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China's Left-Behind Children: Impact Of Parental Migration On Health, Nutrition, And Educational Outcomes

ABSTRACT China's rapid development and urbanization have induced large numbers of rural residents to migrate from their homes to urban areas in search of better job opportunities. Parents typically leave their children behind with a caregiver, creating a new, potentially vulnerable subpopulation of left-behind children in rural areas. A growing number of policies and nongovernmental organization efforts target these children. The primary objective of this study was to examine whether left-behind children are really the most vulnerable and in need of special programs. Pulling data from a comprehensive data set covering 141,000 children in ten provinces (from twenty-seven surveys conducted between 2009 and 2013), we analyzed nine indicators of health, nutrition, and education. We found that for all nine indicators, left-behind children performed as well as or better than children living with both parents. However, both groups of children performed poorly on most of these indicators. Based on these findings, we recommend that special programs designed to improve health, nutrition, and education among left-behind children be expanded to cover all children in rural China.

China's rapid development and urbanization has induced large numbers of rural residents to migrate from their homes in the countryside to urban areas in search of better job opportunities.^{1,2} It is common for migrant parents to leave their children behind with a caregiver—typically the paternal grandparents—in their home communities.³ As a consequence, in the past decade or more a new subpopulation—called left-behind children—has emerged in China.⁴ A report released in May 2013 by All-China Women's Federation estimated that there were sixty-one million left-behind children—three times higher than the estimated number in 2000.^{2,5,6}

The status of left-behind children—or their well-being in terms of physical health, nutrition, and education—has drawn attention from many

researchers in different fields.^{7–10} Some studies suggest that left-behind children ages 2–17 have poorer health and nutrition than their peers who were not left behind by their parents, while other studies indicate a lower rate of health services use among left-behind children ages 6–11.^{9–15} Empirical studies of academic performance indicate that left-behind children ages 8–17 perform more poorly than other children in school.^{7,16,17}

In response to the perception that left-behind children are more vulnerable than other children, Chinese policy makers—sometimes in partnership with international agencies—are considering the development of a number of programs targeting these children. These programs would give left-behind children preferential treatment or extra assistance in social services. For example, in 2006 China's central government developed policies that require local

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governments to supply supplemental educational support for rural left-behind children.¹⁸ The United Nations Children's Fund (UNICEF) has also developed and funded a number of small-scale programs scattered across China to promote left-behind children's uptake of health services, such as childhood vaccinations. UNICEF is also piloting new approaches with selected local governments, schools, and communities in rural China to ensure that left-behind children receive emotional support and community-based child protection services.^{19,20} Two central-government policies that target left-behind children are already on the books, although policy implementation is sporadic.

This study sought first to identify the prevalence of left-behind children in rural China and second to compare, in a comprehensive, empirically rigorous way, the health, nutrition, and education status of left-behind children with that of children living with both parents. Our purpose was to examine whether left-behind children need the special programs that the government and international organizations are developing. One recent (still unpublished) study found only sporadic evidence that left-behind children are the most vulnerable among children.²¹ Moreover, existing studies have a number of systematic weaknesses—specifically, they are based on small sample sizes, consider a limited number of outcomes, and have an unclear comparison group. (For a more complete review of the existing literature, see the online Appendix.)²²

Study Data And Methods

DATA The data used for this study were aggregated from twenty-seven different surveys that the authors and collaborators conducted in rural areas of ten of China's provinces from 2009 to 2013. Appendix Exhibit A1 provides the provinces, years, sample sizes, and primary outcomes of the included surveys.²² Sample children ranged in age from three to seventeen years, similar to the age ranges of children included in previous studies.^{7,9-17} Interested readers can visit the Stanford University website for more information about the surveys.²³

SAMPLE SELECTION The twenty-seven surveys were all based on uniform random-sampling strategies. First, we obtained a list of all counties in each sample province. Second, we randomly selected study counties from those meeting our study criteria. (The precise criteria differed according to each individual study's research goals but typically focused on factors such as population size and income.) Third, using official records, we created a list of all primary and secondary schools in the sample counties. Fourth, we

used official records and telephone calls to principals in the sampling-frame schools, conducting our own canvass survey to identify all schools meeting our study criteria (for example, schools with boarding facilities, schools of a certain size, and so forth). Fifth, we randomly selected schools from the resulting sampling frame. Finally, within each randomly selected school, we randomly selected students in the targeted age groups for inclusion in the studies. The sampling strategies are described in the papers from which the source data came; interested readers are encouraged to refer to the Appendix for more details about those papers.²²

DATA COLLECTION AND OUTCOME MEASURES

The primary outcomes of this study include measures of nutrition, health, and education. We have data on anemia prevalence, rates of infection with soil-transmitted helminths (intestinal worms), refractive error prevalence, weight-for-age z-scores, and height-for-age z-scores—both statistical measurements of how weight and height compare to international standards for children. Weight- and height-for-age z-scores were calculated using World Health Organization (WHO) AnthroPlus, a software application of the WHO Reference 2007 that is used to monitor the growth of school-age children.²⁴ We collected four measures of academic performance: test scores from standardized tests for mathematics, Chinese language, and English, as well as information on school dropout rates from junior high school and vocational high school. We describe these outcome variables in more detail in the Appendix.²²

All of the surveys included in this study followed uniform data collection protocols and employed the same set of experienced enumeration team leaders and supervisors. The enumerators were undergraduate and graduate students from local universities who were recruited from academic departments relevant to the survey focus. All enumerators underwent comprehensive training that lasted from two to seven days, depending on the complexity of the survey and testing instruments, and training was overseen by at least one of the study's principal investigators. Each of the surveys was designed independently by principal investigators and was intended to collect data on a variety of other issues affecting rural children. Some surveys were used as baseline surveys for randomized controlled trials unrelated to migration; other surveys were simply used to collect data on a topic of interest (for example, intestinal worms). All of the survey enumerators were blind to children's parental migration status when outcomes were measured.

In addition to the outcome variables, enumer-

Our data demonstrate high rates of nutrition and physical health problems for the average child, regardless of parental migration status.

ation teams also collected socioeconomic information on the sample students and their households. All of the surveys asked about family composition in a uniform way. Family types were divided into four groups: families with both parents migrated to urban area (pure left-behind children); families with both parents at home (children living with both parents); families with mother at home and father migrated to urban area (partial left-behind children); and families with father at home and mother migrated to urban area (partial left-behind children). School-age children completed the survey on socioeconomic information themselves, in writing, under the direct supervision of trained enumerators.

STATISTICAL ANALYSIS To combine estimates from individual data sets, we constructed a weighted mean using the inverse of the variance from individual data sets as weights. This “fixed effects” method is commonly used in meta-analyses and assumes that there exists one true estimate around which estimates from individual data sets are distributed.^{25,26} This method gives more weight to data sets containing more information, largely determined by sample size.

To test whether the age at which a child is left behind is correlated with growth, we conducted a set of additional analyses using the data sets from Sichuan province (Sichuan 2009a and Sichuan 2009b) and Guizhou province (Guizhou 2009a and Guizhou 2009b) (Appendix Table A1),²² which contain data on weight for age, height for age, and body mass index for age on two distinct age groups: children ages 3–5 and children ages 8–10. By comparing the difference-in-differences in the growth parameters of left-behind children and children living with both parents across the two age groups, we assessed whether younger left-behind children might be more susceptible to faltering growth compared

with older left-behind children.

To test whether parents of left-behind children are fundamentally different from other parents, we used multivariate analysis on a subset of data that includes 18,441 observations (from data sets 21–23 in Appendix Exhibit A1)²² to compare the basic characteristics of the parents of left-behind children to the parents who had not migrated and had children living at home.

Results on the prevalence of left-behind children, anemia rates, soil-transmitted helminth infection rates, refractive error rates, and drop-out rates from formal schooling are presented as percentages. Results from calculations on weight and height for age and from standardized test scores in mathematics, Chinese, and English are described as means of the standardized score of each sample. A chi-square test was used to compare differences in percentage rates between left-behind children and children living with both parents.

LIMITATIONS Our study had several limitations. Although our sample was large, most of the observations were from schools and villages in China’s relatively poor rural areas. Therefore, an important limitation was that we were unable to extrapolate our findings to China’s nonpoor areas or to areas outside of China. That said, we estimate that our study findings apply to around 162 million children living in poor rural areas of China.

A second limitation was that although we were able to measure the differences (or absence of differences) between left-behind children and children living with both parents, we were unable to identify the exact cause of the observed differences.

A third limitation was that our study did not compare the psychological well-being of left-behind children and children living with both parents. Previous literature has suggested that left-behind children may be at greater risk of depression, anxiety, and loneliness as a result of separation from their parents.^{27,28} Compared with children living with both parents, the left-behind children are also reported to have lower levels of satisfaction with life, including lower levels of happiness and quality of life.^{29,30}

Study Results

On average, 15.7 percent of children in the rural areas of China where these surveys were conducted were living in households in which both parents resided outside of the home while the children lived with another caregiver (typically their paternal grandparents). In addition to children living without both parents, 29.6 percent of sample children lived with only one parent in the

household as a result of migration: 23.9 percent lived with just their mother, while 5.7 percent lived with just their father. The majority of children (54.7 percent of the sample group) lived with both parents. In the remainder of the article we focus mostly on comparisons between left-behind children and children living with both parents.

There is considerable heterogeneity in household composition across the different sample areas (Appendix Exhibit A1).²² The share of left-behind children ranged from 6.0 percent in the Shaanxi sample (Appendix Exhibit A2) to 53.5 percent in Sichuan.²² The share of children living with both parents ranged from 23.4 percent in Sichuan to 75.0 percent in Zhejiang (Appendix Exhibit A2).²²

Our data demonstrate high rates of nutrition and physical health problems for the average child, regardless of parental migration status (Exhibit 1). The anemia rate among the 27,535 children tested for hemoglobin levels was 27 percent, indicating that more than one-quarter of children were suffering from anemia. One-third of children were infected with soil-transmitted helminths; the rate of infection among the 3,886 children tested for it was 33 percent. The standardized scores for anthropometry measures for the height and weight of the children in the samples were -0.94 and -0.57, respectively. This means that in comparison with international standards, children in rural China, for their ages, are shorter and lighter. The rate of refractive error among the 18,979 children in the two studies of vision was 16 percent.

Children living with both parents either were worse off or had the same levels of results for

nutrition and health indicators as left-behind children (Exhibit 1). Anemia rates among children living with both parents and left-behind children were both 27 percent. The measures of height and weight show that children living with both parents were either the same as or worse off than left-behind children (*p* values are 0.769 and 0.932, respectively). The rate of soil-transmitted helminth infection was higher among children living with both parents (39 percent) than for left-behind children (25 percent; *p* < 0.001). The rate of refractive error among children living with both parents (17 percent) was statistically higher (*p* < 0.001) than that of left-behind children (13 percent).

Educational performance was equivalent for both groups of children (Exhibit 1). Children living with both parents performed the same as left-behind children, on average, for standardized test scores for mathematics, Chinese language, and English (*p* values: 0.464, 0.725, and 0.301, respectively), and the rate of dropout from junior high school was also the same for both groups (19 percent).

Looking at indicators for measuring progress in child growth and nutrition across different age groups, we found that children living with both parents in the group ages 3–5 had significantly lower weight-for-age scores (*p* < 0.001), height-for-age scores (*p* < 0.001), and body mass index (BMI) scores (*p* < 0.001) relative to left-behind children. Among children ages 8–10, there was little difference between the two groups (Exhibit 2).

Parents of left-behind children were younger (*p* = 0.001 for both fathers and mothers), were better educated (*p* = 0.011 for mother's educa-

EXHIBIT 1

Comparison Of Health, Nutrition, And Education Outcomes Of Left-Behind Children And Children Living With Both Parents In Rural China, 2009–13

Outcome	Sample size	Average value	Left-behind children	Children living with both parents
Anemia rate ^a	27,535	27%	27%	27%
Height-for-age z-score ^b	1,707	-0.94	-0.89	-1.01
Weight-for-age z-score ^b	3,886	-0.57	-0.56	-0.59
Soil-transmitted helminth infection rate	3,886	33%	25%	39%****
Refractive error rate	18,979	16%	13%	17%****
Dropout rate	32,532	18%	19%	19%
Math score ^b	113,366	— ^c	0.018	-0.015
Chinese score ^b	30,843	— ^c	0.040	-0.005
English score ^b	3,540	— ^c	0.030	-0.180

SOURCE Authors' analyses of data from surveys that the authors and collaborators conducted in rural areas of ten Chinese provinces between 2009 and 2013. **NOTES** This exhibit includes only average values of variables that have stand-alone significance. It does not include standardized test scores of math, Chinese language, and English standardized tests because these scores are used only to compare the relative performance of children from different family types. ^aHemoglobin less than 120 g/L. ^bStandardized score (standardized to mean of 0; standard deviation of 1). ^c[please provide] *****p* < 0.001

tion), and came from larger households ($p = 0.003$), compared with parents who stayed home (Exhibit 3). Children living with both parents came from households with significantly lower asset indices relative to left-behind children living with only one parent, mother or father ($p = 0.004$); father only ($p = 0.005$); or mother only ($p = 0.005$).

Discussion

This study has a number of strengths. First, our aggregated sample, comprising twenty-seven different data sets, is much larger (more than 141,000) than that used in any similar studies.²² This gives the study a high degree of statistical power and considerable external validity—at least in terms of relatively poor regions of rural China. Second, nearly all of the observations were collected by a single research team that used a common sampling strategy in all of the substudies. The data collection instrument was standardized, as was the enumeration process. Because of this, we can compare outcome variables across children who live in different household types.

This study makes an important contribution to the domestic and international literature on the status of children left behind as their parents migrate to urban areas in search of employment opportunities. In China, most of the studies related to migrants focus on the relationship between migration and rural community development, not on any possible links of migration to

EXHIBIT 2

Comparison Of Mean Health Indicators By Children's Age Group And Parental Migration Status, 2009

Variable	Ages 3-5 (n = 672)	Ages 8-10 (n = 693)
WEIGHT-FOR-AGE SCORES		
Left-behind children	-0.46	-0.57
Children living with both parents	-0.64	-0.64
Difference between children living with both parents and left-behind children ^a	0.19	0.06
p value	0.031	0.275****
HEIGHT-FOR-AGE SCORES		
Left-behind children	-0.75	-1.02
Children living with both parents	-1.02	-1.00
Difference between children living with both parents and left-behind children ^a	0.26	-0.02
p value	0.018	0.824****
BODY MASS INDEX SCORES		
Left-behind children	0.28	-0.29
Children living with both parents	0.07	-0.37
Difference between children living with both parents and left-behind children ^a	0.21	0.07
p value	0.023	0.160****

SOURCE Authors' analyses of data from surveys that the authors and collaborators conducted in rural areas of ten Chinese provinces in 2009. **NOTE** Analytic sample size is lower than the number of children originally sampled as a result of missing height or weight data. ^aDifference is the coefficient of regressing the health indicator on a dummy variable of left-behind children. **** $p < 0.001$

child health, nutrition, or education for the children who remain in rural households.^{31,32} Most existing studies were conducted in a single province or subprovincial area and focused only on a limited number of outcomes (see the Appen-

EXHIBIT 3

Relationship Between Child And Household Characteristics And Parental Migration Status, 2009-13

Regression model	Children living with parent			
	Left-behind children	One parent (mother or father)	Father only	Mother only
Sex (1 = male; 0 = female)	0.019	-0.008	0.007	-0.009
Age (months)	-0.001	-0.000	0.000	-0.001***
Ethnic minority (1 = yes; 0 = no)	0.014	-0.051	0.007	-0.071
Student is boarding (1 = yes; 0 = no)	-0.008	-0.027	-0.020	-0.032
Father's age	-0.008**	0.001	0.002	-0.004**
Mother's age	-0.006**	0.000	-0.005**	0.000
Father's education (more than primary school = 1)	0.017	-0.000	-0.016	0.020
Mother's education (more than primary school = 1)	0.038**	-0.009	0.020	-0.008
Household size	0.012**	-0.025**	-0.006	-0.030**
Asset index	-0.006	-0.028**	-0.021**	-0.031**
Constant term	0.764**	0.501**	0.247**	0.801**
No. of observations	11,847	18,441	10,714	12,646
R-squared	0.099	0.025	0.077	0.041

SOURCE Authors' analyses of data from surveys that the authors and collaborators conducted in rural areas of ten Chinese provinces in between 2009 and 2013. **NOTES** Comparison group for each regression model is children living with both parents. All multiple linear regressions adjust for county fixed effects. ** $p < 0.05$ *** $p < 0.01$

dix).²² To our knowledge, ours is the first study of Chinese migrants that examines multiple outcome variables including health, nutrition, and education for a multiprovincial sample. In the international literature, studies on migration in other developing countries typically focus on financial issues relating to migration, such as the role of remittances in developing source communities.^{33,34} To date, there have been relatively few studies focusing on the households of mainstream migrant populations and comparing them to nonmigrant populations.³⁵ Indeed, a 2005 comprehensive meta-review that looked at children of international migrants in Southeast Asia specifically called for more use of household data to provide needed information on child characteristics and outcomes for left-behind children.³⁵

Our findings indicate that close to half (45.3 percent) of the children in our sample were left behind by one or both of their parents as a result of migration. Extrapolating this figure to all of rural China, we estimate that there were 73.4 million children left behind by one or both parents.

Restricting the definition of *left-behind children* to include only those children who lived with neither parent, we observed that the incidence of “true” left-behind children as a result of migration was only 15.7 percent. According to this definition, 84.3 percent of children lived with at least one of their parents.

The primary aim of our study was to document whether left-behind children are indeed the most vulnerable children in rural China and, therefore, in need of the special programs that have been set up for them. The results of the empirical analysis reveal that left-behind children are not the most vulnerable in rural China. In the case of nearly every indicator, children living with both parents scored the same as or lower than left-behind children. In other words, results of health and nutrition indicators such as anemia prevalence; height- and weight-for-age z-scores; scores on standardized tests of mathematics, Chinese, and English; and junior high school and vocational high school dropout rates among left-behind children were the same as those among children living with both parents. Left-behind children have lower rates of soil-transmitted helminth infection and refractive error compared to children living with both parents, so the former are slightly better off than the latter.

Regarding our nutritional results, one possible explanation for our findings might be that the age at which the child is left behind is an important factor in determining how affected the child's health will be, since younger children

Our results indicate that all children in rural China are vulnerable and need extra care, attention, and resources.

are typically more susceptible to growth faltering. Our results indeed show a statistical difference in weight, height, and BMI for age; however, we found that left-behind children ages 8–10 actually had worse child growth indicators than left-behind children ages 3–5, although both groups still did better than or the same as their peers living with both parents. One possible explanation for this finding might be that migration of one or both parents to urban areas is more common among families whose young children are in better health or have access to better care at home when the parents are away.

Another factor that may possibly influence our results might be the duration of parental absence. We ran an additional set of supplemental analyses to test for this and found no correlation between duration of parental absence (either mother, father, or combined) and any of our key outcomes. (A detailed explanation of our analytic strategy and results is in the Appendix.)²² More detailed study of the influence of duration of parental absence should be included in future studies of this issue.

While we do not empirically isolate the source of the gap (or lack of a gap) between children living with both parents and left-behind children, we believe it likely that there is some sort of “care versus resources” trade-off at play. By definition, children living with both parents receive more face-to-face care from their parents than left-behind children. However, with the high and rising wage rates in China, if the parents of left-behind children are working full time in the city, they will almost certainly have access to more financial resources than parents of children living with both parents, many of whom earn most of their income from farming on China's small, near-subsistence farms. Hence, one explanation for our findings that left-behind children do as well as or better than children living with both parents is that access to more resources helps, at least in part, offset the nega-

tive effects of the absence of parental care.

In addition, there may be a selection effect involved, as the families deciding to move to the city and leave their children with other caregivers may be fundamentally different from families in which parents decide to stay at home. For example, it may be that when parents are weighing the decision to stay at home versus migrate to the city, they consider the capabilities of the caregivers who will replace them. Younger grandparents with higher levels of education might be better caregivers than older, illiterate grandparents. Families with more capable grandparents may be more willing to have both parents migrate to the city than families with less capable grandparents. If this is true, there may be less of a reduction in care for left-behind children and a considerable rise in household resources (funded by the relatively high earnings of parents who work in the city as compared to the more meager earnings of parents who remain in rural areas).

The choice of parents' occupations may be another dimension of this selection effect that could explain some of our findings. For example, it may be that parents of children living with both parents are more likely to be involved in on-farm occupations and, therefore, that these children are more likely to be spending time helping their parents in the field. This additional time in the fields could contribute to their higher rate of soil-transmitted helminth infection because the fields are often fertilized with fecal matter, which acts as a vector for infection.

Another way in which a selection effect might be involved is if the parents of left-behind children themselves are fundamentally different from the parents of children living with both parents. Indeed, our results show that parents of left-behind children are younger, are better educated, and come from larger households compared with nonmigrant parents, which could indicate the presence of live-in grandparents in households of left-behind children. Given these parental characteristics, left-behind children might be expected to outperform children living with both parents on measures of cognitive performance. However, our results show

that left-behind children perform nearly the same as children living with both parents. Hence, it could be that left-behind children are doing worse than expected given the characteristics of their parents and the nature of their households. Again, however, the fact that they performed nearly the same as children living with both parents, who are themselves performing poorly in terms of health, nutrition, and education, means that both groups of children are in need of support.

It is important to note that our findings should not be construed to mean that left-behind children are not vulnerable. Both groups of children perform poorly on most of the indicators considered in this study. These results are consistent with other studies of rural China and could have important human capital implications for China as these children become working adults.³⁶⁻³⁸ Hence, our results indicate that all children in rural China are vulnerable and need extra care, attention, and resources from governmental and nongovernmental organizations alike.

Policy Implications

According to our results, policy makers should adjust their approaches to implementing programs targeting left-behind children in rural China. The findings in this article demonstrate that left-behind children perform equally with or even slightly better than children living with both parents on the health, nutrition, and education indicators we examined, which suggests that current programs (or planned programs) targeting only left-behind children may represent a misdirection of resources. Both groups of children perform poorly on most of the indicators considered in this study. Therefore, we recommend that special programs designed by policy makers to improve health, nutrition, and education among left-behind children be expanded to cover all children in rural China. In addition, further research is needed to better clarify the role of socioeconomic status and the availability of a safe, reliable caregiver in parents' decision to migrate. ■

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