The Association Between Parental Migration and Childhood Illness in Rural China

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Received: 26 August 2013 / Accepted: 7 May 2015 / Published online: 23 November 2015
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Abstract Many studies have examined the relationship between parental migration and child well-being, but few have examined the influences of parental migration on children's illness and the changes over time in China's internal migration context. Using longitudinal data from the China Health and Nutrition Survey from 1997 to 2009, this study examines how parental out-migration is associated with left-behind children's health, by comparing those children with children of non-migrant parent families. Random-effect models show that fathers', but not mothers', migration is positively associated with the likelihood of being ill. The association between fathers' migration and childhood illness diminished over time: The influence of the fathers' migration on childhood illness lessened as migration rates rose. The study also found that having to do more household chores due to the father's absence partly accounts for the negative effect of fathers' migration on children's health.

Keywords Parental migration · Left-behind children · Childhood illness · Rural China

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1 Introduction

With the Chinese nation's transition to a market economy since the 1980s, the stream of rural-to-urban migration has been increasing rapidly, and many migrants work and live great distances from home. In 2010, there were 261 million people migrating, constituting about 19 % of the nation's population (National Bureau of Statistics of China 2012). An immediate consequence of this large stream of rural-to-urban migration is the emergence of split families, in which migrants leave behind family members, including young children. According to the data from the China Population Census, there were more than 60 million children left behind in 2010 (All-China Women's Federation Research Report 2013), which indicates that in China, one in five children would have been left behind by one or both parents. When one parent migrates, the other remains with the child, whereas when both parents migrate, children will be left with grandparents, relatives, or even on their own. How these children fare has been an important research question and matter of public concern (e.g., Gao et al. 2010; Xiang 2007; Browne 2014).

Among these split families, not only do migrating parents have to deal with the daily struggle of juggling the competing demands of long work hours and caring for family members, but they might also face the negative consequences of their absence on their children's well-being. Problems arise mainly due to the great uncertainty and instability associated with the adult migration process, and the inability to bring children along with them when they head for distant places to work. Just like the "left-behind children" in other settings in the world (e.g., Taylor et al. 1996; Parreñas 2005), the increase in parental migration in China has major implications for the families in which children are nurtured and socialized.

There is a growing body of literature on the effects of parental migration on the left-behind children, including levels of academic achievement, the way they use their time, and psychological well-being (Antman 2011; Graham and Jordan 2011; Halpern-Manners 2011; Smeekens et al. 2012). Physical health is also an important aspect of outcomes for children who are left behind, for example their experience of childhood illness. Childhood illness has substantial consequences for family members' well-being worldwide. Although nowadays illness generally does not lead to death, it constrains children's play time and social interaction, as well as entire families' work and social activities (Schmeer 2009). In addition to its impact on normal family activities and well-being, it also interrupts children's schooling, which might delay their cognitive and physical development and lead to lifelong disadvantages (Case et al. 2005). Previous studies have linked the incidence of childhood illness to sociodemographic factors, environmental exposure, and poverty, as well as parental behaviors (e.g., Hamlett et al. 1992; Bradley and Corwyn 2002). As parental migration largely alters the family setting, it brings great challenges in terms of children's healthy development and their protection; however, we know little about how parental migration affects children's health in the context of internal migration as in China, although previous studies have shed some light on this matter in the context of international migration (e.g., Kanaiaupuni and Donato 1999; Frank and Hummer 2002; Frank 2005).

Similar to immigrants in international migration streams, internal migrants in China might benefit from migration through access to paid employment, enabling them to send remittance money back to their left-behind families. However, in contrast to international migrants, it may be easier for internal migrants to frequently visit their left-behind children, as they face fewer barriers to travel and movement. Consequently, children's health needs may be more closely monitored by internally migrating parents compared to their counterparts in the international migration setting. Therefore, whether the benefits of parental migration offset the detrimental influences on children's health is an interesting question in the Chinese setting and contributes to a better understanding of how the influence of parental migration on children's well-being is embedded within local contexts.

The present study aims to investigate how parental migration impacts childhood illness in rural China. Using data which cover one-third of China's geographical area and more than 10 years' time, we address five research questions. First, does parental migration generally have a positive or negative impact on childhood illness? Second, do fathers' and mothers' migrations each have a different impact? Third, does the effect of parental migration on childhood illness change when migration becomes more prevalent over time? Fourth, does the presence of grandparents moderate the impact of parental migration on childhood illness? Fifth, does involvement of children in household chores mediate the effect of parental migration on childhood illness? By addressing these research questions, this study not only informs our understanding of the relationship between parental migration and children's health in China, but also highlights parental migration as a source of change in the family structure, family arrangement, and the meaning of caregiving over time.

2 Background

2.1 Parental Migration and Consequences for Child Health

The family is probably the most important social institution for protecting children's health and providing health care, which can be explained from the following perspectives. Firstly, family socioeconomic circumstances are important for protecting children's health because they provide amenities such as needed nutrition, care provision, and payment for medical treatment. Families with higher socioeconomic status usually provide better health protection and treatment for their children (Bradley and Corwyn 2002; Ross et al. 1990). Secondly, from the perspective of family structure, intact families are often seen as providing a more caring environment and more emotional support, preventing health issues (Bradley and Corwyn 2002). Specifically, the two-parent family is seen as the ideal and is a fundamental institution of society—the setting in which adults achieve a sense of meaning, stability, and security, and the setting in which children develop into healthy, competent, and productive citizens (Blankenhorn 1995; Popenoe 1996; Amato 2001). However, with the increase in nonresident parents resulting from work–family conflict and marriage dissolution in many parts of the world, scholars

have argued that the absence of parental roles has been partly responsible for the emergence of many deficits in children, including poor health (e.g., Dawson 1991; Victorino and Gauthier 2009). Similarly, left-behind children suffer from the absence of one or both parents in the context of parental migration.

Whether parental absence due to migration will adversely influence childhood illness, however, is theoretically controversial. On the one hand, household responsibilities, including child care and home maintenance, have to be taken on by the remaining parent and perhaps other family members when one parent is absent. Such a shift of responsibilities relates closely to the physical care that is available to children. Additionally, it might also limit their emotional care, which may trigger physical health problems due to not receiving adequate attention. On the other hand, parental absence caused by migration may be different from the situations of divorce or parental death, as children left behind by parental migration still form part of an intact family, which might give them a perception of family stability and a feeling of familial security. Moreover, children left behind by migrating parents might also enjoy health benefits due to the inward flow of funds from their parents' earnings. Specifically, migrant remittances allow parents or other adult family members to purchase more schooling for children and reduce paid and unpaid child labor (Kandel 2003). At the family level, the resulting improvement in their economic situation could largely reduce family stress through better housing conditions, affordable health care and nutrition, as well as better access to transportation (Cohen et al. 2003). Thus, the beneficial or detrimental impacts of parental migration on left-behind children are still largely ambiguous.

This potentially contradictory impact of parental migration on children's health has attracted much interest among international migration scholars, who examined a variety of health outcomes for left-behind children. For example, Kanaiaupuni and Donato (1999) found in the Mexican context that father's migration increases infant mortality in the early stages of the migration process, but diminishes it in the later stage. Others showed that migration reduces the risk of infant mortality and low birth weight, but it increases the risk of being ill and affects anthropometric measures (Frank and Hummer 2002; Frank 2005; Schmeer 2009). In addition to its influences on illness, Hildebrandt et al. (2005) found that children in migration-affected households received fewer preventive health inputs, such as breast-feeding and vaccinations.

2.2 Parental Migration: Does it Matter Who Migrates?

The ambiguity surrounding parental migration and child well-being is further complicated by different configurations of parental migration (father's migration, mother's migration, or both parents migrating). Theoretically speaking, the mother's absence might adversely affect the children to a greater extent than the father's absence, since mothers usually specialize in nurturing and caring for the children (Lamb 2004), and thus bear the main responsibilities for direct childcare, including preparation of food, provision of clothing, and helping with children's daily emotional care and management (Voydanoff 2002; Byron 2005).

The father's absence might also do harm to the health of left-behind children, since it increases the time spent on heavy domestic work by the left-behind children (Antman 2011). The father's absence might also heighten the risk of delinquency and deviant behavior due to the lack of monitoring of proper behaviors and due to a decrease in parental supervision and guardianship (Sampson 1987; Coley and Medeiros 2007), which may lower a child's personal safety and health protection. In contrast, a father's daily involvement will be a source of practical help, advice, and moral support (Amato 1994). Fathers can provide discipline and supervision, and can contribute to their children's physical well-being by acting as the male role model (East et al. 2006). Fathers specialize in playing with children, in particularly boisterous, stimulating, and emotionally arousing play (Lamb 2004). They also provide a perceived safe and relaxed family environment in which children can grow, which will lower children's day-to-day stress levels (Sigle-Rushton and McLanahan 2004). The father's presence in the household also makes it easy to keep a family routine, which make meals and bedtime more regular and balanced (Hetherington et al. 1978; Stewart and Menning 2009).

When both parents migrate, children are usually left under the supervision of grandparents or other relatives, but these alternative care providers may be less sensitive to children's physical condition and emotions than are parents. In migration sending areas, grandparents are often not well educated, and lack adequate knowledge of nutrition and modern parenting practices (Zeng and Xie 2014). As a result, if both parents migrate, this situation may have the most detrimental effect on a child's health. Thus, it is necessary to make a distinction between different configurations of parental migration when studying its effects on children's well-being. However, since existing studies examine *either* fathers' or mothers' migration due to the prevalence of migration of only one gender (e.g., Schmeer 2009; Smeekens et al. 2012), the distinct effects of fathers' or mothers' or their joint migration are under-researched.

Studies dealing with the consequences of parents' migration on child health, although informative, have the following limitations. Firstly, noted by Graham and Jordan (2011), few studies to date have investigated the potentially different impacts of absent mothers and absent fathers on the health of left-behind children. Secondly, many studies examine left-behind children in transnational households (e.g., Kanaiaupuni and Donato 1999; Schmeer 2009; Gibson et al. 2011; Graham and Jordan 2011); yet, few consider the internal migration context, and nearly all studies ignore temporal change in the effect of parental migration on children's health. Thirdly, empirical studies predominantly focus on whether parental migration has a positive or negative impact on children's health outcomes (e.g., Schmeer 2009), while ignoring the mechanisms of this effect. This state of affairs is probably due to the lack of appropriate data on key intermediate variables such as substitute care providers and children's day-to-day activities, which are related to health. It is worthwhile to extend this line of research to the Chinese internal migration context in order to fill some of the above-mentioned gaps.

2.3 Parental Migration and Left-Behind Children in China

Chinese internal migrants experience similar constraints to those international migrants face, mainly because of the household registration system (*Hukou*) (Roberts 1997). Under this system, each person has a *hukou* (registration status), classified as “rural” or “urban,” in a specific administrative unit (Chan and Buckingham 2008; Liang and Ma 2004). Although the gradual relaxation of *hukou* after 1978 permits people to live and work outside their officially registered areas, they are not always eligible for access to local schools, subsidized housing, and government services, living therefore in a condition similar in many ways to that of illegal immigrants (Liang et al. 2008; Wang et al. 2002).

Some measures have been taken to ameliorate the adverse consequences of the *Hukou* system on migrants’ children. For example, more recently, the central government urged schools in areas that attract migrant workers to accept migrants’ children. However, these schools usually charge exorbitant fees for children of non-local *Hukou* status. Also, public schools frequently refuse to admit children of migrants due to pressure from local families, limited space, or out of fear of migrant children’s behavioral problems. Migrant families generally cannot afford the expenses associated with quality private schools and appropriate living spaces for families (Wu 2002), nor do they qualify for subsidized housing in the migration destination. As a result, many migrants have to leave their children behind, which has created an enormous incidence of split families in China.

Studies have made some progress in examining the effect of parental migration on children’s health within China. For instance, Chen (2009) examined the effect of parental migration on children’s body mass index (BMI) and showed that when both parents migrate, the BMI of their children is reduced, a detrimental effect in the Chinese context. De Brauw and Mu (2011) showed that parental migration increased the risk of being underweight in children aged 7–12, further indicating the negative impact of parental migration. Other studies have examined how parental migration influences the psychological health of children and their health-related behaviors. For instance, Wen and Lin (2012) showed that left-behind children are disadvantaged in terms of health-related behavior and engagement at school, but comparable in terms of life satisfaction to those living with parents in the same rural communities. Other studies demonstrated that left-behind children are at greater risk of depression (He et al. 2012; Liu et al. 2009). Among these, few studies have used a nationally representative sample to examine the effect of parental migration on childhood illness in China. Furthermore, some of the regional studies ignore the potentially differing impact of fathers’ versus mothers’ migration on child’s health.

2.4 Parent Migration and Childhood Illness: Changes Over Time

Another research gap stems from ignoring the impact of parental migration on children *over time*. Incorporating a time dimension, however, has the potential to show how mass migration contributes to societal changes. In the past few decades, China has experienced dramatic macro socioeconomic change, in part due to the continual increase in out-migration since the 1990s. Features of the changing

structure of society may increase or decrease the effects of parental migration status on children's health. In particular, at the early stages of mass migration, when its prevalence is low, children and families are not well prepared psychologically for the absence of close family members (Kanaiaupuni and Donato 1999). At the same time, society might be unequipped to deal with the consequence of parental migration on child well-being in the initial stages of migration. It takes time to develop that awareness and respond to potential harm to children. Thus, parental migration might have more severe consequences for children in the early stages of mass migration. As migration becomes more common over time, being a migrant gradually becomes a cultural norm for rural people (Kandel and Massey 2002), so children increasingly "expect" that their parents will leave home to earn money in a distant place. Perceiving that many of their peers are in the same situation might actually enhance their psychological strength and offset any negative consequences of parental migration, including impacts on physical health. Meanwhile, the family and society may begin to pay more attention to any potential harm and launch preventative programs to help left-behind children. For instance, in many migrant sending areas in China, schools, local governments, and voluntary organizations have launched various programs to help with homework and mentoring consultation (Tan 2011). In addition, communication technology has increased dramatically in recent decades, especially the prevalence of telephones (i.e., both land and mobile phones), which were altogether lacking in rural China in the 1990s but have by now become commonplace. Consequently, nowadays migrating parents can connect with family members in their hometown more easily than they could in the past.

2.5 Parental Migration and Health: Intermediate Mechanisms

Although a few studies in contexts outside of China have examined intermediate mechanisms such as remittances (Frank and Hummer 2002), health knowledge (Hildebrandt et al. 2005), diet (Gibson et al. 2011), and social support (Frank 2005), most studies within China have ignored these factors. Other factors that should be considered include, for example, the role of grandparents, children's involvement in household chores, and the neighborhood characteristics. Substitute care providers, such as grandparents, might modify the relationship between parental migration and children's health. Research in other settings has shown that living with a relative, rather than with non-relatives, or in an institution, may reduce the negative influences caused by parental absence because it provides the child with a sense of support and belonging to family (Dubowitz et al. 1994). As a result, the extent to which parental migration affects children's health might depend on who provides care for the children remaining at home.

In China, grandparents often play important roles in taking care of grandchildren (Chen 2004). Chinese society emphasizes collective family ambitions over individual goals, so grandparents see the welfare of their children's families as a cultural mandate (Silverstein 2006). When one or both parents are absent for work reasons, grandparents often become the main care providers (Piotrowski 2009) and take responsibility for their grandchildren's health, safety, and well-being. In such contexts, grandparents have to manage the combined responsibilities of being

family care providers and parental figures (Waldrop and Weber 2001), but the nature of the legal relationship between grandparents and children is usually subordinate to the interests of the parents (Wallace 2008). As a result, the adverse effect of parental migration on children may be buffered by the care from grandparents in the Chinese setting. However, during the time that grandparents take care of their grandchildren, they might also face physical and mental burdens associated with growing older (Letiecq et al. 2008). Moreover, they are usually relatively poorly educated (National Bureau of Statistics of China 2007; Zeng and Xie 2014), with less knowledge about protecting children's health; thus, there is a possibility that the positive and negative impacts of having children residing with their grandparents will offset each other in the presence of parental migration, which would probably make the positive effect of grandparents on children's health less discernible.

Other intermediate factors, such as involvement in household chores, might be a double-edged sword for children's health. On the one hand, parents might purchase labor with income from migrant remittances to reduce their children's workload at home, which might include doing farm work and raising livestock. On the other hand, parental migration may create a labor shortage in the village, increasing the burden for remaining family members (Rozelle et al. 1999; Chang et al. 2011), consequently increasing the number of household chores to be done by the children. Although empirical research on possible labor shortages in rural China is almost nonexistent, fieldwork in villages in the Hunan and Shannxi provinces by Tong, revealed a general shortage of labor in these areas (Tong 2014). One consequence is that children are frequently involved in farm work or cooking, cleaning, and caring for younger siblings/cousins (Chang et al. 2011). Thus, parental migration might increase children's workload, which in turn has a detrimental impact on their health.

3 Hypotheses

This research expands the literature on parental migration and children's health in three ways. First, using origin-based data covering a large geographical area of rural China, an appropriate comparison was made between left-behind children of migrating parents and those of non-migrating parents. We analyzed not only the overall impact on children's health of either parent migrating, but also made a distinction between the impact of paternal and maternal migration. Second, we examine whether the effects of parental migration on children have changed over time in the Chinese context, where migration became increasingly commonplace. Third, we explore the moderating effect or intervening mechanisms of doing household chores and the presence of substitute care providers such as grandparents. Based on the literature reviewed earlier, we formulate the following hypotheses:

Hypothesis 1 Fathers' and mothers' migrations will have a distinct impact on childhood illness. We predict that mother's migration will have a more detrimental

impact on children's health than father's migration, and that the migration of both parents will have a more detrimental impact than only a single parent migrating.

Hypothesis 2 The influence of parental migration on children's health will diminish across time, as families and attitudes adjust to the new reality.

Hypothesis 3 The presence of grandparents will curb the adverse effect of parental migration on childhood illness for children remaining at home.

Hypothesis 4 Doing household chores will mediate the effect of parental migration on childhood illness. We expect that parental migration will increase the burden of household chores taken on by children, leading to higher incidence of childhood illness.

4 Data and Methods

4.1 Data

Our data come from the China Health and Nutrition Survey (CHNS), an ongoing longitudinal study conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill, in collaboration with the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. Currently, the CHNS consists of eight waves (1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009). It employs a multistage random cluster sampling process to draw households from urban and rural areas in nine provinces (Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou) that vary substantially in geographical characteristics, economic development level, and public resources. The CHNS collects extensive information on individuals, households, and communities. The initial primary sampling units were urban neighborhoods, township neighborhoods, suburban villages, and rural villages. The data consist of separate surveys of households, individuals, individual nutrition, women who are ever-married, and communities. It also includes data from physical examinations.

Since migration information was only collected from 1997 onward, we limit our analysis to five waves from 1997 to 2009. Table 1 presents the distribution of sickness and parental migration status for the overall sample, as well as for rural and urban subsamples, over five waves of data collection. Because the majority of left-behind children are in rural areas, our analysis focuses only on such areas. Geographically, the CHNS initially covered eight provinces in China: Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Liaoning, and Shandong. In 1997, Liaoning province was replaced by Heilongjiang, a province similar to Liaoning in geographical and other characteristics. From 2000 onward, Liaoning was included in the survey again, along with Heilongjiang. We include all of these provinces in our analysis, although we note that across waves, our sample includes a slightly different combination of regions. Also, in each year, due to the attrition of households, new households were added to replace those no longer participating in

Table 1 Percentage of parental migration and childhood illness in rural and urban areas by year

Rural and urban	All	1997	2000	2004	2006	2009
Ill or injured in last 4 weeks (yes = 1)	6.49	3.43	4.1	9.56	9.9	10.47
At least one of the parents is a migrant (yes = 1)	13.94	6.75	11.48	18.35	22.58	19.58
Only father is a migrant (yes = 1)	9.27	4.82	7.76	12	14.29	13.1
Only mother is a migrant (yes = 1)	2.39	1.02	1.78	2.69	3.44	5.13
Both parents are migrants (yes = 1)	2.28	0.9	1.94	3.66	4.86	1.35
Neither parent is a migrant (yes = 1)	86.06	93.25	88.52	81.65	77.42	80.42
Father is a migrant, regardless of mother (yes = 1)	11.55	5.72	9.7	15.66	19.15	14.45
Mother is a migrant, regardless of father (yes = 1)	4.67	1.93	3.72	6.35	8.3	6.48
<i>N</i>	11,600	3320	3145	1967	1687	1481
Rural						
Ill or injured in last 4 weeks (yes = 1)	5.36	3.01	3.13	7.68	8.15	9.18
At least one of the parents is a migrant (yes = 1)	16.16	7.45	13.26	22.02	26.16	22.91
Only father is a migrant (yes = 1)	10.46	5.05	8.8	13.65	16.3	15.33
Only mother is a migrant (yes = 1)	2.87	1.26	2.17	3.5	3.91	5.97
Both parents are migrants (yes = 1)	2.83	1.14	2.29	4.87	5.95	1.6
Neither parent is migrant (yes = 1)	83.84	92.55	86.74	77.98	73.84	77.09
Father is a migrant, regardless of mother (yes = 1)	13.29	6.19	11.09	18.52	22.25	16.93
Mother is a migrant, regardless of father (yes = 1)	5.7	2.4	4.46	8.37	9.86	7.58
<i>N</i>	8662	2456	2399	1458	1227	1122
Urban						
Ill or injured in last 4 weeks (yes = 1)	9.84	4.63	7.24	14.93	14.57	14.48
At least one of the parents is a migrant (yes = 1)	7.39	4.75	5.76	7.86	13.04	9.19
Only father is a migrant (yes = 1)	5.75	4.17	4.42	7.27	8.91	6.13
Only mother is a migrant (yes = 1)	0.95	0.35	0.54	0.39	2.17	2.51
Both parents are migrants (yes = 1)	0.68	0.23	0.8	0.2	1.96	0.56
Neither parent is migrant (yes = 1)	92.61	95.25	94.24	92.14	86.96	90.81
Father is a migrant, regardless of mother (yes = 1)	6.43	4.4	5.23	7.47	10.87	6.69
Mother is a migrant, regardless of father (yes = 1)	1.63	0.58	1.34	0.59	4.13	3.06
	2938	864	746	509	460	359

the survey. As a result, although it is a panel study, due to the changing nature of the sample, the data are more characteristic of a repeated cross-sectional survey. The basic characteristics of the households in the sample are comparable to the national averages (Chen 2005).

Our sample includes rural children age 17 or younger during 1997–2009. About 8.8 % of cases were dropped after case-wise deletion, which was caused mainly by parental migration status, household variables such as income per capita, as well as village variables such as daily average labor wages. Among these missing cases, just over half were dropped because of missing information on parental migration status. However, we believe that some of the information needed to classify a parent as a migrant is actually related to parental absence associated with divorce or death. Once the parent is no longer a household member, he/she was not followed up in the survey, and we do not know the migration status of those parents who left the household due to dissolution of marriage. As parents' divorces or deaths are different from parental migration, we consider it more appropriate to exclude them from the sample. Unfortunately, we cannot be fully certain whether the missing parental information is indeed caused by parental divorce or death. There are 8662 children remaining in the analytical sample. To test the mediating effect of doing household chores, we also conducted separate analysis, limiting our sample to only children between the ages of 6 and 15 because this variable is only available for children aged six or above. We limit the maximum age to 15, as age 16 is the legal working age in China, and children are expected to take on more responsibilities at that point, such as agricultural work for the family.

4.2 Measures

4.2.1 *Dependent Variables*

We defined childhood illness as a dichotomous variable, coded 1 if the respondent experienced any illness in the preceding 4 weeks and 0 otherwise. Childhood illness was identified using the following questions in the survey: "During the past 4 weeks, have you been sick or injured? Have you suffered from a chronic or acute disease?" Although illness and injury were covered by the same questions, the questionnaires also asked respondents to identify what illness they experienced. Those most commonly cited include fever, sore throat, cough, diarrhea, stomach ache, and headache. The injury category makes up a negligible share of the responses. For example, only two children reported bone fractures and one child had been burned during the preceding 4 weeks. As a sensitivity analysis, we also recoded the dependent variable to include only types of illness, not injuries, and the results were largely the same. Respondents who answered "Don't know" were coded as missing and dropped from our analysis, which amounted to only about 1.6 % of the children in the sample. We acknowledge that this might not be a perfect measure for childhood illness, since the preceding 4 weeks is not a long period. However, we feel it is a reasonable choice because a longer duration might have been contaminated by recall error.

Table 1 shows that the incidence of children's illness (in the 4 weeks prior to data collection) has been increasing over time in both urban and rural areas,

especially between 2000 and 2004, indicating that the health needs of children have become more important over time. One possible reason for increasing child morbidity could be greater exposure to industrial pollution in recent years. It could also be that people have a heightened awareness about being sick after the Severe Acute Respiratory Syndrome (SARS) epidemic of 2003. As is evident from the lower portions of the table, children living in rural areas were less prone to being sick than children living in urban areas. This is contrary to what would be expected based on the health literature, because people's socioeconomic status in urban areas is generally higher than that of people in rural areas (Wu and Treiman 2004). We speculate that this paradoxical effect might be due to the relatively low population density in rural areas, which makes the spread of infectious diseases less likely to be transmitted interpersonally. People in urban areas, meanwhile, also might suffer more from the poor air quality due to city pollution. Another possibility is that children in urban areas have better health infrastructure and access, and urban residents also have a greater awareness of health issues, so illnesses might be more easily diagnosed in urban areas.

4.2.2 Independent Variables

Our key independent variable is parental migration status. Migration is defined as residence in another county, city, or province (relative to the location of surveyed household) at the time of the survey in each wave. Migration could be of any duration. For example, someone who migrated a decade before the survey is defined as a migrant, as is someone who left only a few months earlier. To test the robustness of parental migration impact, we examined three types of measures of parental migration. Firstly, we examined the impact on childhood illness of any parent migrating. Secondly, we distinguished between the effects of maternal and paternal migration. We made these comparisons using two sets of variables: one set includes two dummy variables of "father migrating" and "mother migrating"; the other set includes a categorical variable with four classifications: (1) neither parent is migrating, (2) only the father is migrating, (3) only the mother is migrating, and (4) both parents are migrating. According to the descriptive statistics, the percentage of children with migrant parents has been increasing rapidly over time. In 1997, around 6.75 % of children have at least one migrant parent, and the percentage increased to 19.58 % in 2009. In rural areas, the percentage of parental migration is even higher, with 22.91 % of children having at least one parent who was a migrant in 2009.

We estimated three sets of models to test whether different classifications of parental migration have a different impact on the dependent variable. We used the variable "year (data wave)" to indicate change over time and treated it as a series of dummy variables, because time intervals are not equally spaced across waves. We included an interaction term between measures of parental migration and the "year" variable to investigate whether the impact of parental migration on children changed over time. We expect that the impact of parental migration on childhood illness will decrease over time, as parental migration became more prevalent nationwide in more recent years. We also estimated a model which included an interaction between parental migration and the presence of a grandparent at home to examine

whether grandparent's involvement modified the influence of parental migration on childhood illness. In addition, we tested the mediating effect of doing household chores at home. We defined "doing household chores at home" as a dichotomous variable, which was coded 1 if the children were reported to be doing the household chores regularly, and 0 otherwise.

Control variables included demographic measures of age and gender. Household-level variables included household size and economic status, for which we used household income per capita, inflation adjusted to 2009 level, to indicate the household's economic situation. Community variables included a dummy variable of whether the village was large (more than 2000 people); the proportion of the working age population who were working outside of the town; and the daily wage for male workers in the village, which indicates the labor condition and the level of economic development in the rural village.

We also included a measure of attending coached exercise as a control variable, as it reflects the health behavior of children. Coached exercise is defined as physical exercise that is supervised by a coach and involves training on a regular basis. Additionally, we included a region measure. We divided the nine provinces into four groups roughly according to their economic development levels. They are (1) the coastal area of Shandong and Jiangsu provinces, which are more economically developed; (2) the northeast areas of Liaoning and Heilongjiang, in the middle spectrum of development; (3) the inland areas of Henan, Hubei, and Hunan, also in the middle spectrum of development; and (4) the southwest mountain areas of Guangxi and Guizhou, which are far less developed. Descriptive statistics can be found in Table 2.

4.3 Analytical Approach

We used a random-effect logit model, which we corrected for clustering of time-specific observations within individual records over time. Although the random-effect model separates within-individual and cross-individual variation, it might not adequately control for unobserved factors which impact both the key independent and dependent variables. As a result, we urge caution in making causal inferences about parental migration on childhood illness. Estimating a causal relationship between parents' migration and children well-being is naturally subject to potential bias due to the temporal order of events as well as to unobserved factors. To control for unobserved individual characteristics, previous studies used fixed-effect models (e.g., Schmeer 2009), experimental data (e.g., Gibson et al. 2011), or an instrumental variable approach (e.g., Hildebrandt et al. 2005). However, we could not find an appropriate instrumental variable for this study. As for the fixed-effect model, the outcome variable usually has to be measured at the interval or ratio level. Although some scholars have used it for the discrete outcome variables, such an approach suffers from both practical and methodological problems (Greene 2004). As a result, we cannot establish a causal relationship between parental migration and childhood illness in this study. Our main contribution is to fill the gap of studying parental migration and children's health in China by examining whether there is an association between these two variables and how this association changed over time or is modified by other factors.

Table 2 Means of independent and dependent variables of rural sample, pooled data 1997–2009

Variable	Mean/percent	SD	Min	Max
Ill or injured in last 4 weeks (yes = 1)	0.054	0.225	0	1
Parental migration status				
Only father is a migrant (yes = 1)	0.105	0.306	0	1
Only mother is a migrant (yes = 1)	0.029	0.167	0	1
Both parents are migrants (yes = 1)	0.028	0.166	0	1
Neither parent is a migrant (yes = 1)	0.838	0.368	0	1
Demographic and economic backgrounds				
Age	10.180	4.777	0.011	17.997
Age squared	126.451	92.282	0.000	323.901
Female	0.162	0.368	0	1
Household size	0.452	0.498	0	1
Logged household income per capita, inflated to 2009	12.195	0.025	12.154	12.783
At least one of the grandparents living together	0.261	0.439	0	1
Village context				
Daily wage for a male labor at village	23.612	16.257	1	202
Proportion of people working out town				
Less 20 %	0.391	0.488	0	1
20–50 %	0.394	0.489	0	1
More than 50 %	0.215	0.410	0	1
Village size				
More than 2000 people in the village	0.543	0.498	0	1
Year				
Year 1 (1997)	0.284	0.451	0	1
Year 2 (2000)	0.277	0.448	0	1
Year 3 (2004)	0.168	0.374	0	1
Year 4 (2006)	0.142	0.349	0	1
Year 5 (2009)	0.130	0.336	0	1
Region				
East coast	0.182	0.386	0	1
Northeast	0.163	0.369	0	1
Middle inland area	0.362	0.481	0	1
Southwestern mountain	0.293	0.455	0	1
Chores and coached exercise				
Having coached exercise (ages 6–15)	0.169	0.374	0	1
Doing household chores (ages 6–15)	0.251	0.433	0	1
<i>N</i>	8662			

5 Results

Our analysis proceeds as follows. First, we examine whether the effect of fathers' and mothers' migrations is distinct. Therefore, we investigate whether the passage of time and the presence of grandparents at home had a moderating impact on the relationship between parental migration and childhood illness. Next, we examine the mediating impact of doing household chores, limiting our sample to children aged 6–15. Results are presented as odds ratios. A value less than one indicates a negative effect, values of one, a zero effect, and values greater than one indicate a positive effect.

In Table 3, Model 1 we examined whether either parent's migration influenced childhood illness. Results show that net of control measures, parental migration is positively associated with childhood illness and increases the incidence of illness by 29 %. Model 2 used two separate dummy variables for fathers' and mothers' migrations, and it showed that fathers' migration is positively associated with childhood illness when comparing with those whose father remained at home, regardless of whether the mother is a migrant. However, mother's migration has a slightly negative association with child illness, which is surprising, as we expected that maternal migration would have a more detrimental effect on child health. We speculate that this might be a selection effect, as fewer mothers than fathers migrate. Model 3 further classified parental migration status according to four categories of "only father migrating," "only mother migrating," "both parents migrating," and "neither parents migrating" and confirmed that "only father migrating" increases the odds of child sickness by about 55 % compared with those children whose parents remained at home. "Mother-only" and "both parents are migrants" did not show statistically significant effects.

In these three models, we also found that age is negatively associated with the likelihood of sickness, but the effect is curvilinear (U-shaped). Gender does not have an impact on illness. The "year" variable shows an increasing incidence of childhood illness in rural China in the past decade. The only exception to this trend is "year 2000" (relative to "year 1997"), which is consistent with the descriptive statistics. The grandparent measure did not show an effect on childhood illness. Household size is negatively associated with childhood illness, but per capita income shows no impact on illness. The village-level control variables show that increasing daily wages for male workers slightly lowers the odds of children being sick. Being in a village where adults frequently work outside of town (>50 %) increases the odds of illness, compared to villages having a moderate incidence of adults working out of town (20–50 %). Village size also matters. Being in a large village (more than 2000 people) tends to increase the risk of child sickness, showing the potential influence of population density on children's health. This seems consistent with descriptive statistics on the incidence of illness between rural and urban subsamples. As for region, children in the northeast area were less likely to be sick than those along the more developed east coast (at 0.1 significant level only), but other regions exhibit no differences.

In Table 4, we examined the moderating and intervening factors on parental migration and childhood illness. We first examined whether the passage of time

Table 3 Parental migration status and childhood illness in rural China: by parental migration status

Variable	Odds ratio Model 1	SE	Odds ratio Model 2	SE	Odds ratio Model 3	SE
Parental migration status						
Either parent is a migrant (Ref. = Neither parent is a migrant)	1.290*	0.164				
Father is a migrant, regardless of mother (Ref. = Father is not a migrant)			1.498**	0.205		
Mother is a migrant, regardless of father (Ref. = Mother is not a migrant)			0.667 ⁺	0.153		
Only father is a migrant					1.545**	0.22
Only mother is a migrant					0.791	0.255
Both parents are migrants					0.886	0.266
Neither parent is migrant (reference)						
Demographic and economic backgrounds						
Age						
Age squared	0.830***	0.032	0.834***	0.033	0.835***	0.033
Female	1.005*	0.002	1.005*	0.002	1.005*	0.002
Household size	0.923	0.098	0.922	0.098	0.922	0.098
Logged household income per capita, inflated to 2009	0.914 ⁺	0.042	0.910*	0.042	0.910*	0.042
At least one of the grandparents living together	0.078	0.172	0.073	0.161	0.075	0.165
Village context	0.979	0.139	1.008	0.144	1.016	0.145
Daily wage for a male labor at village	0.984**	0.005	0.984**	0.005	0.984**	0.005
Proportion of people working out of town						
Less 20 %	1.162	0.141	1.147	0.139	1.147	0.139
20–50 %						
More than 50° %	1.423***	0.192	1.407*	0.190	1.410*	0.190
Village size						
Village size: more than 2000 people in the village	1.578***	0.199	1.560***	0.197	1.560***	0.197

Table 3 continued

Variable	Odds ratio Model 1	SE	Odds ratio Model 2	SE	Odds ratio Model 3	SE
Year						
1997						
2000	1.087	0.188	1.085	0.188	1.083	0.188
2004	2.301***	0.418	2.323***	0.422	2.318***	0.421
2006	3.256***	0.610	3.263***	0.611	3.251***	0.608
2009	4.767***	1.129	4.788***	1.134	4.718***	1.121
Region						
East coast						
Northeast	0.713 ⁺	0.143	0.713 ⁺	0.143	0.713 ⁺	0.143
Middle inland area	1.103	0.176	1.106	0.176	1.104	0.175
Southwestern mountain	1.038	0.169	1.068	0.173	1.065	0.173
Rho	0.172	0.052	0.169	0.052	0.168	0.052
Log-likelihood	-1674.460		-1688.140		-1687.930	
N	8662		8662		8662	

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, ⁺ $P < 0.1$

Table 4 Relationship between parental migration status, changes in years, presence of grandparents, chores, and childhood illness in rural China

Variable	All ages			Ages 6–15		
	Model 1		Model 2		Model 3	
	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE
Parental migration status						
Only father is a migrant	3.634***	1.339	1.620**	0.284	1.508*	0.311
Only mother is a migrant			1.031	0.388	0.940	0.385
Both parents are migrants			0.998	0.564	0.564	0.316
Neither parent is migrant (reference)	–		–		–	
Demographic and economic backgrounds						
Age	0.833***	0.033	0.836***	0.033	0.630*	0.136
Age squared	1.005*	0.002	1.005*	0.002	1.018 ⁺	0.009
Female	0.923	0.102	0.923	0.098	0.962	0.147
Household size	0.900*	0.044	0.910*	0.042	0.877 ⁺	0.065
Logged household income per capita, inflated to 2009	0.036	0.084	0.073	0.162	0.064	0.212
At least one the of grandparents living together	1.076	0.161	1.071	0.168	0.966	0.210
Village context						
Daily wage for a male labor at village	0.983**	0.005	0.984**	0.005	0.978**	0.007
Proportion of people working out of town						
Less 20 %	1.134	0.142	1.151	0.140	1.145	0.197
20–50 %	–		–		–	
More than 50 %	1.367*	0.192	1.407*	0.190	1.349	0.261
Village size						
More than 2000 people in the village	1.533**	0.199	1.564***	0.198	1.730**	0.316
Region						
East coast	–		–		–	
Northeast	0.765	0.158	0.715 ⁺	0.143	0.585*	0.161
					0.600*	0.164

Table 4 continued

Variable	All ages		Ages 6–15			
	Model 1		Model 2		Model 3	
	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE
Middle inland area	1.158	0.192	1.102	0.175	0.862	0.188
Southwestern mountain	1.175	0.199	1.065	0.173	1.004	0.226
Year						
1997	–		–			
2000	1.099	0.210	1.081	0.187	1.050	0.254
2004	2.374***	0.475	2.296***	0.418	2.688***	0.678
2006	3.539***	0.738	3.218***	0.603	3.192***	0.877
2009	5.913***	1.501	4.673***	1.110	6.211***	2.058
Interaction						
Only father is a migrant * year 2000	0.668	0.325				
Only father is a migrant * year 2004	0.475	0.218				
Only father is a migrant * year 2006	0.362*	0.170				
Only father is a migrant * year 2009	0.206**	0.101				
Only father is a migrant * grandparent at home			0.876	0.259		
Only mother is a migrant * grandparent at home			0.443	0.321		
Both parents are migrants * grandparent at home			0.832	0.551		
Chores and coached exercise						
Having coached exercise (ages 6–15)					1.279	0.255
Doing household chores (ages 6–15)						
Rho	0.175	0.054	0.167	0.052	0.256	0.074
Log-likelihood	–1569.040		–1670.473		–923.663	
N	8168		8662		5732	

Due to fewer cases on the categories “only mother is a migrant” and “both parents are migrants,” their interaction with variable “year” cannot be examined in the model 1

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, + $P < 0.1$

moderates the relationship between parental migration and childhood illness. Model 1 shows those results. In this model, we examine the moderating effect by interacting “father-only migration” and the dummy variable of “year.” Due to the fact that so few cases are in the “only mother migrating” and “both parents are migrating” categories across each year, we dropped cases for these two categories in this interaction model. The results reveal that father’s migration greatly increased the incidence of childhood illness in the initial year (the main effect of father’s migration), but the detrimental effect of father’s migration on childhood illness diminishes over time. However, the effect is only statistically significant in the most recent two waves of 2006 and 2009. Thus, hypothesis 2 is generally supported (at least for later time periods), that is, the influences of parental migration on children’s health diminish with time (albeit nonlinearly), as families and attitudes adjust to the new reality. Model 2 in Table 4 adds an interaction of parental migration and the presence of grandparents, and shows that the negative effect of father’s migration on childhood illness slightly increases in the case of no grandparents being at home, indicating that grandparents might have been playing an important role in taking care of children. However, the interaction between parental migration and the presence of grandparent is not significant.

To examine whether doing household chores influences childhood illness and whether it mediates the association of paternal migration with childhood illness, we presented two models in the two right-hand columns of Table 4. In these two models, using children who were aged 6–15 years ($N = 5732$), we first examined whether the father’s migration still has a significant effect on childhood illness after including the health behavior variable of attending regular coached exercise (which is only available for children older than 5 years old). We then examine whether doing chores in the house mediates the effect of father’s migration on childhood illness. To do so, we first examined whether the father’s migration has an influence on children’s domestic workload, and results showed that it significantly increases the chance of rural children doing household chores (not shown). We then examined the mediating effect. Model 4 shows that doing chores significantly increases the incidence of childhood illness by 55 %, the effect of the father’s migration on childhood illness is slightly reduced, and the significant level is also reduced to 0.1. These results confirm that doing household chores is mediating the effect of paternal migration on childhood illness.

6 Discussion and Conclusion

In the context of rural-to-urban migration, split families face great challenges in taking care of their children. Although a few studies have examined the consequences for left-behind children’s psychological well-being in China (e.g., Wen and Lin 2012), children’s physical health relative to parental migration in the migrant sending communities has received relatively little attention. Using origin-based longitudinal data from China, this study examined the relationship between parental migration and childhood illness, as well as the change in that relationship over time. Results show that parental migration, and fathers’ migration in particular,

has negative consequences for children's health. Furthermore, our analysis shows that fathers' and mothers' migration have different influences on children's health, confirming our first hypothesis. However, contrary to the expectations, mothers' migration does not exhibit a negative effect on children's health. Finally, the results indicate that having both parents migrate is not more detrimental than having only one parent migrate.

The lack of influence of the mother's migration on children's health might be due to the comparatively low proportion of migrating mothers relative to migrating fathers in the Chinese internal migration context. Indeed, the overall percentage of mother-only migration is $<3\%$, indicating that they might be a highly self-selected group. Families in China often choose either to have the father migrate alone or to have both parents migrate. Thus, we speculate that fathers' and mothers' migrations are characterized by different selection processes. Mothers usually choose not to migrate if a child is experiencing health problems, while fathers might be more inclined to do so when the child has greater health care needs, as he is expected to earn money to support the family's medical expenses. In the mother-only migration situation, the father remaining at home is more likely to be negatively selected in terms of ability to find jobs in the urban areas. This negative consequence of the father's migration on children's health is consistent with Schmeer's (2009) study in Mexico, although she did not examine the influence of mother's migration. However, the decision of whether the father or the mother migrates depends on the social context; for instance, in a society where parental migration is predominantly represented by mothers, such as in the Philippines, children with mothers abroad reported poorer physical health than those with both parents at home (Smeekens et al. 2012). In the present study, with controls for family economic situation and other community-level variables, this negative consequence of father's migration on children's health might be due to the loss of parental time and supervision by fathers. When the father is absent, the mother is likely to be burdened with other tasks and to experience psychological stress, or mothers might pay less attention to cooking varied and nutritious food when their husband is absent. Another possibility is the perceived loss of security experienced by children. After all, existing research showed that children feel more relaxed and protected when living together with their fathers, as fathers are often considered "pillar of the household" in Chinese families (Bulbeck 2005).

The results further indicate that the influence of father's migration on childhood illness changed over time as rural-to-urban mass migration became more common in China. This change in migration prevalence coincided with our study period from 1997 to 2009, particularly after the middle years of the 2000s, confirming our second hypothesis that the positive influences of parental migration on childhood illness have diminished over time. As such, our findings suggest that when migration becomes a social norm in rural China, families and local communities can better adapt to the changes in family arrangements caused by migration, which may reduce its negative influences on children's health. Having grandparents at home also slightly modifies the relationship between parental migration and illness. If there is no grandparent at home, the negative influence of father's migration on childhood illness is slightly intensified. However, the presence of grandparents is a

relatively loose measure of substitute care provision. We have no information on whether the presence of grandparents is due to the children's needs or the elderly grandparent's needs. The two opposing forces might offset each other when influencing children's health.

This study furthermore showed that doing household work made children more likely to become ill, but it only slightly reduced the effect of father's migration on childhood illness. Its influence on child illness is largely independent of whether parents are migrating. The underlying mechanism for this effect cannot be examined in this study, so we can only speculate about it. One possibility is that doing household chores distracts children from time spent on resting, relaxing, and playing. In rural areas, they may be doing laborious chores, such as weeding, harvesting, feeding animals, and farming, that might lead to fatigue or injury. However, due to data limitations, we cannot directly test whether time constraints among adult family members lead to a higher risk of sickness in children.

There are limitations to this study that warrant further consideration: First, childhood illness is a self-/proxy-reported measure and covers only the month prior to the time of survey. Thus, the measure is not representative of long-term illnesses. Furthermore, children, parents, or other family members who are more sensitive about childhood illness might report more illnesses, even if it is just some mild condition, while less sensitive parents or children might underreport. With greater awareness of health matters over time, people are probably becoming more sensitive to identifying illness. This might have partially contributed to the rising trends in childhood illness in China over the past two decades. There may also be negative health effects related to modern developments, such as pollution and obesity. Moreover, health effects might be seasonal. In the peak influenza season, the reporting rate could be much higher than at other times. However, we confirmed with the survey institute that all data were collected in the same season (from August to December) across all waves. As a result, this should not have caused the fluctuation of sickness levels across years.

Secondly, due to data limitations, we cannot establish a causal relationship between parental migration and children's health. In the first place, the temporal ordering of the father's migration and childhood illness cannot be determined, although we believe the influence to be minor, because information on childhood sickness was requested for only the preceding 4 weeks, while the father's migration could have occurred at any point before the survey (spanning several years). In additional analysis (*available on request*), we also tried to examine the impact of the duration of parental migration on childhood illness among children who are left behind, but did not find any significant difference between different durations. In the second place, we cannot overcome potential bias caused by the unobserved factors, which might influence the father's migration and children's health simultaneously. For example, the father's decision to migrate might be caused by the children's health shocks. As a result, reverse causality and omitted variable bias threaten a causal argument, which we are unable to address. With the availability of instrumental variables and experimental data in the future, this causal relationship can probably be better established. We think that some qualitative research will also be beneficial for a further understanding of these issues. In particular, through

qualitative research, we can obtain more detailed information about how parents interact with children, especially in terms of delivery of health knowledge through visits or communication by technology such as mobile phones.

Thirdly, due to a lack of information on family members who remain behind, we could not very well examine the mechanism underlying parental migration and, in particular, the effect of such migration on childhood illness. Although we made some speculations, the nuances of how the father's migration is associated with children's health warrants further study. The presence of grandparents does not have a direct impact on childhood illness, although it slightly modifies parental migration's effect on childhood illness. Doing chores has a negative impact on child health, but we lack information on what kinds of chores are more likely to lead to illness or injury. Moreover, the data do not allow us to examine whether the grandparents are care providers or whether they are living together with their offspring due to their own health needs, so the lack of direct impact of grandparents on children might be related to this circumstance. Another limitation is related to missing data, about half which was due to missing information about parental migration. Judging by the nature of the collection of the CHNS, we speculate that this situation is mainly caused by parental death or divorce. Unfortunately, we could not obtain these parents' marital status as such information was only collected for people who were remaining in the households in which child data were obtained.

Despite these limitations, this paper fills a gap in the literature on how parental migration influences childhood illness in the context of internal migration in China, which is an extension of existing studies in other settings. Despite similarities in the effects on children's well-being, China's internal migration context is interesting in that, on the one hand, the *Hukou* system creates barriers to migration like those experienced by international migrants, but on the other hand, migration is entirely domestic, which represents fewer impediments, such as language barriers. Chinese migrant parents may therefore have more latitude to travel home to visit and take care of a sick child, whereas international migrants would certainly face greater barriers to movement or travel to return to their origin country. Nonetheless, it should be noted that although this article focuses on the consequence of children being left at home by their migrating parents within rural China, the issue extends far beyond, as both internal and international migrations continue to increase throughout developing countries.

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