

## IMMUNIZATION AND INFECTIOUS DISEASES

The reduction in the occurrence of infectious diseases is the most significant public health achievement of the past 100 years. An improved standard of living, improved hygiene, regulations for food handling, water treatment, the availability of antibiotics and the widespread use of vaccines have all led to prevention and control of infectious diseases. Nonetheless, infectious diseases remain important causes of illness and death in the U.S.<sup>1</sup>

### **Importance of Immunization<sup>2</sup>**

Immunization is the most effective and inexpensive tool for prevention of communicable diseases. The introduction of vaccines has resulted in dramatic reductions in the numbers of reported cases of vaccine preventable diseases. Immunization saves from \$1.70 to \$14.60 for every \$1 spent depending on the particular vaccine.<sup>3</sup> Vaccines made possible the worldwide elimination of smallpox in 1977 and the elimination of polio from the Western Hemisphere in 1991.

Childhood Vaccines. Vaccine preventable diseases are those diseases for which there are effective vaccines and well-established recommendations for routine childhood immunization. These diseases are tracked as the ultimate measure of immunization success. To reach the goal of elimination of vaccine preventable diseases, we must achieve a critical mass of immunized individuals. As we approach successful immunization coverage, there are fewer cases of vaccine-preventable diseases, they are less likely to spread, and counting cases becomes a less effective tool to measure coverage. As we achieve high immunization levels in our children the diseases become less visible, there is less perceived threat from them and less appreciation of the importance of complete immunization. For example, both polio and measles are uncommon in the U.S., yet the threat remains that both diseases will be re-introduced into the U.S. from another country where immunization is less successful.

Not all the diseases for which we immunize infants and children pose a major threat for young children. For example, Rubella (German measles) is a mild illness with few complications for adults and children alike. However, infection during pregnancy can result in serious effects on the fetus. Another example is Hepatitis B which is primarily a sexually transmitted disease; most infants and children are not at risk.

Adolescent Vaccines. Adolescents also need immunization. Tetanus/diphtheria immunization should be repeated every ten years. Because measles outbreaks are a problem in colleges and universities, many institutions require a second dose of MMR (measles, mumps, rubella) at entry. Adolescents who are sexually active or use injection drugs are at risk for developing hepatitis B. While future generations of adolescents will have been immunized against Hepatitis B as infants, the current generation of adolescents have not been immunized.

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<sup>1</sup> U.S. Department of Health and Human Services, Healthy People 2000: National Health Promotion and Disease Prevention Objectives; U.S. Department of Health and Human Services, Healthy People 2000 Midcourse Review and 1995 Revisions

<sup>2</sup> San Francisco Department of Public Health, Immunization in San Francisco, presentation to the San Francisco Health Commission

<sup>3</sup> California Department of Health Services, Immunization Branch, January 1993

## **Standards For Immunization**

Currently, the recommended basic immunization schedule specifies that children by the age of 24 months receive four doses of the diphtheria-tetanus-pertussis (DTP) vaccine, three doses of the polio vaccine, and a single dose of the measles-mumps-rubella (MMR) vaccine. Thus, while additional doses are recommended at school entry and throughout life, 2 years (24 months) is a common age at which to assess immunization completion. Immunizations should be given at the recommended ages because protection may be very age-specific. For example, Hib (Haemophilus influenzae type b) and pertussis immunization provides little protection to school-age children because it is younger children who are at risk of Hib or pertussis complications.

In California, children entering kindergarten have additional immunization requirements including three HBV (hepatitis B) vaccine. The vaccine for Hib (Haemophilus influenzae type b), the most common cause of bacterial meningitis in U.S. children, is included in the infant immunization schedule. School entry requirements have been very successful at ensuring appropriate immunization for children at five years of age. (Refer to the Appendix for immunization requirements for California and recommended immunization requirements for the U.S.) California has seen at least 95% completion rate for vaccinations by school age for at least ten years, although we have been much less successful in achieving completion of recommended doses by 2 years of age.

## **Measuring Childhood Immunization Coverage**

Currently, there is no single, ongoing, comprehensive centralized repository of data on the immunization status the City's children. However, there are various ways to estimate the population immunization rate such as sampling of medical records, random door-to-door surveys, or random telephone surveys. There are issues of cost, accuracy, timeliness and other considerations to each of these approaches.<sup>4</sup>

## **Kindergarten Retrospective Survey**

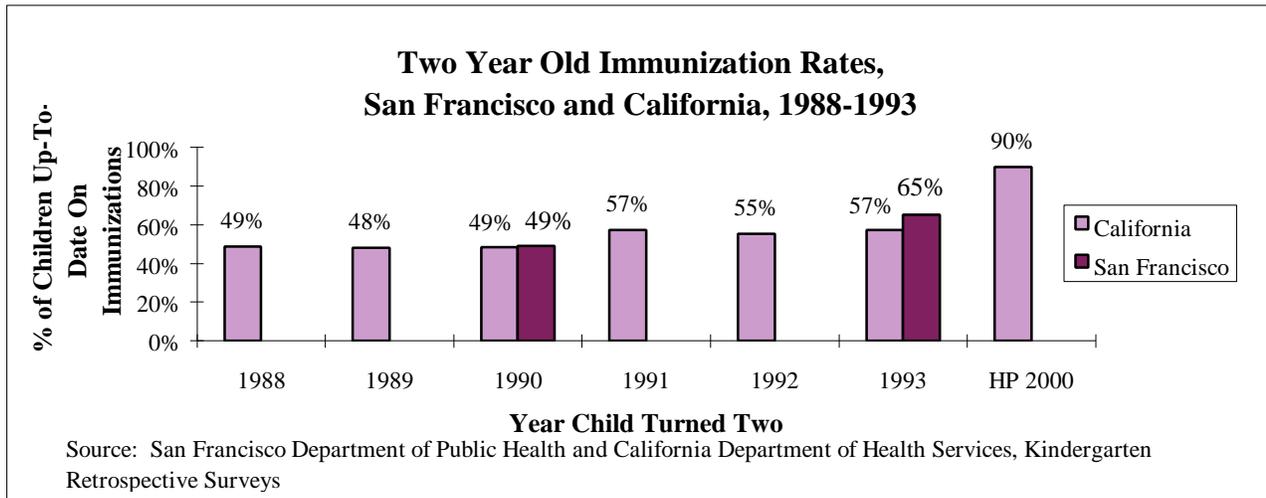
The San Francisco Department of Public Health conducts periodic surveys to assess the immunization status of two-year-olds in the City, using the kindergarten retrospective survey method. The most recent survey was conducted in 1996, which provided an estimate of the immunization status of two year olds in 1993. The kindergarten retrospective method utilizes immunization records collected by the schools in conjunction with the requirements for school entry. It is relatively easy and inexpensive to survey these school records and then calculate how well immunized these children were three years previously, when they were age two. The main disadvantages of this method are that the estimate of immunization rates are at least two years old, and school-based records may be less accurate than medical records.

The 1996 survey showed an overall completion rate of 65% for San Francisco two-year-olds (as of 1993), which is an improvement over the rate of 49% for San Francisco children in 1990. It also compares well with the statewide rate of 57%. (The San Francisco and state surveys used the same

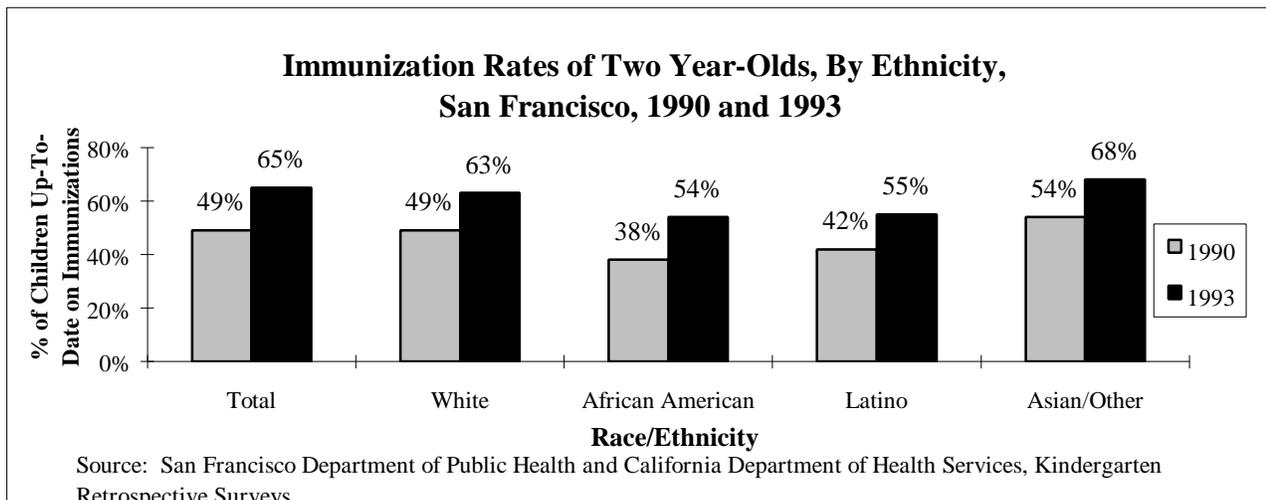
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<sup>4</sup> For example, random door-to-door and telephone methods are expensive, and many calls or visits must be made before successfully identifying an appropriate household. Also, every family does not have a telephone, and children who are not immunized may live in households without telephones, a major bias to telephone-based surveys. Language diversity is also a major challenge in San Francisco. Information collected from immunization records at home may not be accurate. Other tools available to measure progress on toddler immunization coverage include surveillance of disease, an outcome measurement but a very "late-warning" system; and provider surveys which are limited to those in care and complicated by changes of provider and by multiple providers for each patient.

methodology, so the results are considered comparable.) However, San Francisco has not reached the national Healthy People 2000 goal of 90% of children adequately immunized by age two.<sup>5</sup>



Immunization coverage in San Francisco improved for all racial groups between 1990 and 1993, although relative standings remain. Asians had the best results with 68% up-to-date at 24 months. This can be broken down into 72% for Chinese, 82% for Southeast Asians and 56% for Filipinos. African-Americans, Latinos, and Whites had 54%, 55%, and 63% rates of completion, respectively.

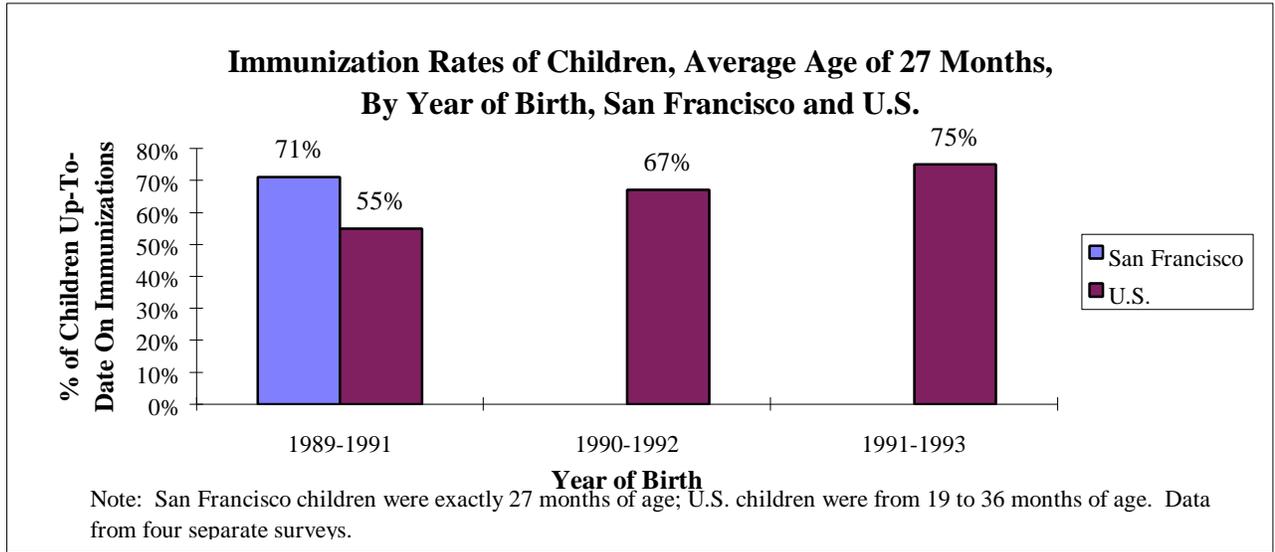


National data on immunization rates is not directly comparable to San Francisco and California immunization surveys.<sup>6</sup> However, when U.S. data is adjusted for age of the children based on year of

<sup>5</sup> In addition to this objective, Healthy People 2000 objective 20.1 is to completely eliminate indigenous cases of vaccine-preventable diseases in the U.S. for diphtheria among people aged 25 and younger, tetanus among people ages 25 and younger, polio, measles, rubella, congenital rubella syndrome; reduce mumps to 500 cases, and reduce pertussis to 1,000 cases.

<sup>6</sup> National immunization rates are calculated from random telephone surveys and include children 19 to 35 months old, with an average age of 27 months. The differences in age of the children, source of the information (school records used for the retrospective survey versus immunization cards used for the telephone survey), and the requirement of a telephone in the household make telephone surveys not directly comparable to kindergarten retrospective surveys. Since the methodologies of local and national surveys are very different, comparison between national and local results must be interpreted with caution.

birth, San Francisco compares favorably with national surveys for the 1989 to 1991 period. Nevertheless, rates remain well below the national Healthy People goal of 90% for all races/ethnicities.



In the 1993 San Francisco survey, boys were more likely to be immunized than girls in all races/ethnicities except Latino, 62% boys vs. 60% girls for whites, 54% vs. 52% for African Americans, 58% vs. 49% for Filipinos, and 78% vs. 65% for Chinese. The difference was statistically significant only for Chinese children. For Latino children a higher percentage of girls (56%) than boys (53%) were up-to-date.

The 1993 San Francisco survey found that nearly 11% of the children immunized were given at least one dose too early. Either the child was too young for the vaccine to be effective or the vaccine was given too soon after the previous dose to be effective. This compares with 16% of children in a national survey.

**Incidence of Vaccine Preventable Diseases**

Identifying the occurrence of vaccine preventable diseases provides a “late warning” system for monitoring a community’s health. From 1990 to 1997, children and youth up to age 18 represented a large proportion of several vaccine preventable diseases in the City including diphtheria (100% of all cases), whooping cough (86%), mumps (46%), measles (42%), and rubella (38%). During the same

**Reported Cases of Vaccine Preventable Diseases,  
By Age Groups,  
San Francisco, 1990-1997**

Disease	Age Groups				
	0-18		19-24		All
	# of Cases	% of All Cases	# of Cases	% of All Cases	# of Cases
Diphtheria	1	100%	0	0%	1
Hepatitis A	230	7%	408	13%	3,176
Hepatitis B	40	6%	125	20%	621
Hib	14	10%	4	3%	134
Measles	22	42%	6	12%	52
Mumps	13	46%	3	11%	28
Polio	0	-	0	-	0
Rubella	3	38%	0	0%	8
Tetanus	0	0%	0	0%	1
Whooping Cough	63	86%	1	1%	73

Source: San Francisco Department of Public Health, Community Health Epidemiology Section, 1998

eight year period, youth ages 19 to 24 represented 20% of the City's Hepatitis B cases, 13% of Hepatitis A cases, and 11% of mumps and measles cases. (Refer to the Appendix for more detailed data.)

The Healthy People 2000 goal is to completely eliminate the occurrence of diphtheria and tetanus among people ages 25 and younger, and to completely eliminate polio, measles, and rubella among individuals of all ages. As of 1997, San Francisco has achieved the Healthy People 2000 objectives for diphtheria and tetanus (ages 25 and younger) and polio, but not for measles and rubella.

Like several other counties in California, San Francisco is in the midst of a Hepatitis A outbreak in adults and adolescents. Although all of the factors contributing to the epidemic are not known, Hepatitis A is more common among gay/bisexual men and injecting drug users. Youth are an important group to immunize because they are likely to be first exposed to Hepatitis A as adolescents or young adults. From 1990 to 1997, 7% (230 cases) of San Francisco Hepatitis A cases occurred among 0 to 18 year olds and another 13% among youth ages 19 to 24 (408 cases).<sup>7</sup>

<sup>7</sup> There are no Healthy People 2000 objectives for Hepatitis A, B, and C specifically addressing youth. Healthy People 2000 objective 20.3 is to reduce Hepatitis A to 16 per 100,000 (for all ages) and Hepatitis B to 40 per 100,000 (for all ages). Subobjectives 10.3a through 20.3k provide Hepatitis A, B, and C goals for a variety of other target populations.

**Incidence of Other Communicable Diseases**

By requiring the reporting of communicable diseases, local health authorities can monitor the occurrence of outbreaks and work to prevent their further spread. Among the reportable diseases in San Francisco that are not preventable through vaccines, the most commonly occurring are Campylobacter, Giardia, Salmonella, and Shigella.

The bacterial species Campylobacter, nontyphi Salmonella, and Shigella, and the parasite Giardia Lamblia are the most common causes of nonviral human enteric (intestinal) infections in the United States and are responsible for significant morbidity and financial costs. Salmonella and Campylobacter infections are acquired from ingestion of undercooked food products (e.g., poultry, eggs) where animals are reservoirs of the bacteria. Giardia infections result primarily from person-to-person transmission through fecal-oral routes, although contaminated water has caused outbreaks. Humans are the only reservoir for Shigella and transmission occurs person-to-person through fecal-oral routes. Salmonella and Giardia are among the communicable diseases that can result in a chronic infection or carrier state.

From 1990 to 1997, most notable among cases of communicable diseases were the large number of cases among children ages 0 to 18 of Campylobacter (1,427) and the large proportion (38%) of all cases of Salmonella (614) which occur in children ages 0 to 18. Children ages 0 to 18 comprised 23%

<b>Reported Cases of Selected Communicable Diseases, By Age Groups, San Francisco, 1990-1997</b>					
<u>Disease</u>	Age Groups				
	0-18		19-24		All
	# of Cases	% of Cases	# of Cases	% of Cases	# of Cases
Campylobacter	1,424	27%	452	9%	5,259
Giardia	655	23%	191	7%	2,870
Salmonella	614	38%	116	7%	1,619
Shigella	627	28%	116	5%	2,252

Source: San Francisco Department of Public Health, Community Health Epidemiology Section, 1998

of all Giardia cases and 28% of all Shigella cases in the City. Youth ages 19 to 24 comprised a smaller proportion of cases of these four communicable diseases compared to children from ages 0 to 18.

**Tuberculosis**

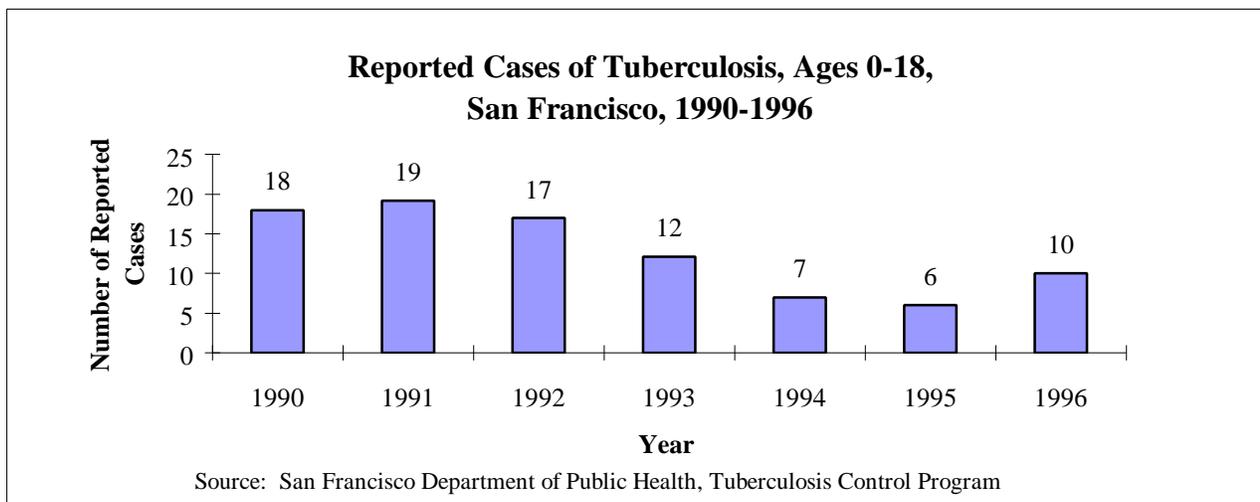
Tuberculosis, or TB, is a disease that usually attacks the lungs, and was once the leading cause of death in the U.S. Following improved standards of living and the discovery in the 1940s of several drugs to

treat the disease, TB slowly began to disappear in the U.S., but began to reemerge in the 1980s. TB is spread through the air from one person to another. However, many people who have TB infection never develop the disease. In some people, especially those who have weak immune systems, the bacteria becomes active and causes TB disease.

TB in San Francisco is a serious problem, mainly among the adult population, with TB case rates 4 times the national rate and double the California rate. HIV, substance abuse, poverty, homelessness, and the large number of foreign-born residents from high-incidence areas.

From 1990 through 1996, there were 89 new reported cases of active tuberculosis (TB) among children and youth ages 0 to 18 in San Francisco, or about 4% of the 2,189 cases in the City. San Francisco is similar to the nation in having a small percentage of all TB cases occurring among children. TB in a child is usually found after first discovering a case in an adult with whom the child has close contact.<sup>8</sup>

Citywide, the number of new cases of TB is decreasing, among both children and adults. San Francisco's decrease in TB cases parallels trends in both California and the U.S. in which the number of new cases has declined each year since 1994. The reduction in new cases of TB is attributed to efforts to target the population in which TB is being transmitted. The ten new cases in San Francisco children and youth ages 0 to 18 in 1996 represents a 44% decline from 1990 (18 cases), and compares to a decline of 21% of cases among individuals ages 19 and over (251 in 1996; 316 in 1990).

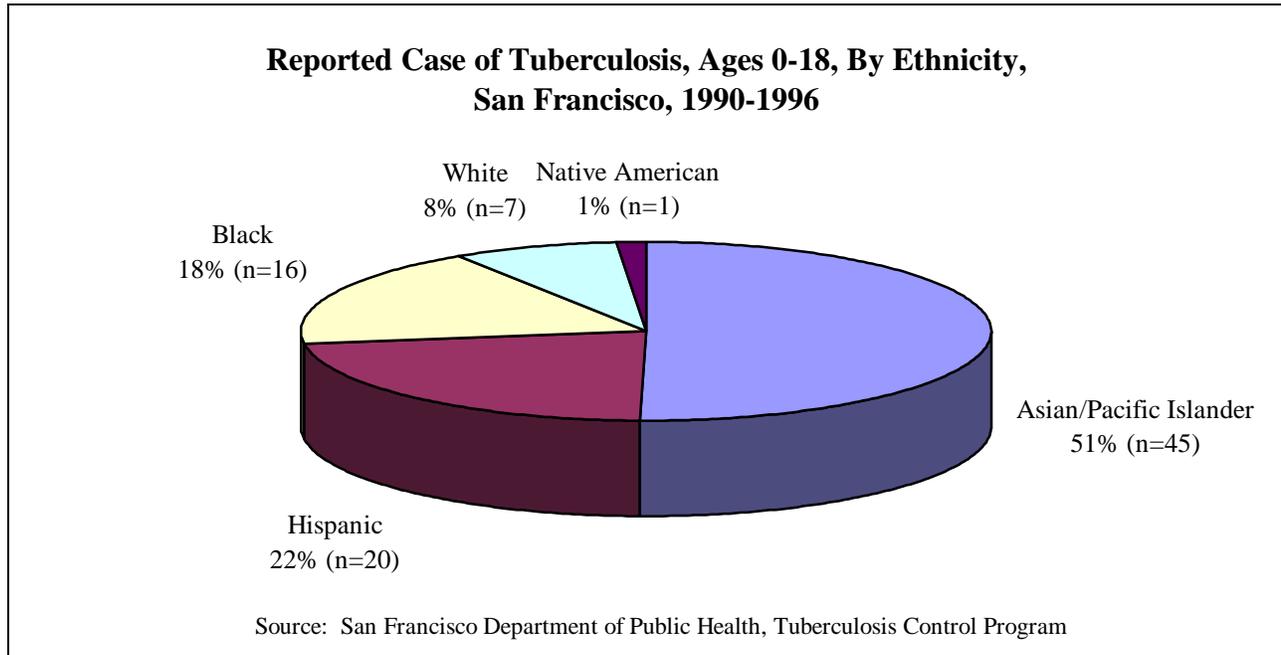


**By Age Group.** During the seven-year period, infants and young children up to age 5 represented 43% (39) of the cases, children ages 6 to 12 represented 21% (19) of cases, and youth ages 13 to 18 represented 35% (31) of cases. In 1996, San Francisco children under age 15 and youth ages 15 to 24 experienced the lowest rates of TB (94.5 and 12.1 per 100,000 respectively in 1996), compared to other age groups (42.7 to 65.1 per 100,000 for ages 25 and older).<sup>9</sup>

<sup>8</sup> Khan, Ejaz A., and Starke, Jeffrey R., "Diagnosis of Tuberculosis in Children: Increased Need for Better Methods," *Emerging Infectious Diseases*, Vol. 1 (4), October-December 1995.

<sup>9</sup> San Francisco Department of Public Health, TB Control Division. *Tuberculosis in San Francisco, 1996*. There are no Healthy People 2000 objectives specifically for the children and youth population. Healthy People 2000 objective 20.4 is to reduce TB to an incidence of no more than 3.5 cases per 100,000 people (all ages). Subobjectives include 20.4a for Asians/Pacific Islanders 15; 20.4b for Blacks 10; 20.4c for Hispanics 5; and 20.4d for American Indians/Alaska Natives 5.

By Race/Ethnicity. Pediatric TB rates between 1990 and 1996 among non-White racial/ethnic minorities were substantially higher than non-Hispanic whites. Nearly all (92%) new TB cases



reported among children and youth were in non-White racial/ethnic groups. About half (51%) of new pediatric TB cases were among Asian/Pacific Islanders, while Hispanics and African Americans comprised an additional 40% of reported cases.

By Foreign-Born Status. Over half (53%) of new active cases of TB among children and youth were among foreign-born residents (Philippines, 16 cases; Central and South America, 15; Southeast Asia, 9; China and Hong Kong 5; Africa 2).