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The Effects of Migration on Child Health in Mexico

Mexico has a long history of sending migrants to the United States, and that flow has grown over time. At any given time, the equivalent of one-eighth of Mexico's labor force is employed in the United States.[1] Remittances from these migrants were estimated as high as U.S.$14.5 billion in 2003. This amount is equivalent to about 1.5 percent of Mexico's GDP, and it surpasses tourism and foreign direct investment as a source of foreign currency.[2]

A decade after the North American Free Trade Agreement (NAFTA) ushered in the free movement of goods and capital, labor mobility between the United States and Mexico remains a contentious issue in U.S.-Mexico relations. In the Guanajuato Proposal of 2001, the presidents of the two countries pledged to work toward more orderly migration between the two countries, discussing proposals for a new temporary worker program and for clarifying the legal status of undocumented Mexicans in the United States.[3] Security concerns halted this process following the September 2001 terrorist attacks on the United States. But talks have resumed, and President Bush launched discussions of immigration reform within one week of being elected to a second term.[4]

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1. Escobar Latapí and others (1998).

2. Scott Johnson and Joseph Contreras, "The Migration Economy," *Newsweek,* 19 January 2004, p. 36; Iliana Chávez M., "Las remesas de los migrantes superarán la inversión extranjera," *El Herald de México,* 9 October 2003, pp. 1A and 4A.

3. See "U.S.-Mexico Migration Talks and Plan of Action for Cooperation on Border Safety," Joint Communiqué, U.S. Embassy in Mexico, 22 June 2001.

4. See "Bush Revives Bid to Legalize Illegal Aliens," *Washington Times,* 10 November 2004, pp. A1 and A15.

A comprehensive understanding of the impact of migration on both sides of the border is a prerequisite for making informed policy decisions. A large literature focuses on the consequences of immigration for the U.S. economy and U.S. workers. Borjas provides a survey of this literature. He concludes that the economic benefits of immigration are relatively small on aggregate, but the distributional consequences can be large.[5] Borjas argues that Mexican immigrants are "negatively selected," meaning that they tend to be predominantly low skilled. This can have harmful effects on the lowest-skilled Americans.

Economists have given relatively little attention to the impact of emigration on the sending country, although the large prevalence of migration and the size of the remittance flows are likely to have a significant impact on the Mexican economy and on Mexican households. At an aggregate level, remittances have short-run effects (on prices and exchange rates) and long-run implications (through their impact on productivity, inequality, and poverty). At the microeconomic level, early sociological studies emphasize that remittances mostly finance consumption and housing expenditures, with limited dynamic effects.[6] More recent research finds that migration is associated with higher levels of entrepreneurship and educational attainment among migrants' children.[7]

This paper investigates the impact of migration on human capital accumulation, focusing on child health outcomes. This is an important aspect of well-being and a key determinant of future productivity. Our results provide evidence that the impact of migration exceeds the direct effects of remittances, suggesting that the additional indirect benefits and costs of migration should be considered in the design of optimal migration policy.

The identification of the health effects of migration is complicated by the fact that migrants are not randomly drawn from the general population. Individuals in poor health are unlikely to be able to endure the rigors of crossing the border into the United States, while the most prosperous and healthy rural Mexicans are not likely to find that the benefits of illegal migration outweigh their other options in Mexico. Another issue is that unobserved shocks such as crop failures or natural disasters may be both an impetus for migration and a cause of worsening health conditions in the community. Consequently, a

5. Borjas (1999).

6. See the literature review in Durand, Parrado, and Massey (1996).

7. See, for example, Hanson and Woodruff (2003) on education; Woodruff and Zenteno (2001) on microenterprises.

simple comparison of the health of migrants and nonmigrants and their children will not provide reliable estimates of the effects of migration.

In this paper we use instrumental variables to account for these difficulties and provide credible estimates of the impact of migration on child health. In turn, these estimates allow quantification of some of the benefits of migration for human capital accumulation in the home country. We draw on a nationally representative demographic survey, the 1997 ENADID, to provide a broad sample of migrants in rural communities with varying levels of migrant experience.[8] We use historic migration networks formed as a result of U.S. demand conditions and the pattern of development of the railroad system in the early 1900s as instruments for current levels of migration. Infant mortality rates and birth weights are the two child health outcomes considered. We find that migration results in lower infant mortality rates and higher birth weights, and failure to account for the selectivity of migration understates these gains. We also find, however, that children in migrant households receive less preventive health inputs such as breast feeding and vaccinations, which may have a detrimental impact on child health at older ages.

Having identified a positive overall effect of migration on child health, we then examine the principal channels through which migration improves health. We use the Grossman health production function approach to explain the likely channels through which migration can affect health outcomes.[9] The first avenue is the direct effect of migration on income and wealth through remittances and repatriated savings, which allows households to spend additional resources on food and health services. Second, migrants may gain health knowledge through exposure to U.S. practices, resulting in a more effective use of financial resources and thus a higher health attainment. We find evidence that migration influences health outcomes through both of these mechanisms: it raises both wealth and health knowledge.

Previous research on the interaction between migration and health is limited, and it tends to focus on differences between immigrants and the native-born population in the United States. This work finds that migrants have worse health along a number of dimensions, but that they have surprisingly positive birth outcomes given their socioeconomic status.[10] Analyses of the impact of migration on health outcomes in the sending region are even scarcer, although

8. INEGI (1999).
9. Grossman (1972).
10. See, for example, Institute of Medicine (1998). Frank and Hummer (2002) provide discussion and references.

two studies by sociologists provide a first assessment. Kanaiaupuni and Donato use data from five Mexican states drawn from the Mexican Migration Project. They find mixed effects of migration on infant mortality, suggesting that it increases in the early stages of the migration process and then declines.[11] Frank and Hummer use the same ENADID data as this study to look at the effect of migration on the incidence of low birth weight; they find the children of migrants to be less likely to be underweight than the children of nonmigrants.[12]

This paper builds on the two sociological studies and the existing literature in several important respects. Despite some discussion of possible selection bias, the two sociological studies choose to treat migration and remittances as exogenous, and their estimated effects of migration are thus probably contaminated by selection bias. By contrast, this paper uses a broad representative survey on both of the health measures studied by these authors, and we explicitly address the endogeneity of migration. We also consider the impact of migration on preventive health care. Previous research finds an important role for migration networks in providing information about the border-crossing process and about labor market opportunities in the United States.[13] Our paper provides a first investigation of the channels through which these networks affect child health, and it shows that the migration process can result in improved health knowledge.

The remainder of the paper is structured as follows: The next section describes the data we use, while the subsequent section discusses the possible selection effects arising from migration and the instrumental variables method. We then estimate the impact of migration on fertility and provide the main results of the effects of migration on infant mortality, birth weights, and preventive care. A later section investigates the channels through which migration affects health outcomes, and the final section concludes. An appendix provides additional detail on the construction of our measure of health knowledge.

Data

This paper uses data from the 1997 *Encuesta Nacional de Dinámica Demográfica* (ENADID) conducted by Mexico's National Institute of Statistics,

11. Kanaiaupuni and Donato (1999).
12. Frank and Hummer (2002).
13. Espinosa and Massey (1997); Munshi (2003).

Geography, and Information (INEGI) in the last quarter of 1997.[14] The ENADID is a nationally representative demographic survey providing information about fertility and contraceptive practices, mortality, and migration. Our analysis uses existing migration networks in each community to control for the nonrandom selection of migrants. The theoretical foundations of our work apply most directly to migration networks in rural communities, so we restrict our analysis to households in municipalities with populations of less than 100,000. The survey asks detailed questions about the fertility history of all women aged fifteen to fifty-four in each household. This gives us an initial sample of 42,527 women aged fifteen to fifty-four living in 29,498 households located in 612 municipalities with populations less than 100,000 across all thirty-one states and the Federal District.

The ENADID survey enables us to construct two indicators of child health outcomes: infant mortality and birth weight. Infant mortality is defined in the standard way, as a live birth dying during the first year of life. Mothers are asked detailed information about their last two births since 1 January 1994, including the birth weight in kilograms of the baby. The initial sample is first used to examine whether women in migrant households are any more or less likely to have had a child since 1 January 1994 than women in nonmigrant households. Finding no difference, we then condition on fertility and study infant mortality and birth weight for babies born after this date for the remainder of our analysis. After we drop missing values, this results in a main sample of 16,593 children born to 12,767 mothers in 12,396 households in 601 municipalities (across all thirty-one states and the Federal District).

Data on birth weight are only available for 12,974 children as a result of both nonresponse and the fact that these data were only collected for the last two children born in each household since 1 January 1994. Furthermore, some misreporting is apparent at the tails, with reported birth weights ranging from 0.5 kilograms to 6.5 kilograms. We trim the top and bottom 1 percent of birth weight observations to reduce this measurement error, leaving a sample of 12,117 children for our birth weight analysis. Nonreporting of birth weight is more common for less educated mothers and, conditional on education, slightly more prevalent in households without a migrant than in households

14. A less comprehensive version of this survey was undertaken in 1992. We restrict ourselves to the 1997 wave because the 1992 wave contains less information on the child health measures used in this paper. Survey methodology and questionnaires are contained in INEGI (1999).

with a migrant. We examine the sensitivity of our results to these reporting differences below.

We classify households according to whether they had at least one member aged fifteen and over who migrated to the United States prior to 1 January 1994. We are then able to look at the impact of previous migrant experience on subsequent child health measures. This timing allows us to avoid concerns that child health outcomes and the migration decision are both the result of contemporaneous shocks, such as poor weather or disease outbreaks. The ENADID survey asks whether each member of the household has ever been to the United States in search of work and whether they have ever lived in the United States. These questions are asked of all household members who normally live in the household, even if they are temporarily studying or working elsewhere. An additional question is whether any household members have gone to live in another country in the past five years. The survey asks migrants how long they have been living in their current location, the year of their last trip to the United States, and the number of times they have been to the United States, but it does not ask the year of their first trip. We therefore classify individuals as having migrated prior to 1 January 1994 if their last trip was before this date; if they made at least two trips to the United States and their last trip was in 1994; or if they made three (or four or five) trips to the United States and their last trip was in 1995 (or 1996 or 1997). In addition to establishing a binary classification into migrant and nonmigrant households, we also construct household migration prevalence ratios, defined as the proportion of individuals aged fifteen and over in the household who had been to the United States prior to 1 January 1994.

Table 1 presents summary statistics for the sample of households in which a child was born after the start of 1994, along with *t* tests for differences in means between migrant and nonmigrant households. The table shows that 19 percent of households have at least one migrant, while 9 percent of all adults in the sample had migrated to the United States at least once before 1994. The infant mortality rate in our sample is 23.7 per 1,000 live births, which is close to the adjusted rate for all of Mexico in 1995 of 25.9.[15] Based on the international standard whereby low birth weight is classified as under 2.5 kilograms, 7.5 percent of births in our sample are estimated to be under-

15. PAHO (1998). Since our sample excludes urban areas, we would expect a higher infant mortality for our sample than for all of Mexico. The unadjusted national infant mortality rate was 17.5 per 1,000 in 1995, which is perhaps more directly comparable to our rates (PAHO, 1998).

TABLE 1. Summary Statistics and Tests of Differences in Means for Sample of Households with a Child Born after 1 January 1994

		All households		Migrant households[a]	Nonmigrant households		
Variable	*No. observations*	*Mean*	*S.D.*	*Mean*	*Mean*	T *statistic*[b]	P *value*
Household-level observations							
Household migration prevalence 1994	12,396	0.094	0.214	0.488	0.000		
Proportion of households with at least one migrant	12,396	0.193	0.395	1	0		
State migration rate in 1924	12,396	0.007	0.009	0.012	0.006	−30.92	0.000
State migration rate in 1955–59	12,396	0.015	0.016	0.025	0.013	−34.17	0.000
Income per capita	12,396	422.1	595.5	404.4	426.3	1.61	0.107
Infrastructure index	12,088	0.000	2.046	0.299	−0.072	−7.91	0.000
Household size	12,396	5.594	2.422	5.700	5.568	−2.39	0.017
Number of recent mothers aged 15–54[c]	12,396	1.034	0.196	1.036	1.033	−0.63	0.526
Number of children born since 1 January 1994	12,396	1.344	0.595	1.358	1.340	−1.30	0.195
Mother-level observations							
Mother's age	12,767	27.5	6.6	28.4	27.3	−7.52	0.000
Mother's years of schooling	12,767	6.68	3.46	6.65	6.69	0.43	0.670
Mother's health knowledge index	12,720	0.000	1.978	0.298	−0.072	−8.35	0.000
Child-level observations							
Infant mortality rate per 1,000	16,593	23.7	152.3	21.0	24.4	1.16	0.247
Birth weight (kilograms)	12,117	3.251	0.564	3.310	3.235	−5.87	0.000
Proportion underweight	12,117	0.075	0.264	0.058	0.080	3.71	0.000
Proportion delivered by doctor	14,083	0.768	0.422	0.851	0.749	−11.65	0.000
Proportion breast-fed	14,571	0.905	0.293	0.891	0.908	2.76	0.006
Proportion visiting doctor in first year of life	14,079	0.795	0.403	0.782	0.798	1.93	0.054
Proportion receiving all vaccines[d]	13,989	0.733	0.442	0.738	0.732	−0.57	0.568

a. Migrant households are defined as households with at least one migrant to the United States prior to the start of 1994.
b. *T* test is for difference in means between migrant and nonmigrant households.
c. Recent mothers are defined as mothers of children born after 1 January 1994.
d. All vaccines include vaccines for tuberculosis, polio, DPT, and measles.

weight. This compares with a 1997 estimate of 8 percent for Mexico as a whole.[16] Our data therefore appear to be well representative of general child health conditions in Mexico.

An initial comparison of migrant and nonmigrant households reveals differences in child health outcomes, health inputs, and household characteristics. Children in migrant households are less likely to be born underweight, have higher average birth weights, and were more likely to have been delivered by a doctor than is the case with children of nonmigrant households. Infant mortality rates are higher in nonmigrant households, but this difference is not statistically significant. However, children in nonmigrant households appear to be slightly more likely to be breast-fed and to have visited a doctor during their first year of life. Migrant households are seen to be slightly larger in size and have older mothers with more health knowledge. Mean household income is not statistically different between migrant and nonmigrant households, but migrant households have better household infrastructure.

Selection Effects and the Instrumental Variables Strategy

The fundamental question that this paper seeks to address is whether these differences in child health outcomes between migrant and nonmigrant households are a result of migration itself, whether they are caused by external conditions affecting both migration and child health, or whether they are simply a reflection of differences in the observable and unobservable characteristics of these households. External shocks, such as crop failure, disease outbreaks, or poor economic conditions in the home community, may both increase migration rates and worsen health conditions. This would tend to result in an underestimation of the health-improving effects of migration. To provide a first means of mitigating such a possibility, we look only at household migration decisions made prior to the birth of children, as well as using the instrumentation strategy described below.

Migrants and nonmigrants may differ along a number of unobservable dimensions that may be correlated with child health outcomes. For example, parents who care more about the health of their future children may migrate in order to increase the resources they will have for raising them, and they may also take better care of maternal and child health during pregnancy and infancy. If this is the case, a simple comparison of migrants and nonmigrants

16. UNICEF (1997).

will overstate the health gains from migration. Individuals may also select into migration according to their health status, although the direction of this selection effect is unclear a priori. The physical nature of migration itself, especially for undocumented migrants making hazardous border crossings, would tend to result in healthier individuals migrating. However, Borjas argues that migrants will be negatively selected from countries such as Mexico, which have higher inequality than the United States, because the incentives for remaining in Mexico are greatest for people in the top of the distribution.[17] If more educated and wealthier people tend to have better health, then this factor would result in migrants having poorer health than nonmigrants. In practice, migration is costly in terms of both the physical and material costs, so the first migrants usually come from the lower-middle ranges of the socioeconomic scale.[18] It is therefore not clear whether they will tend to be negatively or positively selected, on average, compared with non-migrant households.

We employ an instrumental variables strategy to separate the effect of migration from the impacts of these selection mechanisms. Substantial evidence indicates that migration networks play an important role in determining migration from Mexico.[19] We follow earlier works in using historic state-level migration rates as an instrument for current migration stocks.[20] The U.S. migration rate in 1924 for the state in which the household is located is taken from Foerster.[21] Figure 1 shows the geographical distribution. The highest rates are found in the west-central states of Michoacán, Jalisco, Zacatecas, and Durango, along with the border states of Sonora and Coahuila. The lowest rates are found in the most southern states of Quintana Roo, Chiapas, and Yucatán. Nevertheless, high migration does not simply correspond with the border states, and migration rates vary among states of equal distance from the border. These historic rates are arguably the result of the pattern of arrival of railroads into Mexico, coupled with U.S. demand conditions arising from restrictions on immigration from Asia at the turn of the century. Massey, Durand, and Malone outline how these conditions led to some states' having different initial migration rates than others.[22] These initial

17. Borjas (1987).

18. Massey, Goldring, and Durand (1994).

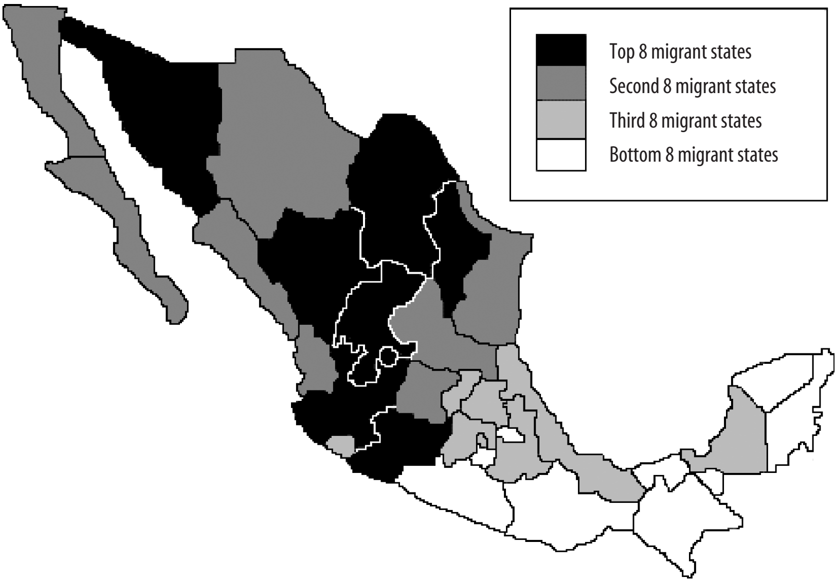
19. See Massey, Goldring, and Durand (1994); Winters, de Janvry, and Sadoulet (2001); Munshi (2003).

20. Woodruff and Zenteno (2001); McKenzie and Rapoport (2004).

21. Foerster (1925).

22. Massey, Durand, and Malone (2002).

FIGURE 1. Map of 1924 State Migration Rates



Source: Authors' rendering of state migration data from Foerster (1925).

migration networks then lowered the cost of further migration. Massey, Goldring, and Durand argue that this resulted in "a self-reinforcing process that . . . over time . . . becomes increasingly independent of the conditions that originally caused it."[23]

As a consequence, a household living in a community that had high levels of migration in the early twentieth century has a higher likelihood of having a migrant member than an otherwise identical household living in a community with low initial migration rates. We therefore use the 1924 state migration rate as an instrument for whether a household had a migrant member in 1994 and for household migration prevalence. Table 2 shows the first-stage results for our instrumental variables estimation. Columns 1 and 2 show that the historic migration rate is an extremely strong determinant of whether a household has a migrant member, with the *F* statistic on the 1924 migration rate above 30. Our estimation thus does not appear to be subject to weak instrument concerns.

23. Massey, Goldring, and Durand (1994, p. 1496).

TABLE 2. First-Stage Results[a]

Explanatory variable	*Household has a migrant member* (1) Probit	(2) OLS	(3) OLS	*Household migration prevalence* (4) OLS
Migration rate in 1924	11.240	12.541	12.789	6.405
	(5.84)**	(6.09)**	(5.70)**	(5.69)**
Age of mother	0.013	0.012	0.011	0.015
	(3.92)**	(3.40)**	(3.15)**	(5.00)**
Age of mother squared	–0.000	–0.000	–0.000	–0.000
	(2.98)**	(2.55)*	(2.42)*	(4.47)**
Mother's years of schooling	–0.000	–0.001	–0.000	–0.002
	(0.14)	(0.40)	(0.29)	(1.48)
Household size	0.005	0.005	0.004	–0.005
	(2.41)*	(2.38)*	(2.20)*	(4.41)**
State-level controls[b]				
Infant mortality rate in 1930			0.001	
			(1.23)	
Doctors per 100,000 population			0.000	
			(0.02)	
Hospital beds per 100,000 population			–0.000	
			(0.24)	
Nurses per 100,000 population			0.001	
			(0.37)	
Hospitals per 100,000 population			–0.063	
			(1.51)	
State GDP per capita 1997			–0.008	
			(1.65)	
Constant		–0.117	–0.119	–0.140
		(2.29)*	(1.47)	(3.90)**
Summary statistic				
No. observations	16,593	16,593	16,593	16,593
R squared		0.08	0.09	0.08
F statistic on 1924 migration rate	34.1	37.1	32.5	32.4

* Statistically significant at the 5 percent level.
** Statistically significant at the 1 percent level.
a. Coefficients for the probit are marginal effects. Robust *t* statistics are in parentheses and are clustered at the state level.
b. State-level health infrastructure data are for 1996.

Threats to Instrument Validity

Our identifying assumption is that the historic community migration rates, reflecting the pattern of early development of the railroad system in Mexico, do not affect child health outcomes over seventy years later, apart from their influence through current migration. Our instrumental variables estimation

TABLE 3. Correlations between Historic Migration Rates and Other State-Level Variables

State-level variable	*Rank-order correlation with 1924 state migration*	P *value for test of independence*
Infant mortality in 1930	0.2268	0.212
Doctors per 100,000 in 1996	0.1381	0.451
Beds per 100,000 in 1996	0.4003	0.023
Nurses per 100,000 in 1996	0.2584	0.153
Hospitals per 100,000 in 1996	−0.0457	0.804
State GDP per capita in 1997	0.3108	0.083

relies on this exogeneity assumption, and it is therefore important to consider possible threats to its validity. We consider two such threats. The first is that different states in Mexico may have different disease environments that have persisted through time. In other words, households in the 1920s may have migrated to escape from states with poor health conditions, and households today may continue to do the same. If this were true, we would find that households in high migration states have worse health outcomes than households in low migration states—not as a result of migration, but as a consequence of the persistent poor health conditions in those states. We examine this possibility in table 3 by testing for independence between the infant mortality rates in 1930, the earliest available at the state level, and the 1924 state-level migration rates.[24] The Spearman rank correlation coefficient of 0.23 is insignificantly different from zero, so we cannot reject the null hypothesis of independence. That is, there is no significant relationship between historic infant mortality and historic migration. Nevertheless, we include the 1930 state infant mortality as an additional control in our analysis.

A second potential threat is that the pattern and timing of the historical development of the railroads, in addition to spurring migration, led to increased economic development and, in particular, expanded health infrastructure. As such, the historic migration rate in a state could be positively correlated with the current level of health infrastructure in that state. Table 3 examines the relationship between the 1924 migration rate and four measures of state-level health care provision in 1996: doctors, hospital beds, nurses, and hospitals per 100,000 inhabitants.[25] High migration states have significantly more hospital beds per capita, but no more doctors, nurses, or hospital buildings. Our final check on overall economic development yields a mar-

24. Infant mortality rates in 1930 are taken from INEGI (2001).
25. These measures are taken from Secretariat of Health (1997).

ginally significant positive correlation between historic migration rates and the 1997 state GDP per capita.[26] Migration itself may have resulted in increased development, so controlling for these variables may remove some of the effects of migration. We therefore present results both with and without these controls when we examine the impact of migration on the principal health outcomes.

Column 3 of table 2 shows that after we add these state-level controls, the 1924 state-level migration rate remains a strong instrument, while none of the state controls are individually significant. This gives us some confidence in the validity of our instrument.

Estimation Methods

Standard two-stage least squares (2SLS) estimation can be used to estimate the impact of migration on birth weight using the historic migration rate as an instrument. Infant mortality is a binary outcome, however, which raises additional estimation choices. Our baseline approach is to use maximum likelihood estimation of Amemiya's generalized least squares estimator.[27] We can then compare the results with those obtained under standard probit estimation when we do not use an instrument. This reduces to a bivariate probit model when our measure of migration is the binary indicator of whether the household has a migrant member. We refer to this as the IV-probit method. This method results in predicted outcomes that lie between 0 and 1, but it relies on joint normality assumptions that may not apply in practice. As an alternative, we also present results from 2SLS estimation. Angrist provides conditions under which linear instrumental variables estimation will consistently estimate average treatment effects in the case of a binary endogenous variable.[28] While these conditions are unlikely to hold exactly, Angrist uses Monte Carlo evidence to argue that they may hold approximately and that the 2SLS technique can perform well in practice.

The Effect of Migration on Fertility

One possible channel through which migration may affect observed child health outcomes is fertility. Migration may alter the fertility decision through

26. State GDP per capita are obtained from *Sistema de Cuentas Nacionales,* available on the INEGI website (www.inegi.gob.mx, accessed 9 November 2004).

27. See Newey (1987). This is estimated using STATA's divprobit add-in package.

28. Angrist (1991).

a number of avenues, such as changes in household income, the opportunity cost of time, and knowledge about contraceptive practices. The decision of whether and when to have a child may affect child health outcomes irrespective of any other effects of migration on health, because having children at very short intervals raises the risk of infant death.[29] We therefore first use our full sample of women aged fifteen to fifty-four to assess whether any differences in child health between migrant and nonmigrant families are in part due to differences in fertility.

Our measures of child health only encompass households that have had a child since 1 January 1994. The first five columns of table 4 examine whether women aged fifteen to fifty-four in migrant households are any more or less likely to have had a child in this period than women in nonmigrant households. Columns 1 and 2 use a probit specification, while columns 3, 4, and 5 use regression. The probit, ordinary least squares (OLS), and instrumental variables results all show a small and insignificant effect of being in a migrant household on the likelihood that a woman gave birth after the start of January 1994. Columns 6 and 7 then investigate the impact of migration on the number of children ever born to women aged fifteen to fifty-four as of the survey date. The OLS results show a significant positive effect of being in a migrant household. We find this effect to be insignificant, however, after instrumenting. We therefore conclude that household migration status does not affect either total fertility or the likelihood that a woman had a child after 1 January 1994. For the remainder of our analysis, we consider health outcomes of children conditional on the children being born.

The Effect of Migration on Child Health

Using this instrument, we now proceed to estimate the causal effect of migration on two child health outcomes: infant mortality and birth weight. We then look at how migration affects child health inputs to provide a broader picture of the child health impact of migration.

Impact on Infant Mortality

Table 5 examines the impact of migration on infant mortality, an extreme measure of child health outcomes. Columns 1 through 5 consider the effect of

29. See, for example, Bongaarts (1987).

TABLE 4. The Effect of Migration on Fertility[a]

	Mother had a child after 1 January 1994					Total no. children ever born	
Explanatory variable	*(1) Probit*	*(2) IV probit*	*(3) OLS*	*(4) 2SLS*	*(5) 2SLS*	*(6) OLS*	*(7) 2SLS*
Migrant household	−0.009	0.008	−0.007	0.009	0.031	0.140	0.375
	(1.45)	(0.39)	(1.09)	(0.26)	(0.81)	(3.50)**	(1.43)
Mother's age	0.131	0.131	0.081	0.081	0.081	0.249	0.250
	(50.69)**	(71.01)**	(31.76)**	(31.70)**	(31.74)**	(23.44)**	(24.32)**
Mother's age squared	−0.002	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
	(48.56)**	(71.58)**	(38.26)**	(38.15)**	(38.23)**	(7.57)**	(7.84)**
Mother's years of schooling	−0.014	−0.014	−0.013	−0.013	−0.013	−0.174	−0.173
	(19.72)**	(24.32)**	(16.04)**	(15.83)**	(14.57)**	(41.07)**	(40.91)**
State-level controls[b]	No	No	No	No	Yes	Yes	Yes
Summary statistic							
No. observations	42,527	42,527	42,527	42,527	42,527	40,372	40,372
R squared			0.13				0.55

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. Coefficients for the probit are marginal effects giving the discrete change in the probability of a child's being born for a migrant household, and the change in the probability for infinitesimal changes in the other variables. The state migration rate in 1924 is used as instrument for being in a migrant household. Robust t statistics are in parentheses and are clustered at the state level.

b. State-level controls are the 1930 infant mortality rate, health infrastructure, and the 1997 GDP per capita.

TABLE 5. The Effect of Migration on Infant Mortality[a]

Explanatory variable	(1) Probit	(2) IV probit	(3) OLS	(4) 2SLS	(5) 2SLS	(6) Probit	(7) IV probit	(8) OLS	(9) 2SLS	(10) 2SLS
Migrant household	−0.003	−0.030	−0.003	−0.045	−0.037					
	(0.96)	(3.97)**	(1.07)	(4.10)**	(3.21)**					
Mother's age	−0.002	−0.001	−0.002	−0.001	−0.001	−0.002	−0.000	−0.002	−0.000	−0.001
	(1.27)	(0.74)	(1.12)	(0.79)	(0.85)	(1.22)	(0.15)	(1.07)	(0.27)	(0.42)
Mother's age squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(1.24)	(0.84)	(1.12)	(0.90)	(0.93)	(1.20)	(0.27)	(1.07)	(0.40)	(0.52)
Mother's years of schooling	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
	(5.22)**	(5.21)**	(5.04)**	(5.16)**	(5.00)**	(5.24)**	(5.49)**	(5.06)**	(5.38)**	(5.28)**
Household size	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.002	−0.001	−0.002	−0.002
	(1.53)	(2.00)*	(1.58)	(1.47)	(1.72)	(1.58)	(3.32)**	(1.64)	(2.20)*	(2.26)*
Household migration prevalence						−0.009	−0.090	−0.009	−0.088	−0.073
						(1.36)	(3.97)**	(1.55)	(3.97)**	(3.28)**
State-level controls[b]	No	No	No	No	Yes	No	No	No	No	Yes
No. observations	16,593	16,593	16,593	16,593	16,593	16,593	16,593	16,593	16,593	16,593

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. The dependent variable is a dummy for a child dying before age one. Coefficients for the probit are marginal effects giving the discrete change in the probability of an infant dying for a migrant household, and the change in the probability for infinitesimal changes in the other variables. The state migration rate in 1924 is used as instrument for being in a migrant household. Robust *t* statistics are in parentheses and are clustered at the state level.

b. State-level controls are the 1930 infant mortality rate, health infrastructure, and the 1997 GDP per capita.

having at least one household member who is a migrant, while Columns 6 through 10 use the proportion of adults in the household with U.S. migration experience. When migration is treated as exogenous, we find a small, negative, and insignificant effect of migration on infant mortality. Once we instrument for migration status, we find a strongly significant negative effect of migration. Children born in households with a migrant member are estimated to be 3.0 percent (IV-probit) to 4.5 percent (2SLS) less likely to die in their first year than children born in households without a migrant member. Controlling for state-level health infrastructure, historic state infant mortality rates, and state GDP per capita reduces the estimated effect slightly to 3.7 percent. Likewise, children in households with a higher prevalence of migration are found to be statistically less likely to die as infants. A one-standard-deviation increase in household migration prevalence is estimated to result in a 1.8 percent lower infant mortality rate, which is approximately three times the size of the reduction associated with a one-standard-deviation increase in the schooling of the mother.

Impact on Birth Weight

Birth weight is an important early indicator of child health. Infant mortality risk declines steeply with birth weight.[30] Low birth weight can also result in cognitive and neurological impairment that limits the returns to human capital investment later in life. Using data on twins, Behrman and Rosenzweig find significant positive effects of higher birth weight on schooling attainment, adult height, and labor-market payoffs.[31] Any impact of migration on birth weight is therefore likely to have important short- and long-term effects.

Table 6 estimates the effect of migration status on birth weight and on the probability of being born underweight (less than 2.5 kilograms). The OLS results in column 1 show a significant but small (69 grams) increase in birth weight associated with having a migrant in the household. As discussed earlier, birth weight is only reported for 73 percent of the babies born after 1 January 1994, with nonreporting more prevalent among mothers with lower schooling and slightly more prevalent in nonmigrant households. We use maximum likelihood estimation of Heckman's sample selection model to examine whether differences in reporting between migrant and nonmigrant

30. Wolpin (1997).
31. Behrman and Rosenzweig (2003).

TABLE 6. The Effect of Migration on Birth Weight[a]

	Birth weight in kilograms							Underweight	
Explanatory variable	*(1) OLS*	*(2) Heckman*	*(3) 2SLS*	*(4) 2SLS*	*(5) 2SLS*	*(6) OLS*	*(7) 2SLS*	*(8) Probit*	*(9) IV probit*
Migrant household	0.069	0.065	0.364	0.335	0.350			–0.021	–0.054
	(4.00)**	(3.68)**	(2.79)**	(3.51)**	(4.11)**			(2.81)**	(2.59)**
Mother's age	0.022	0.021	0.017	0.019	0.019	0.021	0.013	–0.007	–0.006
	(2.77)**	(2.60)**	(2.11)*	(2.53)*	(2.26)*	(2.69)*	(1.58)	(2.05)*	(2.11)*
Mother's age squared	–0.000	–0.000	–0.000	–0.000	–0.000	–0.000	–0.000	0.000	0.000
	(1.62)	(1.43)	(1.15)	(1.39)	(1.26)	(1.52)	(0.62)	(1.70)	(1.78)
Mother's years of schooling	0.007	0.005	0.008	0.007	0.007	0.006	0.008	–0.003	–0.003
	(4.55)**	(3.71)**	(4.59)**	(4.59)**	(4.49)**	(4.28)**	(5.02)**	(4.02)**	(4.47)**
Household size	–0.006	–0.006	–0.008	–0.006	–0.005	–0.003	–0.000	0.001	0.001
	(2.67)*	(2.61)**	(3.47)**	(3.03)**	(2.31)*	(1.41)	(0.06)	(0.43)	(0.79)
Household migration prevalence						0.143	0.653		
						(4.19)**	(3.59)**		
State-level controls[b]	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Subsample of doctor-delivered babies	No	No	No	No	Yes	No	No	No	No
No. observations	12,117	16,593	12,117	12,117	10,687	12,117	12,117	12,117	12,117

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. Coefficients for the probit are marginal effects giving the discrete change in the probability of a child's being underweight for a migrant household, and the change in the probability for infinitesimal changes in the other variables. The state migration rate in 1924 is used as instrument for being in a migrant household. Column 2 corrects for selectivity resulting from missing observations on birth weight. Column (5) is only for the subsample of babies delivered by a doctor. Robust *t* statistics are in parentheses and are clustered at the state level.

b. State-level controls are the 1930 infant mortality rate, health infrastructure, and the 1997 GDP per capita.

households bias our estimates.[32] Column 2 reveals no significant change in the migration coefficient, which suggests that nonreporting should not bias our results.

Columns 3 and 4 of table 6 show a more sizable impact of migration on birth weights after instrumentation. Being in a household with at least one migrant is estimated to raise birth weight by 364 grams, or 0.64 standard deviation, and by 335 grams once state-level controls are included. Birth weight is probably measured most accurately for children delivered by doctors, so in column 5 we present the results just for this group of children. The resulting estimate of the increase in birth weight from migration is very similar to the results for the full sample. Column 6 shows that a one-standard-deviation increase in household migration prevalence raises birth weight by 140 grams, or 0.25 standard deviation. This effect is five times as large as that associated with a one-standard-deviation increase in the mother's schooling. Columns 6 and 7 provide similar results in terms of the impact of migration on the probability of being born underweight. Migration lowers this probability, with a stronger effect found after instrumentation.

Both the infant mortality and birth weight results show stronger improvements in child health from migration after instrumentation. Failure to consider the selectivity of migration therefore understates its impact. This suggests that in the absence of migration, children in what are currently migrant households would have poorer health status than children in observationally similar nonmigrant households. From this we infer that on net, Mexican migrants to the United States are negatively selected in terms of the health status of their children.

Impact on Health Inputs and Behaviors

The ENADID survey also provides results on several health inputs, during both birth and infancy. Table 7 examines the impact of migration on whether children were delivered by a doctor, whether they were breast-fed at all, whether they visited a doctor at least once in the first year of life, and whether they received vaccinations for tuberculosis, polio, measles, and diphtheria, tetanus, and pertussis (DPT). After instrumenting, we find that children in migrant households are significantly more likely than children in nonmigrant

32. Heckman (1979). We do not have variables that can plausibly be assumed to affect the likelihood of nonreporting of birth weight but not birth weight itself, so the selection correction relies on the standard functional form assumptions.

TABLE 7. The Impact of Migration on Health Inputs[a]

	Child was delivered by a doctor		*Child was breast-fed*		*Visited doctor in child's first year*		*Child received all vaccines[b]*		*Probability of dying aged one to four*	
Explanatory variable	*(1) Probit*	*(2) IV probit*	*(3) Probit*	*(4) IV probit*	*(5) Probit*	*(6) IV probit*	*(7) Probit*	*(8) IV probit*	*(9) Probit*	*(10) IV probit*
Migrant household	0.065	0.300	–0.017	–0.192	–0.027	–0.363	–0.000	–0.108	–0.002	–0.005
	(3.21)**	(13.26)**	(2.51)*	(5.56)**	(1.49)	(8.09)**	(0.01)	(2.58)**	(3.08)**	(2.70)**
Mother's age	0.005	–0.002	0.010	0.012	–0.006	–0.002	0.040	0.041	0.000	0.000
	(0.98)	(0.39)	(2.92)**	(4.08)**	(1.33)	(0.57)	(7.20)**	(8.99)**	(0.34)	(0.63)
Mother's age squared	–0.000	0.000	–0.000	–0.000	0.000	0.000	–0.001	–0.001	–0.000	–0.000
	(0.16)	(0.92)	(3.28)**	(4.42)**	(1.58)	(1.05)	(6.14)**	(7.39)**	(0.11)	(0.39)
Mother's years of schooling	0.040	0.039	–0.001	–0.001	0.024	0.024	–0.001	–0.001	–0.000	–0.000
	(19.19)**	(29.50)**	(0.85)	(0.75)	(13.18)**	(20.21)**	(0.96)	(1.09)	(3.36)**	(4.43)**
Household size	–0.017	–0.019	0.003	0.003	–0.011	–0.010	–0.010	–0.010	–0.000	–0.000
	(10.80)**	(13.58)**	(2.33)*	(3.26)**	(7.42)**	(7.43)**	(6.47)**	(6.50)**	(0.73)	(0.86)
State-level controls[c]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. observations	14,803	14,803	14,571	14,571	14,079	14,079	13,989	13,989	24,865	24,865

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. Coefficients for the probit are marginal effects giving the discrete change in the probability of the given health input for a migrant household, and the change in the probability for infinitesimal changes in the other variables. The state migration rate in 1924 is used as instrument for being in a migrant household. Column 2 corrects for selectivity resulting from missing observations on birth weight. Column (5) is only for the subsample of babies delivered by a doctor. Robust *t* statistics are in parentheses and are clustered at the state level.

b. All vaccines include tuberculosis, DPT, polio, and measles.

c. State-level controls are the 1930 infant mortality rate, health infrastructure, and the 1997 GDP per capita.

households to be delivered by a doctor, but less likely to be breast-fed, vaccinated, or taken to a doctor in their first year. Although migration seems to result in lower infant mortality, higher birth weights, and better care at the time of delivery, children of migrants apparently receive less preventive health care in their infancy. Possible reasons for this include, first, a higher opportunity cost of time for migrant parents and, second, periods in which one or both parents are absent from the children, which makes it difficult to breast-feed or take the children to health clinics.[33] Nevertheless, the last two columns of table 7 show that migrant children are slightly less likely than nonmigrant children to die between the ages of one and four, conditional on surviving to at least age one. This implies that the positive effects of migration for health outweigh any negatives for this group.

The Effect of Migration on Child Health Outcomes

The Grossman model of a health production function provides a theoretical framework that can be used to delineate the variety of mechanisms through which migration may be observed to affect child health outcomes.[34] The health status, H_i, of child i at a particular point in time can be written as:

$$H_i = h\left(M_i, T_i, K_i, B_i, \varepsilon_i\right), \quad (1)$$

where M_i represents the medical and nutritional inputs into the health of child i, such as pre- and postnatal care, maternal and postnatal nutrition, and the disease environment; T_i encompasses the time inputs of the parent; K_i is parental health knowledge; B_i represents biological endowments such as genetic factors; and ε_i represents random health shocks. In Grossman's original model health is both an investment and a consumption good, entering the utility function directly. Parents then maximize utility by choosing health inputs such that the present value of gross investment in health equals the marginal benefits. As discussed earlier, the migration decision of the household may be correlated with both its genetic health status, B, and with any random health shocks such as disease outbreaks, ε. Instrumental variables are thus used for estimation.

33. Breast feeding is associated with a number of positive health outcomes and is recommended by the World Health Organization (see González-Cossío and others, 2003).

34. Grossman (1972). See also the detailed discussion of the health production approach in Wolpin (1997).

The most obvious channel through which migration may affect child health is an increase in household income and wealth. Papers that attempt to identify the causal impact of income on health find evidence of a positive relationship at both the macro- and microeconomic levels.[35] As Wolpin notes, financial resources are not themselves direct inputs into health production, but rather determine the behaviors leading to the choices of M_i and T_i.[36] Higher income allows households to purchase more medical and nutritional inputs, since health is a normal good. Moreover, the income from migration may relax liquidity constraints that prevent parents from investing in child health in the current period in order to reap the returns in the future. Finally, the migration experience developed by parents makes it easier for their children to migrate, raising the expected adult wages of children and hence returns to investment in their health.

Migration and Health Knowledge

Migration may also have an impact on health outcomes through nonmonetary channels. One such channel is the transfer of health information. Grossman allows for education to change the efficiency of the health production process, resulting in better health production from a given input set.[37] Glewwe studies the mechanisms through which mothers' education raises child health in Morocco and concludes that mothers' health knowledge—rather than their level of schooling per se—is crucial for improving child health.[38] Migrants may gain information about basic health practices while abroad and share this with family members. Such information may include better understanding of contraceptive practices, the importance of sanitation, and knowledge about diet, exercise, and other lifestyle behaviors. Menjívar provides evidence that social networks among Guatemalan immigrants in the United States engage in regular transmission of medical knowledge, helping one another with information about treatments and health advice.[39]

As discussed in the appendix, we measure health knowledge by the first principal component of a set of questions asking mothers whether they can

35. On the macroeconomic level, see Pritchett and Summers (1996); on the microeconomic level, see Strauss and Thomas (1998).

36. Wolpin (1997).

37. Grossman (1972).

38. Glewwe (1999).

39. Menjívar (2002).

name ten different contraceptive methods, on their own or with help. This provides a measure of health knowledge which clearly represents fertility knowledge, and it may be broadly associated with more general health knowledge on the part of the mother. For example, based on data from the Mexican Health and Migration Survey (HMS) taken in eleven communities in the state of San Luis Potosí, we find a strong and significant correlation between our measure of health knowledge and whether the mother has a good explanation for the causes of diarrhea.[40] Table 8 examines the impact of migration on the health knowledge of mothers. Columns 1 and 2 indicate that mothers in migrant households have more health knowledge than mothers in nonmigrant households. After instrumenting, we find a strong effect of migration: being in a migrant household increases health knowledge by an estimated 0.65 standard deviation.

The remainder of table 8 explores this increase in health knowledge further. If health knowledge is gained directly by the migrant member, then we would expect to see a much larger increase in maternal health knowledge when the mother herself has migrated compared with when her husband or another family member migrates. The problem in attempting to examine this issue is that households choose whether to send the future mother, father, or both, and households that choose to send a mother may differ along a number of dimensions, including health knowledge, from those that choose to send a father. We do not have a suitable instrument for determining which household member migrates, so we present two sets of results. Columns 3 and 4 compare households in which the mother is a migrant with households in which no members have migrated, while columns 5 and 6 compare households in which the father is a migrant with households in which no members have migrated. We do indeed find that the increase in maternal knowledge associated with the mother's migrating is larger than that associated with the father's migrating. However, we cannot rule out the possibility that this result may reflect a selection effect, whereby households in historically high migration areas will only send a mother rather than a father if the mother has a high level of health knowledge.

Health knowledge may also be transmitted from one migrant family to another and from migrant households to nonmigrant households in the same community. These spillover effects can reinforce knowledge gained from migrant members, and they may contribute to the large gains in health

40. See www.mexmah.com for further description of this survey.

TABLE 8. The Impact of Migration on Maternal Health Knowledge[a]

Explanatory variable	*(1) OLS*	*(2) 2SLS*	*(3) OLS*	*(4) 2SLS*	*(5) OLS*	*(6) 2SLS*	*(7) OLS*	*(8) 2SLS*
Migrant household	0.266	1.289						
	(4.01)**	(2.61)**						
Mother has migrated			0.473	4.853				
			(4.41)**	(2.45)*				
Father has migrated					0.238	1.290		
					(3.37)**	(2.51)*		
Proportion of migrant households in municipality							0.519	1.272
							(1.81)	(3.07)**
No. observations	12,744	12,744	10,676	10,676	12,489	12,489	6,135	6,135

* Statistically significant at the 5 percent level.

** Statistically significant at the 1 percent level.

a. The dependent variable is the maternal health knowledge index. Regressions are for women aged 15–54 who gave birth between 1994 and 1997 and were the household head or spouse of the household head. Columns 7 and 8 are for these women in nonmigrant households in municipalities with fifty or more total households surveyed. All regressions include a quadratic in mother's age, mother's years of schooling, household size, 1930 infant mortality rate, health infrastructure, and 1997 GDP per capita, as well as a constant. Robust *t* statistics are in parentheses and are clustered at the state level.

knowledge we observe. Columns 7 and 8 of table 8 examine whether mothers in nonmigrant households living in communities with a large number of migrants have more health knowledge than mothers in nonmigrant households living in communities with fewer migrants. We restrict our sample to communities where at least fifty households were surveyed for this analysis. After instrumenting, we do find significantly higher health knowledge among nonmigrant households in communities with a high level of migration. The 2SLS coefficient indicates that a one-standard-deviation increase in the prevalence of migration in a community results in a 0.11 standard deviation increase in health knowledge of nonmigrant mothers. Since health knowledge is transmitted to nonmigrant households, some of the large impact of migration on health knowledge in migrant households probably results from spillover effects from other migrant families.

Wealth and Knowledge Effects

The ENADID survey does not contain information on time allocation, nutrition, or many other inputs into the health production function, and household income is only partially measured. We therefore examine the joint impact of migration on health outcomes through wealth (proxied by household infrastructure) and the health knowledge gains determined above. The ENADID survey contains information on household infrastructure, including whether the household has a dirt, cement, or wood floor; whether it has access to running water; the type of sanitation service; how the family disposes of dirty water; and whether they have electricity. We take the first principal component to form an infrastructure index of these components. Filmer and Pritchett show that such an index can provide reasonable estimates of wealth effects in situations where wealth data are not directly available.[41] Moreover, better infrastructure may also act as a direct input in the health production function. Column 1 of table 9 shows that migration results in higher scores of this infrastructure index, reflecting the direct wealth effect of migration. Column 2 repeats the health knowledge regression of table 8 for the sample of all mothers, not just spouses and heads of household, and again finds an increase in health knowledge arising from migration.

Migration thus increases both wealth and health knowledge. To approximate how much of the reduction in infant mortality and increase in birth weight from migration can be attributed to these channels, we reestimate the

41. Filmer and Pritchett (2001).

TABLE 9. The Effect of Migration on Improving Health Outcomes[a]

Explanatory variable	*Infrastructure index (1) 2SLS*	*Health knowledge index (2) 2SLS*	*Infant mortality (nonmigrant households) (3) Probit*	*Birth weight (nonmigrant households) (4) OLS*
Migrant household	3.196	1.300		
	(3.83)**	(2.48)*		
Mother's age	0.004	0.163	–0.001	0.019
	(0.19)	(7.12)**	(0.47)	(2.03)
Mother's age squared	0.000	–0.002	0.000	–0.000
	(1.57)	(5.57)**	(0.50)	(1.18)
Mother's years of schooling	–0.065	–0.073	–0.001	–0.004
	(5.69)**	(7.07)**	(1.95)	(1.53)
Household size	0.268	0.192	–0.001	0.001
	(30.94)**	(17.03)**	(2.37)*	(0.39)
Health knowledge index			–0.001	0.014
			(1.95)	(3.61)**
Infrastructure index			–0.001	0.015
			(1.62)	(4.04)**
State-level controls[b]	Yes	Yes	Yes	Yes
No. observations	16,193	16,527	12,966	9,322

* Statistically significant at the 5 percent level.
** Statistically significant at the 1 percent level.
a. Probit coefficients are marginal effects. Robust *t* statistics are in parentheses and are clustered at the state level.
b. State-level controls are the 1930 infant mortality rate, health infrastructure, and the 1997 GDP per capita.

health outcome regressions, replacing migration with health knowledge and the wealth infrastructure index. We do this for the sample of nonmigrant households to predict the change in health outcome associated with the changes in health knowledge and infrastructure stemming from migration. Columns 3 and 4 of table 9 present the reduced-form estimates. We find an increase in the health knowledge index and in the infrastructure index: both are significantly associated with higher birth weight and marginally significantly associated with lower infant mortality.

The two-stage least squares estimates of the increases in health knowledge and infrastructure resulting from migration can then be combined with the estimated change in health status associated with changes in health knowledge and infrastructure. This results in an estimated 0.5 percent fall in infant mortality and a 66 gram increase in birth weight arising from the impact of migration through the mechanisms of health knowledge and wealth infrastructure. These channels thereby explain approximately one-sixth of the estimated overall migration impacts on these child health outcomes.[42] Given the measurement problems with income and the lack of data on time allocation and other inputs, we are unable to provide a complete decomposition of the channels through which migration matters for child health. Nonetheless, we have demonstrated the potential importance of health knowledge gains.

Conclusions

This paper has found that migration from Mexico to the United States improves child health outcomes in Mexico, resulting in lower rates of infant mortality and higher birth weights. We find that failure to control for the selectivity of migration understates the size of health effects; this suggests that migrants are negatively selected from the overall rural distribution in terms of the health of their children.

We then break down some of the channels through which migration affects child health status. In addition to triggering health improvements through income or wealth effects, having a migrant member in the household is associated with sizable increases in the health knowledge on the part of mothers. Despite these improvements in immediate health status, we find that the children of migrants are less likely than the children of nonmigrants to be breastfed, fully vaccinated, or taken to a doctor in their first year of life. Although child mortality between the ages of one and four is not increased by migration on net, the phenomenon of absent parents may have longer-term negative effects on health outcomes. Our results point to a need for future research into the causes of lower preventive healthcare among migrants to support the design of appropriate policy responses.

This research contributes toward a broad view of the benefits and costs of migration for Mexico beyond the volume of remittances and number of migrants, which are the issues that frame much of the policy debate. Mexican immigration continues to be a key political issue on both sides of the border, and various proposals have been made for immigration reform. More detailed analysis of the effects of migration on Mexican communities holds the potential for informing this policy debate and forecasting the likely consequences of any policy changes on Mexico's long-term development. This

42. If one considers the standard errors associated both with the estimated impact of migration on health knowledge and infrastructure and with the point estimates of the changes in health status associated with changes in health knowledge and infrastructure, then these channels can explain up to 80 percent of the overall migration impact.

paper permits clear identification of one such effect, namely, the sizable effects on child health.

Appendix: Constructing an Index of Health Knowledge

The ENADID survey contains a set of questions to all women aged fifteen to fifty-four about their knowledge of ten different contraceptive methods: birth control pills, condoms, diaphragms or sponges, intrauterine devices (IUDs), injections, Norplant implants, tubal occlusion, vasectomy, natural family planning such as the rhythm method, and withdrawal. We use the method of principal components to reduce these ten yes/no answers into a single index. The first principal component is the linear combination of the set of variables whose sample variance is greatest among all such linear combinations, subject to a normalization restriction.[1] The underlying assumption is that general health knowledge explains the maximum variation in knowledge over these different methods. Methods in which knowledge varies most across households are given more weight in constructing the index. The first principal component is found to explain 39 percent of the overall variance in answers to these ten questions. Table A-1 gives the scoring factors and the mean and standard deviation for each method. Knowledge of birth control pills, IUDs, and contraceptive injections are the methods that contribute most to the index.

TABLE A-1. Principal Components of the Health Knowledge Index

Contraceptive practice	*Scoring factor*[a]	*Mean*	*Standard deviation*
Birth control pill	1.549	0.947	0.224
Condom	1.105	0.874	0.331
Diaphragm or sponge	0.511	0.420	0.494
Intrauterine device (IUD)	1.327	0.925	0.263
Injection	1.286	0.915	0.278
Norplant implant	0.428	0.125	0.331
Tubal occlusion	1.154	0.901	0.299
Vasectomy	0.842	0.767	0.423
Natural family planning	0.634	0.610	0.488
Withdrawal	0.535	0.499	0.500
Eigenvalue of first component	3.944		
Share of variance explained	0.394		

a. Scoring factors are divided by the standard deviation; they give the effect of a change from 0 to 1 on the index.

1. Everitt and Dunn (2001) provide a good introduction to this methodology.