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Development-Induced Displacement and Children's Human Capital

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ABSTRACT

Development projects and policies displace an estimated ten million people each year worldwide. In this study we investigate the association between population redistribution schemes and children's human capital outcomes. Using a new dataset from the Lao People's Democratic Republic (Lao PDR), we first describe the resettlement status, nutritional status, and educational attainment of children. We then ask whether children in households that have been resettled have worse nutritional status and lower educational attainment than children in non-resettled households. We use propensity-score matching methods to address unobserved heterogeneity in the likelihood of being resettled. Results suggest that resettlement is associated with poorer long-term outcomes but better short-term outcomes. Ethnicity and district are important predictors of both resettlement status and human capital.

INTRODUCTION

Development projects in poor countries are estimated to forcibly displace ten million people each year worldwide, and have done so since at least 1990 (Cernea, 2000). This population, termed "resettlers" by Cernea, often occupies a particularly precarious position among the displaced. Like refugees and internally displaced persons (IDPs), their migration is involuntary. However, their displacement is caused not by conflict or natural disaster, but by development projects or policies initiated by their own governments and often underwritten by international financial institutions. Resettlers enjoy fewer legal protections by international conventions than do refugees, and tend to command less media (and scholarly) attention than those displaced by conflict or natural disaster.

While large infrastructure projects like dams are the best-known causes of development-induced placement, urban renewal projects and population redistribution schemes also displace large numbers of people each year. Both project-related displacement and population redistribution schemes share a goal of welfare improvements for the population as a whole, including new sources of electric power, improved urban infrastructure, newly resettled territories, and livelihood opportunities. But resettlement may also have significant costs for affected groups. Cernea's risk and reconstruction model for displaced populations identifies eight "impoverishment risks" (Cernea, 2000, p. 14) that often accompany resettlement, including landlessness, food insecurity, increased morbidity, and community disarticulation.

In this study of children in rural villages in northern Lao PDR with high rates of resettlement, we evaluate a specific population redistribution scheme, village resettlement, designed to improve food security and access to health and education facilities. While the government's policy goals for village resettlement imply sizable benefits to children in resettled households, case studies of resettled villages in the region suggest that resettlement has had the opposite effect (Goudineau, 1997). Resolving this contradiction empirically is difficult for several reasons. Most studies of resettled populations tend to sample only resettled populations without adequate comparison groups. Here we use a new cross-sectional dataset from the Lao People's Democratic Republic (Lao PDR) that is population representative but that includes a large proportion of resettled households. We evaluate whether children in resettled households have significantly different nutritional status and educational attainment from children in non-resettled households. We use propensity score matching techniques to address the unobserved heterogeneity in the likelihood of being resettled.

DEVELOPMENT-INDUCED DISPLACEMENT

Development-induced displacement occurs when populations are evicted from their homes either to enable the construction of large-scale development projects such as dams, roads, power plants, mines, or irrigation schemes; or as part of government policies related to urban development and population redistribution (Robinson, 2003). Firm estimates of the number of people displaced by development policies worldwide are not available, but a few examples demonstrate the scale of the problem. The World Commission on Dams estimates that 40-80 million people have been displaced by dams, primarily in China or India (World Commission on Dams, 2000). Urban infrastructure projects have uprooted an estimated 1.5 million people in Myanmar alone, with India, Bangladesh, the Philippines and the Dominican Republic also witnessing large scale urban resettlement. Mining has displaced more than two million people in India since 1950. Population redistribution schemes have generated substantial forced migrations in Cambodia, Vietnam, Tanzania, Ethiopia, and Indonesia (Robinson, 2003). The Indonesian transmigration program is the best known of these, resettling more than six million people in the second half of the twentieth century from the more populous central islands to outlying regions of the country (Adhiati & Bobsien, 2001).

Development-induced displacement is distinct from conflict- or disaster-related displacement in important ways. First, development-induced displacement is linked to a policy decision to relocate people in order to accomplish a development-related goal such as the construction of a dam or border security. In the case of project-related displacement, the resettlement can be thought of as a necessary consequence or cost of the project, and can even be evaluated using standard cost-benefit analysis. Population redistribution schemes may even have a goal of improving the welfare of resettlers, for example by providing access to more or better quality land. In either case, the fact that the resettlement is planned and intentional suggests that governments should, at least in theory, have some obligation to ensure that resettlement and restoration are minimally disruptive. Cernea notes that population resettlement itself may be unavoidable, but the associated impoverishment need not be if care is taken to avoid the risks identified in his model: landlessness, joblessness, food insecurity, increased morbidity, etc. (Cernea, 2000). A key feature of resettled populations is that they are often already poor and vulnerable prior to displacement, increasing the risk of further impoverishment.

Displacement and children's human capital

Much of the literature on the human capital effects of displacement focuses on displacement due to conflicts or natural disasters. The evidence that conflict-related refugees, particularly children, suffer health impacts is strong. Sharp increases in diarrheal diseases have been documented in the Rwandan refugee crisis of 1994 (Goma Epidemiology Group, 1995;

Siddique, 1995) and in Liberia (CDC, 2003). If vaccination programs are interrupted, measles and other infectious childhood diseases may resurge, as happened in Darfur, Sudan (CDC, 2004) and other African settings. Children are at particularly higher risk for malnutrition, malnutrition-infectious disease interactions, respiratory diseases, eye infections, and intestinal parasites (Accorsi et al., 2005; Bisrat, Berhane, Mamo, & Asefa, 1995; Grandesso, Sanderson, Kruijt, Koene, & Brown, 2005). Conflict-related displacement is also associated with increased rates of transmission of tuberculosis (Barr & Menzies, 1994) and malaria (Accorsi et al., 2005; Bloland & Williams, 2003). Many of the same forces that compromise health for conflict-related refugees afflict environmental refugees. Vaccine interruptions, lack of clean water and sanitation facilities, destruction of health services infrastructure, and food insecurity all take a toll. While it is sometimes difficult to distinguish the effects of the disaster itself from the effects of the process of displacement, Watson et al. (2007) point out that displacement is usually the underlying cause of disease outbreaks associated with disasters

Empirical studies of the health effects of development-induced displacement are harder to find (Robinson, 2007). A large case study literature has chronicled the extent of various displacements, with details on compensation schemes, restoration timetables, and the characteristics of the resettled populations (for a thorough review, see Robinson, 2003). This rich literature suggests that the impoverishment risks outlined by Cernea are quite relevant: landlessness and food security are common post-resettlement, as is community disarticulation and loss of livelihoods. However, these studies do not permit rigorous assessment of the specific health effects of displacement for children. In addition, there are few studies, of conflict-, disaster- or development-induced displacement, that have evaluated the implications of displacement for educational attainment of children.

VILLAGE RESETTLEMENT IN LAO PDR

Internal migration in Lao PDR has taken several forms in the past century (Evrard & Goudineau, 2004). The earliest inhabitants of the region practiced semi-nomadic agriculture, with long fallow cycles and periodic movements of households and villages within large territories. Other upland (mountain-dwelling) ethnic groups who came to the region in the nineteenth-century employed shorter cycle "slash and burn" methods with more frequent relocations. Against this backdrop, the country experienced massive internal migration during two successive wars from 1958-1975. In the post-war period, many villages and households moved again, either returning to previously held lands or responding to government incentives to settle unpopulated or politically unstable areas.

Village resettlement as currently experienced in Lao PDR began in the early 1990s and is a more focused and intentional phenomenon (Evrard & Goudineau, 2004)[1]. It refers to the relocation of villages from upland (mountainous) area to nearby lowland (valley) areas. There are several excellent descriptive studies of resettlement policies in Lao PDR (see, for example, Baird & Shoemaker, 2005; Chamberlain, 2001; Cohen, 2000; Evrard & Goudineau, 2004; Goudineau, 1997). Here we highlight key aspects of village resettlement that are relevant for the current study. Because village resettlement is a very sensitive topic not openly discussed or always acknowledged by the Lao government, it is difficult to study the consequences of the policies.

[1] It is important to note that "village resettlement" as analyzed here is distinct from two other forms of resettlement experienced by Laotians: project-related displacement, in which communities are relocated to make way for roads, dams, or mining; and refugee resettlement, or the return and resettlement of Laotian refugees from other countries, a process undertaken by the United Nations High Commission for Refugees (Baird & Shoemaker, 2005).

Resettlement policies were developed initially to accomplish a key development goal: the eradication of swidden or "slash and burn" agricultural techniques. Swidden agricultural systems involve clearing a small area of land for cultivation by burning the existing vegetation, then planting and harvesting a crop on the cleared land. In the following season the cycle is repeated on a new plot of land, and the previously-cleared area is allowed to lie fallow. The sustainability of the system clearly depends on the frequency with which a plot of land is burned, or the length of the fallow period, which in turn depends on the land availability and density of the population employing the swidden techniques.

Since at least the late 1980s, the Lao government has considered swidden agriculture to be environmentally harmful, inefficient, and unsustainable. Swidden agriculture is regarded as incompatible with monoculture tree plantations such as teak or eucalyptus that are seen as important economic development engines (Baird & Shoemaker, 2005). Conservation groups have also raised concerns that continued swidden cultivation could threaten the biodiversity of the upland regions of Laos. Consequently, in 1994 the Lao government decided to eliminate swidden agriculture by 2000. Village resettlement was widely considered the primary means through which the eradication of swidden systems would be accomplished, by physically moving populations who practiced the system from their upland villages to lowland areas where paddy rice cultivation was the dominant agricultural system.

The second key policy goal related to resettlement is the relocation of remote populations closer to infrastructure and services, which suggests that resettlement should in theory make children better rather than worse off. To accommodate resettled populations, the government has planned a series of "Focal Sites," or dense clusters of villages along roads and waterways with access to markets, health facilities, and schools. Focal Sites are intended to concentrate development resources and infrastructure geographically, with the goals of reducing poverty, improving food security, promoting market activity, and increasing access to schools and health facilities (Baird & Shoemaker, 2005) . Government plans announced in 1998 promised 87 Focal Sites consisting of 16 villages each by 2002, with provincial and district governments setting targets for additional Focal Sites. Three other reasons for resettlement policy also offered by the Government of Lao and the development agencies that support resettlement include opium eradication, border security concerns, and cultural integration and “nation-building” (Baird & Shoemaker, 2005). The goals reflect the fact that villages targeted for resettlement are extremely remote, are populated primarily by small ethnic minority groups, and are often located in districts bordering China and Burma.

The goal of eradicating swidden agriculture completely implied a potential resettlement of 900,000 people between 1990 and 2000 (Baird & Shoemaker, 2005; Evrard & Goudineau, 2004). Figures on actual resettlement are harder to pinpoint. An extensive survey of resettled villages in 1997 in six districts with high rates of resettlement indicated that approximately one-third of villages had experienced displacement in the twenty years prior to the survey, reaching as high as 85 percent in one district (Goudineau, 1997). Villages also vary in the degree to which they consider the resettlement compulsory. In some cases the decision to relocate is the end result of a long process of negotiation between the village and the district or provincial officials responsible for land allocation and land use policies. If swidden land is not made available to the village, then relocation may be an economic necessity even if not officially required by the government. Because the negotiation process can be extensive, it is also the case that some households within villages may choose to move first while others wait as long as possible before moving (Goudineau, 1997).

A series of detailed descriptive studies summarized in Baird and Shoemaker (2005) have identified the main effects of resettlement in Lao PDR: severely reduced agricultural yields, compromised food security, increased morbidity and mortality from malaria and other infectious diseases, and widespread livestock disease (Baird & Shoemaker, 2005; World Food Programme, 2005). Effects appear to be particularly severe in the period immediately following relocation, with health effects worst for the elderly and young children. The resettlement policies also appear to have increased mobility because displaced villagers return to upland territories to continue swidden agriculture (Evrard & Goudineau, 2004; World Food Programme, 2005).

The experiences of one resettled village in Luang Prabang Province illustrate the interrelated problems that can accompany resettlement (World Food Programme, 2005). The village was resettled in 2003 from an upland to a lowland area along with two neighboring villages. After resettlement the villagers found it difficult to adapt to their new environment. Little land was made available to them, and they had no experience with the new agro-ecological conditions for paddy cultivation, resulting in a poor rice harvest and rice insufficiency at the household level. One important coping strategy was to continue upland rice cultivation on land near the original village, a six-hour walk from the new village. In the year after relocation, in addition to crop pests and livestock diseases, almost all the villagers suffered one or more bouts of malaria. More than ten people died of the disease, mostly young children. The villagers had no knowledge of proper malaria prevention strategies in their new location, whose lower altitude and proximity to water made it an endemic region[2]. While the villagers remained optimistic that the benefits of resettlement would eventually accrue, the transition period itself had been exceedingly difficult.

[2] This dramatic increase in malaria morbidity and mortality post-resettlement was also reported in all six districts in the Goudineau (1997) study.

No studies to date have looked specifically at the long-term implications of resettlement for children's well-being in this population. The policy goals of the Government of Lao and the anecdotal evidence provided by case studies are contradictory. The policy goals for resettlement include poverty reduction, improved food security, and better access to health services. These should improve both long- and short-term nutritional outcomes for children relative to their pre-resettlement state or to similar children in non-resettled households. However, if resettlement causes food insecurity and increased morbidity, as reported in some resettled communities, then we would expect children in resettled households to achieve shorter heights than children in non-mover households. If the effects of resettlement on food security persist, then the short-term nutritional status of children may also be compromised even several years after resettlement.

Resettlement may also affect educational attainment in several ways. Theoretically, resettlement should improve educational attainment by bringing children closer to schools that offer more grade levels. However, resettlement may also have negative effects on education. If resettlement does compromise linear growth, then resettled children may experience delayed enrollment if they are perceived to be too young or too small to start school[3]. Reduced income due to resettlement may prevent parents from paying school fees or may require children to work on family lands rather than attend school. Increased morbidity and cognitive impairments from poor diets may also affect progression through school. Social exclusion in destination villages or linguistic difficulties may prevent children from taking advantage of schooling opportunities. Based on these conflicting a priori hypotheses about the effects of resettlement on human capital, we employ a series of two-sided tests to evaluate the nutritional status and educational outcomes in children conditional on past resettlement.

[3] In the survey used for this study, parents reported reasons for not enrolling children in school. "Too small or too young" was reported for 61 percent of non-enrolled six-year olds, 32 percent of non-enrolled seven-year-olds, and 17 percent of non-enrolled eight-year olds.

DATA

Studying internally displaced and resettled populations presents many methodological challenges (Jacobsen & Landau, 2003). Sampling is one persistent problem, because most studies of internally displaced or resettled persons are based on convenience samples of already displaced populations. This dataset offers a unique opportunity to analyze a random and representative sample of households with school-aged children from a region with high rates of village resettlement. These unique data aid in making causal inferences because we can construct control groups to more precisely and accurately estimate the effects of resettlement on impoverishment and on children's human capital.

The data for this study are taken from a survey fielded in 2006 in four districts of northern Lao PDR: Nhot Ou, Phongsaly, and Khua districts in Phongsaly Province, and Ngoi in Luang Prabang Province. The survey was conducted by the World Bank and the Lao National Statistics Centre for the UN World Food Programme as part of a school feeding program evaluation. These districts are remote and mountainous, with many villages accessible only by boat or on foot. The region is ethnically very diverse, with over 50 distinct ethnic groups. For the reasons discussed above, resettlement is a common experience in the study population.

The survey sample includes 4,169 households with at least one child ages 6-10 years old ("school-aged") and is representative of rural households with school-aged children in the four districts selected for school feeding program evaluation. A map of the region is provided as Figure 1. The target sample size of 4,500 households was calculated based on current estimates of children's school attendance in the study area from the 2003 Lao Consumption and

Expenditure Survey (LECS3) and assumptions about the change in attendance expected after the school feeding program is implemented.

Eligible households (those with at least one child age 6-10) were randomly selected using a multiple stage probability sampling technique. In the first stage, 75 primary sampling units were randomly selected from each district with probability proportional to the population in each village (as listed by the 2005 census). For the most part, primary sampling units were villages. Some large villages were split into two or more PSUs. At the second stage, enumerators and the village head drew up a complete household roster and identified eligible households based on the village head's knowledge of child ages. Fifteen eligible households were randomly selected from each PSU. In cases where the total number of eligible households was less than the fifteen all eligible households were sampled. The sample was drawn without replacement. From a target of 4,500 households, successful interviews were conducted with 4,169 households, a 93% response rate.

An extensive household questionnaire was used to collect information on household composition, assets, livestock, agriculture, shocks, food security, diet diversity, and social capital. The household questionnaire also included detailed education histories and daily activities for children age 6-14, and diet diversity and anthropometry (height and weight) and hemoglobin assessments for children age 3-10. To the extent possible, the household survey modules were adapted either from the 2002-03 Lao Expenditure and Consumption Survey (LECS3, a Living Standards Measurement Survey) or from survey modules used in Uganda and Burkina Faso, the other two countries involved in the three-country school feeding study. Food security and diet diversity questions were drawn from the FANTA Diet Diversity and Household Food Security scales (Hoddinott & Yohannes, 2002; Swindale & Bilinsky, 2005). Questions on household shocks and vulnerability were informed by a recent Food-for-Work Baseline Survey conducted by the World Food Programme in Lao PDR.

The initial English versions of the questionnaires were translated into Lao by the Lao National Statistics Centre staff and pretested. Revisions were made to the questionnaires based on pretesting. After final revisions of the English and Lao versions, a blind back-translation from Lao to English was completed and checked against the English version for consistency. Enumerators were recruited and trained by the National Statistics Centre and provincial and district officials, and included men and women fluent in at least one local language in addition to Lao. Two nutritionists with extensive training and fieldwork experience were recruited to assist with anthropometry and hemoglobin testing. The HemoCue Hb201+ photometer was used for hemoglobin testing. Locally-made height-boards and locally-sourced scales were used for anthropometry. During fieldwork, the nutritional assessment was conducted at a central location in each sampled village on the final day of interviewing. For complete details on the survey and fieldwork, see Buttenheim & McLaughlin (2006).

Measures of children's human capital and resettlement

We use four measures of nutritional status and three measures of educational attainment as outcome variables. Nutritional status is assessed for children age 3-10 years. The first nutritional status measure is the child's height-for-age z-score (HAZ), indicating the child's height relative to a well-nourished reference population of the same age and sex. HAZ is a commonly-used measure of long-term child health and past nutritional investments (Martorell, 1995, 1999; Martorell & Ho, 1984), and has been linked to health and productivity in later life (Alderman, Hoddinott, & Kinsey, 2002; Behrman, 1996; Grantham-McGregor, Fernald, &

Sethurman, 1999; Grantham-McGregor, Walker, Chang, & Powell, 1997; Thomas & Strauss, 1997).

The other three nutritional status measures reflect short-term nutritional intake and disease status. The second outcome is the child's Body Mass Index (BMI) z-score. BMI is a measure of thinness, calculated as weight in kilograms divided by squared height (in meters). The BMI z-score again compares the child's BMI to a well-nourished reference population. A low BMI suggests a recent nutritional deficit or disease episode. The third measure is hemoglobin concentration, a key indicator of iron-deficiency anemia, the most common micronutrient deficiency worldwide. Iron deficiency is strongly associated with poor health and cognitive outcomes in children (WHO/UNICEF/UNU, 2001). Finally, we measure the child's diet diversity by summing the number of food groups that the child consumed in the day prior to interviewing, as reported by the child's mother. The diet diversity scale is based on the FANTA Diet Diversity and Household Food Security scales (Hoddinott & Yohannes, 2002; Swindale & Bilinsky, 2005), which has been validated in a number of settings and is associated with micronutrient intake and overall nutritional status. In the Lao PDR survey, the scale range is zero to eight.

Educational attainment is measured for children ages 6-14 years. We use three measures of educational attainment. The rural districts of northern Lao PDR have low levels of school enrollment and attendance. Most villages have only an "incomplete" primary school with two or three grades taught. Progression rates from Grade 1 to Grade 2 are also low, with children often repeating Grade 1 multiple times. For all children age 6-14, we use a dichotomous measure indicating current enrollment in school. We consider this a short-term measure of schooling. We also calculate a longer-term measure of an educational attainment "gap." The education gap is measured as the difference between the child's age and the age of a child of the same education level who had experienced no delays in enrollment or progression. Most children who enroll in school start Grade 1 at age six or seven; to be conservative in calculating the educational attainment gap, and to account for the fact that the survey took place more than halfway through the school year, we use seven as the age of a first grader with no delayed enrollment or progression. Therefore, a nine-year-old in this sample who was currently or most recently enrolled in Grade 1 would have a calculated education gap of two years. For children age 11-14, the education gap is a linear measure. Because children under age 6-10 have a truncated and skewed distribution of the linear education gap, we create a dichotomous measure indicating whether the education gap is two or more years.

The focal independent variable is the resettlement status of the household. In the household tracking module the household head or other knowledgeable adult respondent was first asked if the household had moved to the current dwelling from a different dwelling in the past ten years.[4] If the response was positive, the respondent was then asked the reason for the move. Five possible reasons were given: moved from parents' house (that is, the formation of a new household at marriage), other family reasons, for work/employment reasons, a problem in the village (e.g. a bad spirit), or resettlement. Households that indicated that they had moved in the past ten years due to resettlement are considered resettled households.

It was the intention of the investigators that the English phrase "resettlement" would capture the Lao notion of "jat san" or compulsory relocation of the village. Due to the political sensitivity of the resettlement issue in Lao PDR, the Lao phrase "jat san" was replaced after questionnaire translation by a more general phrase which can be translated as "movement of

[4] Note that the respondent gave one answer for the entire household, which may not be accurate if different household members moved at different times or for different reasons.

village." This phrase could suggest either compulsory village relocation or a non-compulsory decision on the part of the village to relocate for a variety of reasons. Consequently, "resettlement" may capture a range of different types of village and household relocations in addition to compulsory village resettlement. In reality, these distinctions may not be great. As discussed above, villages that decide to move based on the expectation of compulsory relocation or the removal of swidden lands face many of the same transition challenges as villages that experience government-mandated relocation.

Another important variable in this analysis is the child's age/birthdate, which is used to calculate height-for-age and BMI z-scores. Many parents in this region of Lao PDR do not know the precise birthdate of their children, and training enumerators to pinpoint children's ages in completed years and in months proved problematic. The calendar previously used by the National Statistics Centre and initially presented in training turned out to be inappropriate for use in the survey as it recommended determining the year of birth and then assigning the month of the survey as the birth month. In order to provide a more useful tool, an age calculation sheet with years (including Chinese zodiac names), months and age in months was provided to participants for each month during which the survey was conducted. The large heaping of birth months on the two survey months (February and March) suggests that this revised sheet was not consistently used.

Other key variables used in the analysis include household characteristics such as religion, ethnicity, land and asset ownership, livestock, and the amount of support given to and provided by the household (a measure of social capital). Village-level variables include the presence of a school, the proportion of households that are poor, and village geography (whether the village is in an upland area versus a lowland or mixed area), all of which are associated with government criteria for relocation. These household and village-level variables are used to calculate the propensity score, discussed below.

Analytic Sample

For the purposes of this analysis, we define three subsamples of children. The first sample includes all children age 3-5 for whom we have complete nutritional data. Of 2,565 children in this age group, we include 2,218 children (86.5 percent) in the sample and exclude 324 children with missing anthropometry and 13 children with no dietary diversity measure. The main reason recorded for missing anthropometry was refusal of the child. The second subsample includes all children age 6-10 for whom we have complete nutritional data and educational outcomes. Of 6,031[5] children in this age group, we include 5,525 children (92 percent) in the sample and exclude 481 children with missing anthropometry and 15 children with no dietary diversity or educational measures. The main reason recorded for missing anthropometry in this age group was child absence. The third analytic subsample includes all children age 11-14 for whom we have complete data on educational attainment. Of 2,876 children in the age group, weinclude 2,845 in the sample. Only 31 children in this age group were missing data on educational attainment[6].

[5] Note that the sample of children age 6-10 years old is substantially larger than the two other age-based subsamples because households had to have at least one child age 6-10 to be included in the sample.

[6] We used logistic regression to estimate the odds of being included in the analytic subsamples conditional on appearing on the household roster. For children age 3-5, inclusion in the analytic subsample is significantly associated with older age, being male, consuming dark green vegetables, and living in Phongsaly district. For children age 6-10, inclusion in the analytic subsample is significantly associated with younger age, being male, consuming meat, owning land, living in Phongsaly district, and living in upland or mixed upland/lowland areas (relative to living in a lowland area). Membership the Sino-Tibetan and Hmong-Iumien ethnic groups significantly reduce the odds of inclusion in the sample. For the oldest age group, inclusion in the sample was significantly associated with younger age and village population size, and negatively associated with the poverty rate in the village. Inclusion in the sample was not significantly associated with resettlement for any age group.

METHODS

The analysis proceeds in three parts. First, we undertake descriptive analyses of the nutritional status and educational outcome of children by resettlement status. We also demonstrate the variation in resettlement status across ethnic groups and districts. Because few household surveys that include all of these measures have been conducted in this region, this descriptive analysis contributes to an understanding both of the local population and of resettlement more broadly.

The next goal is to pinpoint a causal effect of resettlement on children's health and education. This is a classic effect of treatment on the treated problem. We seek to estimate the effect of a "treatment" on an outcome of interest in a treated group, compared to what the outcome would have been for the same group in the absence of the treatment. The ideal dataset for this problem would include several measures we do not have: the specific timing of the household's resettlement; characteristics of the sending villages of resettled households; specific selection criteria for resettlement; and longitudinal measures of children's human capital outcomes. Because the data are cross-sectional in nature (with no pre-resettlement measures of the outcomes of interest), we are not able to observe the resettled children prior to resettlement. With nonexperimental data (i.e. resettlement is not randomly assigned to villages), there is also likely to be substantial selection bias. Resettled villages in northern Laos tend to be the smallest, the most remote and the most underdeveloped. Therefore, it is likely that the children in households that are resettled already exhibit poorer nutritional status and educational attainment prior to resettlement than children from households that are not resettled.

Given the realities of the dataset and the analytic challenges it presents, we proceed cautiously with causal inference. We first use multivariate regression techniques to evaluate the association of resettlement status with the outcomes of interest. Descriptive statistics reveal that ethnicity and district are strong predictors of both resettlement and human capital outcomes. We therefore create a set of dummy variables consisting of ethnicity by district interactions to identify ethno-geographic clusters of similar households. We then interact these cluster dummies with resettlement status in a second set of regression models. The interaction terms show whether the strength of the association between resettlement and human capital outcomes varies by ethno-geographic clusters. These regression techniques do not, however, address unobserved household-specific characteristics that predict both resettlement and children's human capital.

To address this selection problem in a different way, we employ propensity score matching (PSM) techniques. PSM addresses selection bias limiting the comparison of treatment and control subjects to those cases that are most similar in terms of observed characteristics that predict assignment to treatment (rather than outcome). These observable characteristics are used to estimate propensity scores (or the likelihood of being in the treated group). The propensity score can then be used to more closely match treated and control cases and then to estimate the effect of treatment on the outcomes of interest using this smaller matched sample. PSM can substantially eliminate selection bias by creating an analytic sample in which assignment to treatment is random conditional on the propensity score. Recent applications of PSM techniques in the human capital and human resources literature include job training programs (Dehejia & Wahba, 1998; Heckman, Ichimura, & Todd, 1998; Smith & Todd, 2004), government conditional cash transfer programs (Diaz & Handa, 2006), wealth accumulation of migrants

(Wong, Palloni, & Soldo, 2007) and poor-area community investment programs (Chen, Mu, & Ravallion, 2006).

The propensity score matching method is described briefly here; for more details, see the Statistical Appendix. We first estimate a propensity score that represents the likelihood that a household has experienced resettlement conditional on a large set of observed household characteristics. The score is estimated using logistic regression. This household-level propensity score is then assigned to individual children. Children in resettled households are then “matched” to children in non-resettled households with the closest propensity score. Children with propensity scores that fall outside of a common support criteria (calculated according to a formula proposed by Crump and colleagues (2006)) are trimmed from the analysis. On this trimmed sample of 8,694 children, we then use the –psmatch– command in STATA with kernel matching to estimate the effect of resettlement on the outcomes of interest (Leuven & Sianesi, 2003). The propensity score matching estimator does not calculate standard errors, so we bootstrap the standard errors using 1000 replications.

We complete the propensity score matching analysis on the trimmed sample for each of the outcomes of interest: height-for-age and BMI z-scores, hemoglobin, and diet diversity for the 3-10 year-old sample; and education gap and current enrollment status for the 6-14 year-olds.

RESULTS

Descriptive Analysis

Summary statistics for the three age-based samples by resettlement status are shown in Tables 1-3. In the youngest subsample, children in both resettled and nonresettled households have very low height-for-age z-scores – the mean child in both groups is stunted, or more than two standard deviations below the median child of the same age and sex in the well-nourished reference population. The other nutritional outcomes are not as poor. BMI z-scores are near the median for the reference population. Mean hemoglobin scores are above the age-specific cutoff for anemia of 11.5 g/dL for children age 6-59 months and 11.5g/dL for children age 5-11 years (WHO/UNICEF/UNU, 2001). Children consumed an average of four different food groups in the day before the survey.

Among the 6-10 year olds (shown in Table 2), height-for-age z-scores are even lower than the youngest age group, indicating that children continue to experience growth faltering after the preschool years. BMI z-scores are also lower relative to the younger age group, while hemoglobin and diet diversity are comparable. The educational indicators suggest that more than half of children in this age group are not currently enrolled in school, and a sizable proportion have already accumulated an educational attainment gap of two or more years. Educational outcomes appear worse for children in resettled households.

For the oldest age group (Table 3) we report two educational outcomes. These children have accumulated an educational attainment gap of 4.0 years in nonresettled households and 4.5 years in resettled households. Approximately two-thirds of the children are enrolled in school, with enrollment rates higher among non-resettled households.

The household and village characteristics reported for all age groups reflect the overall low levels of socioeconomic development in Lao PDR. Only half the households own land, and households experienced an average of two months of insufficient rice in the last year. Village heads report an average poverty rate of 30-40 percent, although almost all villages report having at least an incomplete primary school.

The descriptive results suggest that long-term nutritional and educational outcomes are worse for children in resettled households than for children in non-resettled households. T-tests of the differences in the unconditional means of the outcomes of interest (not shown) indicate that height-for-age z-scores are significantly lower and educational gaps significantly larger among children in resettled households compared to children in nonresettled households.

The short-term human capital measures paint a somewhat less negative picture of resettlement, however. Among the youngest age group, BMI z-scores are significantly higher among resettled children relative to non-resettled children. BMI z-scores for the middle cohort and hemoglobin and diet diversity measures for the youngest age group do not significantly vary by resettlement status. The observed difference in current enrollment rates is significant, with resettled children lagging by almost 10 percent.

It is clear that the average resettled child in the study area has poorer long-term human capital outcomes than the average non-resettled child. But to what extent is this finding driven by factors that determine both resettlement and human capital investments in children? As discussed above, communities targeted for resettlement are usually remote, upland villages composed primarily of non-Lao-Tai ethnic groups. In addition, government resettlement policies are interpreted and implemented at the district level. Therefore, we would expect that ethnicity and district would be strong predictors of resettlement. We provide evidence of this in Table 4, which shows the proportion of children resettled by ethnic group and district. It is clear from Table 4 that there is considerable variation in resettlement by ethnic group within district, and by district within ethnic group. For example, the 1,123 Hmong-Iumien children in the sample are roughly evenly split between Nhot Ou district and Gnoi district. In Nhot Ou, however, almost half of the children are in resettled households while in Gnoi district only nine percent are resettled. This suggests that some of the observed differences in human capital outcomes by resettlement status might be due to ethnic and district differences unrelated to resettlement. We attempt to address this potential bias through multivariate regression and propensity score matching techniques.

Multivariate Regression

In multivariate analysis we compare two models for each outcome of interest. We first predict the human capital outcomes as a function of household resettlement, controlling for a set of individual, household and village characteristics, including the set of dummy variables identifying ethno-geographic clusters. We then add a set of interactions between resettlement status and cluster to allow the association of resettlement with child outcomes to vary by cluster. The full results for all models are presented in Appendix B Tables B1-B4; we highlight key findings here.

In the analysis of height-for-age for children age 3-10 (first two columns of Table B1), the first model suggests that household resettlement is associated with a reduction in height-for-age z-score of .125 standard deviations, significant at the 10 percent level. The ethnogeographic cluster dummies are jointly significant, with all groups showing lower HAZ scores relative to the Lao-Tai reference cluster. When the interactions of the cluster variables and resettlement status are added, the effect of resettlement changes sign and loses significance. However, F-tests (not shown) suggest that the interaction terms are not jointly significant nor significantly different from each other and the predictive power of the model does not improve. These results indicate that height-for-age may be compromised by resettlement for all ethno-geographic clusters.

Results from the comparable analysis for BMI z-score are shown in the third and fourth columns of Table B1. Here resettlement has no significant association with BMI, either independently or when interacted with cluster. BMI z-scores are significantly higher among ethnic minority groups. In Table B2, results for diet diversity score and hemoglobin status are shown. In the first column, resettlement is not significantly related to diet diversity. Cluster dummies are jointly significant, and suggest that the Mon-Khmer children in Khua and Gnoi districts have less diverse diets than Lao-Tai children, by approximately 0.5-1.0 food groups per day. Sino-Tibetan children in Phongsaly district appear to have the most diverse diets. In the second column of Table B2, the coefficient on the resettlement term become negative and significant at the five percent level, suggesting that resettlement reduces diet diversity by .6 food groups per day for Lao-Tai children. The cluster * resettlement interactions are jointly significant and positive, and are larger than the zero-order term for five of the seven ethno-geographic clusters. These results indicate that for minority ethnic groups outside of Phongsaly district, resettlement may improve diet diversity relative to nonresettled children of the same ethnic group and district. For example, the average non-resettled Lao-Tai three-year old in Phongsaly district consumed 3.9 food groups per day; resettlement reduces this to 3.3 food groups. However, for a three-year old Hmong-Iumien child in Ngoi district, the comparable figures are 3.5 food groups for a non-resettled child, and 4.6 food groups post-resettlement. This difference in diet diversity, however, does not translate into significant differences in iron status, as shown in the third and fourth columns on Table B3.

Multivariate regression results for education outcomes are shown in Tables B3 and B4. Table B3 predicts the education gap (measured in years) associated with resettlement for 11-14 year olds. Results are very similar with and without the cluster * resettlement interactions.

Education gap increases substantially with age and is highest among the Hmong-Iumien children in Nhot-Ou district. The presence of a school in the child's current village and the number of educated adults in the household also reduce the education gap. This model of a long-term human capital outcome predicts a sizable proportion (36 percent) of the variation in education gap. In Table B4, odds ratios from two sets of logistics regression models are presented. The first outcome is a dichotomous measure of an education gap of at least two years for children age 6-10. The first column indicates that resettlement increase the odds of an education gap in this age group by 41 percent, significant at the five percent level. Controlling for the presence of a school in the village, the ethno-geographic clusters outside of Phongsaly district have higher odds of an education gap. Addition of the cluster * resettlement interactions does not improve the fit of this model. The second model in Table B4 predicts the odds of being currently in school for the 6-14 year old age group. While there are strong ethno-geographic differences in the odds of schooling, there is not an independent effect of resettlement nor of resettlement * cluster interactions.

Taken together, the multivariate results suggest a possible decline in long-term nutritional status and educational status associated with resettlement that does not vary by ethno-geographic cluster. There is also an observed improvement in diet diversity (a short-term nutritional measure) for the ethno-geographic groups most likely to be resettled.

Propensity Score Matched Results

We turn finally to the results of the propensity score matching analysis. In this analysis we attempt to control for some of the selection bias inherent in measuring the association of resettlement status and nutritional and educational outcomes by matching children in resettled households to children in non-resettled households with a similar propensity for having been resettled. A separate matching analysis is conducted for each outcome in the same age groupings as the multivariate analysis. Standard errors are bootstrapped. A summary of the seven propensity score matching analyses is presented in the first column of Table 5, along with the comparable coefficients on the resettlement term for the two multivariate analyses (taken from Appendix B Tables B1-B4). The sample sizes are lower in the matched analyses due to sample trimming (see Appendix A).

In the multivariate results shown in the second and third columns of Table 5 and discussed above, we compared children in resettled households to all children in non-resettled households. This non-resettled group included both children in destination villages who would not be targeted for resettlement, as well as children from smaller, more remote villages who might be targeted for resettlement but had not yet moved. This non-resettled group is therefore quite heterogeneous. The analyses in the third column attempt to control for this by allowing the association of resettlement and human capital outcomes to vary by ethno-geographic group. In the propensity score matching analysis, in contrast, we have trimmed the sample to include only those children (resettled and non-resettled) for whom we can make a close match based on the propensity score. Therefore, we are more likely to be comparing the resettled children to the second group of non-resettled children described above.

The propensity-score-matched analyses find two significant effects of resettlement on children's welfare. Resettlement is associated with a reduction in height-for-age z-score of .17 standard deviations among the 3-10 years olds, a result consistent with the multiviarate results with no ethno-geographic cluster interactions. The other significant long-term finding from the multivariate analysis, a higher odds of an education gap for children age 6-10 years, is not supported in the propensity score analysis. Among the short-term measures of children's human capital, resettlement is significantly associated with a increase in BMI z-score of .09 standard deviations in children 3-10 years old. The propensity score analyses cannot confirm the finding of diminished diet diversity associated with resettlement for Lao-Tai children and improved diet diversity associated with resettlement among the Mon-Khmer and Hmong-Iumien.

DISCUSSION

Village resettlement in Lao PDR remains a controversial subject. Substantial anecdotal evidence has been compiled suggesting that resettled communities suffer considerable asset losses, food insecurity, morbidity, and other financial and social disruptions during the resettlement process. The same reports also suggest, however, that the shock may be a transitory one, with an adjustment period of perhaps three years. Resettlement experiences are clearly highly variable across regions and ethnic groups, depending in part on the ability of the receiving community to absorb new demands for land and infrastructure, and on the willingness of district officials to provide social services and support during the resettlement period.

Studying displacement in this population is challenging for several reasons. Resettlement is not always clearly forced or voluntary. Households in villages targeted for displacement may choose to leave their homes right away in order to secure the best land in the destination village, or may wait as long as possible in the origin village to continue existing cropping practices or delay a disruptive move. The decision about the timing of a move may be related to the household's endowments, skills, social networks, demographic composition, risk preferences, and other characteristics that may also influence investments in children's human capital. It may also be the case that children in households that have not resettled but who live in a village where many others have left may suffer because of the outmigration. If so, the analyses presented here would underestimate the negative effects of resettlement.

With the data available, we have attempted an analysis of the relationship between resettlement and children's welfare. The results can only be suggestive at this point. We provide descriptive data on children's health and nutritional outcomes by age group and resettlement status. We also decompose the resettled population by ethnic group and district. The descriptive results show a population with very poor nutritional status and low educational attainment, with notably worse long-term outcomes among chidren in resettled households. In multivariate regression analysis, results suggest that resettlement is significantly associated with lower height-for-age z-scores in the 3-10 year old group. Given the data constraints, this finding is certainly consistent with pre-resettlement differences in height-for-age. We also find larger education gaps for the 6-10 year olds. These associations are net of ethnicity and district effects, and do not vary by ethno-geographic cluster. We also find that children's dietary diversity is better among resettled children in the non-Lao-Tai ethnic groups (compared to nonresettled children in those ethnic groups), but worse among the small sample of Lao-Tai resettled children. Given that dietary diversity is a current measure of nutritional status, this provides slightly more compelling evidence that resettlement is not harmful to dietary outcomes for the 3-10 year-old age group. It could be the case that resettlement is selective on a richer diet, perhaps consistent with foraging for forest foods, growing a wider range of nutrient-rich vegetables, or processing oil from forest trees in upland areas. However, to produce the results that we see, these selective dietary habits would have to persist among the resettled households after their displacement, which seems unlikely.

The propensity score matching results also do not provide consistent evidence of strong effects of resettlement on children. A significant reduction in height-for-age z-score is observed among resettled children age 3-10 (compared to matched non-resettled children), while BMI z-scores are slightly higher for resettled children. No significant education results are found. Based on the policy criteria for resettling villages, we would expect *a priori* that children in resettled households would be worse off in terms of both nutritional status and educational attainment prior to resettlement, relative to non-resettled children, and should be equivalent to non-resettled children once matched on propensity to be resettled. The fact that the propensity score results find significant negative effects only for height-for-age provides at least some suggestive evidence that children are not made substantially worse off by resettlement. One important caveat to this interpretation is that we do not observe any children who died subsequent to resettlement. Mortality bias may be strong given the anecdotal evidence on malaria and other post-resettlement epidemics. The positive association of resettlement with BMI z-scores among the youngest cohort of children is consistent with such a mortality bias (i.e. the fatter, healthier children survive resettlement), but this is very difficult to assess without the ability to pinpoint the timing of resettlement.

The limitations of this study are not insignificant. Clearly the measure of resettlement is crude. Ideally we would have the year of the household's resettlement, if not a complete migration history for the past 10-15 years. A measure of the household's perception of the resettlement as compulsory or not compulsory would also be helpful. Qualitative data at the village level about the timing, extent, and nature of resettlement would permit a richer classification of resettled households, and would also allow analysis of the effects of resettlement on those left behind. While the sample is representative of households with school-aged children in rural villages in the four study districts, the fact that the villages are sampled with probability proportional to size means that there are very few villages in the sample with fewer than ten households. This suggests that there are few villages where a substantial portion of a formerly larger village has already departed. If resettlement is selective by household composition, then the sample may also not be representative of resettled households given that only households with a child age 6-10 are sampled.

In addition to sampling and data availability concerns, there are also potential pitfalls to the multivariate and propensity score methods used here. Neither method truly controls for unobserved characteristics that would predict both resettlement and human capital outcomes. The propensity score method matches children in resettled and nonresettled households based on observable characteristics, but some of these characteristics are measured post-resettlement. Two kinds of matches are theoretically possible: either the resettled child may be matched to a child of a similar background who has not (yet) resettled but lives in resettlement-prone area; or the resettled child may be matched to a child who has some similar characteristics but lives in a region not targeted for resettlement. While the interpretation of these two comparisons might be quite different, the propensity score method does not distinguish them. A follow-up survey scheduled for 2008 will allow a more thorough analysis of this issue with longitudinal data and more detailed migration histories.

Development-induced displacement is a widespread phenomenon in many parts of the developing world. Given the potentially deleterious effects of displacement, even when the displacement is intended to improve welfare, it is important to understand precisely what happens to households and particularly to children in the wake of displacement. If resettlement to more densely-populated areas with better access to services can improve investments in children's educational attainment and nutritional outcomes, then this provides compelling support for the policy. On the other hand, if resettlement is so disruptive that it permanently compromises these human capital outcomes, then this is a true cost to the policy that must be weighed against other potential benefits. In either case, the relocation process itself must be designed to minimize disruptions to livelihoods, recognize and address potential increases in human and animal disease, and ensure food security during the critical transition period. Cernea's risk and reconstruction framework reminds us to scrutinize the welfare of displaced populations in light of specific relocation policies. This scrutiny must acknowledge the methodological challenges inherent in studying resettlers in hopes of designing and implementing resettlement programs that protect vulnerable populations and promote equitable development goals.

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Figures and Tables

Figure 1: District map of northern region of Lao People's Democratic Republic.

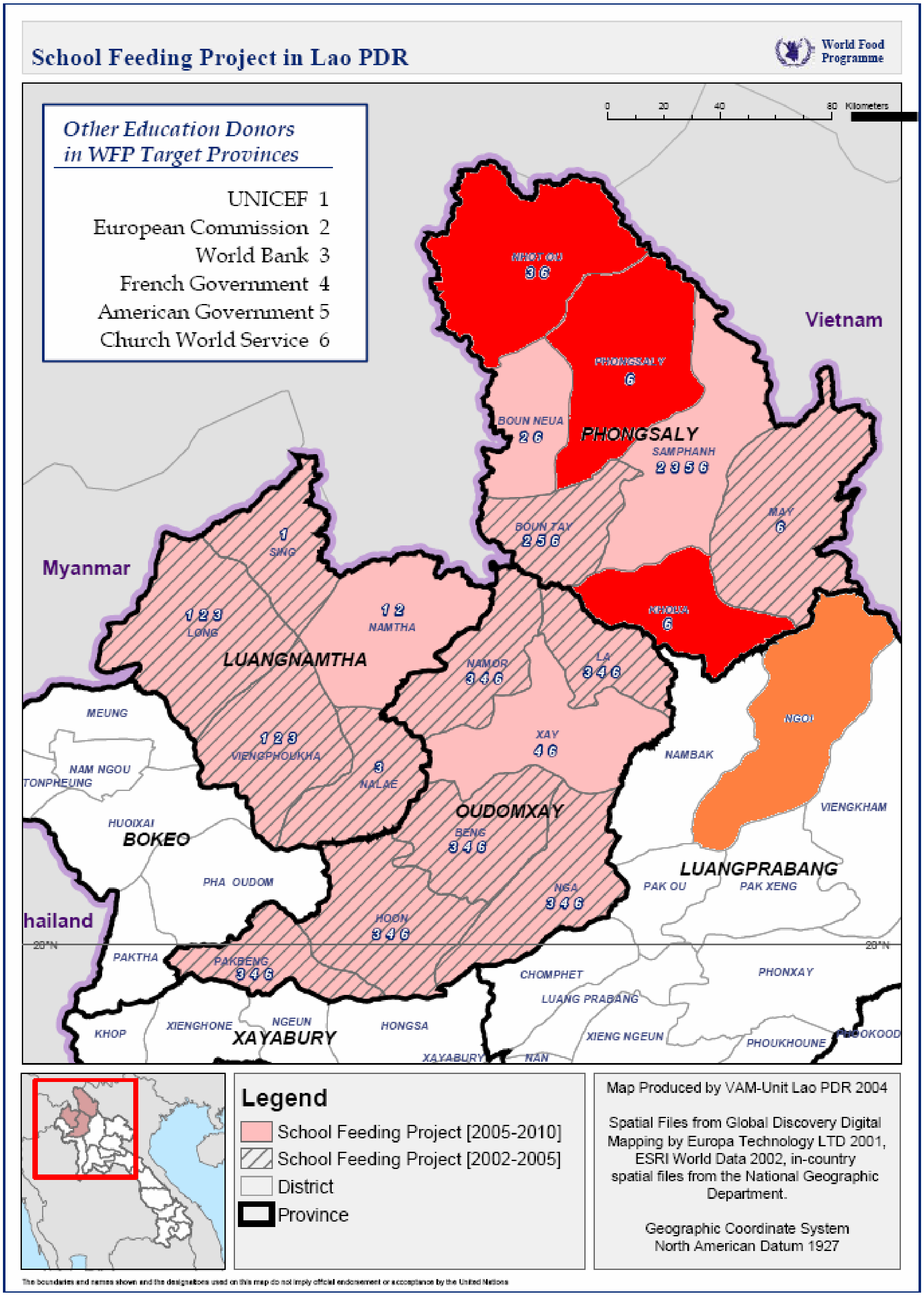

Table 1. Summary statistics for child-, household- and village-level characteristics, children age 3-5 in households with school-aged children in rural villages of northern Lao PDR, 2006 [N=2,218].

	Resettled households		Non-resettled households	
	Mean	SD	Mean	SD
Child				
Age in years	4.03	0.83	4.07	0.82
Male	0.50	0.50	0.50	0.50
Height-for-age z-score	-2.45	1.54	-2.15	1.69
BMI z-score	-0.04	1.00	-0.30	1.05
Hemoglobin (mg/dL)	12.25	0.07	12.22	0.04
Diet diversity score (sum of food groups in last 24 hours)	3.91	1.16	3.76	1.29
Household				
Months of insufficient rice in last year	1.87	2.51	1.70	2.48
Owns land	0.44	0.50	0.48	0.50
Number of adults with > 2 years of education	0.48	0.86	0.87	1.12
Mother absent	0.01	0.10	0.01	0.10
Father absent	0.01	0.10	0.03	0.18
Traditional/Animist religion (vs. Buddhist/other)	0.85	0.36	0.64	0.48
Ethnic group:				
Lao-Tai	0.01	0.11	0.15	0.36
Mon-Khmer	0.26	0.44	0.31	0.46
Sino-Tibetan	0.52	0.50	0.44	0.50
Hmong-Iumien	0.21	0.41	0.10	0.30
Village				
Lowland area	0.05	0.21	0.10	0.30
Upland area	0.74	0.44	0.74	0.44
Lowland and upland areas/Other	0.22	0.41	0.15	0.36
Proportion of households poor	0.41	0.66	0.33	0.56
Village has school	0.95	0.22	0.90	0.31
N	**322**		**1,896**	

Table 2. Summary statistics for child-, household- and village-level characteristics, children age 6-10 in households with school-aged children in rural villages of northern Lao PDR, 2006 [N=5,525].

	Resettled households		Non-resettled households	
	Mean	SD	Mean	SD
Child				
Age in years	7.91	1.49	7.90	1.43
Male	0.50	0.50	0.51	0.50
Height-for-age z-score	-2.62	1.28	-2.34	1.29
BMI z-score	-0.67	0.85	-0.68	0.84
Hemoglobin (mg/dL)	12.34	1.35	12.30	1.30
Diet diversity score (sum of food groups last 24 hours)	3.81	1.09	3.81	1.25
Education gap >= 2 years	0.18	0.38	0.11	0.32
Currently enrolled in school	0.56	0.50	0.66	0.47
Household				
Months of insufficient rice in last year	1.95	2.46	1.70	2.49
Owns land	0.45	0.50	0.46	0.50
Number of adults with > 2 years of education	0.68	1.03	0.96	1.15
Mother absent	0.02	0.12	0.02	0.15
Father absent	0.03	0.16	0.05	0.22
Traditional/Animist religion (vs. Buddhist/other)	0.77	0.42	0.57	0.49
Ethnic group:				
Lao-Tai	0.03	0.18	0.19	0.39
Mon-Khmer	0.31	0.46	0.31	0.46
Sino-Tibetan	0.47	0.50	0.42	0.49
Hmong-Iumien	0.18	0.38	0.08	0.28
Village				
Lowland area	0.02	0.15	0.11	0.31
Upland area	0.80	0.40	0.74	0.44
Lowland and upland areas/Other	0.17	0.38	0.15	0.36
Proportion of households poor	0.38	0.37	0.31	0.51
Village has school	0.97	0.18	0.90	0.30
N	**777**		**4,748**	

Table 3. Summary statistics for child-, household- and village-level characteristics, children age 11-14 in households with school-aged children in rural villages of northern Lao PDR, 2006 [N=2,845].

	Resettled households		Non-resettled households	
	Mean	SD	Mean	SD
Child				
Age in years	12.48	1.06	12.52	1.03
Male	0.53	0.50	0.51	0.50
Education gap (in years)	4.53	1.98	3.98	1.95
Currently enrolled in school	0.62	0.48	0.71	0.45
Household				
Months of insufficient rice in last year	1.82	2.46	1.67	2.45
Owns land	0.45	0.50	0.48	0.50
Number of adults with > 2 years of education	0.58	0.98	0.98	1.19
Mother absent	0.04	0.19	0.04	0.18
Father absent	0.04	0.19	0.06	0.25
Traditional/Animist religion (vs. Buddhist/other)	0.83	0.37	0.62	0.49
Ethnic group:				
Lao-Tai	0.04	0.20	0.18	0.38
Mon-Khmer	0.28	0.45	0.30	0.46
Sino-Tibetan	0.45	0.50	0.42	0.49
Hmong-Iumien	0.23	0.42	0.10	0.30
Village				
Lowland area	0.04	0.20	0.12	0.33
Upland area	0.78	0.41	0.72	0.45
Lowland and upland areas/Other	0.17	0.38	0.15	0.36
Proportion of households poor	0.39	0.58	0.30	0.47
Village has school	0.97	0.18	0.91	0.28
N	**418**		**2,427**	

Table 4. Proportion of children living in resettled households by district and ethnic group; children 3-14 in households with school-aged children, rural villages in northern Lao PDR, 2006 [N=10,588].

		Ethnic Group				
District		Lao-Tai	Mon-Khmer	Sino-Tibetan	Hmong-Iumien/Other	Total
Phongsaly	Proportion resettled	0%	0%	9%	0%	8%
	(N)	(128)	(1)	(2,619)	(11)	(2,759)
Khua	Proportion resettled	7%	17%	14%	0%	15%
	(N)	(307)	(1,559)	(621)	(3)	(2,490)
Nhot Ou	Proportion resettled	1%	0%	31%	44%	25%
	(N)	(736)	(2)	(1,322)	(578)	(2,638)
Gnoi	Proportion resettled	4%	10%	0%	9%	9%
	(N)	(504)	(1,659)	(7)	(531)	(2,701)
Total	Proportion resettled	3%	14%	16%	27%	14%
	(N)	(1,675)	(3,221)	(4,569)	(1,123)	(10,588)

Table 5. Summary of coefficients from models relating household resettlement to chidlren's human capital outcome.

	Propensity Score Matched	Multivariate regression	Multivariate regression with resettlement * ethno-geographic cluster interactions
Long-term measures of human capital			
Height-for-age z-score, Age 3-10	-0.170	-0.125	0.169
Standard Error	[.062]**	[.074]*	[.197]
N	6,373	7,727	7,727
Education gap >= 2 years, Age 6-10 (odds ratio)	0.024	0.341	0.617
Standard Error	[.020]	[.137]**	[.761]
N	4,516	5,373	5,373
Education gap in years, Age 11-14	-0.133	0.085	-0.085
Standard Error	[.113]	[.135]	[.543]
N	2,321	2,761	2,761
Short-term measures of human capital			
BMI z-score, Aged 3-10	0.089	0.046	0.138
Standard Error	[.040]**	[.041]	[.494]
N	6,373	7,727	7,727
Hemoglobin, Age 3-10	-0.01	0.038	-0.071
Standard Error	[.053]	[.082]	[.416]
N	6,373	7,727	7,727
Diet Diversity Score, Age 3-10	0.024	0.102	-0.593
Standard Error	[.047]	[.081]	[.017]**
N	6,373	7,727	7,727
Currently in school, Age 6-14 (odds ratio)	0.011	0.891	3.62
Standard Error	[.019]	[.130]	[4.00]
N	6,837	8,134	8,134

Note: Each coefficient is from a separate model predicting the human capital outcome listed in the left-hand column as a function of household resettlement status and other controls. Standard errors for the propensity-score-matched analyses are bootstrapped with 1,000 replications.
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix A: Propensity Score Matching Methods

This Appendix provides a more detailed account for the propensity score matching methods used in the analyses above. The analysis proceeds in five steps (Caliendo & Kopeinig, 2005). First, we use logistic regression to estimate a propensity score that reflects the likelihood that a household has experienced resettlement. There is considerable debate in the methodological literature on propensity score matching about the best way to estimate such scores (see, for example, Caliendo & Kopeinig, 2005; Heckman et al., 1998; Rubin & Thomas, 1996; Smith & Todd, 2004). We therefore tested three different specifications of the propensity score: one that included all household-level variables, a second that included only those variables that could be considered fixed prior to resettlement (e.g, ethnicity and education of the household head), and a third specification with a longer set of household variables but excluding those related to diet diversity and food security. We excluded diet diversity and food security in this specification because these variables are close proxies for the nutritional outcomes of interest. We selected this third specification as a compromise between adopting a theory-driven set of resettlement predictors in this population and using as complete a set of covariates as possible. Results from the logit model predicting the odds of resettlement are shown in Table A1. Based on the pseudo-R^2 statistics, this model predicts approximately 14% of the variation in the propensity to be resettled. The propensity score for each household is calculated as the predicted odds of resettlement, and assigned to individual children by household.

Once the propensity score is calculated, we then assess the common support across the treated and control groups, i.e, the extent to which the distributions of the propensity score overlap for treated and control groups. One straightforward way to do this is by visual inspection of adjacent histograms, shown in Figure A1. As expected, the distribution is skewed to the left for the non-resettled households – their propensity scores are relatively low. The distribution for the resettled households is bi-modal, with greater density at higher propensity scores. The bi-modal distribution is driven by the differences in resettlement status by district. In Figure A2 we show the distribution of propensity scores among resettled households by district. Nhot Ou district has higher propensity scores than the other districts. We investigated the implications of this distribution by conducting all of the analyses on the subsample of children from Nhot Ou. No substantive differences were found from the main results presented above.

The next step in the analysis is to define the "common support", or the range of propensity scores for which individuals with a given propensity score have a positive probability of being both a treatment and a control. This is a statistical requirement of the propensity score estimator. Again, there is a rich literature on various trimming methods (Caliendo & Kopeinig, 2005; Crump et al., 2006). We employed two different methods for purposes of comparison. First we used the minima/maxima criterion, which trims the sample so that all treated individuals have propensity scores that are less than the maximum and more than the minimum of the control group. As is clear from the common support histograms, this method trims very few cases, as there is a small but non-zero density for controls at the right end of the propensity score scale. The second trimming method uses a theory-driven formula developed by Crump and colleagues (2006) as an alternative to more informal trimming methods. In this case, the formula yields an upper bound for the propensity score of .949 and a lower bound of .051. This method trims the sample by 18 percent, leaving 1,857 of 2,218 children age 3-5; 4,516 of 5,525 children age 6-10; and 2,321 of 2,845 children age 11-14. Note that we conduct the trimming process on the full sample of children and then divide the sample into age-based subsamples. We also conducted the analysis by trimming each age-based subsample separately; no substantive differences were observed.

After trimming we check that the matching procedure has adequately balanced the distribution of the covariates in the treatment and control groups. We want to know that, conditional on the propensity score, there are no significant differences in the covariates between treatment and controls. We test this by stratifying observations by propensity score and then conducting t-tests within strata of the differences in the covariates between treatment and controls (Dehejia & Wahba, 1998).

In the final stage of the analysis we use two different propensity score methods to estimate the effects of resettlement on theoutcomes of interest. First, we regress the outcomes of interest on resettlement, weighting the regression by the log odds of the propensity score for controls, or by one (unity) for the treatments (Chen et al., 2006). This method makes intuitive sense, as the controls with higher propensity scores receive greater weighting in the regression. Chen et al. argue that this method closely replicates more conventional matching estimators with the added benefit that standard errors can be calculated rather than bootstrapped. The second method is the more conventional propensity score matching, using the -psmatch- command in STATA version 9 (Leuven & Sianesi, 2003). Here again, the analyst is presented with several choices for a matching method, including kernel, nearest neighbor, caliper, and radius. Each method offers a different set of trade-offs between bias and efficiency. We report results for the kernel method, but in this case results did not vary significantly based on matching method (Caliendo & Kopeinig, 2005). The propensity score matching estimator does not calculate standard errors, so we bootstrap them using 1000 replications.

Figure A1. Common support test: Distribution of propensity scores by resettlement status, children in households with school-aged children in rural villages, northern Lao PDR, 2006 [N=10,588].

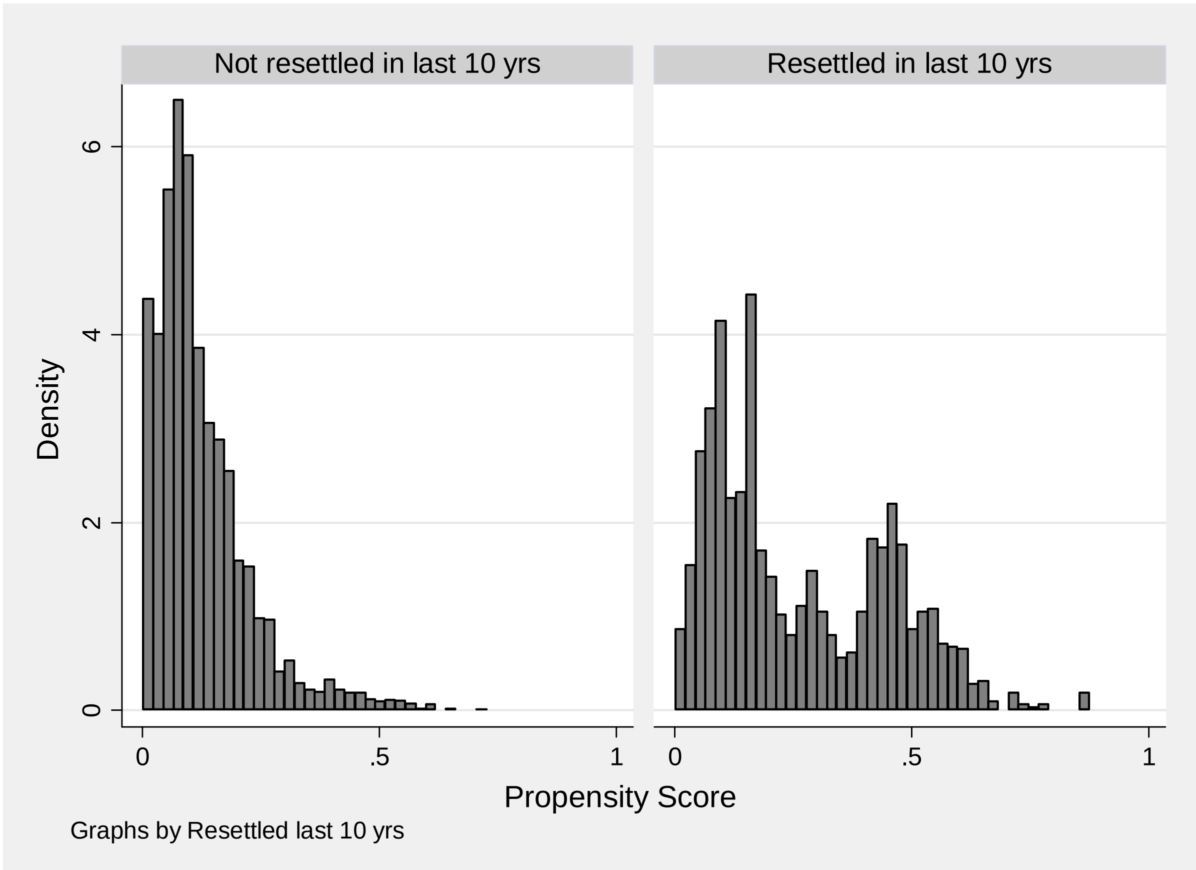

Figure A2. Common support test: Distribution of propensity scores by district, children in resettled households with school-aged children in rural villages, northern Lao PDR, 2006 [N=1,517].

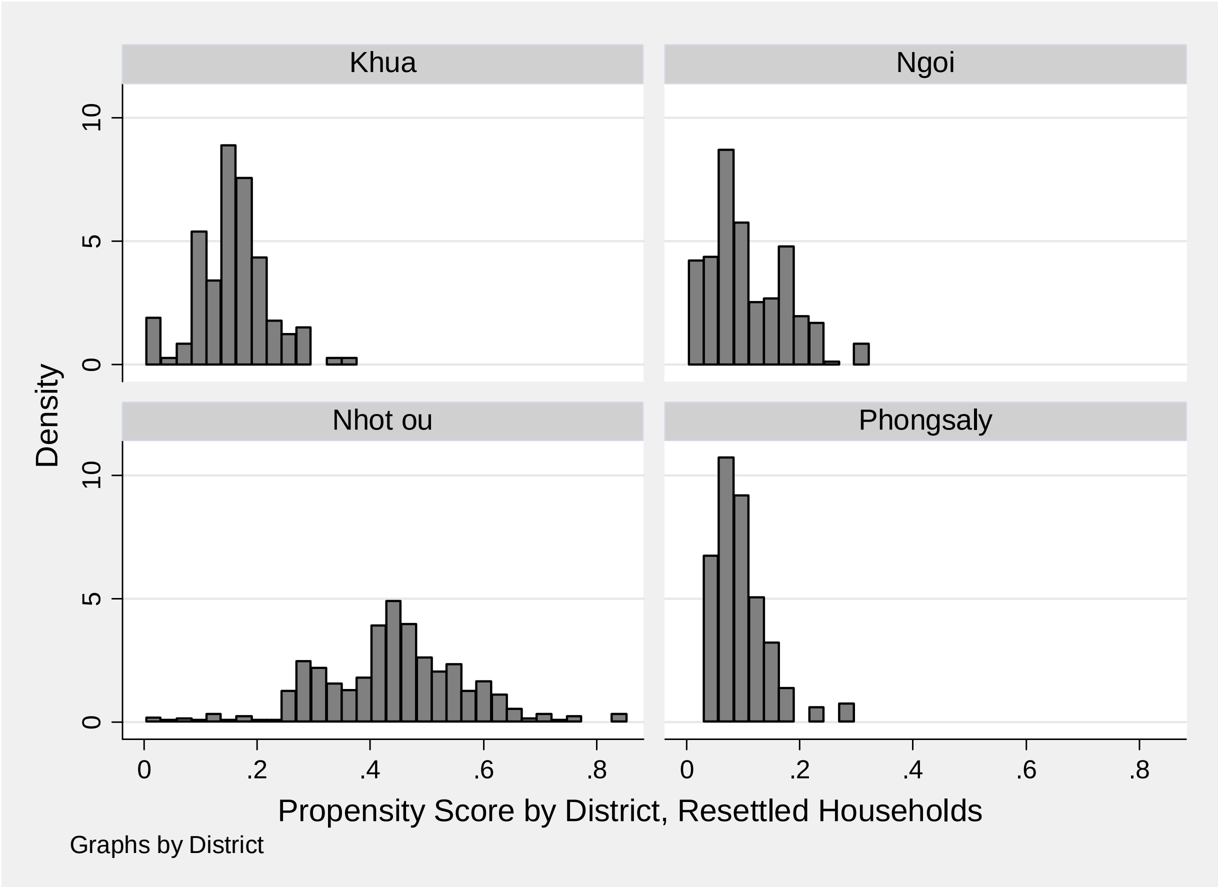

Table A1. Logit estimates of the propensity score (odds of household being resettled last ten years, households in rural villages in Northern Lao PDR, 2006 [N=4,169].

	Odds ratio	Standard error	p-value
Household composition (number of persons)			
Males 0-4	0.975	0.074	0.744
Females 0-4	1.052	0.079	0.503
Males 5-14	1.034	0.056	0.536
Females 5-14	1.049	0.057	0.374
Males 15-49	0.992	0.065	0.902
Females 15-49	1.010	0.069	0.885
Males 50+	1.094	0.130	0.450
Females 50+	1.058	0.115	0.606
Number of adults with >2 years education	0.939	0.057	0.299
Religion = Traditional/Animist (ref = Buddhist/Other)	1.386	0.213	0.034
Ln (household income last year), 000 Kip	1.001	0.013	0.912
Walls of house (ref. = Brick, concrete, tin)			
Wood	4.352	1.516	0.000
Bamboo	5.032	1.754	0.000
Other/missing	3.665	1.341	0.000
Assets (household owns one or more)			
Land	0.774	0.087	0.023
Motorcycle	1.281	0.366	0.386
Bicycle	1.192	0.356	0.557
Sewing machine	0.981	0.163	0.907
Rice cooker	0.669	0.088	0.002
Cooking implements	1.934	0.248	0.000
Agricultural equipment	0.855	0.095	0.161
Agricultural tools	0.960	0.120	0.744
Boat	0.862	0.207	0.537
Fishing net	1.253	0.139	0.043
Radio	1.038	0.142	0.783
Jewelry	1.145	0.189	0.413
Mosquito net	1.281	0.158	0.044
Savings	1.215	0.188	0.206
Livestock (number owned by household)			
Young cattle	0.968	0.074	0.674
Adult cattle	0.986	0.059	0.820
Young buffalo	1.025	0.080	0.747
Adult buffalo	0.855	0.056	0.016
Young pig	1.033	0.024	0.168
Adult pig	1.093	0.033	0.003
Young chicken	1.000	0.006	0.971
Adult chicken	1.013	0.008	0.121

Young duck	1.000	0.045	0.993
Adult duck	0.931	0.039	0.090
Support offered to others (index)	0.982	0.017	0.294
Support received from others (index)	1.018	0.023	0.436
Ethno-geographic cluster (ref = Lao-Tai, all districts)			
Phongsaly - Sino-Tibetan	1.620	0.338	0.021
Khua - Mon-Khmer	2.702	0.560	0.000
Khua - Sino-Tibetan	5.894	1.277	0.000
Nhot Ou - Sino-Tibetan	8.158	2.077	0.000
Nhot Ou - Hmong-Iumien	1.598	0.365	0.040
Gnoi - Mon-Khmer	1.699	0.548	0.100
N	4,163		
Pseudo-R squared	0.138		
Log likelihood	-1,456		

Appendix B: Multivariate Analysis Results

Table B1. Determinants of nutritional status, children 3-10 in households with school-aged children, rural villages in northern Lao PDR, 2006 [N=7,727].

	Height-for-age Z-score		BMI-for age z score	
	(1)	(2)	(3)	(4)
Household resettled in last 10 years	-0.125	0.169	0.046	0.138
	[1.68]*	[0.86]	[1.11]	[0.68]
Male = 1	-0.08	-0.081	0.02	0.02
	[2.44]**	[2.49]**	[0.94]	[0.95]
Age (ref = 3 years)				
4 years	-0.041	-0.044	0.043	0.043
	[0.48]	[0.52]	[0.79]	[0.78]
5 years	-0.224	-0.226	-0.146	-0.142
	[2.80]***	[2.81]***	[2.73]***	[2.65]***
6 years	-0.249	-0.253	-0.274	-0.273
	[3.16]***	[3.19]***	[5.42]***	[5.36]***
7 years	-0.297	-0.301	-0.376	-0.374
	[3.75]***	[3.79]***	[6.97]***	[6.92]***
8 years	-0.401	-0.401	-0.48	-0.479
	[5.16]***	[5.15]***	[9.56]***	[9.55]***
9 years	-0.311	-0.315	-0.506	-0.505
	[4.09]***	[4.13]***	[9.72]***	[9.67]***
10 years	-0.344	-0.346	-0.585	-0.583
	[4.56]***	[4.57]***	[10.93]***	[10.85]***
Number of adults in household with > 2 years of education	0.032	0.032	-0.01	-0.009
	[1.45]	[1.46]	[0.91]	[0.82]
Village is upland	-0.212	-0.214	-0.057	-0.051
	[3.25]***	[3.26]***	[1.08]	[0.96]
District X Ethnic Group Cluster (Ref = Lao-Tai)				
Phongsaly - Sino-Tibetan	-0.503	-0.506	0.529	0.542
	[5.15]***	[5.04]***	[6.01]***	[6.13]***
Khua - Mon-Khmer	-0.373	-0.355	0.46	0.467
	[4.09]***	[3.64]***	[5.60]***	[5.73]***
Khua - Sino-Tibetan	-1.083	-1.105	0.354	0.397
	[6.16]***	[5.81]***	[3.13]***	[3.45]***
Nhot Ou - Sino-Tibetan	-0.758	-0.709	0.452	0.418
	[6.27]***	[5.17]***	[5.22]***	[4.54]***
Nhot Ou - Hmong-Iumien	-0.731	-0.664	0.221	0.226
	[4.70]***	[3.28]***	[1.88]*	[1.56]
Gnoi - Mon-Khmer	-0.467	-0.466	0.412	0.399
	[5.86]***	[5.75]***	[5.15]***	[4.91]***
Gnoi - Hmong-Iumien	-0.381	-0.37	0.502	0.481

	[3.48]***	[3.14]***	[5.72]***	[5.42]***
Interaction of household is resettled X cluster				
Phongsaly - Sino-Tibetan		-0.165		-0.248
		[0.68]		[1.16]
Khua - Mon-Khmer		-0.345		-0.13
		[1.38]		[0.55]
Khua - Sino-Tibetan		-0.078		-0.399
		[0.20]		[1.63]
Nhot Ou - Sino-Tibetan		-0.424		0.021
		[1.53]		[0.09]
Nhot Ou - Hmong-Iumien		-0.429		-0.104
		[1.50]		[0.42]
Gnoi - Mon-Khmer		-0.218		0.047
		[0.90]		[0.20]
Gnoi - Hmong-Iumien		-0.329		0.194
		[1.10]		[0.69]
Constant	-1.416	-1.421	-0.58	-0.588
	[14.45]***	[14.39]***	[7.39]***	[7.50]***
Observations	7727	7727	7727	7727
R-squared	0.06	0.06	0.09	0.09

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B2. Determinants of nutritional status, children 3-10 in households with school-aged children, rural villages in northern Lao PDR, 2006 [N=7,727].

	Diet Diversity Score		Hemoglobin (mg/dL)	
Household resettled in last 10 years	0.102	-0.593	0.038	-0.071
	[1.26]	[2.39]**	[0.47]	[0.17]
Male = 1	-0.01	-0.01	-0.155	-0.154
	[0.35]	[0.36]	[5.54]***	[5.51]***
Age (ref = 3 years)				
4 years	0.007	0.005	0.109	0.11
	[0.11]	[0.07]	[1.72]*	[1.74]*
5 years	0.055	0.062	0.157	0.157
	[1.02]	[1.14]	[2.56]**	[2.53]**
6 years	0.001	0.007	0.268	0.266
	[0.03]	[0.13]	[5.08]***	[5.05]***
7 years	0.049	0.055	0.342	0.343
	[0.86]	[0.97]	[6.03]***	[6.07]***
8 years	-0.042	-0.038	0.493	0.492
	[0.78]	[0.71]	[8.37]***	[8.40]***
9 years	0.033	0.041	0.507	0.504
	[0.62]	[0.76]	[8.15]***	[8.14]***
10 years	0.036	0.04	0.629	0.629
	[0.60]	[0.67]	[11.11]***	[11.07]***
Number of adults in household with > 2 years of education	0.144	0.145	0.061	0.058
	[6.10]***	[6.18]***	[2.65]***	[2.58]**
Village is upland	-0.107	-0.087	0.104	0.103
	[1.13]	[0.93]	[1.37]	[1.37]
District X Ethnic Group Cluster (Ref = Lao-Tai)				
Phongsaly - Sino-Tibetan	0.248	0.245	-0.198	-0.253
	[1.57]	[1.55]	[1.49]	[1.89]*
Khua - Mon-Khmer	-0.455	-0.48	0.145	0.181
	[3.04]***	[3.17]***	[1.20]	[1.50]
Khua - Sino-Tibetan	-0.253	-0.219	0.226	0.227
	[1.40]	[1.26]	[1.19]	[1.22]
Nhot Ou - Sino-Tibetan	-0.007	-0.069	0.166	0.162
	[0.05]	[0.45]	[1.39]	[1.38]
Nhot Ou - Hmong-Iumien	-0.188	-0.247	-0.003	0.079
	[1.30]	[1.75]*	[0.02]	[0.48]
Gnoi - Mon-Khmer	-0.937	-0.986	-0.14	-0.136
	[7.09]***	[7.41]***	[1.28]	[1.19]
Gnoi - Hmong-Iumien	-0.343	-0.451	0.763	0.803
	[1.62]	[2.12]**	[6.06]***	[6.46]***

Interaction of household is resettled X cluster				
Phongsaly - Sino-Tibetan		0.404		0.67
		[1.18]		[1.45]
Khua - Mon-Khmer		0.689		-0.117
		[2.34]**		[0.26]
Khua - Sino-Tibetan		0.264		0.063
		[0.67]		[0.11]
Nhot Ou - Sino-Tibetan		0.822		0.099
		[2.77]***		[0.22]
Nhot Ou - Hmong-Iumien		0.77		-0.095
		[2.71]***		[0.20]
Gnoi - Mon-Khmer		0.959		0.018
		[3.02]***		[0.04]
Gnoi - Hmong-Iumien		1.751		-0.431
		[3.88]***		[0.94]
Constant	3.922	3.926	11.784	11.792
	[30.68]***	[30.76]***	[117.25]***	[117.03]***
Observations	7727	7727	7727	7727
R-squared	0.12	0.13	0.06	0.06

Robust t-statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B3. Determinants of education gap, children 11-14 in households with school-aged children, rural villages in northern Lao PDR, 2006 [N=2,761].

	Education gap in years (Age 11-14)	
Household resettled in last 10 years	0.085	-0.085
	[0.63]	[0.16]
Male = 1	-0.489	-0.492
	[6.42]***	[6.52]***
Age (ref = 11 years)		
12 years	0.602	0.607
	[7.23]***	[7.21]***
13 years	1.305	1.313
	[15.83]***	[15.84]***
14 years	1.812	1.824
	[15.42]***	[15.44]***
Number of adults in household with > 2 years of education	-0.465	-0.466
	[9.77]***	[9.77]***
Village is upland	0.31	0.302
	[2.51]**	[2.45]**
Village has school	-0.622	-0.59
	[3.16]***	[2.92]***
Cluster (Ref = Lao-Tai, all districts)		
Phongsaly - Sino-Tibetan	-0.057	-0.067
	[0.24]	[0.27]
Khua - Mon-Khmer	-0.045	0.023
	[0.25]	[0.12]
Khua - Sino-Tibetan	1.38	1.455
	[6.36]***	[6.49]***
Nhot Ou - Sino-Tibetan	1.216	1.067
	[5.59]***	[4.55]***
Nhot Ou - Hmong-Iumien	1.483	1.411
	[6.64]***	[5.26]***
Gnoi - Mon-Khmer	0.447	0.436
	[2.61]***	[2.57]**
Gnoi - Hmong-Iumien	0.948	1.009
	[4.11]***	[4.12]***
Interaction of household is resettled X Cluster		
Phongsaly - Sino-Tibetan		0.262

		[0.36]
Khua - Mon-Khmer		-0.368
		[0.65]
Khua - Sino-Tibetan		-0.486
		[0.80]
Nhot Ou - Sino-Tibetan		0.63
		[1.06]
Nhot Ou - Hmong-Iumien		0.318
		[0.53]
Gnoi - Mon-Khmer		0.213
		[0.34]
Gnoi - Hmong-Iumien		-0.33
		[0.47]
Constant	3.659	3.636
	[14.81]***	[14.55]***
Observations	2761	2761
R-squared	0.36	0.36

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B4. Odds ratios from logistic regression models predicting education gap (ages 6-10) and current schooling status (ages 6-14), children in households with school-aged children, rural villages in northern Lao PDR, 2006 [N=8,134].

	Education Gap >= 2 years (Age 6-10)		Currently in School (Age 6-14)	
Household resettled in last 10 years	1.406	1.854	0.891	3.622
	[2.47]**	[0.81]	[0.79]	[1.16]
Male = 1	0.805	0.809	1.795	1.792
	[2.33]**	[2.28]**	[7.82]***	[7.80]***
Age (ref = 6 years)				
7 years			2.551	2.56
			[8.89]***	[8.98]***
8 years			5.026	5.127
			[16.78]***	[17.02]***
9 years			8.181	8.283
			[17.75]***	[17.72]***
10 years			10.18	10.268
			[18.25]***	[18.22]***
11 years			6.552	6.654
			[13.21]***	[13.18]***
12 years			6.879	7.007
			[13.85]***	[13.86]***
13 years			4.838	4.871
			[12.26]***	[12.32]***
14 years			3.088	3.069
			[8.59]***	[8.55]***
Number of adults in household with > 2 years of education	0.667	0.669	1.582	1.592
	[5.88]***	[5.82]***	[7.64]***	[7.85]***
Village is upland	1.659	1.652	0.634	0.632
	[3.62]***	[3.57]***	[2.68]***	[2.72]***
Village has school	0.707	0.719	2.023	1.976
	[1.67]*	[1.57]	[2.43]**	[2.33]**
Cluster (Ref = Lao-Tai)				
Phongsaly - Sino-Tibetan	1.112	1.205	0.713	0.746
	[0.45]	[0.77]	[1.24]	[1.07]
Khua - Mon-Khmer	1.332	1.42	0.959	0.977
	[1.41]	[1.61]	[0.17]	[0.09]
Khua - Sino-Tibetan	3.725	3.496	0.137	0.129
	[6.48]***	[6.03]***	[7.04]***	[7.27]***
Nhot Ou - Sino-Tibetan	2.037	1.836	0.318	0.36

	[3.35]***	[2.52]**	[4.52]***	[3.93]***
Nhot Ou - Hmong-Iumien	2.431	2.427	0.211	0.24
	[3.79]***	[3.37]***	[5.50]***	[4.76]***
Gnoi - Mon-Khmer	1.571	1.669	0.717	0.785
	[2.21]**	[2.44]**	[1.36]	[0.97]
Gnoi - Hmong-Iumien	2.393	2.456	0.235	0.224
	[3.11]***	[3.01]***	[4.84]***	[4.81]***
Interaction of household is resettled X Cluster				
Phongsaly - Sino-Tibetan		0.383		0.242
		[1.08]		[1.20]
Khua - Mon-Khmer		0.578		0.296
		[0.67]		[1.06]
Khua - Sino-Tibetan		1.237		0.529
		[0.24]		[0.56]
Nhot Ou - Sino-Tibetan		1.052		0.191
		[0.06]		[1.44]
Nhot Ou - Hmong-Iumien		0.791		0.205
		[0.29]		[1.36]
Gnoi - Mon-Khmer		0.499		0.166
		[0.78]		[1.56]
Gnoi - Hmong-Iumien		0.727		0.627
		[0.30]		[0.39]
Observations	5373	5373	8134	8134

Robust t statistics in brackets

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