Immigration and Tuberculosis Among Children on the United States–Mexico Border, County of San Diego, California

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ABSTRACT. Objective. To identify factors contributing to a 400% increase in tuberculosis among children in San Diego County, California, from 1985 to 1993.


Results. Of 192 children with tuberculosis, the largest increase was observed in children younger than 5 years old, of whom 77.4% were born in the United States, 67.8% had a foreign-born parent, 73.1% came from a non-English-speaking household, and 46.2% were known to visit Mexico. Of 28 source cases, 82.1% were born outside the United States, primarily in Mexico (67.9%). Resistance to at least one first-line antituberculous drug was identified in 27.5% of isolates from children and in 33.3% of isolates from source cases.

Conclusions. The increase in tuberculosis and high level of drug-resistance among children born in the United States may be attributed to transmission outside of the United States or within the United States from household contacts born in countries in which tuberculosis is highly endemic. Pediatrics 1999;104(1). URL: http://www.pediatrics.org/cgi/content/full/104/1/e8; tuberculosis, children, border health, drug-resistant tuberculosis, immigration.

ABBREVIATIONS. AFB, acid-fast bacilli; TST, tuberculin skin test.

A fter a steady decline from 1953 through 1988, reported cases of tuberculosis in children younger than 15 years in the United States increased by 51% from 1133 cases in 1988 to 1708 cases in 1992. After increased public health efforts, tuberculosis cases in children declined by 26% from 1708 cases in 1992 to 1265 cases in 1997, similar to the 26% decline among adults. Coinciding with these declines has been a steady increase in the proportion of tuberculosis cases in the US who were foreign-born, from 22% in 1986 to 39% in 1997, of whom the largest group (43.9%) were from Latin America. The trend for tuberculosis among children in the United States has been characterized by greater increases in case rates for minority children compared with that of white, non-Hispanic children and a relative risk of 8.5 to 12.7 among foreign-born children compared with that of children born in the United States.

From 1985 through 1993, the state of California reported 29% of all cases of tuberculosis in children in the United States, ranking them first among the 50 states and the District of Columbia. During this period, tuberculosis cases in children and adolescents younger than 20 years old reported by the County of San Diego, California increased by 400% from 15 cases in 1985 to 75 cases in 1993. Reported cases were reviewed to provide possible explanations for this increase to better describe the epidemiology of tuberculosis among children and adolescents younger than 20 years old and to identify missed opportunities for prevention of tuberculosis in children.

METHODS

Identification of Cases of Tuberculosis in Children

All suspected and confirmed cases of tuberculosis in children and adolescents younger than 20 years old reported to the County of San Diego Department of Health Services Tuberculosis Control Program during 1989 (preincrease), 1991 (during increase), and 1993 (postincrease) were identified from the local tuberculosis registry. Suspected tuberculosis cases were reported to, but not confirmed by, the health department as meeting the case definition. Suspected and confirmed tuberculosis cases were reclassified as meeting the case definition of a tuberculosis case using the following criteria: meeting the published Centers for Disease Control and Prevention (Atlanta, GA) case definition, ie, 1) a positive culture for Mycobacterium tuberculosis; 2) a positive smear for acid-fast bacilli (AFB) but no culture performed; or 3) meeting the clinical case criteria, including a positive tuberculin skin test (TST), signs and symptoms compatible with tuberculosis, (such as an abnormal, unstable chest radiograph), treatment with two or more antituberculosis drugs, and a completed diagnostic evaluation. Children who did not meet the above criteria but who had signs and symptoms compatible with tuberculosis were treated for tuberculosis, reported by their provider, and confirmed by the health department as a tuberculosis case were also analyzed as a provider-diagnosed tuberculosis case. Children with tuberculosis infection alone (positive TST and no sign of active disease) and children with no evidence of tuberculosis infection or active tuberculosis were excluded from analysis.

Data were abstracted from birth certificates, health department records, and medical records at hospitals and clinics. Data collected included demographic characteristics of the child and parents, household language, travel and immigration history, clinical information, and culture and drug susceptibility results. All positive cultures for M tuberculosis complex were screened routinely for Mycobacterium bovis by the Department of Health Tuberculosis laboratory.
Identification of Potential Source Cases and Potential Missed Opportunities to Prevent Tuberculosis in Children

To identify potential source cases, health department investigation records and medical records for each child with tuberculosis were reviewed. The health department routinely conducts an investigation of all children diagnosed with tuberculosis. Investigation includes household interviews to identify contacts and possible source cases, screening contacts for signs and symptoms of tuberculosis, and tuberculin skin testing. For children younger than 7 years, the emphasis is on source case finding. Health department records of potential source cases who matched the county tuberculosis registry were reviewed to determine whether they were reportedly in contact with the child when the source case had infectious pulmonary tuberculosis.

Potential missed opportunities to prevent tuberculosis in cases among children were identified by matching children with tuberculosis to the list of children younger than 6 years reported to the health department with a positive TST, a reportable condition in San Diego County, and by a review of the contact investigations of source cases. Missed opportunities were classified as 1) no evidence of preventive therapy for a child reported with a positive TST, 2) no evidence of preventive therapy for a child 5 years of age or younger pending determination of tuberculous infection status after exposure to an adult with pulmonary tuberculosis, 3) not identifying a child as a contact during contact investigation of an adult with pulmonary tuberculosis, and 4) not screening a child routinely for tuberculosis infection according to recommended guidelines. Categorical variables among tuberculosis cases were compared using the \( \chi^2 \) test, and trends between age-groups and over time were assessed with the \( \chi^2 \) test for trend using Epi Info Version 6 (Centers for Disease Control and Prevention, Atlanta, GA).

RESULTS

Demographic Characteristics of Cases

Of 255 suspect and confirmed cases reviewed, 63 were excluded from analysis, including 33 with tuberculous infection only, 13 who met the case definition but resided in the jurisdiction of another health department in the state, and 17 with no evidence of tuberculosis or tuberculous infection. Among the 192 cases analyzed, 32 were reported in 1989, 85 were reported in 1991, and 75 were reported in 1993. Demographic characteristics of cases are summarized in Table 1. Some significant trends across age groups were identified. With increasing age of children, there was a decrease in the number who were born in the United States but an increase in the number who were born in Southeast Asia (\( P < .01 \) for both). Among the children who were born in the United States, 62.3% had at least one parent who was born in a country in which tuberculosis is highly endemic (Mexico, Philippines, Vietnam, Somalia, Laos, Ethiopia, and Guatemala), 39.1% were known to visit family in Mexico before the diagnosis of tuberculosis, and 87/105 (82.8%) came from households in which the primary spoken language was not English. The greatest increase in cases was observed among children who were born in the United States and who were younger than 5 years; most (86.1%) of these children were of Hispanic ethnicity and among foreign-born adolescents (Fig 1).

Among children born in the United States (Fig 2), the proportion who were Hispanic increased significantly from 70% in 1989 to 80.4% in 1991 and to 95.3% in 1993 (\( P = .006 \)). Although children of Hispanic ethnicity accounted for most of the increase among foreign-born children, children from Asia and Africa were also important contributing factors (Fig 2). Among the 77 foreign-born cases with known arrival dates in the United States, 37 (48.1%) were diagnosed with tuberculosis within 1 year of arrival, 31/69 (45) 5/16 (31) 10/19 (53) 46/53 (87) 92/157 (59)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Age Group (Years)</td>
<td>&lt;5 Years N = 93</td>
<td>5–9 Years N = 22</td>
<td>10–14 Years N = 24</td>
<td>15–19 Years N = 53</td>
<td>Total N = 192</td>
</tr>
<tr>
<td>Characteristic</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Female</td>
<td>59 (63)</td>
<td>8 (36)</td>
<td>10 (42)</td>
<td>26 (49)</td>
<td>103 (53)</td>
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<tr>
<td>Child’s birthplace</td>
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<tr>
<td>US-born*</td>
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<td>11 (50)</td>
<td>14 (58)</td>
<td>13 (24.5)</td>
<td>110 (57)</td>
</tr>
<tr>
<td>Mexico</td>
<td>17 (18)</td>
<td>6 (27)</td>
<td>3 (13)</td>
<td>25 (47)</td>
<td>51 (27)</td>
</tr>
<tr>
<td>Southeast Asia†</td>
<td>1 (1)</td>
<td>2 (9)</td>
<td>6 (25)</td>
<td>13 (24.5)</td>
<td>22 (11)</td>
</tr>
<tr>
<td>Africa/Central America‡</td>
<td>3 (3)</td>
<td>3 (14)</td>
<td>1 (4)</td>
<td>2 (4)</td>
<td>9 (5)</td>
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<td>Ethnicity</td>
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<td>Hispanic</td>
<td>80 (86)</td>
<td>15 (68)</td>
<td>16 (67)</td>
<td>35 (66)</td>
<td>146 (76)</td>
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<td>Asian</td>
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<td>6 (25)</td>
<td>14 (26)</td>
<td>25 (13)</td>
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<td>2 (9)</td>
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<td>3 (6)</td>
<td>12 (6)</td>
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<tr>
<td>Native American</td>
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<td>2 (9)</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>5 (3)</td>
</tr>
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<td>White, non-Hispanic</td>
<td>1 (1)</td>
<td>1 (5)</td>
<td>1 (4)</td>
<td>1 (2)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Parent foreign-born</td>
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<td>Unknown</td>
<td>30 (32)</td>
<td>11 (50)</td>
<td>10 (42)</td>
<td>42 (79)</td>
<td>93 (48)</td>
</tr>
<tr>
<td>Mexico</td>
<td>57 (62)</td>
<td>9 (41)</td>
<td>9 (37)</td>
<td>6 (11)</td>
<td>81 (42)</td>
</tr>
<tr>
<td>Southeast Asia†</td>
<td>3 (3)</td>
<td>0 (0)</td>
<td>5 (21)</td>
<td>5 (9)</td>
<td>13 (7)</td>
</tr>
<tr>
<td>Africa/Central America‡</td>
<td>3 (3)</td>
<td>2 (9)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>5 (3)</td>
</tr>
<tr>
<td>Household language</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-English‡</td>
<td>68 (73)</td>
<td>16 (73)</td>
<td>9 (37)</td>
<td>22 (42)</td>
<td>115 (59)</td>
</tr>
<tr>
<td>Child known to have visited Mexico</td>
<td>43 (46)</td>
<td>4 (18)</td>
<td>4 (17)</td>
<td>14 (26)</td>
<td>65 (34)</td>
</tr>
<tr>
<td>Culture-positive§</td>
<td>31/69 (45)</td>
<td>5/16 (31)</td>
<td>10/19 (53)</td>
<td>46/53 (87)</td>
<td>92/157 (59)</td>
</tr>
</tbody>
</table>

* \( \chi^2 \) for trend; \( P < .05 \).
† Southeast Asia = Philippines, Vietnam, Laos; Africa = Ethiopia, Somalia; and Central America = El Salvador, Guatemala.
‡ “Non-English” refers to instances in which the health department record (for purposes of whether an interpreter was required) included only languages other than English because the household language was non-English only. Households that were bilingual and included English were considered English-speaking.
§ Of children for whom a specimen was collected, positive specimens include 14/38 (37%) gastric aspirates and 17/31 (55%) lymph nodes.
and 45 (58.4%) were diagnosed with tuberculosis within 2 years of arrival, including 16/19 (84.2%) children younger than 5 years.

**Clinical Characteristics**

Overall, 87 (45.3%) cases had a positive culture for *M tuberculosis* complex, 4 (2.1%) cases had positive AFB smears and no culture done, 85 (44.3%) cases met the clinical criteria for a case, and the remaining 16 (8.3%) cases were diagnosed by a provider. A specimen was collected for laboratory testing from 81.8% of the cases. The proportion of positive gastric aspirate specimens in children younger than 5 years was 14/38 (36.8%). The proportion of culture-positive cases declined from 50.0% in 1989 to 45.9% in 1991 and to 33.3% in 1993 (\( P < .07 \)). In contrast, the proportion of cases confirmed based on clinical criteria increased from 34.4% in 1989 to 36.4% in 1991 and to 57.3% in 1993 (\( P = .008 \)). Most cases were detected as a result of seeking care for symptoms of tuberculosis (58.8%), followed by screening at well-child examination (13.0%), contact investigation (8.8%), refugee/immigrant screening (6.3%), screening of adolescents for employment, pregnancy, or incarceration (3.1%); for 9.9%, the reason for detection was unknown. Of cases detected during well-child examinations, 84.0% of the children or their parents were from a country in which tuberculosis is highly endemic. Only 1/21 (4.8%) children with test results was known to be HIV-positive.

Overall, 51.6% of cases had pulmonary disease, 33.3% had extrapulmonary disease, and 15.1% had both pulmonary and extrapulmonary disease. Of the 93 cases with extrapulmonary disease, types or sites of disease included cervical adenopathy (26.9%), hilar adenopathy (26.9%), other lymphadenopathy (12.9%), pleura (12.9%), meninges (12.9%), peritoneal involvement (8.6%), bone (6.4%), miliary tuberculosis (2.2%), and other sites (2.2%).

Of the 87 children with a positive culture for *M tuberculosis* complex, 14 (16.1%) had a culture positive for *M bovis* and all were of Hispanic ethnicity with extrapulmonary disease; 78.6% were younger than 5 years, and 71.4% were born in the United States. Excluding those children with *M bovis*, drug susceptibility results were available for 94.5% of culture-positive cases and are summarized in Table 2. Most children with drug-resistant tuberculosis were Hispanic (47.4%) or Asian (31.6%), and 89.4% of children or their parents were from a country in which tuberculosis is highly endemic (Mexico, Philippines, Vietnam, or Ethiopia).

**Results of Contact Investigation and Potential Missed Opportunities to Prevent Tuberculosis in Children**

Health department investigations were conducted for 90.6% of tuberculosis cases in children. Of 1244 contacts identified, results were available for 80.7%. Of these, 38.0% had at least a 10-mm induration response to tuberculin skin testing and a normal chest radiograph, 10.6% had at least a 10-mm induration but no chest radiograph result on the contact sheet, 10.8% had a previous positive TST, 12.9% refused testing, 4.1% were new cases of tuberculosis identified during household investigation, 4.0% of contacts (including children and adults) had already known current or previous tuberculosis, and 19.3% had either a negative test or a test that was not read. Cases identified as a result of health department investigation included 17 new cases in children and 7 adults who were the source cases. A significantly higher proportion of contacts with evidence of tuberculous infection was observed when the index child, parent, or source case was foreign-born, compared with when all were known to be born in the United States.

**Table 2. Drug Susceptibility Results From 69 Children With Tuberculosis and 21 Potential Source Cases, County of San Diego, 1989, 1991, and 1993**

<table>
<thead>
<tr>
<th>Drug resistance pattern</th>
<th>Children With TB (N = 69)</th>
<th>Source Cases (N = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any resistance</td>
<td>19 (28)</td>
<td>7 (33)</td>
</tr>
<tr>
<td>Resistant to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only isoniazid</td>
<td>5 (7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Only streptomycin</td>
<td>8 (12)</td>
<td>4 (57)</td>
</tr>
<tr>
<td>Only ethambutol</td>
<td>1 (1)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Isoniazid and streptomycin</td>
<td>4 (6)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Isoniazid and ethambutol</td>
<td>1 (1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Streptomycin and ethambutol</td>
<td>0 (0)</td>
<td>1 (5)</td>
</tr>
</tbody>
</table>

Table excludes 14 children with *M bovis* disease (none had resistance to any drug other than pyrazinamide) and 4 children and 7 source cases with positive cultures but no drug susceptibility test results.
States (mean 39.8% of contacts compared with 26.2% of contacts; \( P = .03 \)).

Of the 192 cases in children, 67 had potential source cases identified. Of these, 32 had potential source cases but no additional information was available, including 18 cases whose potential source case resided outside of the United States. For the remaining 35 children, 27 of whom were younger than 5 years, a total of 28 source cases were confirmed. Characteristics of the source cases are summarized in Table 3. Of the 14 source cases with both known date of arrival in the United States and date of the first positive sputum smear for AFB, 35.7% arrived in the United States <2 years before being diagnosed with tuberculosis. Drug susceptibility results for source cases are summarized in Table 2. The majority of source cases with drug-resistant tuberculosis (71.4%) were from a country in which tuberculosis is highly endemic (Mexico or Ethiopia). Both secondary cases in children with positive cultures had matching drug susceptibility patterns, but the remaining 5 children had negative cultures or cultures were not performed.1

Confirmed source cases were diagnosed with tuberculosis as a result of seeking medical attention for symptoms (32.1%), as a result of health department investigation (25%), during refugee/immigrant screening (17.9%), and for unknown reasons (25%). Chronologically, 57.1% of source cases were identified as having tuberculosis before the index child case was identified, 35.7% were identified after the child, and it was unclear for 7.1% of source cases who was identified first.

Overall, 92.8% of cases in children were linked to a country in which tuberculosis is highly endemic, ie, child, parent, or source was born there; or the child was known to have visited family in Mexico; or the primary household language was other than English. The proportion of cases with this linkage increased significantly from 81.2% of cases in 1989 to 90.6% of cases in 1991 and to 98.7% of cases in 1993 (\( P = .002 \)). Among children born in the United States, the children younger than 5 years were more likely than the older age groups to be linked to a country in which tuberculosis is highly endemic (91.7% of children younger than 5 years, compared with 81.2% of children 5 to 9 years old, 85.7% of children 10 to 14 years old, and 61.5% of adolescents 15 to 19 years old; \( P = .02 \)).

Medical records were available for review to assess adequately potential missed opportunities to prevent tuberculosis in children in 26% of cases. Of these cases, 34% of children were diagnosed with tuberculosis within a few months of entering the United States and were probably not preventable by the health care system in the United States. The remainder included 26% of children who were from a high-risk group and who had not received routine TST screening during well-child care, 12% who had not been identified as a contact to a tuberculosis case, 10% who completed <1 year of preventive therapy, 10% who were younger than 5 years and a known contact to a tuberculosis case yet who were never placed on preventive therapy, 4% with a previous positive TST who did not receive preventive therapy, and 4% who were a known contact of a case but who were not screened.

**DISCUSSION**

The increase in tuberculosis among children on the United States–Mexico border may be largely attributable to transmission outside of the United States in countries in which tuberculosis is highly endemic, as well as within the United States from household contacts born in those countries. In contrast to the national trend of increased cases among those born in countries in which tuberculosis is highly endemic, the greatest increase in San Diego County was observed among young children born in the United States. Over 90% of tuberculosis cases among US-born children younger than 5 years had a parent or source case from a country in which tuberculosis is highly endemic, a history of foreign travel, or a primary household language other than English. These findings may help explain national trends in which only 15% of tuberculosis cases in children younger than 5 years are foreign-born, compared with 35% of cases in children 5 years or older.1 Tuberculosis surveillance systems in the United States do not monitor routinely the birthplace of parents or source cases of children and probably are underestimating the contribution of the global tuberculosis epidemic to US-born children in this country.

The findings of this investigation in San Diego County support the recommendation that children who are from or who have parents who are from regions of the world with a high prevalence of tuberculosis are at high risk and should be screened for tuberculosis infection.11 However, the findings also indicate that screening of children in this population should occur earlier than the currently recommended 4- to 6-years of age.11 Because most of the very young children with tuberculosis were <4-years-old, the findings also indicate that very young children with tuberculosis should be screened and treated when identified.

**TABLE 3.** Characteristics of 28 Confirmed Source Cases, County of San Diego, 1989, 1991, and 1993

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>16 (57)</td>
</tr>
<tr>
<td>Mean age (range)</td>
<td>25 (12–66)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>5 (18)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>20 (71)</td>
</tr>
<tr>
<td>Asian</td>
<td>3 (11)</td>
</tr>
<tr>
<td>Birthplace</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>5 (18)</td>
</tr>
<tr>
<td>Mexico</td>
<td>19 (68)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2 (7)</td>
</tr>
<tr>
<td>Somalia</td>
<td>1 (3.5)</td>
</tr>
<tr>
<td>Laos</td>
<td>1 (3.5)</td>
</tr>
<tr>
<td>Relationships to children with tuberculosis*</td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>12 (43)</td>
</tr>
<tr>
<td>Father</td>
<td>7 (25)</td>
</tr>
<tr>
<td>Siblings/other housemates</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Relatives</td>
<td>6 (21)</td>
</tr>
<tr>
<td>Unknown</td>
<td>6 (21)</td>
</tr>
<tr>
<td>Household non-English speaking</td>
<td>24 (86)</td>
</tr>
<tr>
<td>Visits family in Mexico</td>
<td>11 (39)</td>
</tr>
<tr>
<td>Previous tuberculosis treatment in Mexico</td>
<td>5 (18)</td>
</tr>
</tbody>
</table>

* The 28 source cases could be sources for more than one child and can be counted in more than one category.
years old when diagnosed with tuberculosis, screening at the recommended ages in this setting would
not have identified the majority of young children with tuberculosis. The evidence that only 54% of
source cases were known to be parents also supports the recommendation of screening children who have
a circle of close contacts (eg, other relatives, caretakers, family friends, and neighbors) that includes per-
songs from regions of the world with a high preva-
ience of tuberculosis regardless of their relationship
to the child.

The increase in tuberculosis among children in San
Diego County coincided with similar increases in
immigration into California. After the Immigration
Reform and Control Act of 1986, the number of im-
migrants into California increased by 334% from
168,790 in 1986 to a peak of 732,735 in 1991. The
Immigration Reform and Control Act provided for
immigration of undocumented aliens who had been
resident in the United States since 1982 and for sea-
sonal agricultural workers who had been resident
during 1985 through 1986. Children younger than 15
years are not required to be screened for tuberculosis
during immigration unless known to be contacts to a
tuberculosis case. Each year, >3 million nonimmi-
grant visitors also come to California, but their con-
tribution to transmission would be difficult to docu-
ment. Nearly half of children younger than 5 years
were known to have traveled to visit family in Mex-
ico, suggesting that cross-border contact may have
also contributed to transmission in addition to immi-
gration into the United States. Since 1993, tuber-
culosis cases in children have decreased nationwide. This
is also true for San Diego County in which cases
decreased from 75 cases in 1993 to 45 cases in 1997.
The largest decrease occurred in those children
younger than 5 years in which there was a 70% decrease in the number of cases between 1993 and
1997.

Health department investigation of children with
tuberculosis in San Diego County demonstrated that
they came from a household environment in which
nearly 70% of contacts had evidence of tuberculous
infection. This was particularly true if the child, par-
ent, or source case was foreign-born. Identification
and investigation of these tuberculosis households
should be an effective strategy for case finding and
identification of potential candidates for preventive
therapy. However, the challenges to investigations of
tuberculosis on the border by the health department
were demonstrated by the relatively low proportion
(8.8%) of tuberculosis cases in children identified as a
result of contact investigation, the low proportion
(14.5%) of cases in whom a source case was identi-
fied, and the high proportion (35.7%) of instances in
which the child with tuberculosis was identified be-
fore the source case was diagnosed as having tuber-
culosis. To help improve tuberculosis control in the
United States, cross-border cooperation and collabo-
ration toward tuberculosis control should continue to
be promoted and encouraged by public health
officials in neighboring communities on both sides of
the United States-Mexico border.

The level of primary drug resistance (27.5%) in the
cases among children in this investigation may be the
highest reported to date in children in the United
States. The level of drug resistance among the
source cases (33.3%) is equally alarming. The chil-
dren and their source cases with drug-resistant tu-
berculosis diagnosed in the United States were
linked with countries in which tuberculosis is highly
demic and levels of drug-resistance are high, dem-
onstrating the importance of global control of drug-
resistant tuberculosis to the control of drug-resistant
tuberculosis in the United States. Moreover, 16% of
children with a positive culture had M. bovis, which is
uniformly resistant to pyrazinamide and has different
public health and clinical implications. The presence
of extrapulmonary disease in the Hispanic or
foreign-born child should prompt the clinician to collect appropriate specimens to recover an organ-
ism. Clinical specimens, eg, gastric aspirates or
lymph node biopsy, for culture and drug suscepti-
bility testing should be collected routinely from chil-
dren, particularly when the drug susceptibility re-
results of the isolate from the source case are unknown.
Ongoing surveillance for drug resistance among
young children should help define trends in recent
transmission of drug-resistant organisms in a popu-
lation, as well as optimizing effective therapy for the
child.

This study had several limitations. The extent to
which improved tuberculosis surveillance may have
contributed to increased case detection cannot be
determined, but this may have been a factor as evi-
denced by the increase in the proportion of cases
lacking bacteriologic confirmation from 1989 to 1993.
Also, our methodology using medical record review
limited the ability to assess potential missed oppor-
tunities to prevent tuberculosis in children. The
number of children who had not been screened by a
TST during well-child care is probably particularly
underestimated, because the location of all well-child
records was often unknown and it was clear that
many parents sought care for their children on both
sides of the border. Nonetheless, the majority of
cases of tuberculosis in children were potentially
preventable through current control measures except
for the cases among children who became ill or ac-
quired tuberculosis in an endemic country and who
first presented to health authorities in the United
States with active disease. Our methodology also
probably underestimated the magnitude of contacts
between cases in the United States and foreign-born
individuals because of a lack of complete informa-
tion about parents’ country of birth, their travel to
endemic countries, and visits from individuals who
live in endemic countries. Such information could
help communities to understand local dynamics of
transmission and to develop strategies for improve-
ment. Finally, the role of HIV in tuberculosis in San
Diego County could not be assessed because of the
lack of information concerning both the children and
the source cases.

Control of tuberculosis in children on the United
States-Mexico border will depend on improved con-
truction within Mexico and screening of adult immi-
grants who may transmit M. tuberculosis to young
children. Recommended screening of children who have immigrated recently from endemic countries and of children who have traveled to endemic countries or have household contacts from endemic countries may help increase detection of tuberculosis in children and identify potential candidates for preventive therapy in the United States.11

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