's capacity is maximized to ensure the success of the household as a whole (Lee and Xiao 1998). By caring for their left-behind grandchildren, grandparents enhance their migrant children's economic capacity to reciprocate in the form of remittances (Agree et al. 2002), which may compensate grandparents' efforts as surrogate parents. This form of intergenerational exchange has been called 'intergenerational contract' (Croll 2006) or 'time-for-money' exchange, which has been observed in several Asian countries including China (Cong and Silverstein 2011; Cong and Silverstein 2008; Frankenberg et al. 2002; Shi 1993).

Rationale

Drawing on in-depth interviews with caregivers for LBC in rural China, we explore how caregivers explain migration motives and the social process of taking on care-giving roles for LBC. Most of the literature to date tends to focus on determinants and/or consequences of migration, or the care-giving arrangements of LBC. We argue that decision making for migration and care-giving arrangements are inherently related to each other and are operated at the household level. It is essential to take into account of caregivers' perspectives because as critical social actors in the

migration process they contribute to migration decision (Cohen and Sirkeci 2011). Although caregivers may act as an ‘outsiders’ for migration decision-making, their perceptions of migration can be important because of the potential to influence their decision about taking on care-giving responsibilities for LBC, which in turn may affect their own as well as LBC’s well-being.

Despite rapid socio-economic changes that China is undergoing, the structure of Chinese families continues to be mutually dependent and family obligations still play an important role in family relationships (Qi 2015). We argue that there are some underlying socio-cultural explanations pertaining to economic motives for migration; for example, making contributions for social events (weddings and funerals) in village life, and fulfilling social obligations for left-behind sons’, but not daughters’, futures as an important driver to motivate parents to migrate. Grandparents, particularly on paternal side, are expected to fulfil social obligations to care for left-behind grandchildren even without immediate financial returns. Children left in the care of paternal grandparents may actually receive fewer remittances from their migrant parents than maternal grandparents. This suggests a paradox of intergenerational obligations for boys in a society, where sons are culturally more valued than daughters: because parents migrate to save for sons’, rather than daughters’, adult lives; left-behind boys, in particular boys cared for by paternal grandparents, may have fewer resources in their early childhood than other children in rural China.

7.3 Methodology and data

A qualitative study design was used to enable the generation of rich and in-depth information about the complex phenomenon of migration and care-giving arrangements (Creswell 2006). Qualitative research can ‘capture complexity of family life in the sense of an ongoing stream of behaviour over long period of time that interweaves the perceptions of individuals with behaviours in relationships’ (Wampler and Halverson 1993, p.189), and produce rich data to provide a good understanding of the intra-household dynamics and/or social processes behind the numbers (Jones and Sumner 2009).

7.3.1 Research setting

This study was carried out at a rural site in one township in Henan Province, People's Republic of China, from September 2013 to February 2014. Henan Province is located in the northern central part of China, which is the most populous and traditionally one of the largest migrant-sending provinces throughout China (All-China Women's Federation 2008; 2013). The annual per capita disposable income of urban residents in 2012 was 19,408 RMB (approximate 1,940 GBP) and 7,432 RMB (approximate 740) for rural residents (Yongcheng Government 2013), lower than the national average (24,565 RMB or approximate 2,450 GBP for urban residents and 7,917 RMB or approximate 790 GBP for rural residents) (National Bureau of Statistics of China 2014c). Child participants were recruited at a primary school. The sample was purposive in order to achieve maximum variation (Creswell 2006) of age, gender, and family structures (left by mother, father, or both parents). To be eligible, LBC had to be children who stay in rural areas with at least one parent having migrated to urban areas for employment. Caregivers for eligible children were invited to take part in this study.

7.3.2 Data collection

Child participants were recruited at a primary school. The sample was purposive in order to achieve maximum variation (Creswell 2006) of age, gender, and family structures (left by the mother, the father, or both parents). To be eligible, LBC had to be children who stayed in rural areas with at least one parent having migrated to urban areas for employment reasons. Caregivers for eligible children were invited to take part in this study.

Face-to-face semi-structured interviews were conducted with caregivers, either individually or together with their partners. LBC were present for ten interviews with their caregivers. The interviews took the form of informal conversations in which the interviewer asked open questions about parental migration and care-giving arrangements for LBC using a topic guide. Caregivers were encouraged to elaborate on their answers and to raise additional topics that they considered relevant. Questions became more focused and specified as data analysis progressed and the key themes emerged. Interviews were conducted in Chinese (mandarin or dialect).

Each interview lasted approximately between 1 and 1.5 hours. All interviews were conducted by the first author in participants' homes and were audio-recorded with their permission and subsequently transcribed verbatim in Chinese by a different person outside the research team. The first author checked all the Chinese transcripts to minimize data loss.

Twenty-one LBC were recruited (Table 7.1): 12 boys and 9 girls; 10 were cared for by paternal grandparents, 4 by mothers, 4 by one parent and paternal grandparents, 2 by maternal grandparents, and 1 by an aunt; 19 of 21 LBC have at least one brother within household. Table 7.2 presents the characteristics of caregivers in the study sample. Of the 21 grandparents (17 on the paternal side and 4 on the maternal side), 15 were aged over 60 years old, and 6 were aged over 70. Only two of them went to primary school and the rest had never attended school. The other caregivers (5 mothers, 1 aunt and 1 uncle) had a middle school education or less. Among grandparents, only one paternal grandmother reported that her husband had a pension because he was previously an electrician in his village. Two grandfathers went to the local town occasionally for part-time work in construction site. Other grandparents relied on agricultural income for a living.

7.3.3 Data analysis

Principles and procedures of the constant comparative methods guided data analysis (Charmaz 2006), following transcription and entry into the qualitative analysis computer program Nvivo 10 (QSR 2012). Concurrent data collection and data analysis occurred with codes and categories being inductively developed from the data. Analysis involved identifying codes and their properties and dimensions, grouping the codes to create categories, systematically comparing and contrasting the codes, and examining the connections between the categories and subcategories.

Data analyses were initially processed in Chinese in order to avoid misunderstanding and minimize the risk of losing participants' meanings. It has been argued that the Chinese language is quite complex and it is often difficult to achieve equivalence of meaning in English language (Twinn 1998). As the analysis developed, data related to emerging themes were translated into English to facilitate review and discussion

with co-authors. The translated versions and the original Chinese versions were checked by an independent and bilingual person outside the research team.

7.3.4 Ethics

Ethical approval was obtained from The University of Manchester Research Ethics Committee. Informed consent was obtained from participants using either in writing or by verbal audio-recording from illiterate participants. Pseudonyms have been changed to preserve participants' anonymity.

7.4 Results

7.4.1 Migration to 'make ends meet'

Carers described the economic motives for migration. Three emphasized that migration was a reluctant decision and driven by economic motives in order to meet the basic needs or survival of the household members who remained behind:

No one would ever migrate away if they have enough to eat at home.
(Paternal grandmother 5)

If having enough money for a living, no one would ever migrate away. Just like others [non-migrants], they [migrant parents] also would like to be with their children. Who would not want to be with his wife and children? To put it bluntly, it is just for money. (Paternal grandmother 8)

Some carers described the underlying reasons for migration as being a need to ensure individual survival, such as 'get enough to eat' and 'making a living'. These carers' emphasis on meeting the first and basic stage of physiological needs was consistent with motivational theory (Maslow et al. 1970).

Concerns about the stability and reliability of work were also mentioned. Working away was described as necessary for parents to 'make ends meet' and a secure income was compared with working locally:

Local work is not stable. You may have work today but you may lose it tomorrow. Working away is more stable and reliable. (Paternal grandmother 6)

Working away is better than working locally. Most of the times you have work today but perhaps you may lose it tomorrow. But this is not the case if you work away. They [LBC's parents] were unable to make ends meet when working locally. So they both migrate away. (Maternal grandmother 3)

In addition, some grandparents referred to problems in marital relationships as a motivation for migration. Wives and husbands from poor households sometimes fought with each other in the context of limited household resources. Relationship problems were in essence linked to household economic restrictions:

Life is not well off. And my son has no practical skills to earn money. They [son and daughter-in-law] used to fight over this. At last they decided to migrate away for work. You know, they did not get along well with each other at home as they could not make money. (Paternal grandmother 6)

They [LBC's parents] used to fight a lot when they were still at home as they had no money. Now they are away for work, I am not sure whether they still fight; at least, out of sight, out of mind. I need to care for kids for them. (Paternal grandmother 8)

One paternal grandfather who helped his daughter-in-law care for two left-behind girls indicated non-economic motivations for migration:

He [LBC's father] got some mental problems. When he was around he often beat the kids. The girls were so scared of facing him. I just asked him to migrate away. (Paternal grandfather 2)

The parents' need to migrate for work due to a lack of land to cultivate, or lack of employment opportunities, can be seen as a 'push' factor that drives the rural population to migrate to other places. On the other hand, more employment opportunities and higher salaries 'pull' them to migrate to developed regions (Cheng et al. 2006).

Three carers mentioned that they were not concerned about survival. However, they had to pay contributions to 'ren qing' (social and moral norms of reciprocal favour, 人情) and 'li jie' (cultural etiquette, 礼节) in order to maintain social relationships in their villages, which caused extra pressure on household finances:

The contribution to one funeral used to cost much less than it is nowadays, no more than 10 RMB [1 GBP]. It is now around 100 RMB [10 GBP]. We were asked to give 500 RMB [50 GBP] for one relative's funeral. We had to do so just as others did. (Paternal grandmother 12)

Anyway what he [LBC's father] earned is enough for our survival. We have farmland to provide grains...You know, "ren qing li jie" [social and moral norms of reciprocal favour and cultural etiquette, 人情礼节] can cost a lot every year, at least 100 RMB [10 GBP] for attending just one funeral. Other families in this village are better off than us. They usually contribute several hundred RMB for weddings and funerals. We can do nothing but to follow others. This has made our situation even worse. (Mother 4)

In both these cases, participants experienced financial difficulties with making contributions to social events (weddings and funerals), but described them as important for social interactions in rural areas. It is likely that these expenses can reduce the household resources allocated to children. A longitudinal study from rural southern China suggests that prenatal exposures to social festivals tends to 'squeeze' resources allocated to food and nutrition for poor households, which appears to cause lower height growth in young boys (but not girls) under six years old (Chen and

Zhang 2012). Our data suggested expected contributions to social events are a source of comparison and judgement in the village, and so an additional financial pressure:

Other families in this village make contributions of one or two hundreds for social events [weddings and funerals], it would be inappropriate if you just contribute 50 RMB [5 GBP] as it could make yourself and your host [of the social events] lose face. (Paternal grandfather 2)

7.4.2 Migration to meet social obligations for sons

Another economic motive for migration was to earn and save money for their sons' adults' lives, especially marriage. This was prominent during the interviews with all the caregivers of left-behind boys, but not mentioned by caregivers of girls. This may suggest gender disparities in social obligations for boys and girls in the context of rural China, where sons are more culturally valued and receive more resources than daughters (Burgess and Zhuang 2000; Ebenstein and Leung 2010). Carers of boys referred to social expectations in rural areas that parents would take responsibilities for sons' futures:

We have been in debt since we married off our two sons. First, weddings for sons, then feasts for celebrating the new-born grandchildren – both are our responsibilities. (Paternal grandmother 6)

It was worth noting that seven out of nine left-behind girls also had one brother in their family (Table 7.1). Girls, according to their caregivers' accounts, were not one of the reasons why parents migrated. Meeting social obligation for sons' adult lives appeared to be a prominent rationale. This might suggest a distinct gender disparity in investments (referring to quantity and quality of household resources in this study) which favour boys rather than girls within the same households in rural China.

It is not uncommon in traditional patrilineal family system in China for sons to receive more monetary contributions from their parents than daughters. This may be due to the cultural expectation that sons should take the major responsibility for continuing the family line and supporting older parents, while daughters, especially married daughters, do not (Lei 2013). It has been argued that traditional family

values such as intergenerational support and filial piety may have weakened due to China's modernization and population control campaign (Sheng and Settles 2006). However, in the vast rural areas where the one-child policy is relatively flexible, the influence of traditional family lineage is still powerful (Liguo et al. 2014).

Having a son was considered to be associated with enormous expenses in rural areas:

It would cost hundreds of thousand RMB for a boy, like buying him a house, getting him a wife. This is the reality in rural areas. (Maternal grandfather 1)

Parents started working hard to accumulate wealth even when their son was still young; for example, one paternal grandmother said her son and daughter-in-law started to migrate and save money when their son was only three years old:

They [LBC's parents] are worried about buying house for their son even though he is just three years old. They both could save around 30,000 RMB [3,000 GBP] per year. In this case, it will take about 10 years for them to buy a house. You know, currently the house costs hundreds of thousands RMB, even for the house in the town costing 200,000 RMB [20, 000 GBP]. No one knows where the rate of house will go in ten years. (Paternal grandmother 6)

Evidence suggests that Chinese parents with sons, particularly in rural areas, increase their savings due to the existence of unbalanced sex ratios, in order to improve their sons' relative attractiveness for marriage (Wei and Zhang 2009).

Having more than one son could make life even harder. Therefore, having a second son, for some families, served an additional push to parents to 'migrate again':

I have been talking to my sister all the time, "you do not have the ability to make money then how come you still give birth to babies, in particularly baby boys – the boys make life even harder". So may the God let the rich have more boys and the poor have fewer. But it does not work this way, does it? (Aunt 1)

He [LBC's father] used to work away when our first boy was around five to six years old. When we had our second child, another boy again, so he had to migrate again to make more money. Two boys, how come he stays at home instead of working away? (Mother 1)

In another case, parents were concerned about how they could afford two houses for their two sons. Therefore, both parents decided to migrate to make money:

His [LBC's] father said they [LBC's parents] had to make money for buying sons' houses. They migrated away for their sons' sake. How much money would it cost for two boys, you see? They have been worried sick about this: when will they be able to make enough money for houses? (Paternal grandmother 3)

At least, 'migration especially both parents away make it possible to buy houses for their sons'. (Paternal grandmother 6)

It was surprising that children's education did not emerge as an important driver for parental migration in rural areas, as was initially expected. Three caregivers (one paternal grandfather, one maternal grandfather, and one uncle) expressed their expectations of LBC's education as a way to secure a better future than their parents' generation:

You (LBC) need to work hard at school. Otherwise you will be just like your parents. You (LBC) will follow your parents' paths to become a migrant worker in cities...Education is the only way to change your life. Even if you do not get into college finally, you would probably find a better job as a migrant worker in the cities when you are literate. (Maternal grandfather 1)

Education was an important concern but education *per se* was not considered as a primary driver of parental migration. This may have been partly because primary and secondary education is free and compulsory in China. Caregivers,

especially grandparents, did not express concerns about future educational expenses.

7.4.3 Taking on care-giving roles for left-behind children

Paternal grandparents as the first choice

Most of the 12 children with both parents migrating were left in the care of paternal grandparents (N=10). The remaining two were only left with maternal grandparents because paternal grandparents were not able to provide help with childcare. A six-year-old boy was originally left in the care of his paternal grandmother but transferred to his maternal grandmother due to her health problems:

He [LBC] was cared for by his paternal grandma when he was from one to four years old. Unfortunately, his paternal grandma got hepatitis B. For his health sake, my daughter and son-in-law took him along when they migrated. However, they both worked and could not manage to look after him. My daughter told me her sufferings and requested me to help her. (Maternal grandmother 2)

This maternal grandmother described how the care-giving roles were transferred. She gave priority to looking after her paternal grandchildren. Her daughters-in-laws were an important consideration when she made her decision of looking after her maternal grandson:

You know, I have my own grandchildren [paternal grandchildren] to look after. My sons may have no problem if I look after my maternal grandson but the problem is with daughters-in-law who might not be alright with this. A proverb goes, “Daughters-in-law are not close enough with mothers-in-laws from North China to South China (从南京到北京儿媳妇不跟老婆婆亲)”. So I just told my daughter that I can help her but I cannot guarantee how long I can do this for her. (Maternal grandmother 2)

Another left-behind boy and his younger brother, who were cared for by his maternal grandparents, were expected to be looked after by their paternal grandparents in the first place:

If his [LBC's] parents are away just for one or two days, perhaps he can stay with his paternal uncles. But the thing is his parents are away all the year around. In this case, he can stay with his paternal grandmother who is old and ill though. He complained that his paternal grandma's cooking was dirty. So he ended up staying with us. (Maternal grandmother 1)

Four mothers with LBC directly referred to paternal grandparents when asked about care-giving roles of LBC. Two of them mentioned that the paternal grandparents were too old to provide childcare. Another two indicated that the paternal grandparents refused to provide help due to family conflicts:

He [LBC's paternal grandfather] never helped out...He used to say, "We [LBC's paternal grandmother and paternal grandfather] would starve to death if we depend on you [LBC's parents] for elderly care". In fact, we had three kids and were trying hard to make ends meet for survival, how could we have extra money for you? He even locked the door from the inside once when my kids approached him for food. How could you do this since they are your grandchildren by blood? (Mother 2)

This account suggested that paternal grandparents expected future returns, in the form of elder care from their adult children, when they decided whether to provide childcare or not. This suggests that intergenerational support between grandparents and their adult children in rural China is not a one-way street but follows a bidirectional pattern that resembles a long-term exchange of resources (Li et al. 2004;Zhang 2005).

Three children with only mothers migrating were left behind with fathers who cohabited with the LBC's paternal grandparents. In fact, paternal grandparents were the primary care-givers for the LBC. When the paternal grandparents were too old and/or they their health was poor, the maternal grandparents or other relatives, such

as an uncle or aunt, often assumed their caring roles instead. For example, a 12-year left-behind boy whose paternal and maternal grandparents were too old to provide help was looked after by his maternal aunt.

Concerns about negative consequences of parental migration

Some carers showed concerns about the potentially negative consequences of parental absence on children's well-being, in terms of emotional development, education, and personal development.

Grandparents believe that all LBC need is enough food. They would never understand emotional connections between left-behind children and their parents. Nothing can replace parents' love and care. Every child expects their parents' love. For example, a baby goat would frisk with mother goat. It may become upset if it was taken away from mother goat. This also applies to left-behind children. They feel empty in heart.
(Uncle 1)

This account implied that grandparents as caregivers for LBC tended to focus on survival needs such as food and failed to fulfil the children's emotional needs. This is consistent with previous research indicating that care provided by grandparents is often limited to tangible help and rarely involves spiritual inspiration or attending to LBC's mental well-being (Lee 2011; Li and Xiong 2005; Lv 2007).

In addition, this quote vividly suggested the importance of parents' love and care for children's emotional well-being. This could be seen as a short-term consequence of parental migration. Attention was also paid to the long-term adverse effect on children's potential development:

One child is like a piece of farmland. For left-behind children whose parents are away, it is just like the piece of land would lay waste. You never know how much potential the child has in the future. If the child is not well cultivated he might become a loser in the future. It might not worth it for just making some money. (Uncle 1)

Children who were left behind by parents were described as ‘uncultivated land’ in a metaphorical way. Parental migration improved household economic status at a price, that is, a lack of attention to the potential of children, which might make them become ‘losers in the future’ (Uncle 1). This was partly because the majority of grandparents (19 out of 21) in our study were illiterate and were unable to provide help with LBC’s education. Even though some caregivers were aware of the short-term and long-term influences of parental migration on LBC’s development, it seemed that there was nothing they could do to make things better for the LBC:

What can we do about it? We are not their (LBC’s) parents. What we can do is to cook them food and dress them clean for school. This is just how things work in villages. Parents go to cities for work and children stay behind. This is the reality in rural China. (Maternal grandfather 1)

Our findings appeared to be consistent with existing studies that showed a negative association between parental migration and LBC’s development, including psychological well-being (e.g., He et al. 2012; Wang et al. 2015; Fan et al. 2010; Jia and Tian 2010; Su et al. 2013; Wen et al. 2015; Wu et al. 2015) and educational attainment (e.g., Lee 2011; He 2008; Zhao and Glewwe 2010; Knight et al. 2010; Hu 2012a; Lu 2012; Wang 2007; Wen and Lin 2012). Some studies have suggested that children who were left behind by their parents and left in the care of their grandparents appeared to have poorer diets and nutrition (He 2008; Ye and Pan 2011; Luo et al. 2008), and increased labour burden including farm work and household chores for LBC (Lu 2011; Ye and Pan 2011), especially for left-behind girls (Ye and Pan 2011; Chang et al. 2011a). Given the small sample size, our study was unable to distinguish gender differences in children’s time-use patterns and child development quantitatively.

Caring for left-behind grandchildren: feeling obliged?

Care-giving practices often involved preparing food, washing clothes for LBC, sending young LBC to school and collecting them after class. Some carers indicated that ‘looking after them [LBC] is very demanding’ as they had to care for more than one child. In two cases, grandparents needed to look after four LBC; ‘it is just like

running a kindergarten'. On the other hand, two paternal grandmothers expressed their willingness and pleasure in providing childcare. Otherwise, they would 'feel lonely' without the LBC's companionship.

However, grandparents indicated strong feelings of responsibility and obligation towards caring for left-behind children. Our interviews suggested that caring for paternal grandchildren was a social expectation on grandparents:

Daughters-in-law are expected to give birth to children and paternal grandmother is responsible for rearing them, which is quite true in this village or any other village. They [migrant parents] assigned you a task to care for the kids. So it becomes our responsibility to look after them. What are you gonna do about it? (Paternal grandmother 12)

We are doing this [looking after the two left-behind boys] just for our kids' sake even though we are quite old. What are we going to do? My own paternal grandchildren and my own maternal grandchildren, how come you don't look after them? (Maternal grandfather 1)

These narratives showed strong culture-based responsibility and obligations for grandparents, in particularly paternal grandparents, to help their adult children look after grandchildren. They are the most common caregivers and often the first choice to take on care-giving responsibilities for LBC when both parents are away. Caring for grandchildren in China is considered to be the cultural norm, and thus expected (Burnette et al. 2013). However, this study found that paternal grandparents in particular might feel obliged to take on care-giving roles. Although they found caring for LBC 'not easy' and 'very demanding', especially for ageing grandparents or those in poor health, they still encouraged parents to migrate in order to 'make ends meet'. Adult sons and daughters may be motivated to take up migrant work to improve the household's economic status when parents are available to look after their young children. Those who are left behind in the extended family constitute 'a reliable and effective support system' (Chang et al. 2011b). These findings are also consistent with the group/mutual aid model, in which each household member's

capacity is maximized to ensure the success of the household as a whole (Lee and Xiao 1998).

In our interviews, one paternal grandmother refused to look after LBC as she claimed that her son was too poor to offer her elder care when she became older. She had more than one sons and she chose to look after the children of her second son who was financially better off than her first son. To some extent, grandparents were not always passive recipients and sometimes they made their own decision on whether to provide childcare, or which child they would provide it for. Therefore, providing childcare, under some circumstances, can be seen as a strategic investment made by grandparents in the hope of maximizing the return they will receive in the future (Cong and Silverstein 2011; Brown and Poirine 2005; Silverstein et al. 2002; Sun 2002).

Remittances from migrant parent(s) to non-parental caregivers

In this study, the remittances mainly refer to monetary remittances (for example, money and in-kind goods) rather than social remittances such as ideas, norms, and practices gained through migration and passed on to household members who stay behind (Levitt 1998). Participants' accounts gave the impression that the remittances could be small and irregular, in particular for paternal grandparents acting as caregivers. Ten out of 13 paternal grandparents said they did not receive remittances from LBC's migrant parents (see Table 7.3). Two of three paternal grandparents who did receive remittances described the amounts as inadequate to cover all the LBC's expenses:

My son gives me money irregularly when he gets back home. He asks me to use this money for buying clothes, shoes, food and drinks for them [LBC]. When the money is running out, I spend my own. You know they are my own grandchildren, how come I do not love them? (Paternal grandmother 3)

The other day I spoke to my son, "you think you give me 2000-3000 RMB [200-300 GBP] a year, but you have no idea how much money I need to spend, around 10,000 RMB [1,000 GBP]". He seemed to be all

right with it. I almost spend all my income covering the outstanding expenses. (Paternal grandmother 4)

Two paternal grandmothers showed an understanding for their adult children not sending remittances:

They never gave me money or buy me any clothes. They don't have any money for me since their small business went broke. My son would be able to work in construction fields to earn money if he is in good health condition. They are so poor. I never ask them for money. I don't want to see them suffer a lot. (Paternal grandmother 12)

They [LBC's parents] have no money at all. My daughter-in-law has many siblings so they need to pay many contributions, like weddings, celebrating new-born babies, and so on. Last year I fell down and was sent to hospital. They borrowed money to pay for my medical expenses. So they don't have money. (Paternal grandmother 10)

However, all three maternal grandparent carers said they received remittances from migrant parent(s) (see Table 7.4) and two described it as 'enough for the kids'. One left-behind girl and her little brother were cared for mainly by their paternal grandparents and occasionally by their maternal grandparents. Only the maternal grandparents received remittances:

My daughter sent me money to pay tuition fees for my little grandson. You know he is in pre-school and it is not free. And the rest of money is used to buy some food and snacks for children. It is enough for the kids. (Maternal grandmother 3)

Although financial returns could cover the LBC's own expenses, we were unable to ascertain whether maternal grandparents received additional compensation for their help with childcare. Given the small sample of grandparents (13 on the paternal side and three on the maternal side), it is not possible to draw a definitive conclusion that maternal grandparents are more likely to be reciprocated financially than parental

grandparents. Our findings, however, may shed light on the gender disparities in providing support for parents.

Most paternal grandparents in our study reported that they did not receive regular and adequate remittances from their adult children. The remittances appeared to only cover the LBC's own expenses and did not involve additional compensation for the paternal grandparents' help. Maternal grandparents reported that they received remittances from their adult daughters which were considered to be 'enough' for the LBC. This is consistent with Song et al's (2012) study suggesting that daughters who received support from their older parents (for example, grandchild care) tended to return more financially than sons. Normally, full-time childcare for maternal grandchildren is rare in rural China, where strong patrilineal family values are embedded and family resources are less likely to be expected to be allocated to married daughters (Chen et al. 2000). When childcare is provided for adult daughters, greater expectations of financial returns are expected from them by grandparents (Cong and Silverstein 2012). Whyte and Xu (2003) have observed a general pattern in provision of support for older parents, in that married daughters tend to provide greater support for ageing parents than married sons. It is possible that even without childcare help, maternal grandparents may still be expected to receive financial assistance from their daughters.

Another possible justification for sons rarely making financial support is due to the 'long-term contract' between sons and older parents (Song et al. 2012). The care of the aged is primarily a family responsibility in China (Davis and Harrell 1993), especially in rural areas without a universal social security system (Lei 2013). Sons in a traditional family are morally and legally expected to provide support for their parents especially in later stages of life (Whyte and Ikels 2004; Ebenstein and Leung 2010). In this case, it is possible that sons will reciprocate, probably in a different way (for example, offering elder care), at a later stage. This life course perspective of reciprocal transfer between inter-generations; that is, 'earlier investment in the form of future support' (Thang and Mehta 2012), may explain irregular and inadequate remittances to grandparents for childcare from adult sons.

It should be noted that the different patterns of intergenerational contracts observed in this study can be applied to daughters as well as sons. The inherent difference may be that contracts with daughters tend to be short-term, while contracts with sons are long-term and may persist into the course of later life (Antonucci et al. 2004; Yang 1996). Migration is partly the outcome of meeting social responsibilities for offspring especially sons in rural China. Grandparents, particularly on the paternal side, are expected to fulfil their social obligations to care for left-behind grandchildren even without immediate financial returns. These intergenerational obligations may have inadvertently strengthened family bonds through generations in rural China.

7.5 Conclusion

Although the sample is from only one township in rural China, the findings in this study are consistent with those in previous studies in other parts of the country, which found that economic incentives are an essential motivation for internal migration (Ye et al. 2013; Fan 2005; Hu 2012b; Cheng et al. 2006). This study sheds further light on some underlying socio-cultural explanations pertaining to economic motives; for example, making contributions to social events (weddings and funerals) in village life, and fulfilling social obligations for left-behind sons', rather than daughters', futures. The latter appears to be an important driver in motivating both parents to migrate. When both parents are away, paternal grandparents are often expected to be the first choice for taking on care-giving responsibilities for LBC. Regular and sufficient financial returns are not always available to paternal grandparents. Despite the small size (13 paternal grandparents, three maternal grandparents), the findings of this study tentatively suggest strong culture-based obligations for paternal grandparents to help their adult children take care of LBC.

Despite significant socioeconomic changes in contemporary China, family obligations continue to play an important role in Chinese family ties (Qi 2015). At least two distinctive flows of intergenerational obligations within a split household due to migration can be observed. One is upwards from grandparents to their adult children, via the provision of childcare for LBC. The other is downwards from migrant parents to LBC, by saving up for their young sons' adult lives. Preferences

for sons, though rooted in traditional Chinese culture, are still prevalent in contemporary rural China (Ebenstein and Leung 2010). Sons are considered more valuable and often allocated more household resources than daughters (Davis and Harrell 1993). Chinese parents with sons increase their savings due to the existence of unbalanced sex ratios, in order to improve their sons' relative attractiveness for marriage, which is particularly true in rural areas (Wei and Zhang 2009).

The findings of this study suggest that the gender of the LBC can be an important consideration for parental migration in the context of rural China: parents of boys have the additional motivation of migrating in order to save for their sons' futures. This suggests a paradox of intergenerational obligations, in that left-behind boys are less likely to receive resources in the form of remittances from migrant parents in a society where sons are culturally more valued than daughters. This is because parents migrate to save up for their sons', rather than their daughters', adult lives. Grandparents, particularly on the paternal side, are expected to fulfil social obligations to care for left-behind grandchildren even without immediate financial returns. Children left in the care of paternal grandparents may end up with fewer resources from their migrant parents. Left-behind boys cared for by paternal grandparents may receive even fewer resources in their early childhood from migrant parents than LBC cared for by maternal grandparents. This lack of resources in early childhood potentially makes left behind boys at risk of slower growth and development during a critical period of the life course. Moreover, our findings on the gender differences of LBC in the social obligations and remittances from migrant parents, have an important policy implication in the context of rural China, where son preferences are prevalent (Burgess and Zhuang 2000). Future studies and policy-making on LBC's well-being should therefore consider the variables of the gender of LBC and their relationships with caregivers.

Several limitations were encountered in this study. We explored the motivations for parental migration and care-giving arrangements from caregivers' perspectives rather than migrant parents directly. While this enabled us to discover what is important in making migration decisions with the perspective of an outsider, we were unable to explore migrants' views on their motivations for migration and their care-giving arrangements for LBC. We found that income was a sensitive issue and most

participants were reluctant to disclose their incomes. Although some caregivers did volunteer information about remittances from migrant parents and whether the remittances were sufficient for the LBC, we were unable to compare the amount of remittances received by parental grandparents and maternal grandparents. In addition, the participants may not be representative of the community of caregivers for LBC in the area in terms of socio-demographics or views. However, diversity was maximized within the context based on children's characteristics (for example, age, gender, types of parental migration), and negative and discrepant cases analysed (Maxwell 2012) until theoretical saturation occurred (Charmaz 2006). Future studies may be able to access children and caregivers in different populations with various socio-economic characteristics and elicit further insights from migrant parents directly.

Abbreviations

LBC, left-behind children; Non-LBC, non-left-behind children; RMB: renminbi (the official currency of People's Republic of China); GBP, Pound Sterling

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Table 7-1 Sample size and characteristics of left-behind children (N=21)

	Left-behind children		Total
	Boys	Girls	
Number	12	9	21
Age range			
6-9 years	4	8	12
10-12 years	5	4	9
Siblings			
None	4	0	4
One brother	4	7	11
One sister	4	0	4
Others (two sisters)	0	2	2
Left-behind types			
Only mother away	2	0	2
Only father away	2	4	6
Both parents away	8	5	13
Caregivers			
Paternal grandparents	5	5	10
Maternal grandparents	2	0	2
Mothers	2	2	4
Fathers	-	-	-
Shared: paternal grandparents and mothers	-	2	2
Shared: paternal grandparents and fathers	2	-	2
Others (uncle or aunt)	1	-	1
Total		21	

Table 7-2 Sample size and characteristics of left-behind children's caregivers (N=28)

Characteristics	Paternal grandmother	Paternal grandfather	Maternal grandmother	Maternal grandfather	Mother	Aunt/ uncle	Total
Age Range							
30-39 years	-	-	-	-	2	1	3
40-49 years	-	-	-	-	3	1	4
50-59 years	6	-	-	-	-	-	6
60-69 years	5	3	1	-	-	-	9
>=70 years	1	2	2	1	-	-	6
Educational attainment							
Illiterate	11	5	2	1	1	-	20
Primary school	1	-	1	-	2	1	5
Middle school	-	-	-	-	2	1	3
High school or higher	-	-	-	-	-	-	-
Total	12	5	3	1	5	2	28

Table 7-3 Remittances from migrant parent(s) to non-parental caregivers (N=16)

	Remittances		Total
	Yes	No	
Gender			
Boy	4	8	12
Girl	2	2	4
Age range			
6-9 years	2	4	6
10-12 years	2	8	10
Caregivers			
Paternal grandparent(s)	3	10	13
Maternal grandparent(s)	3	0	3
Other relatives (Aunt)	0	1	1

Table 7-4 Remittances distribution for non-parental caregivers who received remittances

Caregivers	Sent remittances or not ^{&}	Amount [§]	Enough for LBC
Maternal grandfather 1	yes	Not Specific	-
Maternal grandmother 2	yes, quarterly	About 1000RMB (or 100 GBP)	Yes
Maternal grandmother 3	yes	Not Specific	Yes
Paternal grandmother 3	yes, irregularly	Not Specific	No
Paternal grandmother 4	yes	2000-3000 RMB (or 200-300 GBP)	No
Paternal grandfather 1	only Chinese New Year	Not Specific	-

[&] Have his/her parents send remittances back?

[§] How much money roughly has been sent back to you per year?

LBC, left-behind children; RMB, renminbi (the official currency of People's Republic of China); GBP, Pound Sterling

Chapter 8 Intergenerational differences in beliefs about healthy eating among carers of left-behind children in rural China: A qualitative study

Chapters 5-8 present four papers which address specific issues regarding parental migration, care-giving practices and left-behind children's nutritional health in rural China. This chapter is the second qualitative paper using in-depth interviews with caregivers and diaries of child participants to gain insights into the beliefs of healthy eating in villages of northern central China. This paper is motivated by the idea that high prevalence of malnutrition among children is not only due to poor economic status but also to a lack of knowledge regarding healthy diet. This paper suggests intergenerational differences in beliefs about health eating among the parent and grandparent generation. This paper also provides a link between parental migration and left-behind children's nutritional health through care-giving practices in rural China.

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Intergenerational differences in beliefs about healthy eating among carers of left-behind children in rural China: A qualitative study

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8.1 Abstract

China's internal migration has left 61 million rural children living apart from parents and usually being cared for by grandparents. This study aims to explore caregivers' beliefs about healthy eating for left-behind children (LBC) in rural China. Twenty-six children aged 6-12 (21 LBC and 5 non-LBC) and 32 caregivers (21 grandparents, 9 mothers, and 2 uncles/aunts) were recruited in one township in rural China. Children were encouraged to keep food diaries followed by in-depth interviews with caregivers. Distinct intergenerational differences in beliefs about healthy eating emerged: the grandparent generation was concerned about not having enough food and tended to emphasize the importance of starchy foods for children's growth, due to their past experiences during the Great Famine. On the other hand, the parent generation was concerned about food safety and paid more attention to protein-source foods including meat, eggs and milk. Parents appeared to offer children high-energy food, which was viewed as a sign of economic status, rather than as part of a balanced diet. Lack of remittances from migrant parents may compromise LBC's food choices. These findings suggest the potential for LBC left in the care of grandparents, especially with experience of the Great Famine, may be at greater risk of malnutrition than children cared for by parents. By gaining an in-depth understanding of intergenerational differences in healthy eating beliefs for children, our findings could inform for the development of nutrition-related policies and interventions for LBC in rural China.

Keywords: Healthy eating; Left-behind children; Malnutrition; China; The Great Famine

8.2 Introduction

Eating habits developed during childhood can persist into adolescence and adulthood, influencing individual growth, development, and health in later life (Centres for Diseases Control and Prevention 1996; Nicklas and Johnson 2004). For children, their eating decisions are often made within the family context, which is the most influential aspect of the immediate social context (Nicklas 1995; Jiang et al. 2007; Taylor et al. 2005). The family eating circumstances that caregivers provide during early childhood, including their feeding practices, their own eating patterns, and their beliefs and attitudes about healthy eating can directly (through food served) and indirectly (through offering behavioural models) influence and shape children's eating habits (Cooke et al. 2004; Gibson et al. 1998).

Household living arrangements are an important feature of family circumstances that contributes to the formation of children's eating practices (Hasenboehler et al. 2009; Deng 2011). Kinship care of children, especially by grandparents, is a common arrangement in developing countries (Ma 2010). Grandparents therefore play a key childcare role in multigenerational and 'skipped generation' (children living in households headed by their grandparents) households (Burnette et al. 2013). Being cared for by family members other than parents may take a toll on child development. For example, one qualitative study drawing on in-depth interviews with 12 parents and 11 grandparents in Beijing urban areas suggested that young children aged 3-6 years and cared for by grandparents tended to develop unhealthy eating habits (eating more meals and snacks than necessary) (Jiang et al. 2007). A study using the China Health and Nutrition Survey 2006 showed that adolescents living in extended families, where children live with their parents and grandparents were more likely to develop unhealthy food preferences (e.g., preference for fast food, salted snack food and sugared drinks, and less liking for vegetables and fruits) compared to those living in nuclear families (Deng 2011). These intergenerational differences in forming eating habits may be due to differences in generations across a range of socio-economic variables, for example, educational attainment, economic status and early life experiences involving food (Taylor et al. 2005; Jing 2000).

Contemporary China has been undergoing unprecedented rural-urban migration, which has tremendously altered household living arrangements. Around 61 million children (accounting for 37.7% of total rural children and 21.9% of all children in China) live apart from either one or both parents. About one fourth (24.5%) of left-behind children (LBC) share a household with a parent and grandparents, while one third (32.7%) live with grandparents only (All-China Women's Federation 2013). LBC cared for by grandparents in rural China tend to be subject to potential nutritional problems. For example, a large survey conducted in the rural areas of seven Chinese provinces showed that non-parent caregivers had relatively poorer nutrition knowledge regarding the intake of certain nutrients (e.g., animal-source foods, flour, milk, fried food, etc.) than parent caregivers of non-LBC (Tan et al. 2010). Another survey using a sample of LBC and non-LBC from 10 rural communities in 5 provinces across mid-south China showed that grandparents tended to pay less attention to children's diets and were unable to provide meals for LBC on time during farming seasons (Ye and Pan 2011). Although these results suggest that LBC are prone to unhealthy eating, they fail to provide in-depth information about how caregivers understand and manage eating practices for LBC. We argue that intergenerational differences in beliefs about dietary-related behaviours and nutritional intakes, the focus of this work, may put children at different risks for nutritional deficiencies.

The aim of the present study was to explore caregivers' beliefs about healthy eating for LBC in rural China. A qualitative study design was used to provide rich and in-depth information about the complex phenomenon of feeding practices and eating behaviours among children and their caregivers, and to advance an understanding of social and behavioural aspects of food and eating (Bisogni et al. 2012). We employed a social constructionist approach that viewed people as active agents who shape and create meanings and understandings within certain social, cultural and historical contexts (Creswell 2006; Charmaz 2006; Ritzer and Goodman 2003). This perspective recognizes that people construct subjective and complex meaning pertaining to food, eating and nutrition through their personal experiences and interactions with other people and their environments. Understanding of caregivers' perspectives and experiences related to healthy eating could inform the development of nutrition-related policies and interventions for children in rural China.

8.3 Methods

8.3.1 Setting

This study was conducted from September 2013 to February 2014 in a rural township in Henan Province, the most populous and traditionally one of the largest migrant-sending central areas of the People's Republic of China (All-China Women's Federation 2008; 2013). The annual per capita disposable income of urban residents in 2012 was 19,408 RMB (or 1,940 GBP) and 7,432 RMB (740 GBP) for rural residents (Yongcheng Government 2013), which is lower than the national average (24,565 RMB or 2,450 GBP for urban residents and 7,917 RMB or 790 GBP for rural residents) (National Bureau of Statistics of China 2014c).

The agricultural township has a population of 55,000 (Han Chinese) and includes 30 villages under its administrative jurisdiction. Child participants were recruited from a rural primary school. Children who participated in this study were from 7 villages that are geographically close. To be eligible, LBC had to have at least one migrant parent living away for employment reasons. Non-LBC had to be children with both parents currently living at home. Both LBC and non-LBC were aged over 6 years old because this is the normal youngest age of commencement of primary education in China (Shah et al. 2005a), and an age at which children have the cognitive and language capabilities to be interviewed (Rich 1968; Yarrow 1960; Docherty and Sandelowski 1999). Children as young as 6 years old can demonstrate a basic understanding of the purposes of research and what is expected of them during the research process (Broome 1999). The caregivers for eligible children were invited to take part. The sample was purposive in order to achieve maximum variation (Creswell 2006) of age, gender, and family structures (left behind by mother, father, or both parents). The sample size was not fixed until saturation occurred (Corbin and Strauss 2007), which was defined as 'data adequacy', meaning that recruitment stopped when no new information was obtained from additional participants (Morse 1995).

8.3.2 Ethics

Ethical approval was obtained from the University of Manchester Research Ethics Committee. Child participants were included after gaining informed consent from their caregivers, as well as their own assent, either in writing or by verbal audio-

recording from illiterate participants. Pseudonyms have been used to preserve participants' anonymity.

8.3.3 Data collection

Face-to-face semi-structured interviews were conducted with caregivers, either individually or together with their partners, and their children. Prior to interviews, children were encouraged to keep diaries about their daily eating (i.e., breakfast, lunch, supper and snacks) and activities (physical activities, school work, household work, etc.) for around one week. Diaries were used to establish rapport with children and their caregivers, and as a starting point for discussions between participants and the researcher (Spratling et al. 2012). In addition, the diaries were used to facilitate discussions in further interviews with caregivers and to check consistencies and inconsistencies in caregivers' interview accounts regarding children's diets.

Children were provided with pens and interesting and user-friendly notebooks, which may have rendered the children more predisposed to completing the diaries (Tinson 2009). The first author explained to the children how to complete the diaries using plain language and encouraged them to ask questions and/or air any concerns. She asked caregivers to encourage their children to complete the diaries, but not to influence their content. In addition, the first author visited the school twice a week to remind and encourage children to continue completing their diaries.

The interviews took the form of informal conversations in which the interviewer asked open questions about children's food and diet using a topic guide. The topic guide contained open-ended questions designed to elicit caregivers' understanding of healthy eating for children, as well as the related feeding practices (e.g., food preparation, meal places, meal time, etc.) for children under their care. The primary questions included:

1. *What do you think of healthy eating/eating well for children?* Probes included questions such as *can you name some food items that you think are healthy* and *why you think they are healthy*; and
2. *How do you manage the food for children you are looking after?* Probes included food preparation, meal places and meal time.

Caregivers were encouraged to elaborate on their answers and to raise additional topics that they considered relevant. Interviews were conducted in Chinese (Mandarin or dialect). Each interview lasted approximately between 1 and 1.5 hours. All interviews were conducted by the first author in the participants' homes and were audio-recorded with their permission, and subsequently transcribed verbatim in Chinese by a different person outside the research team. The first author checked all the Chinese transcripts to minimize data loss.

8.3.4 Data analysis

There were two sources of data: children's diaries and interviews. The primary data source was interviews with caregivers and children. Children's diaries were not designed to collect reliable data about precise consumption but used principally to build rapport with participants and facilitate further interviews. However, they provided an overall picture of children's daily eating and were also compared with caregivers' accounts concerning children's diets during interviews. The food items and frequency of consumption were summarised to explore consistencies and inconsistencies between the food items that children mentioned in their diaries and caregivers' stated views about healthy food. As children's reports in diaries were consistent with interview accounts, the data were included in this paper to provide additional detail and context.

Principles and procedures of the constant comparative methods guided data analysis (Charmaz 2006), following transcription and entry into the qualitative analysis computer program Nvivo 10 (QSR 2012). Concurrent data collection and data analysis occurred with codes and categories being inductively developed from the data. Analysis involved identifying codes and their properties and dimensions, grouping these codes to create categories, systematically comparing and contrasting the codes and examining the connections between the categories and subcategories.

Data analyses were initially conducted in Chinese in order to avoid misunderstanding and to minimize the risk of losing participants' original meanings. Each transcript was read through carefully several times so that the first author could familiarise herself with the data. During this process, recurring themes were noted as part of the initial coding process. During the second stage, the first author re-read and coded each transcript line-by-line within the Nvivo software package. Data were

fractured into segments and distinct codes. During this process, joint meetings were scheduled with co-authors to review the coding, discuss possible meanings and achieve consensus on categorisation and interpretation. Data related to emerging themes were translated into English to facilitate review and discussion with co-authors. The translated versions and the original Chinese versions were checked by an independent and bilingual person outside the research team. Then, relationships between categories were linked on a conceptual level rather than on a descriptive level, concerning conditions, context, action/interactions and consequences (Corbin and Strauss 2007). Once all interviews had been individually analysed, the identified themes were integrated with subsequent comparative analysis.

8.4 Results

8.4.1 Socio-demographic characteristics

Twenty-six children aged between 6-12 years old were recruited (Table 3.1): 21 LBC (12 boys and 9 girls) and 5 non-LBC (3 boys and 2 girls); 12 of 21 LBC had been left behind by both parents, 3 had been left behind only by the mother, and 6 had been left behind only by the father. Twenty-four (92%) of the children kept diaries. Table 3.2 presents the characteristics of the caregivers. Of the 21 grandparents (17 on the paternal side and 4 on the maternal side), 15 were aged over 60 years old, and 6 were aged over 70. Only two of them attended primary school and the rest had never attended to school. The other caregivers (8 mothers, 1 aunt and 1 uncle, defined as the parent generation) had up to a middle school education.

8.4.2 Intergenerational differences in healthy eating beliefs

‘Healthy eating’ and ‘eating well’ were broadly interpreted by participants and were used interchangeably during the interviews. Caregivers illustrated individual food items that were believed to be ‘good for children’ when asked about what they thought as eating well/healthy (Table 8.1). The grandparent generation emphasized the importance of home-grown foods, such as starchy foods and vegetables (although sometimes bought from the local markets). For the parent generation, the foods that were most valued were animal products from local markets, which were described as associated with household economic status.

There were distinct differences in expectations and concerns regarding food between these two generations. The grandparent generation expected food as a means for avoiding hunger and they viewed meat as a special treat for special occasions, while the parent generation viewed food, especially meat, as a sign of economic status within their communities. Grandparents tended to be concerned about having enough food for the children they cared for, while the parent generation paid more attention to food safety and tended to express concerns about the lack of access to fresh milk for their children growing up in rural areas, compared to children growing up in urban areas.

Food items and frequency of consumption, as noted in children's diaries, were grouped into three categories based on children's living arrangements (Table 8.2). Table 8.2 presented as contextual data for interpretation of caregivers' interview accounts regarding children's daily eating. Food items reported in children's food diaries were broadly consistent with the descriptions in the interviews with caregivers. There were no distinct differences in the consumption of starchy foods and vegetables between children left in the care of the grandparent and parent generations. Protein-source foods including animal products, eggs and milk were mentioned more often for each meal among children left in the care of the parent generation, compared to children who were cared for by the grandparent generation.

Grandparent generation

The food items most frequently mentioned by grandparents as 'good for children' (in order of frequency) were steamed buns, noodles, meat, rice and eggs. According to grandparents, starchy foods were more important than other food groups for children's growth (Table 8.1). Starchy/staple foods are an essential part of Chinese dietary culture, which can include wheat and wheat products, rice and rice products, and foods of other grains (Newman 2004). One paternal grandfather of a 10-year-old left behind boy believed that starchy foods could help children grow 'taller and bulkier':

He is too thin for his age. We try our best to let him eat more staple food, like steamed buns and noodles. One of his playmates in this village can eat a couple of bowls of noodles at a time. So he is quite

bulky. How could you possibly become taller and stronger without staple food? (paternal grandfather 5, LBC)

Similarly, one grandmother of a six-year-old left-behind girl believed that the intake of starchy foods was essential for meeting children's nutritional needs. She illustrated this by comparing her two grandchildren:

She [left-behind girl] is not as tall and strong as her little brother. She is quite fussy about the food. She does not like steamed buns, rice and sweet potatoes. At least her little brother eats steamed buns. How can her nutritional needs be possibly met? (paternal grandmother 6, LBC)

Four grandparents spontaneously referred to their past experiences during the Great Famine when asked about 'good food for children'. The Great Famine took place in China from 1959 to 1961, leading to 30 million deaths (Ashton et al. 1984; Smil 1999). The province where this study was conducted experienced a severe reduction (around 40% in 1961 compared to that of 1960) in grain, which was an essential part of the Chinese diet at the time (Peng 1987). The experience of starvation during their (child participants) grandparents' early years of life appeared to have shaped their values about food, which in turn may have influenced their feeding practices. One paternal grandfather mentioned that his left-behind grandson constantly complained that 'the food was not nice' and 'we have noodles all day'. The grandfather argued for the importance of starchy foods and believed that modern food was much better than before:

Modern people eat way better than before [the Great Famine]. Nowadays they have very nice steamed buns. But steamed buns alone are not good enough for them. They want more, such as delicious dishes. But you know in the old days, we did not even have salt. We were so hungry then that we had to steal wheat sprouts to feed our empty stomachs. (paternal grandfather 4, LBC)

Steamed buns were the food item most frequently described by grandparents as 'good for children.' They were considered to be 'nice' from the grandparents' point of view, as they were rarely available during the Great Famine:

When seeing others have nice steamed buns [during the Great Famine], I was wondering when I could possibly have one of my own. You know in the old days, even high-ranking officials had no access to nice steamed buns and dishes like there are today. I tried my best to live one more day just for one more steamed bun. (paternal grandmother 8, LBC)

One key reason why grandparents emphasized the value of starchy foods was that it could prevent feelings of hunger:

Even watery rice was not available at all during the Great Famine. It was all about water-boiled edible wild herbs in the communal kitchens. How could you not be hungry by only eating this? (paternal grandmother 10, LBC)

Most of our grandparent participants (15 out of 21 aged over 60 years old) experienced the Great Famine which was a period of severe food shortage and food consumption was a matter of survival. Grandparents argued for the value of staple or starchy foods regarding children's growth and persuaded their grandchildren to consume more of these items, placing a special value on one specific food that was often associated with limited access and/or survival (Kumanyika 2008). Starchy foods in our study were given greater emphasis by the grandparent generation, compared to other foods. The value given to these foods appeared to persist throughout their lives, even after they become widely accessible and abundant.

Meat was one of the most frequently mentioned foods by grandparents as 'good for children', after starchy foods. Seven grandparents directly referred to meat (mainly pork). The key issue was affordability, especially for those LBC who received little remittances from their migrant parents. Therefore, meat was provided occasionally and seen as a special treat:

We are unable to afford meat and eggs every day. I cook meat every ten days or so. I mince the meat into quite small pieces and mix them with some vegetables when served. But she [LBC] only picks out the meat and never the vegetables. (paternal grandmother 6, LBC)

For the grandparent generation, meat was considered a special treat. This finding is consistent with Lora-Wainwright's observations in southern rural China (2007), which suggested that offering meat to household guests was proof of the value placed on the guests in question. Animal-source foods are important to children's growth and development, but access to them is still limited for poor families in the developing world (Neumann et al. 2002).

Financial remittances from migrant parents were described as an important economic resource for improving the diet of LBC who were being cared for by grandparents. LBC whose parents sent little or no remittances tended to have limited access to meat, so that it appeared that a lack of remittances compromised the diversity of foodstuffs provided to some LBC. A paternal grandmother caring for a 12-year old boy and his younger sister said that she did not receive financial support from the LBC's migrant parents:

He always complains that we have noodles all the time. What else do you expect me to cook for you? Your parents never send money back...I used to tell them [LBC and his younger sister], "You two poor things have to suffer now [as I have no money to buy you meat or other stuff]. You can eat whatever you want when you grow up and have the capacity to make your own money." (paternal grandmother 10)

In the above case, LBC had to 'suffer', as stated by their paternal grandmother, because she was unable to afford foodstuffs other than noodles. This may support the idea that some LBC who received no remittances from parents have limitations in their diets. An 11-year old boy and his little brother with congenital heart disease had migrant parents who earned a low income and rarely sent back remittances. Their maternal grandparents, aged over 80, were struggling to prevent the children from going hungry and as such, nutrition itself was not a priority:

How can we care about the nutrition? We are trying our best not to end up being hungry. (maternal grandfather 1, LBC)

A left-behind boy wrote in his food diary that he ate bean sprouts for almost every meal during the period when he was asked to record his meals. His maternal grandmother further elaborated on this:

The bean sprouts were from our own field. We harvested soy beans around one month ago. Some were left in the fields and grew to bean sprouts. We collected them and then cooked them for meals.
(maternal grandmother 1, LBC)

According to maternal grandmother 1 and three other grandparents, their expectation of food was to avoid hunger and to meet basic survival needs (Table 8.1). They were more concerned about not having enough food for the children, rather than nutrition. This may be partly due to their poor financial status, and also influenced by their experiences of hunger during the Great Famine.

Parent generation

Amongst this generation, there was more diversity in food items than amongst the grandparent generation. Children's diaries showed that children who were cared for by the parent generation tended to have better protein intake including animal-source food, eggs and milk (Table 8.2). Five caregivers from the parent generation (n=11) mentioned 'cooking different foods' and 'preparing different dishes' for children. Only one mother mentioned about the Great Famine when she was promoted by her elderly neighbour. The parent participants in our study were mostly in their 30s and 40s and had not experienced the Great Famine. They tended to hold different attitudes towards starchy foods:

In the past, people used to be alright with just eating wheat flour, but this is not the case for modern people. How can children nowadays eat food only made of wheat flour? By the way, almost half of the nutrients come from meals with vegetables, meat, or a mixture of both instead of staple foods. Eating only wheat flour is not sufficient at all.
(uncle 1, LBC)

The maternal aunt of an 11-year-old left-behind boy whose parents had migrated for employment said that her family's finances were good, as her husband had secured a permanent job in the local coal mine industry. Despite receiving no remittances from the boy's migrant parents, she was still able to afford a variety of food for the boy and her own daughter:

Sometimes I make dumplings and noodles mixed with meat. My husband usually goes fishing, so we do not need to buy fish. Sometimes I make deep-fried cakes with melted sugar in it. The cooking oil is allocated by my husband's company so the quality is quite good. They [LBC and his cousin] find the food and snacks from local markets not as tasty, so I make these foods on my own for them.
(maternal aunt 1, LBC)

A varied diet does not always mean a balanced or nutritious diet. In the above case, for example, the maternal aunt made her children home-made snacks using deep-fried cooking methods by using cooking oils (and sugar), which has a high energy content, but very few nutrients. Frying generally implied more edible oils and cooking special foods (e.g., animal foods), which to some extent are related to purchasing power in China (Wang et al. 2008).

Like the grandparent generation, the parent generation frequently mentioned meat (mainly pork). Meat was seen as a sign of economic status by comparing access to it with peers in the same communities. Three mothers with LBC highlighted this fact, “we are not (financially) better off than other families..., how can we afford our children meat for three meals a day?” One neighbour in his 20s compared himself with two left-behind boys cared for by their paternal grandmother, who were only offered meat occasionally and claimed proudly that “my family eat meat every day because we are loaded (financially well-off)”.

As a symbol of economic status, offering sufficient meat was described as essential for meeting children's nutritional needs. For example, the mother of an eight-year old non-left behind girl said:

I think we meet our children's nutritional needs as we often go to local restaurants compared to other families in this village and we provide as much meat as they [the children] want. (mother 8, non-LBC)

This particular household was financially better off than their village peers, since they were running ‘a profitable vegetable greenhouse,’ which allowed them to afford dining out at the local restaurants on a regular basis, and providing meat for their children. The mother interpreted what the children ‘want’ as their nutritional ‘needs.’

This may lead to offering children excessive amount of high-energy foods. The potential risk in this case was that some children were likely to over-consume meat because it was considered a sign of economic status, rather than part of a balanced diet. This may contribute to children's being overweight or in the long term, even obesity. However, none of the parent caregivers involved in our fieldwork showed any awareness of this. Chinese children in rural areas have been experiencing a dramatic shift in nutrition, from a traditional low-fat and high-carbohydrate diet to a high-fat/energy diet. This is especially true among children from relatively affluent families (Cui and Dibley 2012). The prevalence of being overweight/obesity has increased among rural children in China (Yu et al. 2012;Lyu et al. 2013), which may be partly due to parents' attitudes about the symbolic representation of meat as a status symbol.

Furthermore, the parent generation was concerned about barriers to healthy eating in rural communities, including food safety and lack of access to fresh food (for example, fresh milk and vegetables) for rural children, compared to urban children. Compared to the grandparent generation, the parent generation's beliefs about healthy eating extended beyond survival, but suggested higher expectations of food and a growing demand for food quality.

It should be noted that our fieldwork was conducted during the winter season, a time that is not optimal for rural people to cultivate vegetables on their own lands. Instead, they instead relied on local markets for supplies. One mother of two non-left-behind children, who herself used to migrate to cities for work, described the lack of variety regarding food choices in rural communities, compared to urban areas. She compared restricted food access for rural children to urban children, highlighting in particular 'fresh vegetables' and 'fresh milk':

It is winter now. There are not many vegetables available from the local market as there are in the cities. The local market is not open every day. Sometimes I go there to buy enough fresh vegetables to last a few days. The problem is that they do not stay fresh for long. Urban kids have access to fresh vegetables all the time. They drink fresh milk every day, but rural kids don't. (mother 7, non-LBC)

The parent generation was concerned about food safety, which was described as a threat to healthy eating for rural children. However, none of the grandparent caregivers raised this issue during the open-ended conversations. Two mothers expressed their concerns about food safety in rural areas:

We had food poisoning after eating frozen dumplings from the local market. We did not feel well after lunch. My two kids became very ill. We were sent to the central hospital in the city. After that, I no longer buy frozen dumplings from the local market. (mother 5, LBC)

You see, although bean sprouts from the local market do not look as good as before the additives [added to bean sprouts to make them grow faster and look more tender] were banned by the law, they are safer to eat. This is what it is like to live in rural areas. We have to worry about food safety. (mother 7, non-LBC)

8.5 Discussion

The aim of this study was to explore caregivers' beliefs about healthy eating for LBC in rural China. Intergenerational differences in beliefs about healthy eating showed that where the grandparent generation tended to emphasize the importance of starchy foods for children's growth due to their own past experiences during the Great Famine, the parent generation paid more attention to protein-source foods including meat, eggs and milk. Parents were also more likely to offer their children more high-energy foods (for example, meat), which was emphasized as a sign of economic status, rather than as part of a balanced diet. These could imply that the parent generation may have a different, but not necessarily better understanding of healthy eating for children, compared to the grandparent generation. This is inconsistent with previous studies suggesting that grandparents who cared for LBC had poorer nutritional knowledge and attitudes than the children's parents (Tan et al. 2010), and that they may not be able to provide a proper diet for LBC (Ye and Pan 2011).

Our findings suggested that financial remittances from migrant parents were described by grandparents as an important source for being able to include higher cost foodstuffs such as meat in LBC's diet. Some grandparents suggested lack of remittances from migrant parents limited food choices they could offer LBC. Our previous work found that left-behind boys were less likely to receive resources in the

form of remittances from migrant parents in a society where sons were culturally more valued than daughters (Zhang et al. 2015b). This was because their parents migrated to save up for their sons' adult lives, rather than for the lives of their daughters. Limited financial remittances for left-behind boys may reduce their food choices, which might restrict their growth and development during the early course of their lives.

Another important finding of this study is how grandparents' past experience during the Great Famine influenced their expectations and concerns about food, as well as their beliefs about healthy eating for children. From the interviews conducted with grandparents, a prominent theme that emerged in our data was grandparents' past experiences about food availability during the Great Famine, which occurred from 1959 to 1961 (Ashton et al. 1984). Despite rapid socio-cultural and economic changes in China during the past few decades, the experience of food shortage in early life stages persisted. Evidence shows that individuals exposed to famine in early life are at increased risk of adverse health outcomes (e.g., obesity, type 2 diabetes and coronary heart disease) in later life, which could be partially explained by persistent unhealthy food preferences across their life course (Portella et al. 2012). This is partly supported by evidence that exposure to the Dutch Famine in early gestation is associated with increased energy intake due to a fat preference (Stein et al. 2009). On the other hand, early-life experiences can shape people's attitudes towards food and healthy eating, thus directly (through food served) and indirectly (through offering behavioural models) influencing the feeding practices of caregivers and eating habits of children (Cooke et al. 2004; Gibson et al. 1998). Therefore, the influence of people's early-life exposures to food shortage may be passed on to their offspring through generations. This has an important implication, because a substantial number of LBC who were left behind by their parent(s) and were cared for by their ageing grandparents in rural China due to its large-scale rural-urban migration (All-China Women's Federation 2013). It is important to take into account caregivers' experiences and intergenerational effects when exploring LBC's health and well-being in rural China.

Several limitations were encountered in this study. The key concepts of 'healthy eating' and 'eating well' were self-defined by our participants. These terms may have different meanings due to individual experiences. It may also have been

unrealistic to ask participants to quantify food intakes during interviews and to note them in diaries. Additionally, we only asked about food items that were normally consumed. We expected and found that income was a sensitive issue and most participants were reluctant to disclose their incomes. Therefore, we were unable to compare income differences between the parent and grandparent generations quantitatively. However, our interviewees did volunteer information and suggested that remittances from migrant parents which they identified were reported as an important financial source to improve LBC's food and diet. Reflexivity is essential in qualitative research and it encourages the researcher to be part of, rather than separate from, the research (Lipson 1991). The first author initially approached the LBC through school channels, which may have left an impression that she was a friend of the school staff, thus imposing pressure on children to take part. On the other hand, as native Chinese, the first author shared the same cultural background with the participants. However, their personal experiences, preferences, as well as world views may have been different, which may have led to different interpretations of conversations (Suddaby 2006). A qualitative study of this kind has some limitations in terms of its representativeness. The sample size was sufficient to reach saturation (32 caregivers and 26 children aged 6-12 years) and it was not designed to be statistically representative of the community of caregivers for LBC.

Despite these limitations, our study tentatively suggests potential for two separate types of nutritional risks for children, especially LBC in rural China: LBC cared for by aged grandparents, who had experienced the Great Famine, were likely to suffer from malnutrition, especially in the case of children lacking remittances from their parents. Although the parent generation placed greater emphasis on protein-source foods, the risk was that they also tended to provide their children with excessive high-energy food. This may contribute to children being overweight or obesity in the long term when they grow up. These findings suggest that research on LBC's nutritional health in rural China can benefit from exploring the beliefs regarding healthy eating and expectations about food of caregivers. It is important to identify intergenerational differences in beliefs of healthy eating for children and expectations to inform development of educational programmes and other interventions specific to the parent and grandparent generations.

Abbreviations

LBC, left-behind children; Non-LBC, non-left-behind children; RMB, Renminbi (the official currency of People’s Republic of China); GBP, Pound Sterling

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Table 8-1 Caregivers' beliefs about health eating for children (N=32)

Caregivers	The grandparent generation (N=21)	The parent generation (N=11)
Beliefs about healthy foodstuffs	<ul style="list-style-type: none"> • Starchy foods: steamed buns, noodles, porridge, sweet potatoes, potatoes, rice • Animal source food: meat • Vegetables: spinach • Eggs • Dumplings (a mixture of vegetables and/or meat or egg with wheat flour) 	<ul style="list-style-type: none"> • Starchy foods • Animal source food: meat, chicken, duck, lean meat • Fresh vegetables • Dumplings • Eggs • Milk
Expectations of food	<ul style="list-style-type: none"> • To avoid hunger • Meat as a special treat for special occasions • Access to calories: primarily starchy foods • Home-grown food 	<ul style="list-style-type: none"> • To demonstrate economic status within the community • Regular access to meat and other animal products • Food bought from local markets
Concerns about food	<ul style="list-style-type: none"> • Not having enough food for children • Based on grandparents' past experience during the Great Famine 	<ul style="list-style-type: none"> • Food safety • Lack of access to fresh milk and fresh vegetables (in winter) • Based on comparisons with urban children

Table 8-2 Food items from children's diaries (N=24)

Children	Food groups	Food items		
		Breakfast	Lunch	Supper
Care for by parent generation (n=10: 5 LBC, 5 non-LBC)	<i>Starchy foods</i>	Porridge, noodles, dumpling (2), sweet potato, instant noodles	Noodles, steamed rice, fried noodles, dumpling (1), sweet potato, steamed bun, instant noodles	Steamed rice, noodles, fired noodles, sweet potato, steamed bun
	<i>Vegetables</i>	Beans, pumpkin, radish	Bean sprouts, Chinese melon, mushroom, Chinese cabbages, potato	Beans, mushroom, bean sprouts, Chinese cabbage, radish
	<i>Animal source</i>		Pork (2), chicken (2), fish (2), sausage (1)	Sausage (1), chicken (1), beef (1)
	<i>Eggs</i>	Egg soup (4), fried egg (1)	Fried egg (1), egg (1), egg soup (1)	Egg (1), egg soup (2), fried egg (1)
	<i>Milk</i>	Milk (2), soybean milk (2)	Milk (2), soybean milk (2)	
Cared for by grandparent generation (n=9)	<i>Starchy foods</i>	Porridge, steamed bun, rice, dumpling (2), instant noodles	Noodle, porridge, steamed rice, sweet potato, dumpling (1)	Porridge, noodles, steamed rice, Stuffed bun
	<i>Vegetables</i>	Onion, bean curd, bean sprouts, pumpkin	Bean sprouts, pumpkin, Chinese melon, Chinese cabbage, potato	Pumpkin, Chinese melon, lotus roots, potato, towel gourd, Chinese cabbage
	<i>Animal source</i>	Pork (1)	Pork (2)	Chicken (1), chicken feet (1)
	<i>Eggs</i>	Egg soup (1)	Egg soup (1), fried egg (1)	Egg soup (1)
	<i>Milk</i>	-	-	-
Cared for by parent and grandparent generation (n=5)	<i>Starchy food</i>	Instant noodles, watery rice, steamed bun, rice, dumpling (1)	Fried noodles, steamed rice	Watery rice, rice, noodles
	<i>Vegetables</i>		Potato, Chinese melon	Pumpkins
	<i>Animal source</i>		Pork (1)	Chicken (1), pork (1), fish (1)
	<i>Eggs</i>	Egg soup (1)		Fried egg (1)
	<i>Milk</i>	-	-	-

LBC: left-behind children; non-LBC: non-left-behind children; the number of children who mentioned one particular food item in his/her food diary was included in brackets.

Chapter 9 Discussion and conclusion

This thesis set out to investigate how parental migration influences the nutritional health of children who are left behind in rural China. Previous studies failed to examine either the long-term effects of parental migration on left-behind children's nutritional health or the gender differences (among parents and children) in those associations: Chapters 5 to 8 have presented four separate papers with different foci in their analyses of the phenomenon of left-behind children in rural China. Those in Chapters 5 and 6 used data from the CHNS to explore the associations between parental migration and nutritional outcomes, including anthropometric measures and macronutrient intakes of children left behind in rural China; Chapters 7 and 8 made use of qualitative data to explore care-giving practices for left-behind children in one township in northern central China from the perspectives both of children and of their caregivers.

This is the concluding chapter of the thesis. Firstly, the chapter ties together the four papers from Chapters 5 to 8, and proposes links between parental migration, care-giving practices, and the nutritional health of left-behind children in rural China. Secondly, the chapter sums up the contributions that this thesis has made to current knowledge about left-behind children's nutritional well-being in rural China, both in terms of the methodological and the substantive aspects. Thirdly, this chapter discusses the limitations of this thesis, which primarily concern the use of a secondary longitudinal dataset and the reflexivity of qualitative research. Finally, the chapter suggests possible topics and directions that could be explored in further research, and provides several recommendations for policy-making processes aiming to improve left-behind children's healthy development in rural China.

9.1 Summary of results

This research was designed to answer three key research questions. The first was to examine whether the associations between parental migration and children's nutritional outcomes (e.g., physical growth and macronutrient intakes) differ according to the status of being left behind at different stages of childhood in rural China, drawing on a life-course approach. The second was to investigate whether these associations differ according to the gender of the parents in rural China. The third was to examine whether these associations differ according to the gender of children in rural China.

The research presented in this thesis found negative associations of parental migration, especially of maternal migration during early childhood as a critical period of child growth and development, with the nutritional health of LBC, and particularly of left-behind boys, in the context of rural China. These results confirmed the hypotheses on the gender differences of the parents and the LBC in the influence of parental migration on children's nutritional health in rural China.

Main findings

The thesis consists of four separate papers presented above in Chapters 5, 6, 7, and 8, investigated parental migration, care-giving practices and the nutritional health of LBC in rural China. The first quantitative paper (Chapter 5) employed a life-course approach and growth curve models to explore the long-term associations between being left behind due to parental migration and children's physical growth in terms of height growth and weight gain. This is an important addition to the literature, as most of the previous evidence mostly relied on cross-sectional data. After adjustment for socio-economic and demographic factors, the subgroup analysis results show that being left behind during early childhood aged younger than 6 years old, could lead to slower growth rates for boys in height and weight, as compared to children from intact families. However, being left behind during early childhood did not appear to significantly affect the growth of left-behind girls. One possible explanation for the gender difference might be the relatively small sample size of left-behind girls (N=369), which may have resulted in insufficient statistical power to detect a significant association. However, if the gender differences are real, this may be

consistent with literature from human biology that suggests boys are more susceptible to adverse nutritional environments than girls in the early years of life (Wells 2000). In conclusion, this paper suggests that early childhood is a particularly important life stage during which parental migration can affect growth in later childhood.

The second quantitative paper (Chapter 6) looked at different measures of parental migration (by the father or the mother) and their associations with macronutrient intakes of protein, fat, and carbohydrates. It used multilevel modelling analyses (Level-1: occasions; Level-2: children; Level-3: villages) to estimate whether relative macronutrients (protein, fat and carbohydrates) contributing to total energy intake differ between children left behind by the father, the mother, or both parents, as compared to children from intact families in rural China. After adjustment for socio-economic and demographic confounders, the analyses suggest that being left behind by the mother only, or by both parents, seem more detrimental than being left behind by the father. Young boys left behind by their mothers had a reduced relative protein intake compared to boys left behind by their fathers. Moreover, parental migration significantly increased young boys' relative fat intake. For older boys aged 6-17 years, being left behind due to parental migration appears to reduce the relative protein intake compared with boys from intact families. No significant associations were found for younger and older girls, which could be due to relative small sample sizes. The sample sizes of pre-school girls left behind by the father only and by at least the mother are 55 and 17, respectively, compared to 90 and 17 for school-aged girls. The results suggest that left-behind boys, especially young pre-school boys, are subject to a higher-fat and lower-protein diet compared to their non-left-behind peers. This may put them at increased risk of being overweight or obese, and/or suffering from stunted growth, as they grow up.

The third and fourth papers (Chapters 7 and 8) are qualitative in nature and used in-depth interviews to explore the care-giving practices for LBC in a specific rural township in northern central China. The qualitative data drew heavily on socio-cultural facets to understand the phenomenon of parental migration and LBC in rural China. The third paper made particular use of in-depth interviews with caregivers to explore their understanding of migration motives and the social process of taking on care-giving roles for LBC. This paper found underlying socio-cultural explanations

pertaining to economic motives for migration, such as making contributions for social events (weddings and funerals) in village life, and fulfilling social obligations for left-behind grandsons' futures. Longitudinal evidence from rural southern China suggests that monetary contributions to social festivals tend to 'squeeze' resources allocated to food and nutrition, particularly for poor households. This may be associated with reduced height growth of young boys (not girls) under 6 years old (Chen and Zhang 2012). The gender of LBC could be an important consideration for parental migration in the context of rural China: parents of boys tended to have an additional motivation to migrate. There is potentially a paradox of intergenerational obligations in a society where sons are more valued culturally than daughters: parents migrated to save for sons' but not daughters' adult lives, while grandparents, particularly on the paternal side, were expected to fulfil social obligations to care for left-behind grandchildren even without immediate financial returns. Left-behind boys, and in particular boys cared for by paternal grandparents, were suggested to be at greater risk than other LBC, as they may receive even fewer resources in form of remittance from migrant parents in their early childhood. This may potentially reduce opportunities for early childhood nutrition and thus development for left-behind boys.

Although malnutrition occurs primarily due to inadequate dietary intake and is rooted in disadvantaged economic circumstances, evidence from China shows that the high rates of malnutrition among children are largely due to a lack of knowledge regarding healthy dietary intake, rather than food shortages (Tan et al. 2010; Chang et al. 2000). Motivated by this idea, the last qualitative paper used interviews and diaries to gain insights into the beliefs about healthy eating held by caregivers of LBC and non-LBC in the context of rural northern central China. This paper found intergenerational differences in this regard: the grandparental generation emphasized the importance of starchy foods for children's growth due to their experiences during the Great Famine, whereas the parental generation paid more attention to protein-source foods including meat, eggs, and milk. Moreover, the study suggested that parents were more likely to offer their children high-energy foods because they were viewed as a sign of economic status, rather than they formed part of a balanced diet. One systematic review with meta-regression has suggested that fat intake is more sensitive to income changes than calories and protein (Santeramo and Shabnam

2015). The present findings suggested that inadequate remittances from migrant parents could also reduce LBC's food choices. LBC left in the care of grandparents, especially grandparents who lived through the Great Famine, may be at greater risk of malnutrition compared to children cared for by parents. This suggests two separate types of nutritional risk for children: an over-emphasis on starchy foods for children cared for by grandparents, potentially leading to malnutrition due to lower proportions of protein and fat, and an excess of high-energy foods consumed by children cared for by parents, potentially contributing to overweight or obesity. There is a substantial regional variation in dietary patterns throughout China: northern diets feature high intakes of wheat and starch products while southern diets include high intakes of rice and vegetables. The northern dietary patterns are associated with a higher risk of childhood obesity (Zhang et al. 2015a). Complementing the findings from the third paper that suggests carers of left-behind boys are less likely to receive resources in the form of remittances from their migrant parents, the fourth paper suggested such limited financial remittances for left-behind boys could reduce their food choices, which in turn might restrict their growth and development in early life.

Taken together, under the specific socio-cultural context of rural China, this thesis highlights that early childhood is a critical period for the nutritional well-being of LBC, especially for boys. Moreover, this thesis suggests gender differences in nutritional outcomes work out in favour of girls rather than boys, especially boys left behind by their mothers and in the care of their paternal grandparents.

Integration of findings

Figure 9.1 illustrates how the quantitative results and the qualitative findings were related and integrated. In the quantitative study, a critical period during early childhood (from ages 0 to 5) was identified for LBC's physical growth, especially for boys. The qualitative data suggested that a lack of remittances from migrant parents reduced the food choices of LBC. A lack of financial remittances from migrant parents to the carers of LBC could potentially explain the slower physical growth and poorer dietary intakes of LBC, compared to their peers from intact families, as identified in the quantitative analyses. The 'critical period', from birth to

5 years, for the exposure to parental migration in terms of height growth and weight gain was only observed for left-behind boys, not for left-behind girls.

Furthermore, the quantitative study suggested a gender difference in dietary intakes of LBC; being left behind appeared to reduce the relative protein intake and increase relative fat intake of young boys, but not girls. This finding linked to the exploration of gender differences in care-giving practices of LBC in the qualitative research. I found strong socio-cultural norms for sons: migrant parents tended to save up for sons' adult lives rather than sending financial returns immediately during early life. This may help explain the gender differences in nutrition and growth of LBC identified in the quantitative component.

Furthermore, intergenerational differences in beliefs about healthy eating for children were identified: grandparents left as the primary carers when both parents migrated who had been through the Great Famine, and tended to emphasize starchy foods, while parents focused on protein-source and high-energy foods. This finding was, to some extent, confirmed in further quantitative analyses: children left behind by at least the mother, especially left-behind boys, tended to have a reduced intake of protein compared to children left behind by the father only. The qualitative study also found strong intergenerational obligations for paternal grandparents to care for their grandchildren: parental grandparents were expected to care for their grandchildren without immediate financial reciprocity, while maternal grandparents expected to receive financial returns. This suggests that it is important to consider whether the LBC's grandparent carers are on the paternal side or the maternal side.

The quantitative and qualitative elements of the research were complementary and informed each other, both addressing the problem of LBC from different angles.

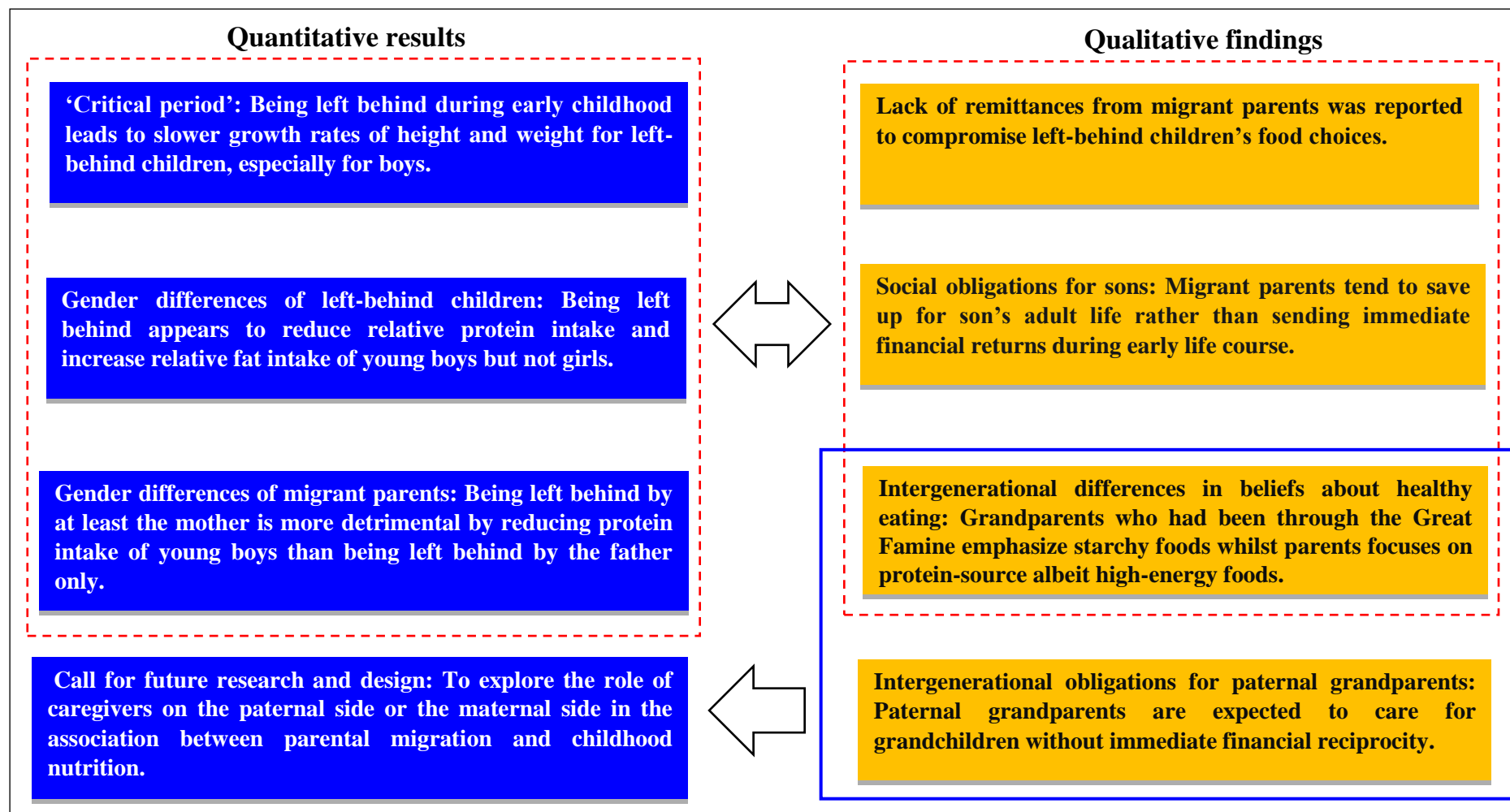


Figure 9-1 Integration of quantitative and qualitative findings

9.2 Contributions

This thesis contributes to current knowledge about LBC's nutritional well-being in rural China in the following methodological and substantive ways.

Firstly, the mixed-methods approach used here has suggested links between parental migration, care-giving practices for LBC, and LBC's nutritional health in rural China. The quantitative elements found significant associations between parental migration and LBC's nutritional outcomes by analysing a secondary data set – the CHNS. Since the CHNS is an observational study, the association found between parental migration and LBC's nutritional health might not be interpreted as causal due to potential unobserved confounders, such as care-giving practices. Therefore, the qualitative component of the research explored care-giving practices for LBC from the different perspectives of the caregivers and the children themselves. The rich data generated from the qualitative study provide possible explanations for the association between parental migration and LBC's nutritional health, and generate some plausible hypotheses to be tested in future research. For example, the role of socio-cultural factors, such as intergenerational obligations of grandparent-grandchild, and the culturally greater value of sons than daughters in the Chinese context, could be important in explaining the link between parental migration and LBC's nutritional health.

Another important finding regards gender differences in the associations between parental migration and left-behind children's nutritional health in rural China: parental migration appeared to affect boys more than girls in terms of physical growth and nutritional intakes, especially in early childhood. These quantitative findings have challenged to some extent the conventional Chinese cultural value of 'son preferences,' where boys are valued more than girls. The qualitative element provided some socio-cultural explanations: migrant parents of boys tended to save up for their son's adult lives rather than sending financial remittances immediately, as they did for their daughters. Without the mixed-methods study design, it would be hard to explain the gender differences found in the quantitative element.

Another contribution of this research lies in its use of a longitudinal dataset and advanced statistical methods – an improvement on the methodologies of most previous studies in this area (Chen et al. 2011; Luo et al. 2008; Gao et al. 2010; de

Brauw and Mu 2011;Guo 2012;Mu and De Brauw 2015). The longitudinal nature of the CHNS has enabled the detection of changes in parental migration status and LBC's development as children grow and develop. Another benefit of longitudinal data is that they reduce individual heterogeneity as subjects are observed more than once (Rabe-Hesketh and Skrondal 2012). In addition, it is important to take clustering effects into account (i.e., repeated measurements at level-1, individuals at level-2 and villages at level-3) to reduce the bias of estimates. This corrects the estimated standard errors, thereby adjusting for the clustering of observations that occurs within units (Duncan et al. 1998). Another methodological improvement is the treatment of missing data/attrition, considered by using multiple imputation techniques to produce less biased estimates.

Finally, compared to previous studies, this thesis provides a holistic view on different patterns of parental migration (i.e., being left behind by the mother or the father, being left behind at different stages of childhood course) and multiple nutritional outcomes (i.e., anthropometric measures, physical growth, and macronutrient intakes) among rural children. This research has emphasized the gender of migrant parents and of LBC, as particularly important in the context of China, where sons are culturally more valued than girls. It has also highlighted the importance of multilevel contextual factors, including individual-level, household-level, and village-level characteristics. Socio-cultural explanations from the qualitative data can enrich our understanding of the links between parental migration and LBC's nutritional well-being in rural China from a wider perspective.

9.3 Limitations

Comparisons with existing studies are articulated above in Chapters 5 to 8. This section summarizes some general caveats that underpin this research. The findings should be interpreted with caution within the context of the methodological strengths and limitations in terms of study design, samples, measures used, missing data/attrition, potential confounders, and selection bias.

9.3.1 Measurements

As with any quantitative study using secondary data, there are some limitations that should be considered when interpreting results. The CHNS was not originally designed to study migration in China. This research draws on the five waves of the

CHNS (1997, 2000, 2004, 2006, and 2009), and LBC status was defined according to the migration status of parents, which is based on CHNS waves. However, parental migration status could change between waves. For example, neither parental return nor new parental migration between two CHNS waves was tracked by the CHNS. This may lead to an underestimation of the LBC sample.

In addition, the nutritional outcomes in terms of macronutrient intakes may introduce some bias into these analyses. Two possible sources of bias should be considered: bias relating to self-report, and bias due to measurement errors. The mother or caregiver reported information on behalf of young children who were younger than 12 years old. Diet information was based on individual recall over a 24-hour period, although steps were taken by interviewers to obtain accurate information (Paeratakul et al. 1998). These still may lead to inaccurate estimates. Moreover, income data in the CHNS was self-reported and self-recalled over the year prior to the survey date, which is also a potential source of biased estimates.

Another issue that should be considered is the relatively short follow-up for measuring nutritional outcomes among children. This is important because the exposure effect of parental migration on children's nutritional health may be cumulative and only become manifest at later stages of life course. In this research, multiple cohorts of children aged 0-5 years from 1997-2006 were followed up until 2009. Although the study period ranged from 1997 to 2009, very few children were followed up for the full 12 years, and other children were only followed up for a relatively short period. Therefore, the duration of follow-up may be not long enough to capture significant differences in nutritional health between LBC and non-LBC.

9.3.2 Longitudinal cohorts study design

Multiple cohorts of children aged 0-5 years in 1997, 2000, 2004, and 2006 were followed up until 2009 in Chapters 5 and 6 to examine the associations between parental migration and children's nutritional outcomes in terms of anthropometric measures and macronutrient intakes. An accelerated longitudinal design enabled tracking of age-outcome trajectories over the entire childhood (from ages 0 to 17) during a relatively short study period (from 1997 to 2009). However, one risk of an accelerated longitudinal design is that it assumes there are no age-by-cohort interaction effects. In other words, it assumes that a single growth trajectory can

represent all the cohorts (Collins 2006). In fact, such effects may arise due to demographic differences (e.g., age, family background) between cohorts, and also due to period specific effects (Miyazaki and Raudenbush 2000). This research adjusted for time effects by adding multiple baseline waves to minimize such cohort differences, but data pooled from multiple cohorts ignoring demographic or period differences between the cohorts, may lead to biased inferences.

9.3.3 Missing data/attrition

A common problem in the use of longitudinal data such as those in the CHNS is that of sample attrition. In the CHNS, older children may not take part in later surveys, and school children who were in boarding schools, and children who subsequently entered colleges and universities, may miss certain rounds of survey. Also, children themselves may also migrate when they reach the age of 16 (Popkin et al. 2010). Sample attrition could thus lead to biased results. The present research examined predictors of sample attrition and missingness, and found several variables related to attrition/missingness, such as household income per capita, household size, child age, whether or not a child is the only child within his/her household, and asset score. These predictors could cause either downward or upward bias in the estimates. For example, poorer children were shown to be more likely to drop out of subsequent surveys, and this may be because they experience more difficulties in participating. Given that poor children may have slower growth rates than less disadvantaged children, the attrition of poorer children can lead to a downward bias in estimates of the effect of being left behind on children's growth rates. Children from larger families were found to be less likely to drop out. A larger family size could be more detrimental to children's growth rates due to restricted resource allocation, meaning that estimates could have been overestimated. Since it was impossible to distinguish the exact direction of the bias introduced by sample attrition and missingness, this is a major limitation of this research.

Most previous studies did not deal with missing data and restricted their analyses to complete cases analyses. However, in the present work, restricting the sample to complete cases would have meant a significant reduction in sample size, as shown in Figure 6.1. Multiple imputation analyses did not show substantive differences compared with complete cases analyses (as shown in Chapter 6). One limitation of the multiple imputation analyses here is that the multilevel structure in the

imputation models was not taken into account because of computational feasibility, and this could lead to incorrectly imputed estimates (Goldstein 2009). Another issue that should be considered is that multiple imputation was performed under the assumption of MAR (missingness dependent on observed data but not on unobserved data), whereas it is possible that the missing data mechanism in my study is MNAR. However, it is not possible to distinguish between these two mechanisms using observed data (Sterne et al. 2009).

From a wider perspective, China is undergoing a rapid urbanization process (Figure 9.2). The urbanization rate showed a twofold increase from 28% in early 1993 to 51% in 2011 (National Bureau of Statistics of China 2014b). The CHNS data, however, shows only a modest increase in urbanization. The discrepancy in the urbanization rate between NBSC (National Bureau of Statistics of China) and the CHNS can be caused by migrant workers without urban *hukou* status living in urban areas, who contributed to the calculation of the NBSC urbanization rate (Gong et al. 2012). Moreover, unlike the NBSC, the CHNS is not a nationally representative sample (Popkin et al. 2010), which may lead to over/under-sampling of the rural population. In the present research, the rural population was defined as those who hold ‘rural’ household registration (*hukou*). Urbanization may contribute to sample attrition of rural children. In other words, some families may be classified as ‘rural’ in earlier waves of the CHNS, and later become urban households due to external processes of urbanization.

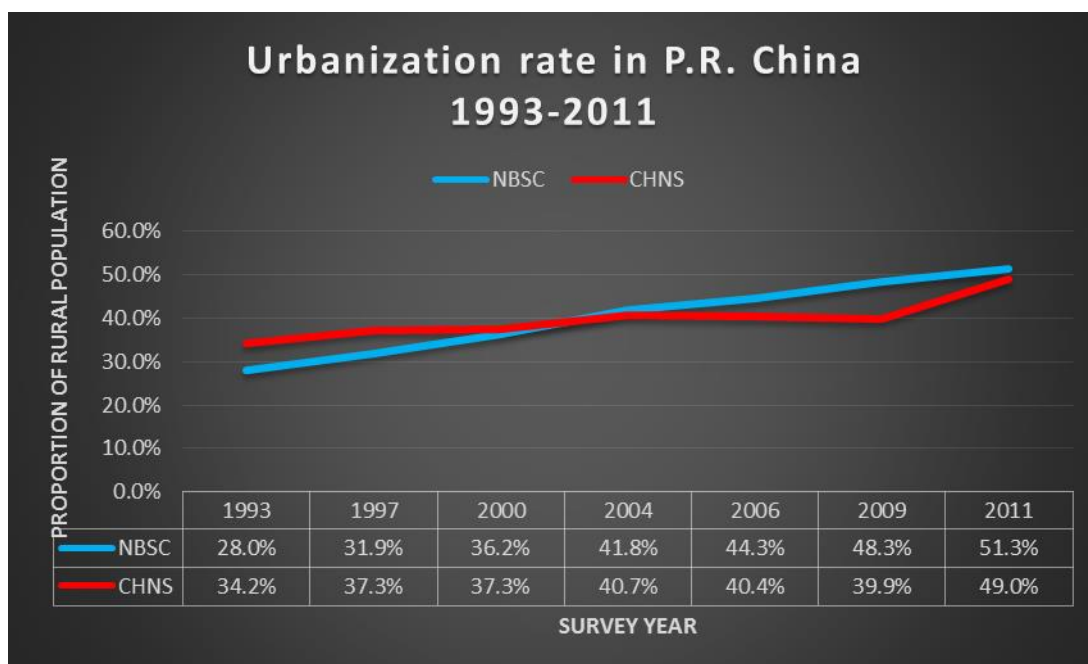


Figure 9-2 Urbanization rates in China, 1993-2011

Source: NBSC, National Bureau of Statistics of China; CHNS: China Health and Nutrition Survey

CHNS urbanization rate is based on household registration system (*hukou*); NBSC rate is calculated based on population residing in rural areas for more than 6 months.

9.3.4 Association or causation

One key objective of this research was to estimate the nutritional effect of parental migration (exposure) on children by using a longitudinal dataset – the CHNS. Since the CHNS is observational rather than experimental, the statistical results can only be interpreted as associations, and do not represent causation (Hernán and Robins 2006). The remainder of this section will deal with some methodological difficulties regarding the validity of estimates of exposure effects using longitudinal studies, including confounding factors, selection bias, and reverse causality.

Confounding factors (omitted explanatory variables)

Throughout this research, confounding factors (confounders) are more in line with econometrics, referring generally to control variables or ‘omitted variables’, unlike in epidemiology, where confounders are associated both with exposure or risk factor for an outcome, and with the outcome independent of the exposure (Gunasekara et al. 2008).

Drawing on the conceptual framework and previous studies, two important sets of confounding factors were not captured by the CHNS: remittances from migrant parent(s), and care-giving arrangements for children who were left behind. Another caveat is that the research does not consider the energy-related activities which partly determine children's energy and nutrient needs (Millward and Jackson 2004). Information about physical activities of children is available only from 2004 onwards in the CHNS, and data on pre-schoolers are substantially missing. Previous studies using the CHNS data did not find significant association between maternal employment and the physical activities of school children aged 6-18 in China (Nie and Sousa-Poza 2014). Moreover, LBC, especially girls, tend to engage in increased household workloads (Chang et al. 2011a), especially when being cared for by elderly grandparents (Ye and Pan 2011). This suggests that, on average, LBC may need more energy intake than their peers from intact families.

Although parental migration may improve household economic status, it is unclear how much of the additional income gain is allocated to child development. The rising price of foods (protein-source food, oil and meat) can off-set the positive effects of household income on children's nutritional intakes (You et al. 2014). This may suggest that economic improvement due to parental migration may not always increase purchasing power given wider contextual factors. Household income growth in China can generally improve diet adequacy, but it does not always improve dietary quality resulting in deficiencies of some key micronutrients (Liu and Shankar 2007) and increased consumption of high-fat low-fibre diets (Du et al. 2004), especially for low-income families. This may be partly due to poor nutritional knowledge and dietary preferences. My qualitative findings suggest that migrant parents of left-behind sons tended to remit little and instead save up for sons' adult lives. Despite of a lack of generalizability due to a small qualitative sample, the findings still suggest a limited contribution of parental migration to LBC's nutritional improvement through the remittance channel.

Moreover, care-giving arrangements for LBC may act as a mediator between parental migration and children's nutritional health. The CHNS did not specifically set out to study care-giving practices for LBC. The process and quality of care-giving practices are relatively abstract and difficult to measure, which means they may not simply translate well into quantitative measures (Jones and Sumner 2009).

Therefore, the qualitative data exploring the care-giving practices for LBC could provide a better understanding of associations derived from quantitative findings, although these interpretations may not be safely generalized due to the small sample sizes (Harding and Seefeldt 2013). For example, my qualitative findings suggested distinct intergenerational differences relating to healthy eating among caregivers of children, and boys left in the care of paternal grandparents could be at greater risk of nutritional problems. This can be used to partly explain the negative association between parental migration and boys' poorer physical growth in the first quantitative paper (Chapter 5).

Selection bias

One key methodological issue that has been well debated in the empirical literature is selection bias due to the fact that migration is largely a human choice. In other words, migration is not randomly allocated but self-selected. Potential variables (e.g., household characteristics at baseline) that are correlated with both the migration decision and its consequences on family members who stay behind may introduce problems of endogeneity, and decrease the comparability between households with migrants, and those without. This could lead to biased estimates of the impact of migration on the left-behind members (Gibson et al. 2013). Propensity score methods, which assume that the migration decision depends on observed variables but not on unobserved characteristics, have been proposed to address heterogeneity in observational studies (Xu and Xie 2015), although such methods are still vulnerable to the omitted-variable problem. It has been argued that observational studies often give similar results on estimating treatment effects, regardless of propensity score methods or traditional regressions to adjust for confounding (Shah et al. 2005b). The present research used multivariate regression models to adjust for relevant individual characteristics, but there are still unobserved confounders that could bias treatment effects of parental migration on LBC's nutritional health in China.

Reverse causality or simultaneity

The research has suggested that parental migration is associated with poorer nutritional health of children left behind in rural China. This should be interpreted with caution: does parental migration lead to LBC's poorer nutrition, or does LBC's

poorer nutrition act as a motivation for parents to migrate? It is important to take account of reverse causality. This can be an important limitation in cross-sectional datasets where migration has occurred prior to the survey. Longitudinal studies can remedy this problem by observing children's nutritional outcomes before and after parental migration. However, parental migration in the research is a time-varying exposure with missing values, which complicates the identification of pre- and post-treatment status. The qualitative data presented above suggest that improving children's nutrition and health was not reported as a driver of parental migration, which may negate the limitation of reverse causality in this thesis.

9.3.5 Reflexive consideration of the qualitative research

The qualitative element of the work was carried out in a small township in northern central China. As in other in-depth qualitative studies, the number of participants is not large (32 caregivers and 26 children aged 6-12 years), and may not be fully representative of the community of caregivers and LBC. However, qualitative research was not designed to generalize from a sample to a wider population. Rather, the purpose of the qualitative component was to gain in-depth understanding of the care-giving practices of LBC in a specific socio-cultural setting from northern central China. The insights gained may be transferable to other settings provided that similarities and differences between contexts are taken into account.

The fieldwork was conducted in the autumn and winter season, from September 2013 to February 2014. The influence of seasonality of food supplies in rural China, especially fruits and vegetables, could be an important factor. The qualitative data found subjects had limited access to certain food items, especially vegetables, in winter: three grandparents of LBC expressed their difficulties in gaining access to fresh food, which could have influenced their accounts of food and eating for LBC during the interviews. Future studies on LBC's foods and diets should take into account the seasonal variations in food supply.

The qualitative research did not involve migrant parents who may still maintain active roles in care-giving practices for LBC, either through regular communication by telephone or home visits. Therefore, it is important to obtain insights directly from migrant parents to gain a comprehensive understanding of care-giving practices for LBC in rural China.

Another issue that should be considered is that the child participants who were directly approached were of primary school age between 6-12 years. It should be noted that most of these children (23 out of 26) had younger and/or older siblings (outside the age range of 6-12 years) living with them during data collection. Therefore, caregivers of the child participants may be caring for a wider age range of the child population, which may better integrate with the quantitative component.

Despite these limitations, this research presented in this thesis has applied a novel methodological approach with advanced quantitative and qualitative methods, and found negative associations of parental migration, especially of maternal migration during early childhood, with the nutritional health of LBC, particularly left-behind boys, in the context of rural China.

9.4 Recommendations

Recommendations for future research

Some questions arise which need to be addressed in future research.

First, future studies on LBC's health and well-being may benefit from taking into account the variables of the gender of LBC and their relationships with caregivers. For example, the qualitative data show that it is important to differentiate between paternal and maternal grandparents. Further studies are needed to confirm the gender difference in nutritional outcomes in favour of girls rather than boys in a society where boys are culturally more valued than girls.

Second, it is recommended to take into account important broader contextual factors, including food prices and the food choices that are available in rural communities. Evidence suggests that people living in less developed regions are more vulnerable to changes in nutrient intakes responding to increased food prices, as they substitute more expensive foods such as animal-source foods with staple foods (Green et al. 2013). It is also important to consider socio-cultural factors (e.g., participating in social festivals and other social obligations for boys) within rural communities because the monetary contribution to village social ceremonies can decrease resources that are allocated to diets and nutrition in poor households (Chen and Zhang 2012).

Third, the work has identified a critical window (ages 0-5) of exposure to parental migration in terms of effect on children's physical growth. There is consistent evidence suggesting that malnutrition in early childhood is associated with developmental delay, including growth retardation, cognitive deficits, and reduced economic productivity in adulthood (e.g., Victora et al. 2008; Grantham-McGregor et al. 2007; Walker et al. 2007; Mendez and Adair 1999). It can be useful to identify and narrow down the specific ages at which the window of opportunity opens, in order to facilitate interventions. For example, it is of interest to look at the '1000 days' of life from conception to a child's second birthday, which is thought to be the best time for nutrition interventions (Shekar et al. 2006). Nutrition is particularly crucial during this period of life because the brain and the body are growing so rapidly (Berk 2008).

Humans also have a substantial growth spurt during puberty (Sinclair and Dangerfield 1998; Rogol et al. 2000; Tanner 1981). In addition to early childhood, puberty may provide another window of opportunity to achieve optimal height potential (Qi and Niu 2015; Prentice et al. 2013). Therefore, catch-up growth, which is characterized by height velocity above the normal statistical limits for age in a certain period of time following a transient period of growth inhibition (Pando et al. 2010), may occur during adolescence prior to adulthood (de Wit et al. 2013). Considerable height gain can be obtained through nutrition supplementation (Pando et al. 2010) and changes in the living environment (Coly et al. 2006). For example, Coly and colleagues (2006) found that Senegalese children who were malnourished during preschool ages experienced catch-up growth in height through rural-urban migration during adolescence. Adolescence is recognized as the second sensitive developmental period for adult health throughout the life course after the first 1000 days of life from conception to a child's second birthday, which can offer a good opportunity for potential interventions (Viner et al. 2015). Future studies could therefore examine how parental migration influences height growth during puberty.

Finally, another important research topic to which neither the research presented here nor previous work has responded is the role of psychological disruption in the associations between parental migration and LBC's nutritional well-being. In other words, it is of interest to decipher the interplay between physical development and psychological well-being among LBC. It is recommended to take a comprehensive

look at LBC's development including psycho-social well-being throughout childhood.

Policy implications

Several recommendations for policy-making processes arise from the findings.

First, recognition of early childhood as a critical period for children's growth is important in order to design and deliver interventions. Early childhood is a critical period offering a window of opportunity for interventions to mitigate malnutrition in later life that are associated with parental migration during the early life course, especially for young boys in rural China. It is particularly important to promote healthy child development (e.g., physical growth and brain growth) during the prenatal and infancy periods (Shekar et al. 2006). It is likely that catch-up growth – a return to a genetically influenced growth path – can be obtained for LBC as long as conditions improve during childhood. However, the brain and other internal organs may be permanently compromised (Hales and Ozanne 2003).

Second, public health policies should recognize the importance of parental migration, especially maternal migration, and encourage a more balanced diet for LBC in rural China. For example, it could be useful to provide balanced school lunches, as the qualitative research suggested that LBC were more likely to have meals at school. It can be important to promote formal social support/services available for split families and LBC, for example, providing educational or peer-support programmes in order to improve LBC's and caregivers' coping strategies when parents are away.

Third, interventions aimed at improving LBC's healthy development should take into account caregivers' experiences and beliefs. It can be important to understand caregivers' understanding, expectations, and concerns over food and nutrition. Given distinct differences in beliefs about healthy eating for children found in my study, it is useful to devise educational programmes specific to grandparents and other caregivers to promote healthy eating for children in rural China.

Fourth, despite the fact that the work has focused on LBC, it also sheds light on some of the adverse influences on caregivers, especially ageing grandparents. For example, caring for LBC can increase the labour burden for ageing grandparents who may have poor health. In addition, grandparents lacking adequate remittances

from their adult migrant children may experience financial hardship. Both the children and the elderly who are left behind due to internal migration face great challenges. Future studies and policy-makers are recommended to pay attention to both LBC and left-behind elderly.

9.5 Final conclusion

China's rural-urban migration has resulted in 61 million children living apart from their parent(s) in rural communities. Previous studies have demonstrated diverse yet contradictory evidence on how parental migration to cities influences the nutritional outcomes of the children who are left behind in rural areas.

The research findings presented in this thesis suggest that gender of migrant parents and left-behind children is an important factor in the nutritional well-being of left-behind children in rural China. A negative association was found between parental migration, especially maternal migration, and left-behind children's nutritional outcomes, based on anthropometric measures and macronutrient intakes; this was especially true for boys left behind during early life. Socio-cultural factors should be considered, since there seemed to be a paradox in intergenerational obligations in a Chinese culture where sons are more valued than daughters. This is because parents migrated to save for sons' but not daughters' adult lives, rather than sending remittances to support their male children who stay behind. Grandparents, particularly on the paternal side, were expected to fulfil social obligations to care for left-behind grandchildren even without immediate financial returns.

The research has also recognized the importance of grandparents as carers, and their experiences and beliefs about care-giving practices in children's nutritional health. Inadequate financial support from the migrant parents of boys in rural China, in particular boys cared for by paternal grandparents, may result in greater risk of poor nutrition during early childhood. This potentially renders such left-behind boys vulnerable to developmental delays. These findings are important for policy-makers to devise effective interventions to improve left-behind children's nutritional well-being in rural China.

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Appendices

Appendix 1 Topic guide for carers

Opening statement

I am Nan Zhang, a PhD student at University of Manchester. I am interested to know the care-giving practices for left-behind children in rural China. This is part of my PhD project. I have some questions to ask you about your experience of caring for left-behind children.

Opening questions

- Would you tell me about yourself, such as age, education, family size, health status, etc.?
- What is the relationship between you and the left-behind child?

Main interview questions

- Can you tell me about your experience of caring for the left-behind children?

Secondary questions

- How do you manage the food for the left-behind children, such as food preparation, meal places, meal times, snacks, etc.?
- What do you think of healthy eating for children?
- What is the children's daily routine like (i.e., physical activities, school work, housework, etc.), are there family rules on watching TV, bedtime, etc.?
- Can you tell me something about their migrant parents, i.e., how long have they been away? How do you communicate with them? How often do they come back to visit the child? Have they sent remittances back?
- Can you tell me some changes of your life since you cared for the left-behind children?
- Can you tell me some of the contributions that the children have made to the family?

Prompts

- Could you say something more about that? Do you have further examples for this?
- Tell me what you were thinking when...?
- How did you handle it when that happened?

Closing questions

- How did you feel about talking to me today?
- Is there anything else you think is important that we haven't covered?

Appendix 2 Chinese version for topic guide for carers

开场

我是来自曼彻斯特大学的博士生张楠。我对中国农村地区的留守儿童生活照料非常感兴趣。这也是我博士课题的一部分。针对这个话题我有一些疑问想向您请教一下。

导入性话题

- 您能简单介绍一下您自己吗，比如年龄，教育程度，健康状况，家里几口人？
- 您跟目前照顾的留守儿童是什么关系？

主要访谈问题

- 您能分享一下照顾这个孩子的经历吗？

次要问题

- 您是如何解决孩子的吃饭问题的，比如如何准备食物，吃饭地点和时间，零食，等？
- 您觉得对孩子来讲什么是健康的饮食？
- 这个孩子普通一天的生活是怎样的，比如玩耍，作业，家务活，晚上睡觉时间，看电视等？
- 您能说一下这个孩子父母的一些情况吗，比如他们外出打工多久了，平时如何联系，多久联系一次？他们多久回来一次看望孩子？他们会寄钱回来吗？
- 您能讲一下自从照顾这个孩子以来您的生活有没有改变？
- 您觉得这个孩子对您现在的家庭来讲意味着什么，他/她的贡献是什么？

提示

- 您能详细说一下吗，有没有例子？
- 您当时的感受如何？
- 您当时是如何处理的呢？

结尾问题

- 今天跟我聊天的感受如何？还有什么其他的事情您想告诉我吗？

Appendix 3 Topic guide for left-behind children

Opening statement

I am Nan Zhang, a PhD student at University of Manchester. I am interested to know the care-giving practices for left-behind children in rural China. I would like to hear your story about being left-behind children very much.

Opening questions

- Can you tell me something about your hobbies, your favourite subject, your best friend, your favourite TV programme?

Main interview questions

- Can you tell me something more about the diaries or photographs you already completed?
- Can you tell me your experience of being left-behind?

Secondary interview questions

- What is your daily routine, such as meal time, meal places, snacks, school play, school work, household work, bedtime, leisure activities?
- Can you tell me something about your parents, such as where they are, how long have they been away, how often do they come back to visit you, how do you communicate with your parents?
- What is your expectation for your parents?
- What is your expectation for your carers?

Prompts

- Could you say something more about that? Do you have further examples for this?
- How did that make you feel?
- Tell me what you were thinking when...?

Closing questions

- If you had one wish for your parents and/or your carers what would it be?
- If you had one wish for you what would it be?
- Is there anything else you think is important that we haven't covered?
- Would you like to ask any questions?

Appendix 4 Chinese version for topic guide for left-behind children

开场

我是来自曼彻斯特大学的张楠。我对中国农村地区的留守儿童生活照料非常感兴趣。我非常想听听你的故事。

导入性话题

- 你平时喜欢做什么，你最喜欢的科目，你最好的朋友是谁，你最喜欢的电视节目是什么？

主要访谈问题

- 你愿意给我讲讲你刚刚完成的日记或照片吗？
- 你能说说在父母不在身边的这段日子的经历吗？

次要问题

- 给我讲讲你普通一天的生活是怎样的，比如吃饭时间，地点，零食，玩耍，作业，家务活，睡觉时间，其他的有趣的事情，比如看电视等等？
- 你愿意说说你的父母吗，他们去哪里了，离开多久了，多久回来一次？如何与他们联系，上次联系是什么时候？
- 你对父母有什么样的期待？
- 你对照料者有怎样的期待？

提示

- 您能详细说一下吗，有没有例子？
- 您当时的感受如何？

结尾问题

- 如果让你为父母或照料者许个愿，那会是什么？
- 如果让你为自己许个愿，那会是什么？
- 还有其他事情你想告诉我吗？
- 你有问题要问我吗？

Appendix 5 Topic guide for non-left-behind children

Opening statement

I am Nan Zhang, a PhD student at University of Manchester. I am interested in the care-giving practices for children in rural China. I would like to hear your story about it very much.

Opening questions

- Can you tell me something about your hobbies, your favourite subject, your best friend, your favourite TV programme?

Main interview questions

- Can you tell me something more about the diaries or photographs you already completed?
- Can you tell me your daily life routine?

Secondary interview questions

- What are your eating habits, such as meals, meal time, meal place, snacks?
- What are your physical activities (including household work, farm work), and leisure activities, such as school play, watching TV, play at home, bedtime?
- What is your expectation for your parents?

Prompts

- Could you say something more about that?
- Do you have further examples for this?
- How did that make you feel?
- Tell me what you were thinking when...?

Closing questions

- If you had one wish for your parents, what would it be?
- If you had one wish for you what would it be?
- Is there anything else you think is important that we haven't covered?
- Would you like to ask any questions?

Appendix 6 Chinese version for topic guide for non-left-behind children

开场

我是来自曼彻斯特大学的张楠。我对中国农村地区的儿童生活照料非常感兴趣。我非常想听听你的故事。

导入性话题

- 你平时喜欢做什么，你最喜欢的科目，你最好的朋友是谁，你最喜欢的电视节目是什么？

主要访谈问题

- 你愿意给我讲讲你刚刚完成的日记或照片吗？
- 你能给我讲一下你普通一天的生活是怎样的吗？

次要问题

- 你能给我讲讲你的饮食习惯吗，吃什么，吃饭时间，地点，零食？
- 你每天体育锻炼怎样，包括家务活，农活，休闲活动如何，包括玩耍，看电视，及其他有趣的事情，晚上睡觉时间？
- 你对父母有什么样的期待？

提示

- 您能详细说一下吗，有没有例子？
- 您当时的感受如何？

结尾问题

- 如果让你为父母许个愿，那会是什么？
- 如果让你为自己许个愿，那会是什么？
- 还有其他事情你想告诉我吗？
- 你有问题要问我吗？

Appendix 7 Diary booklet format for children

My Name: _____

My Age: _____

My Grade: _____

My Daily Routine	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
My Eating 							
My Play 							
My Work 							
Anything Else? 							

Appendix 8 Chinese version for diary booklet format for children

我的名字: _____

我的年龄: _____

年级: _____

我的日常生活	星期一	星期二	星期三	星期四	星期五	星期六	星期日
今天我吃了什么? 							
今天我玩了什么? 							
今天我做了什么? 							
还有其他事情吗? 							

Appendix 9 Carers' information sheet



Can you help with my project?

The Care-Giving Practice for Left-Behind Children in Rural China

CARER INFORMATION SHEET

My name is Nan Zhang and I am doing a project about the care-giving practice for left-behind children in rural China. This is part of my PhD project. Please have a look at this leaflet and contact me if you have any questions, or would like to take part. I would really like to hear from you.

WHAT IS THE STUDY ABOUT?

This study is trying to understand your experiences and perspectives of caring for the left-behind children.

WHY HAVE I BEEN CHOSEN?

If you would class yourself as a carer for a "left-behind child" (if any of the child's parents have left the home to seek work elsewhere and is living away from where the child lives) and the child you care for is aged 6-12, then I would be interested in hearing from you !

DO I HAVE TO TAKE PART?

No, it is entirely up to you. Even if you consent to take part, you are absolutely free to withdraw at any time without giving a reason. If you also take part and later change your mind you are still free to withdraw without it having any effect on you and your family.

WHAT WILL I NEED TO DO?

If you agree to take part, I will be inviting you to take part in one interview, either individual interview or an interview with your partner. Also, I would like to talk the left-behind child your care for, I need you to give consent for them to take part or not. Before giving consent, you are expected to talk with their parents about this study.

WHAT WILL HAPPEN IN THE INTERVIEW?

I will be asking you some questions about the experiences of being care-givers for left-behind children and taking care of them.

It can take place in your home if this is your wish.

It will take about 1 hour for individual interview. It can take longer if it is couple interview, around 1.5 hours.

If you agree, our talk will be audio-recorded.

I will just use your words but not your name, so no one will know who you are!

CAN I SAY NO OR STOP THE INTERVIEW?

Of course, you can say no at any time.

You can stop the interview at any time.

You do not have to answer any questions you don't want to.

WILL MY DATA BE
CONFIDENTIAL?

Our talk will be just between us. No one will know who you are. I will never tell it to others unless you are at risk.

Your interview will be transcribed. Your quotes will be used in publications.

Your data will be kept for 5 years. All your data will be managed in a secure way to ensure that your **confidentiality is protected**.

Some measures will be taken:

- All the recordings will be stored on Nan's password protected computer drive.
- Any third party for transcription & translation will need to sign a confidentiality agreement.
- Any electronic files containing personal information will be encrypted.
- Any original copies (e.g. signed consent form, diaries) will be kept in a locked cabinet on University premises.
- Anonymised transcriptions of interviews will be stored on the University computer, which is password protected. Transcriptions and any notes made about interviews will be identified only by an alphanumerical ID. I will be asking you some questions about your daily life (e.g., food, play and helping out).
- Only the research team will have access to the data, including me and my supervisors (Professor Peter Callery, Professor Tarani Chandola and Dr Laia Bécáres).

WILL THE
OUTCOMES BE
PUBLISHED?

The outcomes of the study will be submitted for publication in reports and/or peer-reviewed journals. Your direct quotes will be used. However, the papers will not contain your name or address. So you will not be identified. If you want, we will send you a summary of the findings after the final data analysis.

WHAT IF SOMETHING
GOES WRONG?

This study is reviewed by the University of Manchester Research Ethics Committee 1.

The University of Manchester provides insurance cover for this study.

If something goes wrong, please feel free to contact **me (Nan Zhang) on the first instance**. Any complaint will be taken very seriously. You can also contact my supervisors.

If you wish to make a **formal complaint** about the conduct of the research please contact the head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, UK, M13 9PL.

Please feel free to contact me with any questions:

Nan Zhang

Mobile: 13811341623

Email: nan.zhang-7@postgrad.manchester.ac.uk

Supervisors

Prof Peter Callery peter.callery@manchester.ac.uk ,

Prof Tarani Chandola tarani.chandola@manchester.ac.uk

Dr. Laia Bécares laia.becares@manchester.ac.uk

Appendix 10 Chinese version for carers' information sheet



您愿意帮助我一起完成以下课题吗？

中国农村留守儿童生活照料

照料者须知

你好，我是张楠。我目前正在开展“中国农村留守儿童生活照料”的研究课题，也是我博士论文的一部分。请您仔细阅读以下信息，如果您有任何疑问或者有兴趣参加，请联系我！期待您的回复。

该课题是关于什么？

本课题旨在了解您照料留守儿童的经历和感受。

我可以参加吗？

如果您正在照顾的孩子是留守儿童（即他或她的父母双方或一方外出务工），并且这个孩子年龄在 6 到 12 周岁，那么恭喜您，您可以参加这个课题！我非常希望您够帮助我一起完成这个课题。

我必须参加吗？

当然不是，是否参加完全取决于您。即使您同意参加，您可以在任何时候选择退出。

我需要做什么？

如果您决定参加这个课题，我将对您进行一个访谈，您可以选择是单独参加还是与您的一起参与接受访谈。另外，希望您够同意您照料的孩子参与这个课题。由于他或她的父母外出务工不在身边，期待您能够同其父母取得联系并获得他们的同意。

访谈是如何进行的？

访谈形式很随意，以聊天的形式进行。在访谈中，我会问您一些关于您如何照料留守儿童的经历和感受。

您可以决定您认为方便的时间和地点（如果您愿意可以在您家中进行）接受访谈。

整个访谈大概需要一个小时到一个半小时之间。

如果您愿意的话，这个访谈将会被录音（以方便之后整理资料）。

我会引用您的话，但不会偷漏您的名字及其他身份信息，所以您完全不用担心。

我可以中止访谈吗？

当然可以，你可以拒绝回答任何您不想回答的问题。

您可以在任何时候提出中止访谈。

我的资料是保密的吗？

这个访谈仅限于我们之间。访谈结束后，您的资料将会完全保密。仅有课题组成员可以看到您的资料，包括我和我的导师（Peter Callery 教授，Tarani Chandola 教授和 Laia Bécares 博士）。

如果出现预期之外的状况怎么办？

如果预期之外的事情发生，请您第一时间联系我（联系方式在结尾处）。您的任何疑问和申诉都会得到妥善的处理。您也可以联系我的导师。如果您不满意我及我导师的回复，您可以联系：The head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, UK, M19 9PL.

如果您有任何疑问，请联系我：张楠

手机：13811341623

邮箱：nan.zhang-7@postgrad.manchester.ac.uk

或联系我的导师：

Peter Callery : peter.callery@manchester.ac.uk

Tarani Chandola : tarani.chandola@manchester.ac.uk

Laia Bécares: laia.becares@manchester.ac.uk

Appendix 11 Children's information sheet (aged 6-9)



Can you help with my project?

The Care-Giving Practice for Left-Behind Children in Rural China

CHILD INFORMATION SHEET

My name is Nan Zhang and I am doing a project about left-behind children in rural China. Please have a look at this leaflet and contact me if you have any questions, or would like to be take part. I would really like to hear from you.

WHAT IS THE STUDY
ABOUT?

This study is trying to understand children's everyday lives. Some have parents at home, and some parents have to live away for work.

WHY HAVE I BEEN
CHOSEN?

I am talking with children aged 6-9 years. I would like to hear your story. You are very important to me!

WHAT WILL I NEED TO
DO?

If your carers and/or parents agree on your participation and you are also interested, I will give you a diary and/or camera to write or take photographs about your daily life for one week, e.g., food, play and helping out.

Then we can talk about what you have written in the diary or your photographs.

WHAT WILL HAPPEN IN
THE INTERVIEW?

I would like to ask about your daily life. We can talk about what you do every day, like eating, playing and helping out.

Our chat can be in your home if this is your wish.

You can talk for as long as you like or stop whenever you want to. I don't expect the interview to last for more than one hour. If you don't want to talk on your own it might be possible for us to talk with a group of friends. It might take 1.5 hours for group interview. Break and snacks will be provided.

If you agree, our talk will be audio-recorded.

I will just use your words but not your name, so no one will know who you are!

CAN I SAY NO OR STOP
THE INTERVIEW?

Of course, you can say no at any time.

You can stop the interview at any time.

You do not have to answer any questions you don't want to.

I promise I will not mind at all.

WILL THE THINGS I
TELL YOU BE KEPT
SECRET?

Our talk will be just between us. I won't tell anyone your name. If I am worried about something you say, we might need to ask someone else with whom you are comfortable with for help.

If we talk in a group other children will hear what you say. But I will ask the group not talk about what is said.

Please feel free to contact me with any questions:

Nan Zhang

Mobile: 13811341623

Email: nan.zhang-7@postgrad.manchester.ac.uk

Appendix 12 Chinese version for children's information sheet (aged 6-9)



你愿意帮助我一起完成以下课题吗？

中国农村留守儿童生活照料

儿童参与者须知

你好，我是张楠。我目前正在完成一项关于农村地区小朋友的功课。我需要你的帮助和参与。请你阅读下面的信息，如果有疑问或是有兴趣参加的话，请随时联系我。我非常期待听到你的声音。

这个功课是关于什么？

主要想了解一下小朋友们的日常生活是怎样的。一些小朋友跟爸爸妈妈住在一起，有的小朋友的爸爸妈妈在外地打工。

我可以参加吗？

如果你今年**6到9岁**之间，那么恭喜你，非常欢迎你参加并帮助我一起完成这个功课。你对我来说非常重要哦！

我需要做什么？

如果你的照料者（比如你的爷爷或奶奶）或你的父母同意你参加，并且你自己也愿意参加的话，我希望你能完成为期一周的生活日记或是记录日常生活的照片，包括吃饭，玩耍或家务劳动等。我会提供给你纸笔或一次性相机。当你完成这些之后，我希望能跟你一起分享你的生活日记或照片。

访谈是如何进行呢？

我们一起讨论你刚刚完成的生活日记或照片。
如果你愿意的话，访谈可以在你家里进行。
如果你单独跟我聊天，大概需要 **1** 个小时。
如果你跟其他小朋友一起，大概需要 **1.5** 个小时。
访谈进行大约一个小时的时候，我们会休息一下，会有零食哦。
如果你愿意的话，我们的谈话将会被录音。
我会引用你的话但不会引用你的名字，所以别人不会发现你是谁！

我可以不参加吗？

当然可以，你可以在任何时候退出。
你可以在任何时候终止我们的谈话。
如果有的问题你不想回答，你完全可以选择**不回答**。
我保证我不会生气的：)

我们的谈话是保密的吗？

是的，我们的谈话是完全保密的。我不会告诉其他人我们聊了什么。其他小朋友也会被要求对我们聊天内容保密。
别人不会知道也不会发现你是谁！

如果你有任何疑问，请联系我哦：

张楠

手机：13811341623

邮箱：nan.zhang-7@postgrad.manchester.ac.uk

Appendix 13 Children's information sheet (aged 10-12)



**School of Nursing, Midwifery
& Social Work**

University of Manchester

University lace

Oxford Road

Manchester, UK

M13 9 PL

M13 9PL

Can you help with my project?

The Care-Giving Practice for Left-Behind Children in Rural China

CHILD INFORMATION SHEET

My name is Nan Zhang and I am doing a project about left-behind children in rural China. Please have a look at this leaflet and contact me if you have any questions, or would like to be take part. I would really like to hear from you.

WHAT IS THE
STUDY ABOUT?

This study is trying to understand children's everyday lives. Some have parents at home, and some parents have to live away for work.

WHY HAVE I BEEN
CHOSEN?

If you are **10-12 years of age**, I would like to hear from you. You are important to me and my project!

WHAT WILL I NEED
TO DO?

If your carers and/or parents agree on your participation and you are also interested, I will be asking you to write short diary or take photographs about your daily life for one week, e.g., food, play and helping out. Diary booklet, pen and/or disposable camera will be provided.

Then I will talk to you after the completion of diary and/or photographs.

WHAT WILL HAPPEN
IN THE INTERVIEW?

I will be asking you some questions about your daily life (e.g., food, play and helping out).

It can take place in your home if this is your wish.

You can talk for as long as you like or stop whenever you want to. I don't expect the interview to last for more than one hour. If you don't want to talk on your own it might be possible for us to talk with a group of friends. It might take 1.5 hours for group interview. Break and snacks will be provided.

If you agree, our talk will be audio-recorded.

I will just use your words but not your name, so no one will know who you are!

CAN I SAY NO OR STOP
THE INTERVIEW?

Of course, you can say no at any time.

You can stop the interview at any time.

You do not have to answer any questions you don't want to.

WILL THE THINGS I
TELL YOU BE KEPT
SECRET?

Our talk will be just between us. No one will know who you are. However, your interview answer may be shared with other children if it is a group interview. But they will be encouraged to keep secret. We might need to ask someone else with whom you are comfortable for help when you or another person are at risk.

Your interview will be transcribed. Your anonymised quotes will be used in publications.

All your data will be looked after carefully and will be only kept for 5 years.

Only the research team will have access to the data, including me and my supervisors (Prof. Peter Callery, Prof. Tarani Chandola and Dr. Laia Bécáres)

WHAT IF SOMETHING
GOES WRONG?

If something goes wrong, please feel free or ask someone who you think are appropriate to contact me (**Nan Zhang**) on the first instance. Any complaints will be taken very seriously. You can also contact my supervisors.

If you wish to make a formal complaint about the conduct of the research please contact the head of the Research Office, Christie Building, University of Manchester, Oxford Road, Manchester, UK, M13 9PL.

Please feel free to contact me with any questions:

Nan Zhang

Mobile: 13811341623

Email: nan.zhang-7@postgrad.manchester.ac.uk

Supervisors:

Prof. Peter Callery peter.callery@manchester.ac.uk

Prof. Tarani Chandola tarani.chandola@manchester.ac.uk

Dr. Laia Bécares laia.becares@manchester.ac.uk

Appendix 14 Chinese version for children's information sheet (aged 10-12)



英国

曼彻斯特大学

护理和社会工作学院

邮编: M13 9PL

你愿意帮助我一起完成以下课题吗？

中国农村留守儿童生活照料

儿童参与者须知

你好，我是张楠。我目前正在完成一项关于农村地区小朋友的课题。我需要你的帮助和参与。请你阅读下面的信息，如果有疑问或是有兴趣参加的话，请随时联系我。

这个课题是关于什么？

主要想了解你普通一天的生活是怎样的，比如吃饭，玩耍，家务劳动，等。

我可以参加吗？

如果你今年在 6 周岁和 12 周岁之间，那么恭喜你，非常欢迎你参加并帮助我一起完成这个课题。

我需要做什么？

如果你的父母同意你参加，并且你自己也愿意参加的话，我希望你能完成为期一周的生活日记或是记录日常生活的照片。我会提供给你纸笔或一次性相机。当你完成这些之后，我希望能跟你一起分享你的生活日记或照片。

我可以拒绝参加吗？

当然可以，是否参加完全取决于你。
而且你可以在任何时候退出。
你可以在任何时候终止我们的谈话。
如果有的问题你不想回答，你完全可以选择不回答。

访谈是如何进行呢？

我们一起讨论你刚刚完成的生活日记或照片。
如果你愿意的话，访谈可以在你家里进行。
如果你单独跟我聊天，大概需要 **1** 个小时。
如果你跟其他小朋友一起，大概需要 **1.5** 个小时。
访谈进行大约一个小时的时候，我们会休息一下，会有零食哦。
如果你愿意的话，我们的谈话将会被录音。
我会引用你的话但不会引用你的名字，所以别人不会发现你是谁！

我们的谈话是保密的吗？

是的，我们的谈话是完全保密的。我不会告诉其他人我们聊了什么。其他小朋友也会被要求对我们聊天内容保密。
访谈结束后，你的资料将会完全保密。仅有课题组成员可以看到你的资料，包括我和我的导师（**Peter Caller** 教授，**Tarani Chandola** 教授和 **Laia Bécares** 博士）。
别人不会知道也不会发现你是谁！

如果你有任何疑问，请联系我哦

张楠

手机：13811341623

邮箱：nan.zhang-7@postgrad.manchester.ac.uk

Appendix 15 Carers' consent form



**School of Nursing, Midwifery
& Social Work**

University of Manchester
University Place
Oxford Road
Manchester, UK
M13 9PL

The Care-Giving Practice for Left-Behind Children in Rural China

CARER CONSENT FORM

If you are happy to participate please respond to all of these questions and sign the consent form below

Please initial box

1. I confirm that I have read and understand the information sheet on the above study and have had the opportunity to ask a member of the research team any questions I may have about the study.	<input type="checkbox"/>
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason, and without my legal rights being affected.	<input type="checkbox"/>
3. I am aware that the interview will be audio-recorded (no one else, apart from the researchers, will have access to the data), which will be stored in a secure location and destroyed by the researchers once the study has been written up. I agree to this.	<input type="checkbox"/>
4. I agree to the use of my direct quotes in any reports or publications, if they are used in such a way that I will not be identified.	<input type="checkbox"/>
5. I agree to take part in this study	<input type="checkbox"/>

Name of Participant Date Signature

Name of person taking consent Date Signature

You will have a copy of this form to keep. A further copy will be stored in the researcher's site file.

Lead Researcher: Nan Zhang, School of Nursing, Midwifery and Social Work, University of Manchester, University Place, Oxford Road, Manchester, M13 9PL, UK. Tel: (86) 13811341623 (China), (44) 07436960144 (UK)

Appendix 16 Chinese version for carers' consent form



英国
曼彻斯特大学
护理和社会工作学院
邮编：M13 9PL

中国农村留守儿童生活照料 照料者同意书

如果您愿意参与该研究，请仔细阅读以下内容并签署该同意书。

请在内划✓

1. 我确认我已经阅读并理解这项研究课题，我有向研究者询问问题并且我的疑问已得到妥善的解答。	<input type="checkbox"/>
2. 我知道我的参与完全是自愿的，我可以在任何时间退出该研究，而且我的退出不会对我及我的家庭造成任何影响。	<input type="checkbox"/>
3. 我明白访谈过程会被录音。除了研究课题组之外的任何人无法获得录音资料。我的任何资料都是严格保密的。	<input type="checkbox"/>
4. 我同意研究者可以在将来的出版物中引用我的话，但是任何引用都是匿名的，即我的身份不会被识别出来。	<input type="checkbox"/>
5. 我同意参加该课题研究。	<input type="checkbox"/>

参与者姓名

日期

签名

研究者姓名

日期

签名

您将获得这份同意书的副本作为备份。原件将保留由研究者保存。

**研究者： 张楠，英国曼彻斯特大学，护理和社会工作学院； 邮编： M13
9PL； 手机： 13811341623（中国），（44）07436960144（英国）**

Appendix 17 Left-behind children's consent form



**School of Nursing, Midwifery
& Social Work**

University of Manchester

University Place

Oxford Road

Manchester, UK

M13 9PL

**The Care-Giving Practice for Left-Behind Children in Rural China
CARERS CONSENT FORM FOR CHILD**

Child's Name _____

Date of Birth _____

Please read the statements below and initial the box next to each if you agree with them.

Please initial box

1. I confirm that I have read and understand the information sheet on the above study and have had the opportunity to ask a member of the research team any questions I may have about the study.	<input type="checkbox"/>
2. I understand that the participation of the child I care for is voluntary and that he/she is free to withdraw at any time, without giving a reason, and without his/her legal rights being affected.	<input type="checkbox"/>
3. I am aware that the interview will be audio-recorded (no one else, apart from the researchers, will have access to the data), which will be stored in a secure location and destroyed by the researchers once the study has been written up. I agree to this.	<input type="checkbox"/>
4. I agree to the use of the child's direct quotes in any reports or publications, if they are used in such a way neither I nor the child will be identified.	<input type="checkbox"/>



The Care-Giving Practice for Left-Behind Children in Rural China CHILD CONSENT FORM

Your Name _____ Date of Birth _____

This is the form you need to fill in to agree to take part in my research project.

If you want to take part, please fill in this consent form. We can work through it together.

Please choose a box to ✓ to answer each question.

1. I have read/my carers or parents have read me the information sheet about the above study.



2. I know my carers or parents have given approval for me to take part, but I also have a choice about whether I want to or not.



3. I have been able to ask Nan any questions about the study.



4. I understand that I can stop taking part at any time and I don't need to tell Nan why.



5. I know that if there is a question I don't want to answer or I cannot answer it and Nan won't mind.



6. I know that if get very upset during the interview that is fine and Nan will not mind, but Nan will have to tell my carer(s) or my parents.



7. I know that Nan will not tell anyone outside the research team what I will tell her.



8. I know that Nan will audio-record what we talk but she will not play the recording to anyone outside the research team.



9. I know that Nan will use my quotes in publications; if they are used I will not be identified.



10. I am happy to do the study.



Name of child

Date

Signature

Name of researcher

Date

Signature

Your carers must sign a different form for you to be able to take part in this study.

Lead Researcher: Nan Zhang, School of Nursing, Midwifery and Social Work, University of Manchester, University Place, Oxford Road, Manchester, M13 9PL, UK. Tel: (86) 13811341623 (China), (44) 07436960144 (UK)

Appendix 18 Chinese version for left-behind children's consent form



英国
曼彻斯特大学
护理和社会工作学院
邮编: M13 9PL

中国农村留守儿童生活照料

儿童同意书（照料者）

孩子姓名_____ 出生日期_____

如果您同意该孩子参与该研究，请仔细阅读以下内容并签署该同意书。

请在内划✓

1. 我确认我已经阅读并理解这项研究课题，我有向研究者询问问题并且我的疑问已得到妥善的解答。	<input type="checkbox"/>
2. 我知道该孩子的参与完全是自愿的，他或她可以在任何时间退出该研究，而且其退出不会对其本人及其家庭造成任何影响。	<input type="checkbox"/>
3. 我明白访谈过程会被录音。除了研究课题组之外的任何人无法获得录音资料。任何资料都是严格保密的。	<input type="checkbox"/>
4. 我同意研究者可以在将来的出版物中引用该孩子的话，但是任何引用都是匿名的，即该孩子及我本人的身份不会被识别出来。	<input type="checkbox"/>
5. 我同意该孩子的信息可能公开。但是在公开信息之前研究者将与我提前沟通。	<input type="checkbox"/>
6. 我同意该孩子参与此项研究。	<input type="checkbox"/>

照料者姓名

日期

签名

研究者姓名

日期

签名

您将获得这份同意书的副本作为备份。原件将保留由研究者保存。

**研究者：张楠，英国曼彻斯特大学，护理和社会工作学院；邮编：M13 9PL；
手机：13811341623（中国），（44）07436960144（英国）**



中国农村留守儿童生活照料

儿童同意书

你的名字 _____ 你的生日 _____

如果你愿意参加，那么跟我一起来完成这个表格吧。在合适的□内划✓。

1. 我已经阅读或我的照料者已经帮助我阅读并理解这个研究。



2. 我知道我的照料者已经同意我参加这个课题，但是我可以自己决定是否参加。



3. 我已经向张楠询问了目前所有的针对该课题的所有疑问。



4. 我理解我可以在任何时候退出该课题，甚至不用告诉张楠我为什么要退出。



5. 我知道如果我愿意回答所有的问题，张楠不会生气的。



6. 如果在访谈中我不开心的话，张楠不会介意的。不过有可能她会告诉我的照料者或者父母。



7. 我知道张楠不会将我们的谈话告诉除了研究者之外的任何人。



8. 我知道我们的谈话将会被录音。但是张楠不会将录音播放给除了课题组之外的任何人。



9. 我知道张楠可能会在将来出版物中引用我的话，但是不会泄露我的名字及任何其他身份信息。



10. 我同意参加。



孩子姓名

日期

签名

研究者姓名

日期

签名

你的照料者需要签署第一份同意书。

研究者： 张楠，英国曼彻斯特大学，护理和社会工作学院； 邮编： M13 9PL； 手机： 13811341623（中国），（44）07436960144（英国）

Appendix 19 Non-left-behind children's consent form



**School of Nursing, Midwifery
& Social Work**

University of Manchester
University Place
Oxford Road
Manchester, UK
M13 9PL

**The Care-Giving Practice for Left-Behind Children in Rural China
PARENT CONSENT FORM FOR CHILD**

Child's Name _____ Date of Birth _____

Please read the statements below and initial the box next to each if you agree with them.

Please initial box

1. I confirm that I have read and understand the information sheet on the above study and have had the opportunity to ask a member of the research team any questions I may have about the study.	<input type="checkbox"/>
2. I understand that the participation of the child I care for is voluntary and that he/she is free to withdraw at any time, without giving a reason, and without his/her legal rights being affected.	<input type="checkbox"/>
3. I am aware that the interview will be audio-recorded (no one else, apart from the researchers, will have access to the data), which will be stored in a secure location and destroyed by the researchers once the study has been written up. I agree to this.	<input type="checkbox"/>
4. I agree to the use of the child's direct quotes in any reports or publications, if they are used in such a way neither I nor the child will be identified.	<input type="checkbox"/>



The Care-Giving Practice for Left-Behind Children in Rural China

CHILD CONSENT FORM

Your Name _____ Date of Birth _____

This is the form you need to fill in to agree to take part in my research project.

If you want to take part, please fill in this consent form. We can work through it together.

Please choose a box to ✓ to answer each question.

1. I have read/my parents have read me the information sheet about the above study.



2. I know my parents have given approval for me to take part, but I also have a choice about whether I want to or not.



3. I have been able to ask Nan any questions about the study.



4. I understand that I can stop taking part at any time and I don't need to tell Nan why.



5. I know that if there is a question I don't want to answer or I cannot answer it and Nan won't mind.



6. I know that if get very upset during the interview that is fine and Nan will not mind, but Nan will have to tell my carer(s) or my parents.



7. I know that Nan will not tell anyone outside the research team what I will tell her.



8. I know that Nan will audio-record what we talk but she will not play the recording to anyone outside the research team.



9. I know that Nan will use my quotes in publications; if they are used I will not be identified.



10. I am happy to do the study.



Name of child

Date

Signature

Name of researcher

Date

Signature

Your parent must sign a different form for you to be able to take part in this study.

Lead Researcher: Nan Zhang, School of Nursing, Midwifery and Social Work, University of Manchester, University Place, Oxford Road, Manchester, M13 9PL, UK. Tel: (86) 13811341623 (China), (44) 07436960144 (UK)

Appendix 20 Chinese version for non-left-behind children's consent form



英国
曼彻斯特大学
护理和社会工作学院
邮编: M13 9PL

中国农村留守儿童生活照料 儿童同意书 (父母版)

孩子姓名_____ 出生日期_____

如果您同意该孩子参与该研究, 请仔细阅读以下内容并签署该同意书。

请在内划✓

1. 我确认我已经阅读并理解这项研究课题, 我有向研究者询问问题并且我的疑问已得到妥善的解答。	<input type="checkbox"/>
2. 我知道该孩子的参与完全是自愿的, 他或她可以在任何时间退出该研究, 而且其退出不会对其本人及其家庭造成任何影响。	<input type="checkbox"/>
3. 我明白访谈过程会被录音。除了研究课题组之外的任何人无法获得录音资料。任何资料都是严格保密的。	<input type="checkbox"/>
4. 我同意研究者可以在将来的出版物中引用该孩子的话, 但是任何引用都是匿名的, 即该孩子及我本人的身份不会被识别出来。	<input type="checkbox"/>
5. 我同意该孩子的信息可能公开。但是在公开信息之前研究者将与我提前沟通。	<input type="checkbox"/>
6. 我同意该孩子参与此项研究。	<input type="checkbox"/>

父母姓名

日期

签名

研究者姓名

日期

签名

您将获得这份同意书的副本作为备份。原件将保留由研究者保存。

**研究者：张楠，英国曼彻斯特大学，护理和社会工作学院；邮编：M13 9PL；
手机：13811341623（中国），（44）07436960144（英国）**



中国农村留守儿童生活照料 儿童同意书

你的名字 _____ 你的生日 _____

如果你愿意参加，那么跟我一起来完成这个表格吧。在合适的□内划✓。

1. 我已经阅读或我的照料者已经帮助我阅读并理解这个研究。



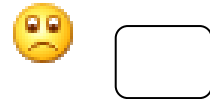
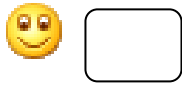
2. 我知道我的照料者已经同意我参加这个课题，但是我可以自己决定是否参加。



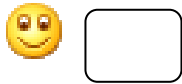
3. 我已经向张楠询问了目前所有的针对该课题的所有疑问。



4. 我理解我可以在任何时候退出该课题，甚至不用告诉张楠我为什么要退出。



5. 我知道如果我愿意回答所有的问题，张楠不会生气的。



6. 如果在访谈中我不开心的话，张楠不会介意的。不过有可能她会告诉我的照料者或者父母。



7. 我知道张楠不会将我们的谈话告诉除了研究者之外的任何人。



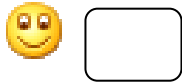
8. 我知道我们的谈话将会被录音。但是张楠不会将录音播放给除了课题组之外的任何人。



9. 我知道张楠可能会在将来出版物中引用我的话，但是不会泄露我的名字及任何其他身份信息。



10. 我同意参加。



孩子姓名

日期

签名

研究者姓名

日期

签名

你的父母需要签署第一份同意书。

研究者： 张楠，英国曼彻斯特大学，护理和社会工作学院； 邮编： M13 9PL； 手机： 13811341623（中国），（44）07436960144（英国）

Appendix 21 Transcriber/Translator confidentiality agreement

Transcriber/Translator Confidentiality Agreement

The Care-Giving Practice for Left-Behind Children in Rural China

This project is being undertaken by Nan Zhang, PhD student in the School of Nursing, Midwifery and Social Work, University of Manchester. The purpose of this research is to understand the care-giving practice for left-behind children in rural China from the perspectives of children as well as their care-givers.

As a transcriber/translator of this project, I understand that I will be hearing recordings of confidential interviews (or looking at transcripts). All this information on these recordings (or transcripts) has been revealed by interviewees who agreed to participate in this project on the condition that their interviews would remain strictly confidential. I understand I have a responsibility to honour this confidentiality agreement.

I agree not to share any information I have access to, with anyone outside the research team of the project. Any violation of this and the terms detailed below would constitute a serious breach of ethical standards and I confirm that I will adhere to the agreement in full.

1. Keep all the information shared with me confidential by not discussing or sharing the content in any form or format with anyone other than the research team.
2. Keep all the information in any form or format secure while it is in my possession.
3. Return all information in any form or format to the research team when I have completed the transcribing or translation.
4. After consulting with the research team, erase or destroy all information in any form or format regarding this project that is not returnable to the research team.

_____	_____	_____
Name of transcriber/translator	Date	Signature

_____	_____	_____
Name of researcher	Date	Signature

Appendix 22 Approval from local government, China

证 明

英国曼彻斯特大学：

经过本镇决议，批准英国曼彻斯特大学博士生张楠在我镇范围内展开研究课题“中国农村地区留守儿童生活照料”。望张楠在课题开展期间遵守当地法律法规和风俗习惯，顺利完成课题。

特此证明

遂宁市尚村镇人民政府
签字： 张楠
日期：2013.6.12.

Translated version for Approval from Local Government, China

University of Manchester:

This letter is to confirm that the PhD project “The Care-Giving Practice for Left-Behind Children in Rural China” by Nan Zhang has been approved by the local government of Yongcheng County, Henan Province. We sincerely hope Nan could abide to the local law and regulation during the course of the fieldwork and complete her project successfully.

Yours Sincerely

Suhua, Liang

Huicun Township Government (sealed)

Yongcheng County

Signature: Suhua, Liang (signed)

Date: 12 June, 2013

Appendix 23 Ethics approval from University of Manchester

Faculty of Medical and
Human Sciences
The University of
Manchester
Oxford Road
Manchester M13 9PT

+44(0)161 306 0100
www.manchester.ac.uk

Secretary to Research Ethics Committee 1

*Email: Katy.boyle@manchester.ac.uk
Phone : 0161 275 1360*

Miss Nan Zhang
PhD Student
School of Nursing, Midwifery & Social Work
University of Manchester
M13 9PL

Nan.zhang-7@postgrad.manchester.ac.uk

ref: ethics/13102

30 July 2013

Dear Miss Zhang

Research Ethics Committee 1

Zhang, Callery, Chandola, Becares: The care-giving practice for left-behind children in rural China (ref 13102)

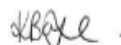
I write to confirm that the amendments to the ethics application form, participant information sheet and consent form; the provision of a participant information sheet and consent form for non left-behind children; provision of a disclosure form for transcribers, and clarification around how you will deal with possible child distress and the distribution and collection of letters satisfy the concerns of the Committee and that the above project therefore has ethical approval.

The general conditions remain as stated in the letter of 11th July 2013.

Finally, I would be grateful if you could complete and return the attached form at the end of the project or by July 2014, whichever is earlier. When completing this form, please reference your project as:

"Zhang, Callery, Chandola, Becares: The care-giving practice for left-behind children in rural China (ref 13102)"

Yours sincerely,



Katy Boyle
Secretary to University Research Ethics Committee

Appendix 24 School agreement, China

证 明

英国曼彻斯特大学：

经过本校决议，批准英国曼彻斯特大学博士生张楠在我校范围内展开研究课题“中国农村地区留守儿童生活照料”。在课题开展期间本校将给予张楠必要的帮助和支持。望张楠遵守当地法律法规和风俗习惯，顺利完成课题。

特此证明

永城市高庄镇谢庄小学

签字：谢俊臣

2013年10月8日

Translated version for School Agreement, P.R. China

University of Manchester:

This letter is to confirm that our school committee has agreed that the PhD project “The Care-Giving Practice for Left-Behind Children in Rural China” by Nan Zhang can be conducted in Xiezhuang Primary School, Yongcheng County, Henan Province. We sincerely hope Nan could abide to the local law and regulation during the course of the fieldwork and complete her project successfully.

Yours Sincerely

Junyu, Xie (headmaster)

Gaozhuang township Xiezhuang Primary School

Yongcheng County

Signature: Junyu, Xie (signed)

Date: 8 October, 2013

Appendix 25 Examples of children's diary

No. _____ Date _____

(1) 起床的时间是6:20分,睡觉的时间是9:00分。
今天我做了什么
(1) 学校劳动我打扫了教室。
(2) 家庭作业和英语作业情况,写了英语日记。
(3) 爸爸劳动我在家做了些家务活洗碗,洗衣服,扫地。
(4) 不干家务
(5) 其它内容
(6) 没有。

2013年10月19日 第四天
姓名: [redacted] 性别: 男 年龄: 11 年级: 六年级
家庭住址: 崇仁村郭宋 联系电话: 15195414850

今天我吃了什么
(1) 早饭我吃了香米粥,煮鸡蛋两个,吃的时间是6:35分,跟妈妈一起吃。
(2) 午饭我吃了韭菜炒鸡蛋,西红柿炒鸡蛋,炒肉丝,炒白菜,炒鸡蛋。
(3) 晚饭我吃了米饭,炒鸡蛋,吃的时间是6:20分,跟妈妈和妹妹一起吃。
(4) 零食我吃了苹果一个,橘子两个。
今天我玩了什么
(1) 学校由体育老师带领我们去操场玩。
(2) 回家以后和小伙伴们玩了半个小时,玩了半小时。
(3) 看电视,不玩电脑,看了英语故事,看了一个小时。
(4) 起床的时间是6:20分,睡觉的时间是9:00分。
今天我做了什么
(1) 学校劳动没有。
(2) 家庭作业和英语作业都已经写好了。
(3) 爸爸劳动我在家做了些家务活洗碗,洗衣服,扫地。
(4) 不干家务。




No. _____ Date _____

(1) 爸爸劳动我在家做了些家务活洗碗,洗衣服,扫地。
(2) 不干家务。
(3) 其它内容
(4) 没有。

2013年10月20日 第五天

今天我吃了什么
(1) 早饭我吃了米饭,煮鸡蛋两个,吃的时间是6:30分,跟妈妈一起吃。
(2) 午饭我吃了西红柿炒鸡蛋,炒肉丝,炒白菜,炒鸡蛋,炒肉丝,炒白菜,炒鸡蛋。
(3) 晚饭我吃了米饭,炒鸡蛋,吃的时间是6:20分,跟妈妈和妹妹一起吃。
(4) 零食我吃了苹果一个,橘子两个。
今天我玩了什么
(1) 学校劳动没有。
(2) 回家以后和小伙伴们玩了半个小时,玩了半小时。
(3) 看电视,不玩电脑,看了英语故事,看了一个小时。
(4) 起床的时间是6:20分,睡觉的时间是9:00分。
今天我做了什么
(1) 学校劳动没有。
(2) 家庭作业和英语作业都已经写好了。
(3) 爸爸劳动我在家做了些家务活洗碗,洗衣服,扫地。
(4) 不干家务。

míng zì 我的名字: [redacted] nián líng 我的年龄: 7 xīng bié 我的性别: 男

日常活动	第1天	第2天	第3天
今天我吃了什么? jīn tiān wǒ chī le shén me? 	今天吃了mítáo子 今天吃了fāng mian 方面 今天吃了mǐ fàn	今天吃了fāng mian 方面 今天吃了mǐ 米 今天吃了mǐ 米	今天吃了fāng mian 方面 今天吃了mǐ fàn 米饭
今天我玩了什么? jīn tiān wǒ wán le shén me? 	qì chē kǎ	cāng lái piàn	zhā yǒu mǐ cǎo
今天我干了什么活? jīn tiān wǒ gàn le shén me huó? 	sǎo dì	sǎo dì	sǎo dì

不知道的话可以问问爸爸,妈妈,爷爷,奶奶; 不会写的字用拼音代替; 期待你能顺利完成这个作业

**Appendix 26 Question from the CHNS household questionnaire to identify
migration**

Question (A5e): still lives in your household?

- 1 Yes
- 2 No, gone to school
- 3 No, military school
- 4 No, sought employment elsewhere
- 5 No, gone aboard
- 6 No, other
- 9 Unknown

Appendix 27 An example of coding strategy

The screenshot shows the NVivo interface with a search for 'Nutrition & Food cho'. The left sidebar shows a tree of nodes, with 'Nutrition & Food choices' selected. The main window displays a table of nodes:

Name	Sources	References	Created On	Created By	Modified On	Modified By
Carbohydrate	43	195	25/02/2014 19:39	NZ	26/04/2014 08:45	NZ
Differences	9	14	01/03/2014 20:14	NZ	02/04/2015 13:58	NZ
Eating habits	12	25	01/03/2014 20:28	NZ	02/04/2015 13:58	NZ
Food preparing	11	26	01/03/2014 20:20	NZ	02/04/2015 13:58	NZ
Food safety	3	4	01/03/2014 20:19	NZ	02/04/2015 13:58	NZ
Nutrition	18	79	25/02/2014 19:39	NZ	06/10/2014 21:12	NZ
Balance	4	7	01/03/2014 20:54	NZ	26/04/2014 09:44	NZ
Grandparents' beliefs	13	58	01/03/2014 20:53	NZ	06/10/2014 21:12	NZ
Parents' (aunt or uncle) b	6	17	01/03/2014 20:59	NZ	26/04/2014 09:44	NZ
Protein	38	97	25/02/2014 19:39	NZ	06/10/2014 21:12	NZ
School food	10	13	25/02/2014 19:39	NZ	26/04/2014 18:29	NZ
Snacks	43	108	25/02/2014 19:39	NZ	26/04/2014 18:43	NZ
Tastes	9	15	25/02/2014 19:39	NZ	26/04/2014 09:55	NZ
Vegetables	34	92	25/02/2014 19:39	NZ	06/10/2014 21:12	NZ

The screenshot shows a text document titled 'Huiyi&Paternal Grandma' with several paragraphs of text. Some text is highlighted in yellow, indicating it has been coded. On the right side, a coding density chart shows the distribution of codes across the text. The chart includes categories such as 'Grandparents', 'Nutrition', 'Eating habits', 'Grandparents' beliefs', 'Experiences & Feelings', 'Snacks', 'Differences', 'Protein', 'Food preparing', 'Growth', 'Wishes', 'For parents', and 'Negative'. The 'Grandparents' and 'Nutrition' categories show the highest density of coding.

Text excerpts from the document:

- Grandma: 哎, 吃馍, 吃面条, 老喝或汤的啥数。
- LBC: 有啥数, 好, 长大。今天中午喝的汤, 黑来, 炖稀饭。
- Nan: 天天她吃什么你就给她做什么?
- Grandma: 嗯, 你要是做不向她心里她不愿意吃。
- Nan: 您从六月份开始照顾他俩, 觉得生活上也有啥变化吗?
- Grandma: 没啥, 也没啥变化。天天就那, 我又不能出去干活去, 我就在家照顾他们, 跟她妈在家里一样, 吃啥你吃啥, 天天给她做饭, 她不吃馍, 肯喝或汤, 那啥就天天给她熬或汤。鸡和肉不能天天吃, 偶尔吃一次。
- Nan: 那多长时间能改善生活一次?
- Grandma: 那十来多天, 给她买一回鸡蛋吃, 有时候十来天给她买点肉, 切切, 切点, 熬或汤给她放点, 她肯喝或汤, 你要是给她吃点肉, 她也不吃菜, 她若那个肉吃, 放啥菜她都不吃, 肉切的细的, 小的, 熬或汤放里面, 让她汤汤一起喝。
- Nan: 这啥数也都不容易。
- Grandma: 不容易, 天天做个饭不, 想着点子, 她咋能往里去, 咋样她肯吃, 都是那啥。