Household resources, household composition, and child nutritional outcomes

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Abstract

In many developing countries the composition of rural households is influenced by the migration of adult household members to urban locations in search of employment. Children may be left in the care of their mother alone, or in the care of grandparents when both parents have migrated. Using representative data from rural Northeast Thailand, this paper investigates whether household composition has any effect on the nutritional outcomes of children. Our findings suggest that household types other than nuclear families result in some significantly worse child nutritional outcomes. One implication is that governments should target programs to protect the welfare of the children of migrants in origin communities..

JEL: I12, O15, O18
Keywords: migration, household composition, children, Thailand

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1. Introduction

Understanding the determinants of child welfare is important, since negative impacts on children's well-being can have long-lasting consequences into adulthood (Cravioto & Arrieta, 1986; Lichter, 1997). To date, there have been many studies on the effects of various socioeconomic factors on child welfare, including the effects on child nutritional outcomes in developing country settings. However few such studies have considered the long-run effects of migration and household composition on children, in particular comparing children in migrant and non-migrant families in rural areas. We are unaware of any studies of the effects of migration on children's welfare at all in Thailand, despite migration being a significant feature of rural livelihoods. This paper therefore addresses two significant gaps in the literature on child welfare. First we study the effects of migration and household composition on child nutritional outcomes in rural Northeast Thailand. Second we draw inferences about the minimum effects of AIDS-related mortality on child welfare due to the similarities with migration in its effect on household composition.

We will consider the impact of four common household types, in comparison with a nuclear family – extended families where both parents are present, extended families where one parent is present, single parent or grandparent families, and other household types (a category which in this study was dominated by extended families with no parents present, or grandparents raising grandchildren with no intermediate generation). As a measure of the long-run welfare of children, we use child height-for-age, weight-for-age, and weight-for-height. The resilience of these nutritional outcomes to the effects of temporary shocks (e.g. see Stillman & Thomas, 2002) suggests that they provide a good measure of long-run child welfare and may be suitable for studying the implications of household composition.

After accounting for genetic variation and socioeconomic characteristics, we find that child weight-for-height is significantly negatively affected by all household types other than nuclear families, and that child weight-for-age is significantly negatively affected by extended family households where both parents are present. Receipt of remittances in excess of B8000 from former migrant household members provides a positive marginal effect on child weight-for-height and weight-for age, suggesting that the negative effects of different household types can be mitigated by direct income transfers to the household. This suggests several possible avenues for policy intervention, including targeted programs or through increased opportunities for employment in rural areas.

The paper proceeds as follows. Section 1 presents a short history of migration in Thailand, with a particular focus on migration from the rural Northeast. Section 2 presents the theoretical framework for studies of child health outcomes, and summarises previous studies on the effects of migration on child welfare. Section 3 presents the methodology and data used in the analysis. The results are presented in section 4 and discussed in section 5. Section 6 concludes the paper.

1.1 The Traditional Domestic Cycle in Northeast Thailand

Lux (1969) provides an excellent description of the traditional Thai family system and domestic cycle in Northeast Thailand[1]. His description applies well to the family types we will use in our analysis. There is an initial phase, where the household is occupied by a nuclear family. As the children of the household head reach maturity, they marry. Young men leave the household, while daughters successively bring their new husbands into the household until such time as the next daughter is married. Finally, the youngest daughter remains in the household and her family eventually assumes control of the household on the death of her parents. The household might then traditionally move from a nuclear family, to an extended family with both parents, and then return eventually a nuclear family on the death of the parents[2].

1.2 Migration from Northeast Thailand

In Thailand, growth in the rural population during the last century resulted in the use of increasingly marginalised land, particularly in the North and Northeast regions. Clearing of forest and the increased planting of cassava as a cash crop depleted the soil, reducing rice yields. The Thai government also artificially deflated the market price of rice in order to reduce inflationary pressure on urban wages. Falling rice income and rice output per capita, increasing indebtedness and landlessness, and the increasing use of expensive inputs such as tractors and fertiliser created the need for a ready source of alternative cash income for rural households (Porpora & Lim, 1987). Thus migration became a major coping strategy of rural households, as they sought to take advantage of greater economic opportunities (Ritchey, 1976). These migrants would then support their rural family through remittances. By the late 1980s, migrants accounted for about 30 per cent of the population of Bangkok, and most originated from the Northeast, the poorest and most agriculturally-disadvantaged region (Falkus, 1993; Richter, Guest, Boonchalaksi, Piriyathamwong, & Ogena, 1997). From 1985-1990, the Northeast region experienced a net migration loss of 554 000 people (Sussangkarn, 1995).

Migrants are attracted to Bangkok not only by the prospect of higher wages, but also because of perceived gains in social status and the opportunity to engage themselves in the desirable 'modern' urban culture (Porpora & Lim, 1987). Most of these workers are recruited before they migrate, often through social networks such as friends or relatives already working in the urban centre (Fuller, Kamnuansilpa, & Lightfoot, 1990). They are often employed in the construction, transport or manufacturing sectors, where they can be offered lower wages than their urban peers. Despite higher-paying urban jobs many rural-urban migrants may find, when faced with higher costs of living, that they have very little spare money to remit to their families.

Thailand also experiences large-scale rural-rural population mobility due to the seasonality of demand for agricultural labour. The surplus of labour outside of the traditional planting and harvesting times is especially apparent in the Northeast region (Richter et al., 1997). The seasonal cycle permits Thais to migrate in search of income opportunities while maintaining their farming household. This rural-rural migration is typically short-term, lasting only the current agricultural season.

[1] See also Foster (1978; 1984) for Thailand in general.
[2] Obviously, significant variation in this family cycle is possible, with single-parent variants also apparent.

1.3 Migration and the Domestic Cycle in Northeast Thailand

Increased migration of young adults from the Northeast to urban destinations such as Bangkok (as described above) changes the domestic cycle considerably. Now, as the children of the household head reach maturity, they may migrate in search of employment. Eventually they may return to their origin household to have children. Sometimes after the children have been weaned they may migrate again, possibly leaving the children in care of the household head, often the children's grandparents.

Migration where one (or both) parents leave the household results in a different cycle of family structures. If we begin with a nuclear family, if one parent migrates (often the father), then the household becomes a single-parent household. When the migrant returns, the household returns to a nuclear family. Alternatively, the household might begin as an extended household and one (or both) parents migrate, changing the household structure either to an extended family with no parents, or to a grandparent-grandchildren household (both of these households are included in our description of 'other' household types). There is significant variation in contemporary Thai households – for instance, using Demographic and Health survey data, Lloyd and Desai (1992) found that seven per cent of Thai children were living away from their mother, and 25 per cent were living away from their father. Guest (1998) also notes that migration is responsible for most of the change in household composition in rural northeast Thailand.

The reasons for parental absence across our sample of 424 children (see Section 3.2) are summarised in Table 1. Children being raised in a household without a father totalled 185 (43.6 per cent) of the sample, while those without a mother totalled 117 (27.6 per cent). Almost all of these absences were due to migration, with comparatively very few due to death or family break-up. This confirms the prominent role that migration plays in the observed pattern of family composition in Northeast Thailand.

Table 1: Reasons for parental absence

	Fathers	Mothers
Migrated	148 (34.9%)	100 (23.6%)
Divorced or separated	23 (5.4%)	7 (1.7%)
Deceased	14 (3.3%)	10 (2.4%)

The importance of migration's effect on the domestic cycle becomes clear when the similarity with the effects of the death of an HIV-infected parent are considered. Both migration and AIDS-related mortality are concentrated among young adults, typically parents. However, the key difference is that when a parent migrates they are likely to both remit some portion of their income to the origin household, and to later return to that household. Obviously, neither of these positive effects is present in the case of AIDS-related mortality. Therefore by studying the effects of migration on child welfare, we might be able to draw an inference on the minimum effects of AIDS-related mortality on child welfare.

2. Literature Review

2.1 Theoretical Framework

Within a household, child nutritional outcomes can be thought of as the output from a health production function which includes as its determinants the 'factors of health production', including genetic endowment, lifestyle and structural factors (such as the quality of healthcare), and food (nutrient and calorie) consumption. Food consumption and quality of healthcare are determined by household preferences[3] which are influenced by parental education, but may also constrained by available income, household food production, distance to healthcare services, and the number of dependents competing for the same pool of resources in the household. In various forms, this health production function approach has been used in many studies of the determinants of child health outcomes (e.g. see Cebu Study Team, 1992; Rosenzweig & Schultz, 1982; Rosenzweig & Wolpin, 1988; Rubalcava & Contreras, 2000). The key difference of our approach is the inclusion of household composition as an additional explanatory variable affecting food consumption and the quality of healthcare received by children.

2.2 Determinants of Child Nutritional Outcomes

Several studies have examined child nutritional outcomes, and the effects of socioeconomic characteristics on those outcomes (Haddad & Hoddinott, 1994; Handa, 1999; Horton, 1988; Kennedy & Peters, 1992; Strauss, 1988), but few of these have considered the effects of different household structures. Several socioeconomic characteristics have been found to significantly affect child nutritional outcomes. For instance, Haddad and Hoddinott (1994) found that children's age, the proportion of income earned by female household members, and distance to medical facilities were significant predictors of child height-for-age in Cote d'Ivoire, and mother's age and education level were significant for child weight-for age. Horton (1988) found that in the Philippines child's age, birth order, and parent's height were significant for both child height-for-age and weight-for-height, and that rural location and water availability significantly affected weight-for-height. Strauss (1988) found that in Cote d'Ivoire child's age, and both mother's and father's education had a significantly positive effect on child weight-for-height, and standardised mother's height and mother's education had a similar effect on child height-for-age. Community characteristics, such as local wage rates, the health environment, and quality of health infrastructure were most important as predictors of child nutritional outcomes. Thomas (1990) showed that in Brazil child height-for-age and weight-for-height were significantly positively related to mother's unearned income and in some estimations related to father's unearned income and both parent's education levels. When considering boys and girls separately, mother's unearned income had a positive effect on girl's nutritional outcomes, and father's unearned income had a positive effect on boy's nutritional outcomes. Horton (1986) found strong effects of birth order and family size on child height-for-age in the Philippines.

[3] Note that there are several possible approaches for representing household preferences ranging from collective decision-making models to intra-household allocation models. Since we are not directly testing the intra-household allocation of resources, the distinction here is not necessary.

The studies mentioned above did not consider household composition as an explanatory variable for child nutritional outcomes. Studies that have included household composition have found mixed results. Thomas et al (1990) studied a large data set from Brazil and found parental education and parental height had significant positive effects on child height-for-age, after accounting for differences in income status. Kennedy and Peters (1992), using data for Kenya and Malawi, compared the nutritional status of preschoolers in male-headed households with their status in female-headed households and in households where the household head was de facto female (due to the male head being absent at least 50 per cent of the time). They did not control for other socioeconomic variables, but found that preschoolers in female headed households were significantly better off in terms of weight-for-age and height-for-age in Kenya, but not Malawi. Desai (1992) examined data from six countries in Latin America and West Africa, and found that child's age, mother's age, mother's literacy, father's education, household wealth, and the number of siblings were variously significant as predictors of child height-for-age. For the three Latin American countries, child height-for-age was significantly lower for children in a family where the mother was in a consensual (non-married) union, after controlling for other variables. There was no significant difference for other household types (including single parents and mothers in polygamous relationships), or for any household types in West Africa.

Harriss-White (1997) summarised five studies which used the ICRISAT data from India to investigate nutritional intake or anthropometric outcomes, showing significant differences and little commonality in findings between the studies. The differences were due to differences in sample classification and the analytical methodologies employed. Handa (1999) found that children's height-for-age in Jamaica was significantly greater when their mother was the household head, and that the presence of the father in the household also had a significant positive effect. She also found that children's age, mother's education, and household income were all significant explanatory variables. Bronte-Tinkew and DeJong (2004) showed, using data from the 1996 Jamaica Living Standards Measurement Study survey, that children in a single-parent household or a cohabitating household had significantly higher likelihood of stunting (low child height-for-age) than those in nuclear households, after controlling for other socio-economic characteristics. However, of the other explanatory variables, only the number of siblings in the household was significant.

2.3 Household Structure and Child Welfare

The literature on household composition and child welfare in developed countries is extensive (Amato & Keith, 1991; Dawson, 1991; Heer, 1985; Kamerman, Neuman, Waldfogel, & Brooks-Gunn, 2003; Roempke Graefe & Lichter, 1999; Thomson, Hanson, & McLanahan, 1994), but the consequences are still fiercely debated (Cherlin, 1999). The few studies utilising data from developing countries settings have considered the effects of different household size and headship on children, in particular the effect of female- versus male-headed households (Barros, Fox, & Mendonca, 1997; Handa, 1996), single and cohabiting parents (Bronte-Tinkew & DeJong, 2004), and family size or the number of siblings (Horton, 1986). Some have also considered more complex household structures such as extended families (Bronte-Tinkew, 1998).

Handa (1996) found that female-headed households in Jamaica had significantly larger budget shares allocated to child goods. Barros et al (1997) found lower school enrolment rates for children from female-headed households in Brazil, even when allowing for differences in income. Ray (1999), using data from India, found that children in female-headed households were more likely to enter the workforce, and had a lower level of schooling, than other children.

Using data from Trinidad and Tobago, Bronte-Tinkew (1998) found no support for differences in child well-being (measured by receipt of vaccinations, and school attendance) for different household types. Bronte-Tinkew and DeJong (2005) studied data from Jamaica and Trinidad and Tobago and found that household structure and income were significant predictors of child immunisation.

2.4 Migration and Child Welfare

There have been surprisingly few studies on the long-run effects of migration on children, and no published studies in the development literature on Thailand or Southeast Asia in general. Most studies have focused on migrants in North American settings, particularly Mexican migrants to the United States.

Hildebrandt and McKenzie (2005) investigated the impact of international migration on child health outcomes in Mexico. They found that children in migrant households had lower rates of infant mortality, and higher birth weights. While they did not specifically study the effect of household composition, and they clearly focused on children who migrated with their parents rather than those that remained in the origin household which is a quite different situation from that observed in Northeast Thailand, their results are interesting nonetheless. Frank and Hummer (2002) studied Mexican migrant and non-migrant households and found that membership in a migrant household reduced the risk of low birth weight, largely through the receipt of remittances. Brockerhoff (1990) examined Demographic and Health Survey data from 1986 and found migration was associated with improved child survival rates in Senegal. Conversely, Kanaiaupuni and Donato (1999) found higher rates of infant mortality in origin migrant communities that experienced intense Mexico-U.S. migration. This effect was confounded somewhat by a significant positive effect of migrant remittances.

In Thailand, a large-scale migration survey was undertaken in 1992 (see Richter et al., 1997), but the effects on children were not explored in detail. Using the same data, Chamrathrithirong and DeJong (1999) investigated the consequences of migration on quality of life, but again did not address the effects on children.

2.4 Contribution of this paper

This paper investigates the effects of different household compositions on child nutritional outcomes. Differences in household composition in Northeast Thailand typically arise as a result of parental migration, so by implication this paper also investigates the effect of parental migration on child nutritional outcomes. As shown above, there have been few studies in developing countries that consider the effect of household structure on child welfare, and fewer that consider the effects of migration. This paper addresses those gaps in the existing literature on child welfare.

3. Methodology

3.1 Data Collection and Transformation

A representative household survey was conducted in two districts (Ban Phai and Phon) in southern Khon Kaen province in Northeast Thailand from June to October 2003. All non-municipal sub-districts in both districts (ten in Ban Phai, and twelve in Phon) were included in the sampling frame. Three villages were selected for the sample from each sub-district using weighted random sampling, with the village sizes (in terms of number of households) from the Basic Minimum Needs Survey 2002 undertaken by the Ministry of Interior used to provide a-priori weights for sampling. This provided a village sample of 66 villages. In each village, all households were enumerated using the procedures recommended by the World Bank for their Living Standards Measurement Surveys (Grosh & Munoz, 1996). After enumeration was completed, a sample of ten households was selected by random sampling. This provided an overall sample of 660 households which, when appropriately weighted (as detailed in Deaton (1997)), is representative of the two districts surveyed.

Three teams of interviewers were recruited locally and trained in data collection methods and interview technique. Recruitment of local interviewers ensured that interpretations and language used for the survey were consistent with those in use in the survey area. Each household was visited twice during the survey period, two weeks apart. On the first visit, detailed data were also collected about on who lived there, their characteristics, what they did for income, migration data, health data, and agricultural data. The second visit collected additional data on expenditure which is not used in this study.

Anthropometric measurements of all household members including children were taken once on each visit, and the results were averaged. Child height and weight for all children aged under ten years were then standardised by the mean and standard deviation of height and weight of a well-nourished child of the same age and sex, using the World Health Organisation's international reference data tables (Dibley, Goldsby, Staehling, & Trowbridge, 1987; Dibley, Staehling, Nieburg, & Trowbridge, 1987). This transformed the height and weight data into z-scores of height-for-age, weight-for-age, and weight-for-height. This standardisation accounts for the different ages and sex of all children in the sample, thereby allowing data from all children to be pooled for analysis (Waterlow et al., 1977).

3.2 Econometric Model

To test whether household composition has a significant marginal effect on child nutritional outcomes, multiple regression techniques were employed. However, in line with previous studies there was some indication of heteroskedasticity in our models, so standard errors presented in section 4 have been adjusted using the HC3 estimators developed by MacKinnon and White (1985). All data was weighted at the household level to account for the stratified nature of the sampling procedure, and the weighting was distributed between children when there was more than one child in the same household. Dependent variables included three measures of child nutrition: z-scores of child height-for-age, weight-for-age, and weight-for-height. Following a similar procedure as World Health Organisation (1995), outliers in the z-scores for height-for-age, weight-for-age, and weight-for-height were attributed to measurement error, and the data was truncated at a maximum z-score of +4.0 and a minimum z-score of -6.0.

We evaluate the child health outcomes with reference to the five different household types shown in table 2. Of the 660 households in the whole sample, 311 had children aged under ten years, and in total there were 424 such children in those households. 'Other household types' mainly includes extended family households where neither parent was present.

Table 2: Household types with sample sizes

	Sample Size	% of total households	% of households with children (under age 10)
Total sample	**660**	**100**	**–**
Nuclear family	65	9.8	20.9
Extended family with both parents	103	15.6	33.1
Extended family with one parent	72	10.9	23.2
Single parent/grandparent	19	2.9	6.1
Other household types	52	7.9	16.7
Households with no children (under age 10)	349	52.9	–

Several explanatory variables for child health outcomes have been suggested in the literature (see section 2). For this study, the explanatory variables used in the health production theoretical model are those with direct effects on child nutritional outcomes including (i) genetic endowments; and (ii) quality of healthcare facilities. We account for genetic variation in child nutritional outcomes by using the average height of adult household members as an additional explanatory variable for child height-for-age and child weight-for-height[4]. We also account for differences in sex[5] and age of the child. Since all villages in the survey area had similar village-level healthcare facilities (including a village health volunteer), distance to the nearest district hospital was used as a proxy for quality of healthcare. Explanatory variables with less direct effects (e.g. effects on food consumption, which affects nutrition) included (i) household composition or type; (ii) number of children in the household, and birth order[6]; (iii) parental

[4] This measure is not as good a measure of genetic endowment as parental height. However, for many children one or more parents were not present in the household (due to factors outlined in Section 1.3) so this data was not available for the children of interest.
[5] A dummy variable where 1 = male.
[6] Since we do not have data on birth order for children who are not part of this household, we use here the order of birth among children aged less than 14 years.

education[7]; (iv) wealth; (v) receipt of remittances; and (vi) a dummy variable for district, to account for unobserved differences in outcomes between the two districts. Wealth was evaluated by quartile, determined by the total value of household assets excluding the house and land[8]. Remittances were separated categorically into: (i) households that had received no remittances in the previous twelve months; (ii) those households that had received remittances in the previous twelve months, but had received less than B8000 (approximately US$200) in that time; and (iii) those households that had received more than B8000 in remittances in the previous twelve months. A Wald test is then employed to determine whether the coefficients on all household type variables are significantly different from zero.

The summary statistics for the dependent and explanatory variables are presented in table 3. As can be seen, the data are highly variable, in particular the dependent variables.

Table 3: Summary statistics for dependent and explanatory variables

	n	Mean	Std. Dev.	Min	Max
Height-for-age z-score	384	-0.9058	1.8175	-5.8412	3.7583
Weight-for-age z-score	397	-0.8536	1.4061	-5.1434	3.4918
Weight-for-height z-score	412	-0.4316	1.6334	-5.5023	3.9086
Regional dummy (1 = Phon district)	424	0.4418	0.4972	0	1
Distance to hospital	424	10.123	5.390	1.25	23.5
Sex (1 = male)	424	0.5143	0.5004	0	1
Age (years)	424	4.7656	2.8542	0	9
Birth order (number of older children)	424	0.5070	0.6210	0	4
Number of children	424	1.8331	0.7314	1	5
Total Household Assets value (baht)	424	81509	142370	0	1548000
Total Remittances (previous year; baht)	424	12385	36169	0	360000
Father's education (years)	424	7.27	3.35	0	17
Mother's education (years)	424	6.79	2.93	0	16
Average adult height	424	159.3	5.0	144	176.5
Average adult BMI	424	23.0	2.5	17.5	30.7

4. Results

For each of the three measures of child nutritional outcome, three models were run. Model A includes only household composition as an explanatory variable. Model B includes family factors such as child's sex, age, birth order and number of children, parental education, and genetic

[7] Education was measured in years of schooling, including post-secondary schooling.
[8] Other measures of wealth were considered, but this measure was preferred due to perceived errors in other measures, particularly the valuation of home and land ownership.

endowment, in addition to household composition. Model C includes all explanatory variables detailed in Section 3.2.

The results of all three models for child height-for-age z-scores are presented in table 4 (p-values in brackets). In the final model (model C), wealth provides a plausible and significant marginal effect on child height-for-age, as does the genetic endowment variable average height. Age has a significant negative effect on child height-for-age in both model B and model C, suggesting that as children get older, on average they move further away from the mean of the reference population. Surprisingly parental education does not have a significant effect on child height-for-age. All household type coefficients are positive but none are significant, suggesting that household type has no effect of child height-for-age. Further, a Wald test cannot reject that the coefficients on all household type variables are zero in this model (p=0.492).

Table 5 presents the same three models applied to child weight-for-age. Unlike height-for-age, mother's education provides a significant positive marginal effect on child weight-for-age, though in the final model the coefficient is only weakly significant. Only the second wealth quartile is significant (and negative), and the receipt of more than B8000 in remittances is positive and significant. Age again is significant and negative, while children in Phon district were of significantly higher weight-for-age than those in Ban Phai district. An extended family with both parents present provides significantly worse child weight-for-age z-scores compared to a nuclear family. Other household compositions did not provide significantly different weight-for-age outcomes from nuclear family households. Again, a Wald test cannot reject that the coefficients on all household type variables are zero in this model (p=0.275).

Table 6 presents the models applied to child weight-for-height. The results show that mother's education has a weakly significant positive effect on child weight-for-height, as does receipt of remittances in excess of B8000. Average adult height is significant and negative. This may represent genetically taller children being taller but not necessarily heavier than their shorter cohorts. All alternatives to the nuclear family household type provide significantly worse child weight-for-height z-scores, although for three of the household types significance is only attained once all other explanatory variables have been included in Model C. Extended families with both parents present provide significantly worse weight-for-height outcomes for children in all three models. A Wald test on Model C rejects that the coefficients on all household type variables are zero in this model (p=0.019), suggesting that household types other than nuclear families provide significantly different child weight-for-height outcomes.

Table 4: Multiple regression results for height-for-age z-scores

	Model A	Model B	Model C
Nuclear family	–	–	–
Extended family with both parents	0.1451 (0.672)	0.2489 (0.463)	0.1610 (0.627)
Extended family with one parent	0.1676 (0.644)	0.1692 (0.634)	0.0284 (0.937)
Single parent/grandparent	0.3274 (0.441)	0.7478 (0.109)	0.7447 (0.141)
Other household types	0.2469 (0.554)	0.4855 (0.246)	0.4197 (0.313)
Birth order	–	-0.1410 (0.489)	-0.1630 (0.427)
Number of children	–	0.1902 (0.393)	0.2374 (0.286)
Sex	–	-0.3195 (0.180)	-0.3117 (0.192)
Age	–	-0.3019** (0.036)	-0.2879** (0.049)
Age^2	–	0.0278* (0.072)	0.0250 (0.108)
Father's education	–	-0.0006 (0.989)	-0.0027 (0.948)
Mother's education	–	0.0296 (0.575)	0.0123 (0.816)
Average Height	–	0.0695*** (0.005)	0.0674*** (0.006)
Regional dummy	–	–	0.0667 (0.761)
Distance to hospital	–	–	-0.0105 (0.616)
Wealth quartile 1 (lowest)	–	–	-0.7041** (0.029)
Wealth quartile 2	–	–	-0.5424* (0.100)
Wealth quartile 3	–	–	-0.3704 (0.252)
Remittances < B8000	–	–	0.2363 (0.481)
Remittances > B8000	–	–	0.2279 (0.470)
Constant	-1.0532*** (0.000)	-11.9533*** (0.004)	-11.0474*** (0.007)

* significant at 10%; ** significant at 5%; ***significant at 1%

Table 5: Multiple regression results for weight-for-age z-scores

	Model A	Model B	Model C
Nuclear family	–	–	–
Extended family with both parents	-0.3744 (0.166)	-0.4669* (0.080)	-0.5288** (0.047)
Extended family with one parent	-0.0130 (0.964)	-0.2237 (0.436)	-0.3412 (0.238)
Single parent/grandparent	0.0678 (0.854)	0.0103 (0.976)	-0.1323 (0.711)
Other household types	0.0328 (0.918)	-0.0926 (0.769)	-0.2211 (0.462)
Birth order	–	-0.1382 (0.468)	-0.1575 (0.399)
Number of children	–	0.1912 (0.234)	0.1978 (0.202)
Sex	–	-0.2135 (0.229)	-0.1721 (0.325)
Age	–	-0.2329** (0.032)	-0.2055* (0.058)
Age^2	–	0.0180* (0.099)	0.0145 (0.185)
Father's education	–	-0.0134 (0.631)	-0.0173 (0.556)
Mother's education	–	0.0700** (0.034)	0.0606* (0.066)
Regional dummy	–	–	0.3887** (0.027)
Distance to hospital	–	–	-0.0111 (0.473)
Wealth quartile 1 (lowest)	–	–	-0.3936 (0.145)
Wealth quartile 2	–	–	-0.4958* (0.077)
Wealth quartile 3	–	–	-0.4122 (0.112)
Remittances < B8000	–	–	0.0630 (0.762)
Remittances > B8000	–	–	0.4724** (0.050)
Constant	-0.7348*** (0.003)	-0.6364 (0.186)	-0.3137 (0.597)

* significant at 10%; ** significant at 5%; ***significant at 1%

Table 6: Multiple regression results for weight-for-height z-scores

	Model A	Model B	Model C
Nuclear family	–	–	–
Extended family with both parents	-0.7962*** (0.004)	-0.9454*** (0.001)	-0.9574*** (0.001)
Extended family with one parent	-0.3236 (0.273)	-0.4622 (0.129)	-0.5825* (0.059)
Single parent/grandparent	-0.3790 (0.357)	-0.6758 (0.114)	-0.8848** (0.042)
Other household types	-0.2036 (0.538)	-0.5384 (0.104)	-0.6478* (0.058)
Birth order	–	0.0050 (0.981)	0.0036 (0.986)
Number of children	–	-0.0389 (0.824)	-0.0458 (0.787)
Sex	–	-0.1246 (0.515)	-0.0454 (0.813)
Age	–	0.0458 (0.719)	0.0750 (0.532)
Age^2	–	-0.0079 (0.549)	-0.0109 (0.384)
Father's education	–	-0.0040 (0.908)	-0.0052 (0.889)
Mother's education	–	0.0762* (0.073)	0.0787* (0.072)
Average Height	–	-0.4272** (0.040)	-0.0455** (0.034)
Regional dummy	–	–	0.0278 (0.157)
Distance to hospital	–	–	-0.0090 (0.633)
Wealth quartile 1 (lowest)	–	–	0.0640 (0.827)
Wealth quartile 2	–	–	-0.3359 (0.268)
Wealth quartile 3	–	–	-0.2512 (0.361)
Remittances < B8000	–	–	-0.2679 (0.243)
Remittances > B8000	–	–	0.5162* (0.065)
Constant	-0.0321 (0.890)	6.6003* (0.054)	7.0769** (0.047)

* significant at 10%; ** significant at 5%; ***significant at 1%

5. Discussion

There was no significant difference in any of the nutritional outcomes between boy and girl children. Distance to the nearest hospital as expected had a negative effect on all final models, but the marginal effect was not significant in any model. Many of the other explanatory variables in our models also did not attain significance in any model, including birth order and number of children. Genetic factors (represented by average adult height) are strongly associated with child nutritional outcomes in height-for-age and weight-for-height. Low wealth has a negative effect on outcomes, but is mostly non-significant except in the case of child height-for-age. Outcomes were better for children living in Phon district when compared to Ban Phai district, though this effect was only significant for weight-for-age. Father's education appears to have no effect on child nutritional outcomes, while mother's education has a significant positive effect on children's weight-for-age and weight-for-height, but not height-for-age.

Our results suggest that the nutritional outcome with the longest 'memory', child height-for-age, is unaffected by migration or household composition, once other explanatory variables are taken into account. This may be due to the significant variation in the data, but is more likely due to the short period of time in which many of the children would have resided in the household type observed during data collection. Additional historical or longitudinal data would be necessary to explore this effect in more detail. Child weight-for-age is negatively impacted by extended family households where both parents are present. This may be due to both household composition and nutritional outcomes being determined simultaneously by the same socioeconomic factors. Another reason may be that nutritional resources are spread more thinly among dependents in a larger extended family, although number of children in the household is not separately significant.

Child weight-for-height is significantly negatively affected by all household types when compared with nuclear family households, after accounting for other explanatory variables. The negative marginal effects were largest for extended families with both parents present, which is consistent with child weight-for-age. If only one parent was present (presumably the other parent has migrated to work elsewhere), the marginal effects were less negative. If both parents had migrated, as shown by 'other household types' the marginal effects become larger again. It is possible that where both parents have migrated, and left the children with relatives to raise, the altruistic intergenerational ties to their children might be less strong. This might also be reflected in the decision to migrate in the first place.

Single parent (or single grandparent) households also provide large negative marginal effects on child weight-for-height. Where only one adult is responsible for caring for and providing for the children, it is possible that they are unable to do so to the same standard as a multiple-adult household. Receipt of remittances in excess of B8000 from former migrant household members provides a positive marginal effect on child weight-for-height and weight-for-age. For weight-for-height this positive marginal effect is less than the marginal effect associated with all alternative household types. This suggests that the negative effects of different household types can be mitigated by direct income transfers to the household.

Using these results, we can draw inferences about the effects of AIDS-related mortality on child nutritional outcomes. As noted in section 1.2, the effect of migration on household composition is very similar to the effect of AIDS-related mortality on household composition. Provided as above that migrant remittances provide for better outcomes then the results presented above represent an upper-bound of the results that would be obtained from a study of AIDS-related morbidity on child welfare. If this follows, then the nutritional outcomes of children affected by the AIDS-related death of a parent will be significantly adversely affected by the resulting change in household composition. This is without considering any additional psychological impacts of the death of a parent.

These results suggest several policy implications. If children remaining in the origin household while one or both of their parents migrate are significantly negatively affected, then the government could consider several alternative policies. First, targeted income transfers to families with migrated household members could mitigate the negative impacts associated with household types other than nuclear families. However, this type of transfer reduces the implicit costs associated with migration and may increase the numbers of affected children. A better alternative than a direct income transfer is probably to facilitate the transfer of remittances from urban to rural areas, possibly through the provision of low-cost banking services in rural areas. Second, to reduce the number of children living in family arrangements without parents, they could facilitate the movement of children with their parents by providing low-cost childcare services in Bangkok and other destination communities. This encourages the maintenance of nuclear family households but may place additional pressure on urban infrastructure – seen as a key problem in the crowded metropolis of Bangkok. Third, they could consider facilitating the movement or urban jobs, including manufacturing, to rural areas. These rural development projects offer improved income generation opportunities for rural people, and reduce the incentives for migration allowing the family unit to remain intact. These last two policy alternatives would allow children to remain in the significantly better nuclear family or extended family with both parents present.

5.1 Comparison with other literature

Thomas et al (1990) studied the impact of household characteristics on child survival and height-for-age in Brazil, and found significant positive income and parental education effects, as well as significant positive genetic factors (measured by parents' height). We also found significant positive genetic and wealth effects on child height-for-age. However, our finding that child height-for-age is apparently unrelated to household type is in line with the findings of Wingerd and Schoen (1974), who found in a study of over 3700 U.S. children that parental height accounted for over 88 per cent of the variation in child height at age five.

Cochrane et al (1982) summarised the literature on parental education and child health and found that mother's education had a significant positive effect on child health outcomes including weight-for-age and height-for-age. This is in line with our results for weight-for-age and weight-for-height, but in height-for-age mother's education had a negative but insignificant effect in our analysis.

Our results for child weight-for-height are similar to the findings of Kanaiaupuni and Donato (1999), who found higher rates of infant mortality in origin migrant communities in Mexico. While they did not study subsequent nutritional factors for children, the child health outcomes are similarly negative for migration-affected children. This corroborates our finding that alternative household types, which exclude one or more parents, result in significantly worse child weight-for-height outcomes.

5.2 Caveats

The sample size for this study was rather small, including 660 households in two districts in Khon Kaen province, Northeast Thailand. However, only 311 of those households had children under age ten, and only 424 children were included in the sample. The small sample size makes the results especially sensitive to the presence of outliers. Once outliers were excluded, the remaining sample sizes were only approximately 400.

The calculation of z-scores for the long-run nutritional outcomes of children in our study relied on a reference sample drawn from a developed country. There is therefore a bias towards negative values, as identified by the mean z-scores in table 2. It is difficult to determine whether this downward bias has any significant effect on our results, and indeed it would not unless there was a significant difference in the standard deviation of the nutritional outcome measures between the WHO international reference data tables and an equivalent Thai reference population. To our knowledge no such Thai reference sample for child anthropometrics exists.

It is entirely probable that household composition (or household type) is not independent of the decision to migrate, or independent of the nutritional outcomes for children. It is possible that parents who choose to migrate do so as a result of the same economic conditions that result in poor nutritional outcomes. Indeed, as noted by Gugler (1993) we would expect that migrants migrate in order to improve the conditions of the rural household. Poverty provides a confounding factor which may be imperfectly overcome by the use of wealth as an explanatory variable in our analysis, thereby allowing us to compare poor children from different households with different compositions.

Finally, we have not taken account of the length of time that children have experienced the household type they were in at the time of interview. It is likely that children who have only recently experienced a change of household type are significantly less affected – this presents the most serious problems in investigating child height-for-age which is the longest-run measure of the three. This arose partly because the data collected was not originally intended to study the effects of migration on child health, and may result in an underestimate of the effects of household composition on outcomes. The extent of any bias would depend on the distribution of durations children have lived in their current (at the time of the survey) household type.

5.3 Suggestions for future research

The results of this paper suggest several avenues for future research. First, our results should be treated as preliminary in that the data collection was not specifically focused on the collection of data to examine the effects of migration on child health outcomes. Future research should employ a larger sample size and more focused questions on migration history, and changes in household composition. A comparison between children who migrated with their parents and children who did not might also provide informative analysis, and the use of panel or repeated cross section data would allow for differences over time to be adequately analysed (Guest, 1998).

Also, if AIDS-related mortality has similar effects on household composition to migration, then child welfare is also affected in similar ways. Future research should focus on estimating the specific effects on AIDS-related mortality on child health and other welfare measures, and develop policies to mitigate the effects of parental mortality on children.

It is also possible that the relationships between the explanatory and dependent variables are not stable across the distribution of child nutritional indicators. Quantile regression could be employed to determine where the marginal effects of different explanatory variables are significant.

6. Conclusion

Among other effects, migration results in changes in household composition. Our results from a representative sample of children in Khon Kaen province in Northeast Thailand suggest that household structures other than a nuclear family have a significantly negative effect on child welfare, as measured by child weight-for-height and weight-for-age, but have no significant effect on child height-for-age. Receipt of remittances in excess of B8000 from former migrant household members provides a positive marginal effect on child weight-for-height and weight-for age, suggesting that the negative effects of different household types can be mitigated by direct income transfers to the household. To the extent that the effects of migration on household composition are similar to the effects of AIDS-related mortality on household composition, these results also suggest a lower bound to the effect of AIDS-related mortality on children's nutritional outcomes. More focused research in this area is required, to determine whether these effects are robust to the interaction between the decision to migrate and nutritional outcomes.

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