

Preventing Infectious Diseases during and after International Adoption

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Families of internationally adopted children face risks associated with travel if they pick up their children overseas. Unlike other travelers, they also face risks because of close contact with a child with uncertain infection and vaccination status. Tuberculosis organisms, hepatitis A virus, hepatitis B virus, and measles virus have been transmitted from adopted children to family and community members. Intestinal parasites, *Bordetella pertussis*, and other infectious disease agents can also be transmitted. Some of these infections may be inapparent or may not manifest in adopted children until many years after the adoption. Increased

attention to preventive measures for family members and early diagnosis of infectious diseases in adopted children can reduce transmission of the organisms causing these infections. Those providing health care to families planning international adoption should know about standard pretravel advice, as well as the spectrum of possible infections in adopted children, so that they can protect the health of the travelers and family members and close friends who will welcome the new child into the home.

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From 1989 to 2002, U.S. families adopted more than 167 000 children internationally (1). In 2002, U.S. citizens adopted 20 099 children from 20 countries; by comparison, 7093 foreign-born children were adopted in 1990 (1). During the past decade, the countries from which most children have been adopted have changed. In 1989, children were adopted most frequently from Korea, Colombia, India, the Philippines, and Chile (1). By 2002, only 1 of these countries (Korea) remained in the list of top 5 countries; China, Russia, Guatemala, and the Ukraine replaced the other 4 countries (Figure). This shift can be associated with a change in disease epidemiology in adopted children. The outbreaks of severe acute respiratory syndrome (SARS) illustrate the dynamic relationship of infectious diseases and travelers and the need to have up-to-date information.

Health status and medical management of internationally adopted children have been described by experts in the field (2–6). Most recommend pretravel advice for parents traveling to bring home their adopted children. Parents who travel to bring home newly adopted children are at risk for both travel-related illness and disease organisms that may be carried by their new child. In addition, other family members who do not travel may also be at risk because of subsequent contact with the child. Thus, preparation for adoptive families must expand to include non-traveling family members and risks from the adopted child that may be unrelated to travel. We review the data on health status of internationally adopted children, describe potential risks for disease transmission from these children to their adoptive families, and recommend appropriate general pretravel counseling of adoptive families for the primary care physician. For details on the literature search used to identify the data, see the Appendix (available at www.annals.org). This paper is not a comprehensive review of travel medicine.

HEALTH STATUS OF INTERNATIONALLY ADOPTED CHILDREN

Health status of internationally adopted children has been described in reports summarizing findings in children

from many countries and in papers focusing on children from a single country. Hostetter and colleagues (2) identified important medical conditions in 57% of 293 internationally adopted children; 81% of these unsuspected diagnoses were made by obtaining a specific panel of screening tests. Initially evaluating internationally adopted children for infectious diseases has evolved to include a detailed history and physical examination and laboratory screening by using a consistent panel of tests for diseases present in countries from which children are adopted. Current recommendations include hepatitis B surface antigen, surface antibody, and core antibody; HIV testing; Mantoux test; stool examination for ova and parasites; rapid plasma reagin for syphilis; complete blood count with erythrocyte indices; and hepatitis C virus testing (Table 1). Table 2 summarizes the infectious diseases found in internationally adopted children.

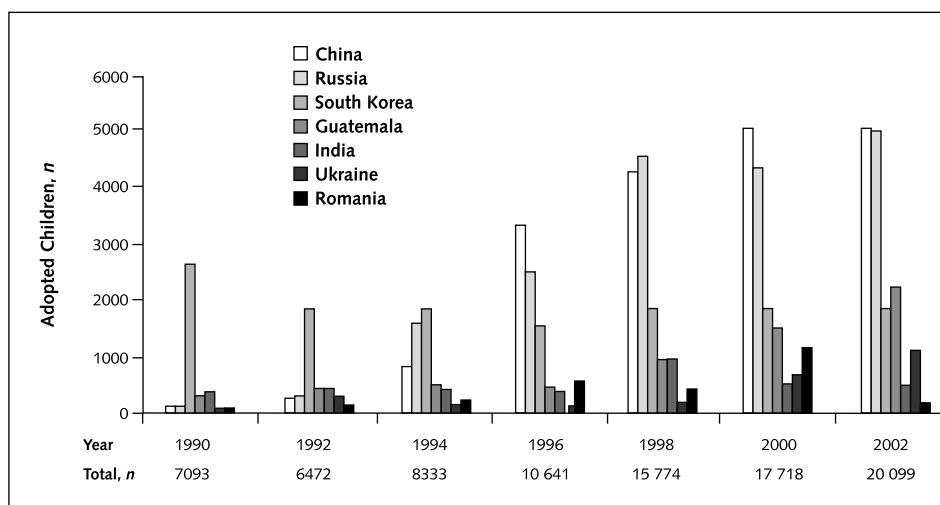
INFECTIOUS DISEASES IN ADOPTED CHILDREN AND POTENTIAL FOR TRANSMISSION

Tuberculosis

Positive tuberculin test results are more common in internationally adopted children than in children of similar age born in the United States (2). Tuberculosis is highly prevalent in many countries from which adopted children originate, including China, Russia, Korea, Vietnam, India, Guatemala, and Ukraine (11). Higher rates of positive skin test results occur because of more frequent exposure to tuberculosis and because internationally adopted children are more likely to have received Bacille Calmette–Guérin vaccine. Case rates of tuberculosis in internationally adopted children are at least 4 to 6 times higher than those among individuals born in the United States, and immigrants remain at risk for developing active tuberculosis for many years after arriving in the United States (11). Tuberculin skin test results are positive in 3% to 5% of internationally adopted children in most studies (2, 7–9), but rates as high as 19% have been reported (10).

Although latent tuberculosis is the most common form of tuberculosis identified by screening, active tuber-

Figure. Trend in the number of adopted children from the most common countries of origin (1).



culosis spread in the community has also occurred. In 1998, tuberculosis organisms were transmitted from a 9-year old child from the Republic of the Marshall Islands to his female guardian in North Dakota (12). Bilateral cavitary pulmonary tuberculosis was diagnosed only after his guardian developed tuberculous arthritis and osteomyelitis. Of the 276 individuals in contact with the child who were tested, 56 individuals (20%) had a positive Mantoux test result (≥ 10 mm), and 118 individuals received preventive antituberculosis therapy. Preventing transmission of tuberculosis organisms from adopted children rests on screening and timely diagnosis in adopted children. Because treating asymptomatic individuals who have positive tuberculin skin test results does not prevent all disease, a high index of suspicion must be maintained for tuberculosis in the years after adoption.

Hepatitis B

Hepatitis B surface antigen was identified in 2% to 20% of internationally adopted children, indicating a potential to infect the children's contacts (2, 7–10). The highest rate was noted in adopted children from Romania (7) and was consistent with the serologic data from Romanian orphanages, where 35% of the children had hepatitis

B surface antigen (13). Hepatitis B virus infection is also highly prevalent in many other countries where internationally adopted children originate, including China, Korea, Vietnam, and Kazakhstan (14). Hepatitis B surface antibody was found in 14% to 53% of the adopted children, reflecting past infection or, in some cases, immunization. One report noted the diagnosis of chronic hepatitis B in adopted Romanian children who had been presented as uninfected before adoption (15).

Household transmission of hepatitis B is well described (16, 17). In a report of hepatitis B virus transmission from Asian children to their adoptive U.S. families, 9% of 77 family members exposed to children carrying hepatitis B virus had evidence of past or present infection, compared with 2% of 232 family members without such exposure (18). In a series of 65 patients with chronic hepatitis B seen in the Department of Pediatrics at Université catholique de Louvain, Brussels, Belgium, from 1989 to 1993 (19), 31 patients were adopted, most of whom were from Romania and Asia. Seven of 11 (64%) nonvaccinated parents had acute hepatitis B that was attributed to the adopted child. Three additional parents had hepatitis B surface or core antibodies. One teacher, one grandfather, and one 16-year-old friend had acute hepatitis B. Only 4 of the infected individuals had recognized contact with blood or body fluids of the carrier child.

Hepatitis A

Symptomatic hepatitis A virus infection rarely occurs in internationally adopted children, and most experts do not screen for hepatitis A. However, hepatitis A is highly prevalent in most countries from which children are adopted (14). One series (2) mentions 2 children with hepatitis A virus infection, but it is unclear whether the children had current infection or evidence of past infection. Transmitting hepatitis A virus from asymptomatic children to their adoptive family members is possible. In 1

Table 1. Testing Recommended by the American Academy of Pediatrics in Screening Internationally Adopted Children for Infectious Diseases (6)

Hepatitis B surface antigen, hepatitis B surface antibody, and hepatitis B core antibody
HIV test
Mantoux skin test
Stool examination for ova and parasites
Syphilis serology
Complete blood count with erythrocyte indices
Hepatitis C virus test (for all children from China, Russia, eastern Europe, and southeast Asia; children from other areas should be screened depending on history)

Table 2. Infection or Evidence of Past Infection Found in the Screening of Internationally Adopted Children*

Variable	Study (Reference)				
	Hostetter et al. (2)	Johnson et al. (7)	Albers et al. (8)	Miller and Hendrie (9)	Saiman et al. (10)
Length of study	April 1986–June 1990	October 1990–September 1991	June 1991–March 1995	January 1991–December 1998	January 1997–December 1998
Nationality of adopted children	All internationally adopted children	Romania	Former Soviet Union and eastern Europe	China	All internationally adopted children
Patients, <i>n</i>	293	65	56	452	504
Patients with hepatitis B surface antigen, %	5 (2% acute, 3% chronic)	20	2	6	2.8
Patients who tested positive for hepatitis B surface antibody, %	>2 with past infection (additional 6% may have past infection, maternal antibodies, or undocumented vaccination)	53 (study reported total percentage with serologic evidence of hepatitis B virus infection)	14	22	35
Patients who tested positive on Mantoux, %	3 (4 of 10 patients found positive were subsequently diagnosed with acute pulmonary tuberculosis)	2 of 41 (5%)	5	3.5	19
Patients with gastrointestinal parasites, %	14	33	51	9	7 by microscopy 19 by <i>Giardia lamblia</i> antigen 4 with <i>Cryptosporidium</i>
Patients with bacterial pathogens in stool, <i>n</i>	4 with <i>Salmonella</i> 3 with <i>Campylobacter</i>	NA	NA	4 of 86 had <i>Salmonella</i> 2 of 86 had <i>Campylobacter</i> 2 of 86 had both <i>Salmonella</i> and <i>Campylobacter</i> 1 with <i>Clostridium difficile</i>	5 with <i>Campylobacter</i> 3 with <i>Shigella</i> 2 with <i>Salmonella</i>
Patients with hepatitis A, <i>n</i>	2	NA	NA	NA	NA
Patients with hepatitis C, <i>n</i>	NA	NA	NA	1 past exposure	4 with hepatitis C antibody 0 with hepatitis C PCR
Patients with syphilis, <i>n</i>	1 (secondary)	1 (congenital)	0	1 (congenital)	10 were found positive for fluorescent treponemal antibodies but negative for rapid plasma reagin; 1 was found positive for rapid plasma reagin but was found negative on repeat testing
Patients with HIV, <i>n</i>	1 (tested positive by ELISA, indeterminate Western blot, negative culture, and negative PCR)	0	0	0	2 tested positive for antibodies but had negative results on PCR
Patients with cytomegalovirus, %	45 (tested by urine)	NA	NA	NA	NA
Patients who previously had polio, <i>n</i>	2 paralytic	NA	NA	NA	NA
Other infectious diseases	Scabies Lice <i>Molluscum contagiosum</i> Ringworm	NA	NA	NA	NA

* ELISA = enzyme-linked immunosorbent assay; NA = not available; PCR = polymerase chain reaction.

case, an adoptive parent who traveled to Russia to adopt a 15-month-old child developed hepatitis A more than 2 months after return (20). The asymptomatic child had hepatitis A IgM and was presumed to have been incubating hepatitis A when he left Russia.

Pertussis

Pertussis occurs worldwide but is a greater risk for people who are underimmunized or people with waning immunity. Pertussis was diagnosed by culture in a 10-month-old adopted infant 2 days after arrival in the United

States from Russia. The adoptive family and many passengers on the flight from Russia were exposed (21). The Centers for Disease Control and Prevention collaborated with the U.S. embassy, adoption agencies, visa applicants, medical clinics in Moscow, and the airline to identify and notify exposed persons. The child had no record of immunization against pertussis.

Measles, Mumps, and Rubella

Measles is a risk in many countries, and outbreaks have occurred in some European and Asian countries (22). Cases of measles and mumps have been reported in internationally adopted children (23).

In 2001, fourteen U.S. measles cases were identified in children recently adopted from China and their family members and close contacts in 8 states. In 13 of these cases, patients were probably exposed to measles in China during visits to an orphanage or during medical screening or travel. The outbreak highlighted the large number of persons potentially exposed during the adoption process: the adoptive families, representatives of adoption agencies traveling with the families and meeting them on return, staff at the U.S. Consulate, and passengers and crew members of international and domestic flights. Ten cases were reported in recently adopted children 9 to 12 months of age. Other cases included 2 U.S.-born adoptive mothers, 1 U.S.-born caretaker who spent a week in the household with an adopted child with measles, and 1 sibling of an adopted child (24).

In the United States, measles vaccine is almost always administered as combined measles, mumps, and rubella vaccines. In contrast, some countries immunize children with monovalent measles or combined measles and rubella vaccines; hence, children may lack mumps or rubella coverage, or both. Ideally, adoptive families should be immune to mumps and rubella, as well as measles.

Intestinal Parasites

Pathogenic gastrointestinal parasites were found in 9% to 51% of internationally adopted children. *Giardia lamblia* was the most commonly identified pathogen. Saiman and colleagues (10) reported rates of *G. lamblia* antigen by country; the highest rates were reported in children from Romania (50%), Bulgaria (67%), Moldova (36%), Russia (25%), and China (15%). Transmission of intestinal parasites from adopted children to families, classmates, or other close contacts has not been reported but is possible. Parasites may not be identified until the child has been in the United States for some time, resulting in numerous exposures to others (25). Among the top countries of origin, Korea has been shown to have a lower risk for parasites (2). Many intestinal parasites are not directly transmitted from person to person and thus pose no risk to close contacts; however, they still merit treatment to minimize late complications. For example, strongyloidiasis can persist for decades through an autoinfection cycle. Hyperinfection

and dissemination can occur if the host later becomes immunocompromised (26).

Bacterial Intestinal Pathogens

Rarely, children have infections with *Salmonella*, *Shigella*, *Campylobacter*, or *Clostridium difficile* (2, 9, 10). Because asymptomatic shedding of some of these organisms can occur, transmitting organisms to family members is possible; however, this has not been reported to date.

Other Infections

Symptomatic congenital syphilis was identified rarely, although interpreting serologic results and previous treatment records is challenging for many professionals who care for internationally adopted children. Syphilis transmission is unlikely unless the child has active disease, and this has not been reported. Hepatitis C virus infection also occurs rarely; cautious interpretation of serologic results is warranted because of lack of information about the prevalence of this infection in adopted children. HIV infection has been reported in adopted children but is rare. In the study by Hostetter and colleagues (2), a 3-year-old child was found to be HIV positive by enzyme-linked immunosorbent assay, with indeterminate results on Western blot and negative culture, polymerase chain reaction, and HIV-2 test results. Other series did not identify any HIV-positive children (2, 7–10). Most experts recommend that all internationally adopted children be screened for HIV despite the low prevalence. Household transmission has not occurred, and therefore, risk is extremely low. Although Hostetter found cytomegalovirus in the urine of 45% of adopted children (2) and transmission is possible, routine testing for cytomegalovirus is not recommended. Information about transmitting cytomegalovirus can be provided to adoptive parents, with instructions about careful handwashing and other measures to reduce likelihood of transmission. Scabies, lice, molluscum contagiosum, and ringworm have been reported, although transmission to family members has not.

IMMUNIZATION STATUS OF INTERNATIONALLY ADOPTED CHILDREN

Vaccines given routinely in the United States may not be used in some countries from which children are adopted, including *Haemophilus influenzae* type B, pneumococcal, varicella, and mumps and rubella vaccines. Immunization status of adopted children may be difficult to assess because immunization records may be lacking or incomplete, immunizations may be falsely recorded, or potency of vaccines may be inadequate (27–30).

A study conducted at the New England Medical Center from June 1991 to March 1995 found that 43% of children adopted from the former Soviet Union and Eastern Europe had no vaccinations recorded (8). A study from the Netherlands comparing serologic status with medical records showed that 30% of 98 adopted children from

China seen between June 1998 and May 2000 lacked protective antibodies against tetanus, diphtheria, and polio, despite vaccination records documenting vaccination (27). Miller and colleagues (28) reported lack of protective antibodies to 1 or more polio serotypes in 35% of children with documented immunization; to diphtheria in 12%; to tetanus in 36%; and to 1 or more components of measles, mumps, or rubella vaccine in 10%. Hostetter and Johnson (29) found protective titers to diphtheria and tetanus in only 35% of 17 adopted children from China, Russia, and Eastern Europe, and they hypothesized that residing in an orphanage (where 12% of children had protective titers) was a risk factor for lack of protection compared with residing in a foster home (where 78% of children had protective titers). Recently, Staat and Daniels (30) studied 51 children from 11 countries and found that most children were protected against diphtheria (100%), tetanus (82%), and hepatitis B (67%).

Lack of consensus in studies comparing protection against disease with documentation of immunization complicates decision making for providers seeking a unified approach to immunizing internationally adopted children. Currently, an approach that combines repeated immunizations with judicious use of serotesting may be appropriate (31). Some experts devise an individualized approach for each child that minimizes the number of injections or venipunctures. For varicella vaccine, serotesting before immunization is probably cost-effective and would reduce unnecessary use of vaccine for school-aged and adolescent adopted children (32). Cost-effectiveness approaches have not been developed for other vaccines to date.

PRETRAVEL RECOMMENDATIONS FOR FAMILIES OF INTERNATIONALLY ADOPTED CHILDREN

Pretravel consultation before international adoption is different from typical pretravel consultation because it must include consideration of risks for disease during travel and exposures from close contact with the adopted child. In addition, family members who are not planning to travel must be considered in the consultation and protected against exposures that may occur when the adopted child joins the family. Other relatives or friends who accompany the adoptive parents on the international trip and anticipate close contact with the child should also be considered to have similar exposures.

Most countries from which children are adopted internationally are developing countries. Families traveling to pick up adopted children should be protected against diseases they may encounter during their travels in the same manner as other travelers. Many excellent resources on preventing travel-related illness are available (33). The travel portion of the Centers for Disease Control and Prevention Web site (www.cdc.gov/travel) and *Health Information for International Travel* (14) list recommendations. Risks for

travel-related illness depend on travel destination and medical history of those persons traveling.

Vaccines for International Travel

Immunization records of travelers should be reviewed to update routine immunizations, such as measles, diphtheria, and polio, for which risk may be greater during travel than in the United States. Travelers to most parts of the world, except Scandinavia, Australia, New Zealand, Japan, parts of Europe, and parts of North America, will benefit from protection against hepatitis A. Although it is a 2-dose series, a single dose administered at least 2 weeks before travel provides adequate protection for the trip. In areas where safety of food and water cannot be guaranteed, protection against typhoid is also desirable. Travelers to parts of Africa and South America where yellow fever is endemic should receive yellow fever vaccine and information about preventing mosquito bites. Individuals traveling to parts of Asia and the Indian subcontinent in the warm season may be candidates for Japanese encephalitis vaccine, especially if travel includes rural areas during transmission season and extends 1 month or longer. Animal contact and animal bites are unpredictable in international travel. Rabies is a serious problem in parts of Asia, Africa, and Latin America and is present in Eastern Europe. Adoptive families planning travel to remote areas with limited medical facilities in rabies-endemic areas should be advised to avoid animal bites and instructed about what to do if bitten. In general, rabies vaccine is not recommended before most short-term travel.

Preventing Malaria

Families traveling to areas where malaria is present should be protected against malaria by reducing exposure to mosquitoes (by using bed nets and insect repellents containing N,N-diethyl-m-toluamide) and appropriate chemoprophylaxis. Options for chemoprophylaxis include chloroquine (in locations where chloroquine resistance is not present), atovaquone and proguanil, mefloquine, and doxycycline. Choice of an antimalarial agent depends on the country of destination; medical history of the traveler; length of stay; and, to some degree, personal preference. Sources for more detailed information about malaria prevention include *Health Information for International Travel* (14), the travel portion of the Centers for Disease Control and Prevention Web site (www.cdc.gov/travel), *The Travel and Tropical Medicine Manual* (34), *Blackwell's Primary Care Essentials Handbook: Tropical Medicine* (35), and travel medicine specialists (International Society of Travel Medicine, www.istm.org; American Society of Tropical Medicine and Hygiene, www.astmh.org).

Other Pretravel Advice

Parents traveling to adopt children internationally should be counseled about usual food and water precautions. If the destination is a dengue-endemic country, the risk for dengue (a mosquito-borne virus) should be ad-

Table 3. Checklist for Preparing Families Who Are Adopting Internationally

Action	Standard Dose or Route	Traveling Person	Home Contact
Review and update all vaccines for any children in household		✓	✓
Review indications for routine adult vaccines and administer as needed		✓	✓
Hepatitis B*	1.0 mL intramuscularly, 3 doses at 0, 1, and 6 mo	✓	✓
Influenza	0.5 mL intramuscularly, according to season	✓	✓
Measles, mumps, and rubella	0.5 mL subcutaneously, documented 2 doses separated by ≥ 1 mo	✓	✓
Pneumococcal polysaccharide	0.5 mL subcutaneously or intramuscularly	✓	✓
Polio†	0.5 mL subcutaneously	✓	✓
Tetanus or diphtheria	0.5 mL intramuscularly	✓	✓
Varicella	0.5 mL subcutaneously, 2 doses separated by 4–8 wk	✓	✓
Review and update vaccines if asplenic		✓	✓
<i>Haemophilus influenzae</i> type B	0.5 mL intramuscularly	✓	✓
Meningococcal	0.5 mL subcutaneously	✓	✓
Pneumococcal polysaccharide	0.5 mL subcutaneously or intramuscularly	✓	✓
Review need for special vaccines for travel to high- or intermediate-risk areas‡		✓	✓
Hepatitis A*	1.0 mL (adult) or 0.5 mL (pediatric) intramuscularly, 2 doses at 0 and 6 mo	✓	✓
Typhoid	0.5 mL intramuscularly or 4 capsules orally	✓	
Required or recommended because of high-risk areas or activities§		✓	
Japanese encephalitis	1.0 mL subcutaneously, 3 doses on days 0, 7, and 30	✓	
Meningococcal	0.5 mL subcutaneously	✓	
Rabies	1.0 mL intramuscularly, 3 doses on days 0, 7, 21, or 28	✓	
Yellow fever	0.5 mL subcutaneously	✓	
Review itinerary for specific disease risks and provide education and empirical therapy¶		✓	
Food- and waterborne infections		✓	
Vector-borne infections		✓	
Fresh water contact in schistosomiasis-endemic areas		✓	
Altitude		✓	
Injury		✓	
Bloodborne infections		✓	
Direct skin contact with soil or sand contaminated with animal feces		✓	
Determine whether malaria prophylaxis is indicated	Adults: Chloroquine phosphate, 500 mg orally weekly; mefloquine, 250 mg orally weekly; doxycycline, 100 mg orally daily; or atovaquone–proguanil, 1 tablet orally daily	✓	

* Combination hepatitis A and hepatitis B vaccine is available for adults as an alternative to single-antigen vaccines. The combination vaccine is a 3-dose series, with 1.0 mL intramuscularly administered at 0, 1, and 6 months.

† Countries with indigenous poliomyelitis during 2002 include India, Nigeria, Niger, Pakistan, Afghanistan, Egypt, and Somalia, and wild poliovirus importations have occurred in some African countries (42). Additionally, outbreaks of paralytic polio caused by vaccine virus have occurred in the Philippines in 2001; Haiti and the Dominican Republic in 2000–2001; and Madagascar in 2002 (42). Adults traveling to these areas may need to update their polio vaccinations. Immunocompromised individuals may be at risk for vaccine-associated paralytic polio when they have contact with persons shedding the live (oral) vaccine-strain polio. Oral polio vaccine is still used in many countries, and adoptive children may have received it. Therefore, immunocompromised adults in the household may benefit from a polio booster (42).

‡ Referral to travel medicine specialist is advised.

§ Because knowledge of disease epidemiology is crucial and possible serious vaccine side effects can occur, these vaccines should be administered by travel medicine specialists.

|| Because of increasing malaria drug resistance, potential side effects, and medication interactions, malaria prophylaxis should be discussed in detail, preferably with travel medicine specialists. All drugs taken for chemoprophylaxis are started before travel and continued during and after travel, but regimens vary depending on the drug.

dressed. Avoiding insect bites should be discussed where appropriate.

Minimizing the risks for animal bites (and rabies), fresh water exposure (leptospirosis and schistosomiasis), soil contamination (hookworm, cutaneous larva migrans, and strongyloides), and blood and body fluid contact (hepatitis B and C viruses and HIV) should be reviewed as with the usual traveler. General safety measures should be discussed, including risk for road traffic accidents and traveling in unfamiliar areas, especially after dark. Families can be encouraged to protect themselves against excess sun exposure in tropical areas by wearing sunglasses and using sunscreen.

Jet lag merits discussion, as it adds stress to the expe-

rience of long airplane flights with small children. Although there are no certain remedies or prophylactic drugs for jet lag, some individuals may benefit from increased exposure to bright light (36, 37). Many parents appreciate information about surviving long flights with children (in this instance, a newly adopted child), such as arranging appropriate seating on the airplane and bringing snacks and age-appropriate toys or books.

PROTECTING FAMILY MEMBERS

Introducing an internationally adopted child into a family is an opportunity for all family members to update their routine immunizations. Siblings' routine immuniza-

tions can be updated if necessary because of the small but possible risk for exposure to diseases, such as measles and pertussis. Adult family members may find that they are not protected optimally against tetanus or diphtheria, boosters for which should be given every 10 years throughout life. Adult family members and caretakers should be vaccinated against measles before international travel unless they are immune by birth before 1957 or have a reliable history of measles (physician-diagnosed), serology, or documented receipt of 2 doses of live attenuated measles vaccines given at least 1 month apart after the first birthday (24). Adult caretakers who are at increased risk for complications of influenza or pneumococcal disease may benefit from receiving these vaccines, if they have not already done so, before welcoming a young child into the household. Colonization rates with pneumococcus, presumed to be an antecedent event to disease, are higher in adults living in households with children (38). Indirect evidence of the children's role in adult pneumococcal disease comes from a recent paper documenting decreases in pneumococcal disease in some adult age groups after introduction of universal infant immunization with pneumococcal conjugate vaccine (39).

Family members of newly adopted children are at increased risk for hepatitis A and B, tuberculosis, cytomegalovirus infection, and other infectious diseases. Immunization against hepatitis A and B is desirable for family members and others who will have close contact with the adopted child. Hepatitis A vaccine may be given to children beginning at 2 years of age. Hepatitis B vaccine is now given routinely to children, but older adolescents and adults may be unprotected. Initiation of the 3-dose vaccine series before adoption is advised for family members and close contacts of the child.

There is currently no vaccine to prevent cytomegalovirus; the available vaccine against tuberculosis, Bacille Calmette-Guérin, is not recommended for adoptive families in the United States. Families may be informed about each disease and means of prevention. For cytomegalovirus, handwashing when caring for the adopted child, especially when changing diapers, should protect against disease transmission if the child is a carrier. The adopted child should receive tuberculin skin testing on arrival. If the test result is positive, the child should be evaluated for active tuberculosis. If active disease is found, family members may have been at risk for transmission. If they remain well, skin testing 3 months after exposure should identify whether transmission has occurred. An exception would occur if infants or young children resided in a household with an adopted child with active pulmonary tuberculosis; in this case, risk for transmission is so high that preventive therapy with isoniazid, or alternative agents if the isolate is drug resistant, may be warranted. Consulting with tuberculosis experts is desirable in such cases. The prevalence of resistance to isoniazid approaches 30% in some regions (40, 41). Some of the adopted children come from coun-

tries with high prevalence of resistance and may continue to have a risk for developing tuberculosis despite treatment for latent tuberculosis.

Family members may also be at risk for other infectious diseases, such as scabies and fungal skin infections. Assessing and treating children with skin rashes early may prevent transmission. Excellent hand hygiene and early diagnosis and treatment of the child may prevent transmission of diarrheal diseases or intestinal parasites. **Table 3** summarizes the recommendations discussed.

ADDITIONAL RESOURCES

Most adoption agencies have materials that prepare the adoptive parents before they receive their children. Many parents are adopting children for the first time and are entering into "instant parenthood." Some may not have had previous experience with children. Advice on managing common health problems, such as diarrhea, rash, and upper respiratory tract infections, in young children may be useful. Acetaminophen and oral rehydration salts are essential during international travel. The international adoption portion of the U.S. State Department Web site (www.travel.state.gov/int'ladoption.html) contains some information on adopting children internationally and lists several additional resources.

SUMMARY

The number of international adoptees has increased steadily, and the countries from which children are adopted change over time. Screening adopted children after arrival in the United States sometimes reveals previously unknown infections. Organisms causing hepatitis A, hepatitis B, tuberculosis, and measles have been transmitted to close contacts after adoption; other infectious agents may also be transmitted. A strategy to protect adoptive families goes beyond protecting only those who are traveling. Pretravel evaluations of adoptive families should include updating routine immunizations and starting hepatitis B series and possibly hepatitis A vaccine for all family members. Other pretravel advice should consider the destination of the family, the prevalence of diseases in the adopted child's country of origin, and the adopted child's health status.

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APPENDIX

We searched the U.S. State Department Web site for statistics related to international adoption (www.travel.state.gov/int'ladoption.html) in June 2002 and May 2003. We performed a MEDLINE and PubMed search for *health of adoptees* in October 2001 and chose studies that analyzed infectious diseases in series of adoptive children to be included in our review. We have also systematically reviewed the following journals over the past several years for articles relevant to the topic: *The New England Journal of Medicine*, *Clinical Infectious Diseases*, *The Lancet*, *Morbidity and Mortality Weekly Report*, *Journal of the American Med-*

ical Association, *Pediatric Annals*, *Pediatric Infectious Disease Journal*, *Pediatrics*, *Journal of Pediatrics*, *Archives of Diseases in Childhood*, *Journal of Travel Medicine*, *American Journal of Tropical Medicine and Hygiene*, *Emerging Infectious Diseases*, *Annals of Internal Medicine*, and *Transactions of the Royal Society of Tropical Medicine and Hygiene*.

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