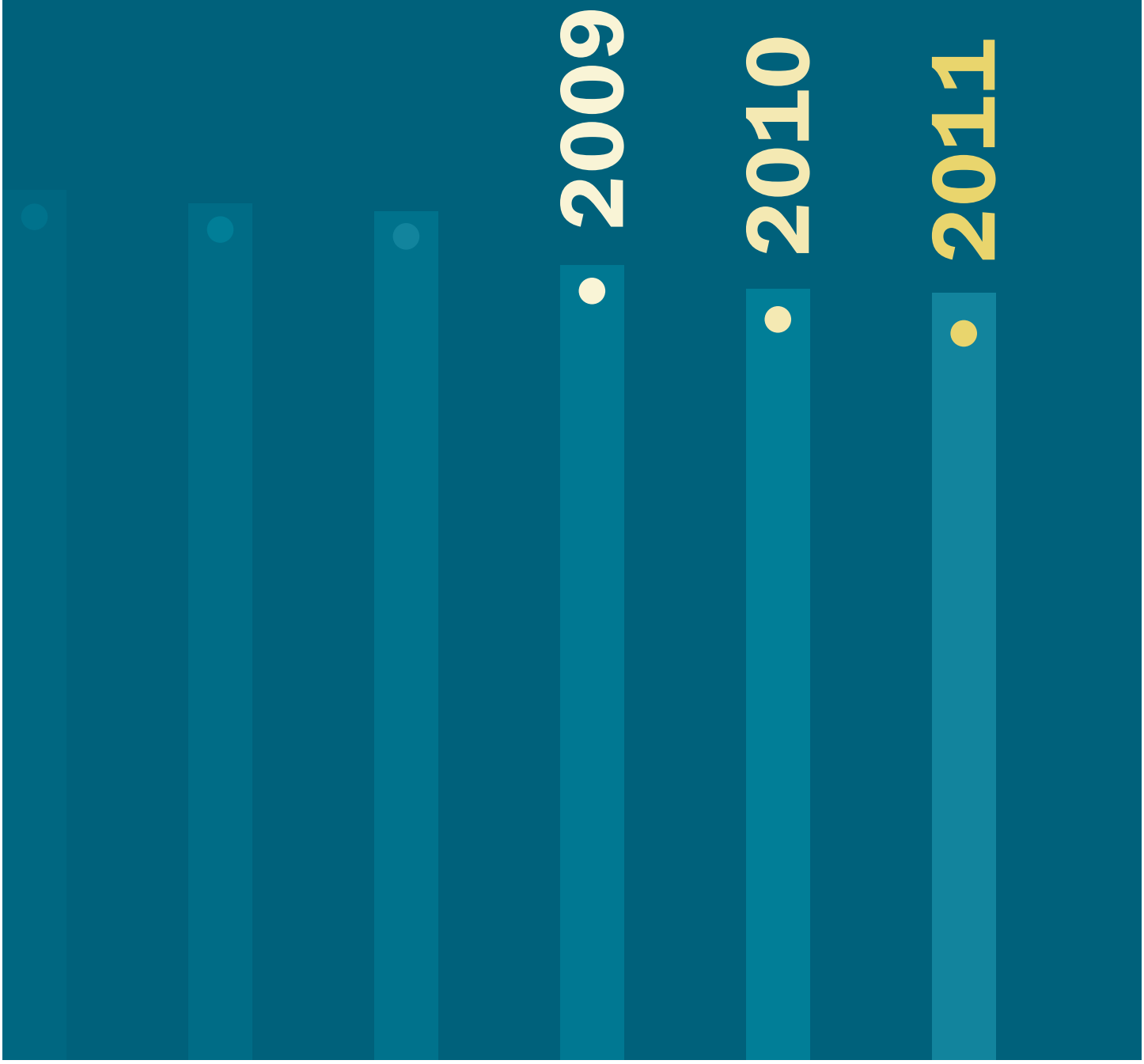
THREE-YEAR SUMMARY

New York City Department of Health and Mental Hygiene
Bureau of Tuberculosis Control



MISSION

The mission of the Bureau of Tuberculosis Control (BTBC) is to prevent the spread of tuberculosis (TB) and to eliminate it as a public health problem in New York City

GOALS:

- To identify all individuals with suspected and confirmed TB disease and ensure their appropriate treatment, ideally on a regimen of directly observed therapy
- To ensure that individuals who are at high risk for progression from latent TB infection to active disease (e.g., contacts of active cases, immunocompromised individuals, recent immigrants from areas where TB is widespread) receive treatment for latent TB infection and do not develop disease

ACTIVITIES INCLUDE THE FOLLOWING:

- Maintain a surveillance system of TB suspects and all TB cases and their contacts, and ensure confidentiality of data
- Ensure that providers and laboratories report suspected and confirmed cases to BTBC
- Monitor and document the treatment status of all patients with active TB
- Conduct intensive case management to ensure TB cases remain under medical supervision until treatment completion, with directly observed therapy as the standard of care
- Conduct contact investigation to identify and treat individuals with TB infection or disease and place them on appropriate treatment
- Conduct outbreak detection and management to prevent spread of TB in New York City
- Set standards and guidelines, and provide consultation on all aspects of TB control, including prevention, diagnosis and treatment of TB disease and latent TB infection
- Perform timely reviews and approvals of discharge and treatment plans submitted by hospitals and providers
- Operate state-of-the-art chest centers to screen, diagnose and treat TB cases at no cost to the patient
- Ensure that TB culture specimens are sent to the Public Health Laboratory for DNA analysis
- Collaborate with community-based organizations and other agencies to improve prevention and control of TB

THREE-YEAR SUMMARY: 2009, 2010, 2011

New York City Department of Health and Mental Hygiene

Bureau of Tuberculosis Control

NYC Health

ACKNOWLEDGEMENTS

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ABOUT THIS REPORT:

This report covers calendar years 2009, 2010 and 2011 and provides robust surveillance data, concise summaries of core program activities and highlights for the reporting period.

The data herein reflects the most complete information available as of March 9, 2012.

In September 2010, the Bureau of Tuberculosis Control began using a new TB surveillance system. Due to differences in the way some variables are collected in the new system, data may be unavailable and/or may not be directly comparable to data collected in previous years. These instances are noted where applicable.

A pdf of this report and slides for select figures and tables will be available at nyc.gov, search "TB report"

March, 2012

Dear Colleagues,

The incidence of tuberculosis (TB) in New York City (NYC) continues to steadily decline, decreasing from 9.3 per 100,000 persons in 2009 to 8.5 in 2011. In 2009, there were 760 cases of TB in NYC, which decreased to 711 in 2010 and to 689 in 2011 (the lowest number since TB became reportable). Since the peak of the TB outbreak in 1992, the number of TB cases has declined by 82%, while the number of multidrug-resistant TB cases has decreased by 97% (from 441 to 16).

TB incidence in NYC, and in the United States (U.S.) as a whole, is directly tied to the global TB epidemic. In 2011, 80% (552/689) of all TB cases in NYC were among individuals born outside the U.S. The NYC Department of Health and Mental Hygiene Bureau of TB Control (BTBC) is committed to working with providers and communities to develop innovative strategies for high-risk populations, while continuing to offer high-quality care, case management and consultation for all NYC TB patients.

In commemoration of World TB Day 2012, the BTBC joins the World Health Organization and the Centers for Disease Control and Prevention in adopting the slogan "Stopping TB in My Lifetime". This message encourages each one of us to take action toward the goal of TB elimination. Despite reduction in resources, the BTBC is doing its part by:

- Consolidating its chest centers to maximize utilization
- Introducing new technology to provide better case management for TB patients
- Developing effective and sustainable strategies for reducing TB in high-risk populations

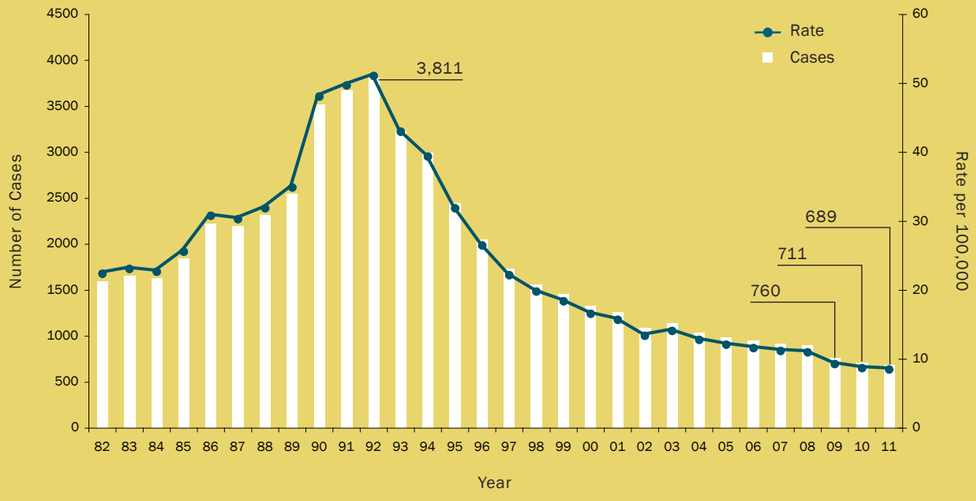
I thank the BTBC staff, non-BTBC providers and partners who report cases and manage TB patients. Without your dedicated work, the continued decline of TB in NYC would not be possible. I look forward to ongoing collaboration between the BTBC and all providers, and hope that you find this report informative as we strive to "stop TB in our lifetime"!

Sincerely,

Diana Nilsen, MD, RN
Acting Assistant Commissioner, Bureau of Tuberculosis Control

In 2011, the number of confirmed tuberculosis (TB) cases in New York City (NYC) dropped to **689**, the lowest number since the disease became reportable in 1897.

FIGURE 1: Tuberculosis cases and rates[1], New York City, 1982-2011



1. Rates are based on official Census data and intercensal estimates prior to 2000. Rates from 2000 to 2006 are based on intercensal estimates, and for 2007 to 2011 on American Community Survey 3-year estimates (2008-2010)

In 2011, the number of TB cases in NYC decreased by three percent from the previous year and by 30% since 2005, when the number of reported cases first fell below 1,000. The NYC case rate declined by nine percent between 2009 and 2011 (from 9.3 to 8.5 per 100,000 persons) but remained more than twice the national rate of 3.4 per 100,000 persons *(provisional)* in 2011.

From 2009 through 2011, there was an average annual decline of nine percent in the number of reported TB cases. However, in 2009, there was a much larger decrease of 15% from the previous year. This unusually large decrease in reported cases in 2009 was seen across the United States (U.S.) and was found to be not the result of underreporting or any amendments to TB control, but was potentially due to the economic recession.[1]

TB continues to disproportionately affect foreign-born persons and ethnic/racial minorities in NYC. Since 2000, more than 60% of TB cases occurred among foreign-born persons, while 80% of the total reported cases in 2011 were among the foreign-born. The highest number of cases among the foreign-born occurred among Asians. Among the U.S.-born, the highest number of cases occurred among non-Hispanic blacks.

While the proportion of multidrug-resistant (MDR TB) cases remains low in NYC (2% in 2011), the number of MDR TB cases increased from nine in 2009 to 16 in 2011. Of the 16 MDR TB cases counted in 2011, all occurred among foreign-born persons and two were extensively drug-resistant (XDR).

Decreased utilization, in conjunction with the significant reduction in TB cases, prompted the closure of four Bureau of TB Control (BTBC) chest centers between 2009 and 2011, reducing the number of chest centers from nine to five. The BTBC also revised its policy on eligibility for TB testing at BTBC chest centers in 2009.This revision excluded from eligibility anyone seeking testing for administrative purposes such as for work or school unless dictated by existing laws or mandates.

In August 2010, the BTBC began using tablet computers to capture and count each patient's directly observed therapy (DOT) observation and more efficiently track treatment adherence rates.

Between 2009 and 2011, the BTBC identified 14,995 contacts to TB cases, of whom 12,043 (80%) were evaluated. Expanded contact investigations were conducted at 71 congregate settings.

Three outbreaks identified through genotyping prompted extensive BTBC intervention between 2009 and 2011. An ongoing outbreak which began in 2007 led to a TB education campaign in Harlem in 2009. A cluster-related expanded contact investigation in an adult entertainment establishment involved large-scale use of QuantiFERON®-TB Gold In-Tube in the field and an environmental assessment. Identification of seven geographically-concentrated cases with a TB strain not seen before in NYC prompted targeted outreach activities in the neighborhood of Sunset Park, Brooklyn.

The New York City Health Code was amended in June 2010 to require health care providers to submit a discharge plan to the BTBC for review and approval prior to discharging infectious TB patients from the hospital. In addition, providers must now submit to the BTBC a proposed treatment plan within one month of treatment initiation for all persons newly diagnosed with active TB.

Despite the progress made in reducing both the number of TB cases and the TB rate, eliminating TB as a public health problem in NYC cannot be achieved without further program enhancement, particularly among foreign-born communities. To that end, the Commissioner of the NYC Department of Health and Mental Hygiene (DOHMH) has prioritized the development of innovative interventions to prevent TB in foreign-born populations.

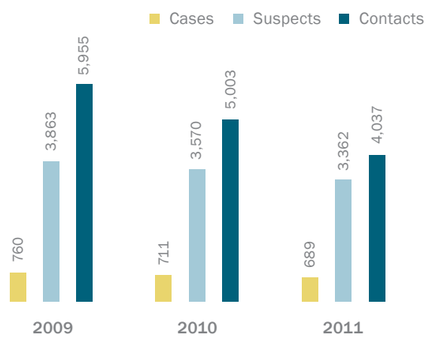
1. Winston et al.: Unexpected decline in tuberculosis cases coincident with economic recession – United States, 2009. BMC Public Health 2011 11:846.

Surveillance

Surveillance is a crucial component of TB control in NYC. The BTBC's surveillance unit ensures thorough and accurate reporting of TB suspects and cases by providers and laboratories, assigns patients for case management, reviews data for timeliness and completeness, and coordinates the inter-jurisdictional transfer of patients into and out of NYC. The surveillance unit also maintains the TB registry, monitors TB trends, prepares surveillance reports, and provides data support to other BTBC staff. *For information on TB reporting requirements in NYC, see Appendix III.*

From 2009 through 2011, the BTBC received and processed new reports for 12,955 persons. The number of reports received by the BTBC decreased 12% from 2009 to 2011.

NUMBER OF CASES, SUSPECTS AND CONTACTS, NEW YORK CITY, 2009-2011



The BTBC referred 1,623 patients (including cases, suspects and contacts) to other jurisdictions for follow-up and treatment between 2009 and 2011; 979 patients were referred to the BTBC from other jurisdictions during the same period.

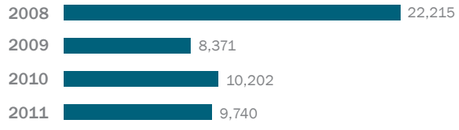
Since 2006, New York State has required nucleic acid amplification (NAA) testing for all initial acid-fast bacilli (AFB) smear-positive respiratory specimens. Rapid diagnostic tests help to prioritize contact investigations for TB suspects and lend support to TB diagnoses. Between 2009 and 2011, 74% of TB suspects and cases with respiratory AFB smear-positive specimens in NYC received NAA testing, compared to 64% in 2005.

★ In September 2010, the BTBC replaced its mainframe-based TB registry with a web-based surveillance and case management system. The new system features electronic case reporting by health care providers and laboratories and permits automatic patient referrals and assignment among BTBC staff, resulting in more efficient management of patient care and treatment.

Chest Centers

BTBC operates chest centers located throughout NYC. Each chest center provides TB diagnostic testing, outpatient medical and nursing care, treatment for latent TB infection (LTBI) and active TB disease, social service referrals, human immunodeficiency virus (HIV) counseling and testing, and directly observed therapy (DOT) at no cost to the patient. TB diagnostic testing includes sputum induction, chest radiographs, tuberculin skin test (TST), and QuantiFERON®-TB Gold In-Tube (QFT) blood-based tests. QFT has several advantages over TST, including a lower likelihood of false-positive results and only requiring a single clinic visit.

NUMBER OF QUANTIFERON® TESTS ADMINISTERED AT BTBC CHEST CENTERS, 2008-2011

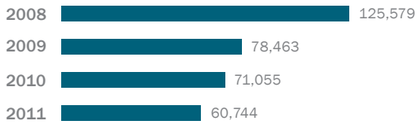


★ The BTBC revised its policy on eligibility for TB testing at chest centers in 2009. This revision excludes from eligibility anyone seeking testing for administrative purposes such as work or school unless dictated by existing laws or mandates. Testing for TB infection at BTBC chest centers is currently available to persons exposed to infectious TB disease and those for whom testing is mandated by law, including new entrants into secondary schools in NYC.

In 2009, the BTBC operated nine chest centers. As a result of decreased utilization and the significant reduction in the incidence of TB disease in NYC, four chest centers were closed between 2010 and 2011. There are currently five BTBC chest centers in NYC, one in each borough. *For a complete list of BTBC chest centers, see page 31.*

The number of patient visits to BTBC chest centers decreased 37% between 2008 and 2009, largely due to changes made to the TB testing policy in the first quarter of 2009. The number of visits decreased 23% between 2009 and 2011. These decreases were expected because of the closure of BTBC chest centers.

NUMBER OF PATIENT VISITS TO BTBC CHEST CENTERS, 2008-2011



The BTBC conducts domestic follow-up evaluations for newly arrived immigrants with an overseas TB screening classification within 90 days of arrival to NYC to rule out active TB and offer treatment. From 2009 to 2011, there were 3,134 immigrants and refugees with overseas TB screening classification reported to the BTBC. Between 2008 and 2009, there was an increase in the number of immigrants with overseas TB screening classification, corresponding to implementation of new screening guidelines in countries contributing a large number of immigrants to NYC. On average, over 80% of immigrants and refugees with a TB screening classification are evaluated within 90 days of arrival in the U.S.

From 2009 to 2011, BTBC conducted 14,959 tests for HIV. Of these, 14,603 (98%) tests were provided at BTBC chest centers using OraQuick Rapid HIV-1/2 antibody tests, and 356 tests were conducted by BTBC staff members for contacts of TB cases in the field using conventional OraSure HIV-1 antibody tests. The proportion of HIV-positive results for this period was 0.4% (52/14,959).

Field Services

The BTBC provides DOT and case management activities in all five boroughs of NYC. These activities are provided to hospitalized patients, to those who receive care from outpatient clinics and medical offices, to patients incarcerated at Rikers Island (the largest correctional facility in NYC), and to difficult-to-treat TB patients (who failed all other interventions) detained at the Bellevue Hospital Center.

All confirmed TB cases and many persons with suspected TB disease are assigned to BTBC case managers. Case management of TB patients includes the following activities:

- Patient education on TB pathogenesis and transmission
- Comprehensive standardized patient interview
- Identification and evaluation of contacts to TB patients (includes TB testing in the field)
- DOT
- HIV testing in the field
- Patient support to maintain or improve adherence to treatment
- Locating non-adherent patients and returning them to medical supervision
- Ongoing case review with BTBC physicians
- Quarterly cohort review to ensure treatment completion for all cases and evaluation of all contacts
- Collaboration with non-BTBC health care providers
- Transfer of clinical care between NYC and other jurisdictions for patients who move

During 2009-2011, the BTBC provided case management to 2,160 newly counted cases and 3,779 suspects. The BTBC also continued to increase its collaboration with non-BTBC providers to control and manage TB in NYC.

PROPORTION OF TB CASES TREATED EXCLUSIVELY BY NON-BTBC PROVIDERS, 2009-2011

Between 2009 and 2011, 14,995 contacts to TB cases were identified. Of these, 12,043 (80%) were evaluated. and 2,233 (19%) were found to have latent TB infection.

★ Prior to August, 2010, DOT data were collected manually. In August 2010, the BTBC began using tablet computers to capture and count each patient's DOT observation, enabling the BTBC to more efficiently track treatment adherence rates. In 2011, BTBC case managers conducted 17,488 observations for 699 patients.

Medical Treatment and Consultation

BTBC physicians provide medical evaluation and treatment for active TB cases and suspects and patients with LTBI. In addition, they conduct standardized reviews of TB cases and suspects and provide non-BTBC providers with consultation on TB treatment and patient management. The BTBC monitors all cases with drug-resistant TB in NYC and provides treatment and monitoring recommendations. BTBC physician experts give medical grand rounds on TB topics at hospitals and outpatient facilities throughout the city, and work with hospitals to coordinate presentation of challenging TB cases at Citywide TB Rounds.

During 2009-2011, the BTBC continued its ongoing collaborations with the four Centers for Disease Control and Prevention (CDC)-sponsored Regional Training and Medical Consultation Centers, working closely with the Northeastern RTMCC at the New Jersey Medical School Global TB Institute. BTBC personnel have served as trainers, lecturers and coordinators at courses on genotyping, cluster investigation and medical management of TB. BTBC staff also serve on the Northeastern RTMCC medical advisory board and the project advisory committee for the Southeastern RTMCC's *Vivir a Todo Pulmón* campaign. BTBC physicians participate in the TB Expert Network Conference, a joint project between the CDC, all RTMCCs and the National Jewish Medical Research Center. BTBC conducts research on all aspects of TB control, including participation in clinical research through the CDC TB Trials Consortium, which conducts national and international research studies to develop new treatment regimens for TB and LTBI. *For a list of BTBC publications and presentations, see Appendix IV.*

Universal Genotyping, False Positive Investigation and Clustering

In 2001, the BTBC began universal genotyping of TB isolates using spacer oligonucleotide typing (spoligotyping) and IS*6110* restriction fragment length polymorphism (RFLP) analysis. Genotype results identify whether TB strains are genetically related (i.e., are clustered), which helps the BTBC identify false-positive culture results, detect outbreaks, and detect places where TB transmission may be occurring.

Participation of hospital and commercial laboratories continues to be high. Isolates were submitted to NYC and New York State public health laboratories for 1,517 (98%) of 1,551 culture-confirmed cases between 2009 and 2011. Complete genotyping results were available for 1,459 (94%) patients during the same period, of which 43% were clustered to another NYC case. These clustered cases were in 700 different genotype clusters that ranged in size from two to 193 persons.

The BTBC performs prompt investigations of false-positive cultures to make sure that patients are not placed on anti-TB medications unnecessarily. False-positive investigations are initiated through BTBC physician review of patients with single positive respiratory cultures, prospective matching of genotype results, and requests from BTBC staff or non-BTBC physicians, laboratories, and health departments.

FALSE-POSITIVE INVESTIGATIONS, NEW YORK CITY, 2009-2011

Year	Number of investigations	Confirmed false-positives	False positive yield[1]
2009	54	21 (39%)	4%
2010	53	20 (38%)	4%
2011	47	13 (28%)	3%

1. False positive yield=(number of confirmed false-positive cultures) / (number of confirmed positive cultures + number of confirmed false-positive cultures)

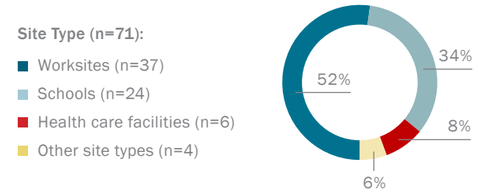
During 2009-2010, cluster investigation of five cases with matching TB strains resulted in an expanded contact investigation at an adult entertainment establishment. The investigation involved three phases of testing, including large-scale use of QFT testing in the field, two education sessions, and an environmental assessment.

★ In July 2010, a strain of TB not seen before in NYC was identified. By the end of 2011, six additional cases were diagnosed with this strain. All seven patients were male, between the ages of 22 and 28, born in the Fujian Province of China, and resided within a four-square-block area in Sunset Park, Brooklyn. To date, only two patients have been linked as known contacts to each other. Given the rapid growth in the number of clustered cases, the relative lack of links between cases, and the strong geographic concentration of the cluster, BTBC conducted community outreach in Sunset Park. BTBC staff distributed Chinese-language posters and flyers to enhance case-finding, educate neighborhood residents about the signs and symptoms of TB, and direct them to available resources for medical evaluation. BTBC staff approached more than 180 businesses, including restaurants, stores, pharmacies, and internet cafes. Posters were installed or given to business owners or flyers were left for customers at 173 (96%) sites.

Outbreak Detection and Management

Early detection of TB is crucial to preventing transmission and controlling outbreaks. When exposures occur, the BTBC uses multiple methods to identify and control TB transmission. The BTBC investigates all TB exposures in congregate settings to identify contacts and to determine if transmission has occurred and whether further testing is warranted.

EPIDEMIOLOGIC INVESTIGATIONS IN CONGREGATE SETTINGS BY SITE TYPE AND TRANSMISSION ASSESSMENT, 2009-2011



Transmission assessment	2009 (n=28)	2010 (n=18)	2011 (n=25)
Probable	9 (32%)	9 (50%)	5 (20%)
Possible	3 (11%)	3 (17%)	3 (12%)
Unlikely	15 (53%)	5 (28%)	17 (68%)
Could not be assessed	1 (4%)	1 (5%)	-
Number of contacts tested	1,257	1,010	975

Education, Training and Outreach

As the number of TB cases decreases in NYC, the need for continuous educational efforts to maintain knowledge and vigilance about TB is essential. The BTBC's education, training and outreach unit ensures that BTBC staff, non-DOHMH health care providers, and communities receive relevant training and updates throughout the year.

The BTBC held medical conferences for health care providers in 2009, 2010 and 2011 in honor of World TB Day. Each conference educated about 200 local health care providers on new advances in TB diagnosis and treatment, infection control, and other relevant topics. In 2009, the conference for health care providers was complemented by a community forum, attended by local elected officials, community leaders and others. Each year, the BTBC also provides training for up to 100 non-DOHMH nurses on TST administration.

In response to an ongoing outbreak, the BTBC conducted outreach in Harlem in 2009 to increase TB awareness and educate the community about TB symptoms and the availability of BTBC services. After piloting educational materials among BTBC chest center patients and community members, BTBC staff members distributed posters and handouts to approximately 350 local businesses and organizations. Positive feedback on the campaign materials and interest in the posters led to their translation, publication and distribution in ten languages. *For information about ordering free TB educational posters and other materials, see Appendix II.*

★ In 2011, the BTBC launched the Stop TB in Foreign-born Populations Initiative in response to the large proportion of foreign-born persons with TB in NYC. The initiative aims to develop innovative and customized interventions to decrease the burden of TB in high-risk, foreign-born populations.

Mexican and Tibetan populations were selected for the piloting of this project. In the first phase of the initiative, the BTBC is conducting needs assessments among TB patients and community members, in addition to health care providers serving these communities. To date, the BTBC has reached out to more than 10 government and community organizations, administered an online survey to all BTBC staff, and conducted 39 key informant interviews. The information gathered through these needs assessments will be used to inform the development of tailored interventions to reduce TB in foreign-born communities in NYC.

Patient Characteristics

COUNTRY OF BIRTH

The proportion of TB cases among foreign-born persons was 80% in 2011, a slight increase from 77% in 2009. The 2011 TB rate in foreign-born persons was 18.5 per 100,000 persons, more than seven times higher than the rate among the U.S.-born (2.6 per 100,000 persons) (Figure 2). In each of the past three years, China, Mexico, Dominican Republic and Ecuador were among the top five countries of birth for foreign-born persons with TB.

RACE/ETHNICITY

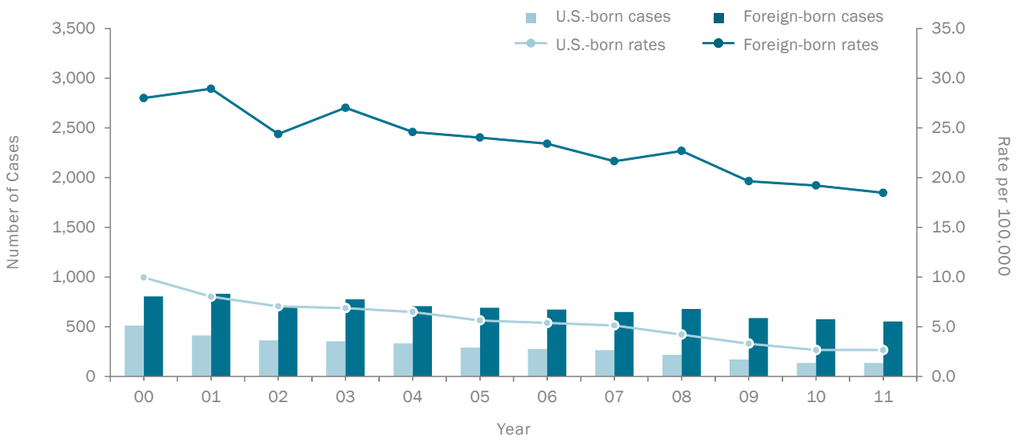
Although the TB rate has decreased among most racial/ethnic groups in the past few years (Figure 3), ethnic minorities continue to be disproportionately affected by TB disease. In 2011, the TB case rate among Asians—the group with the highest incidence—was nine times higher than the rate for non-Hispanic whites, the group with the lowest incidence (25.3 versus 2.6 per 100,000 persons, respectively).

AGE

The largest number of TB cases continued to occur among those in the 20- to 44-year old age group, with 342 cases (45%) in 2009, 312 cases (44%) in 2010, and 318 cases (46%) in 2011 (Figure 4).

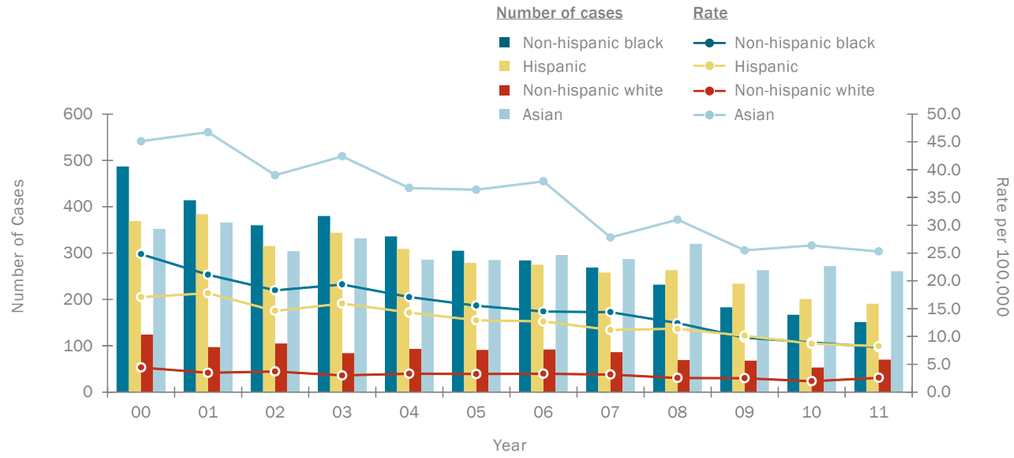
Persons in the 65 years and older age group had the highest TB rate from 2009 through 2011. In 2011, the rate in persons 65 years of older increased by 14% from the previous year (from 11.9 to 13.6 per 100,000), after a decline from 2009 (from 14.4 to 11.9 per 100,000 persons).

FIGURE 2: Tuberculosis cases and rates[1] by birth in the United States (U.S.),[2] New York City, 2000-2011



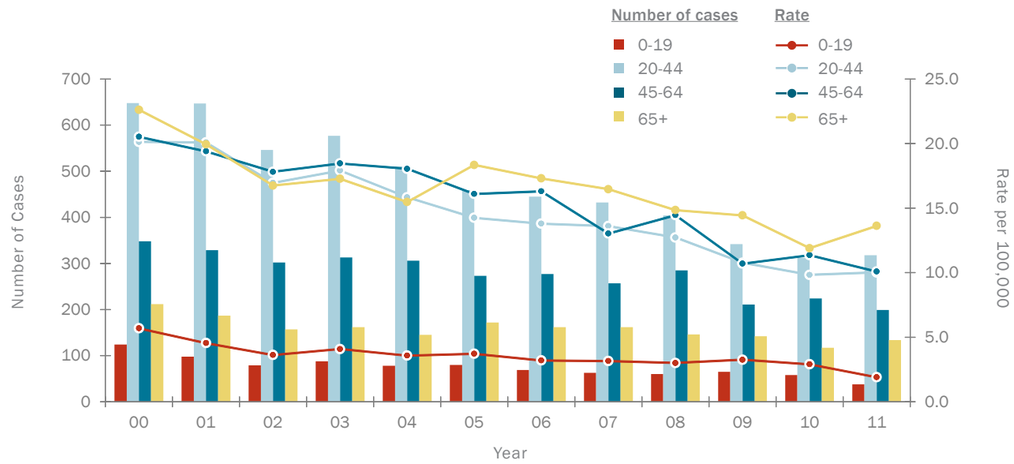
1. Rates are based on official Census data and intercensal estimates prior to 2000. Rates for 2000 to 2006 are based on 2000 Census data, and those for 2007 to 2011 on American Community Survey 3-year estimates (2008-2010)
2. Puerto Rico and U.S. Virgin Islands are included as U.S.-born

FIGURE 3: Tuberculosis cases and rates[1] by race/ethnicity, New York City, 2000-2011



1. Rates are based on official Census data and intercensal estimates prior to 2000. Rates for 2000 to 2006 are based on 2000 Census data, and those for 2007 to 2011 on American Community Survey 3-year estimates (2008-2010)

FIGURE 4: Tuberculosis cases and rates[1] by age in years, New York City, 2000-2011



1. Rates are based on official Census data and intercensal estimates prior to 2000. Rates for 2000 to 2006 are based on intercensal estimates, and those for 2007 to 2011 are based on American Community Survey 3-year estimates (2008-2010)

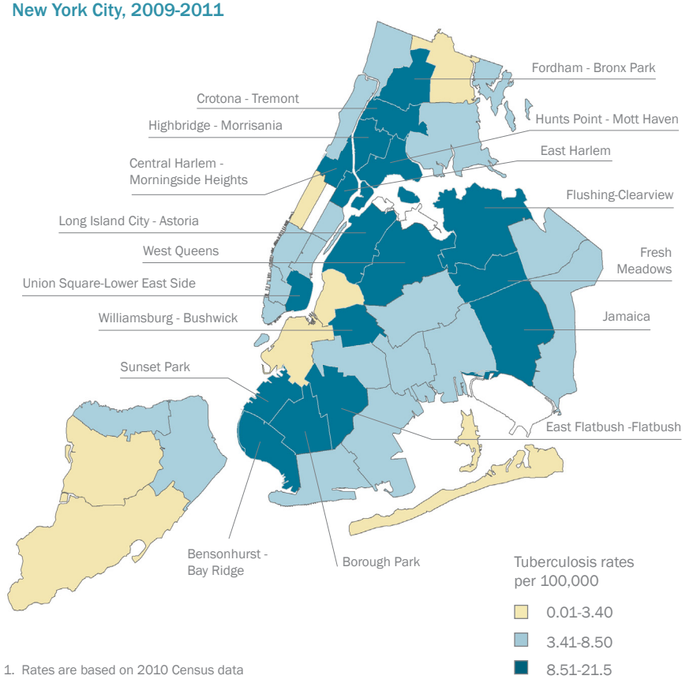
GEOGRAPHIC DISTRIBUTION

From 2009 to 2011, there were 17 United Hospital Fund (UHF) neighborhoods with a TB rate that exceeded the 2011 NYC TB rate of 8.5 per 100,000 persons (Figure 5). The UHF neighborhood with the highest TB rate in 2011 was West Queens (Figure 7).

Queens continued to have the highest burden of TB between 2009 and 2011, with 36% of all NYC cases for each year (276 cases in 2009, 259 in 2010 and 249 in 2011) (Figure 6). Overall, the TB rate decreased from 2009 to 2011 in all boroughs except Brooklyn, where the rate increased from 8.2 to 8.8 per 100,000 persons.

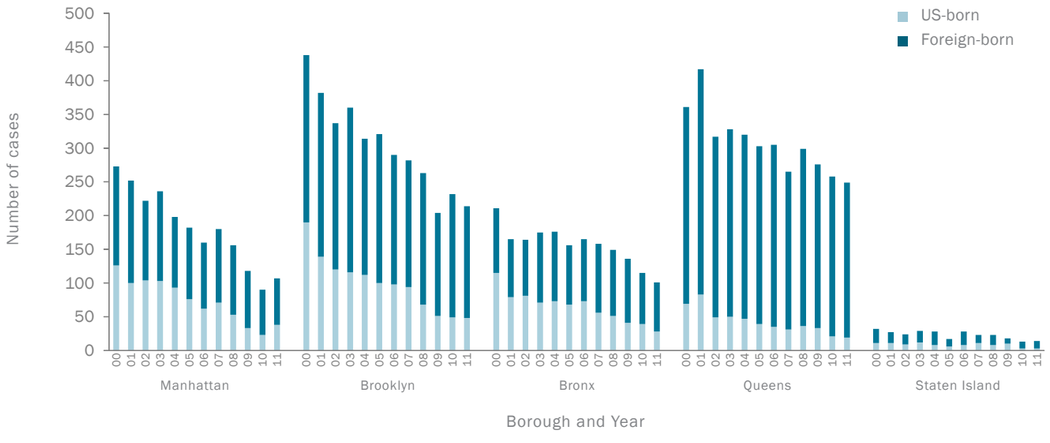
In Sunset Park, Brooklyn, the rate increased dramatically from 2009 to 2010 (14.9 to 22.7 per 100,000 persons), likely attributable to an outbreak in that neighborhood *(see page 12)*. The rate in Sunset Park decreased to 18.8 in 2011.

FIGURE 5: Tuberculosis rates[1] by United Hospital Fund neighborhood, New York City, 2009-2011



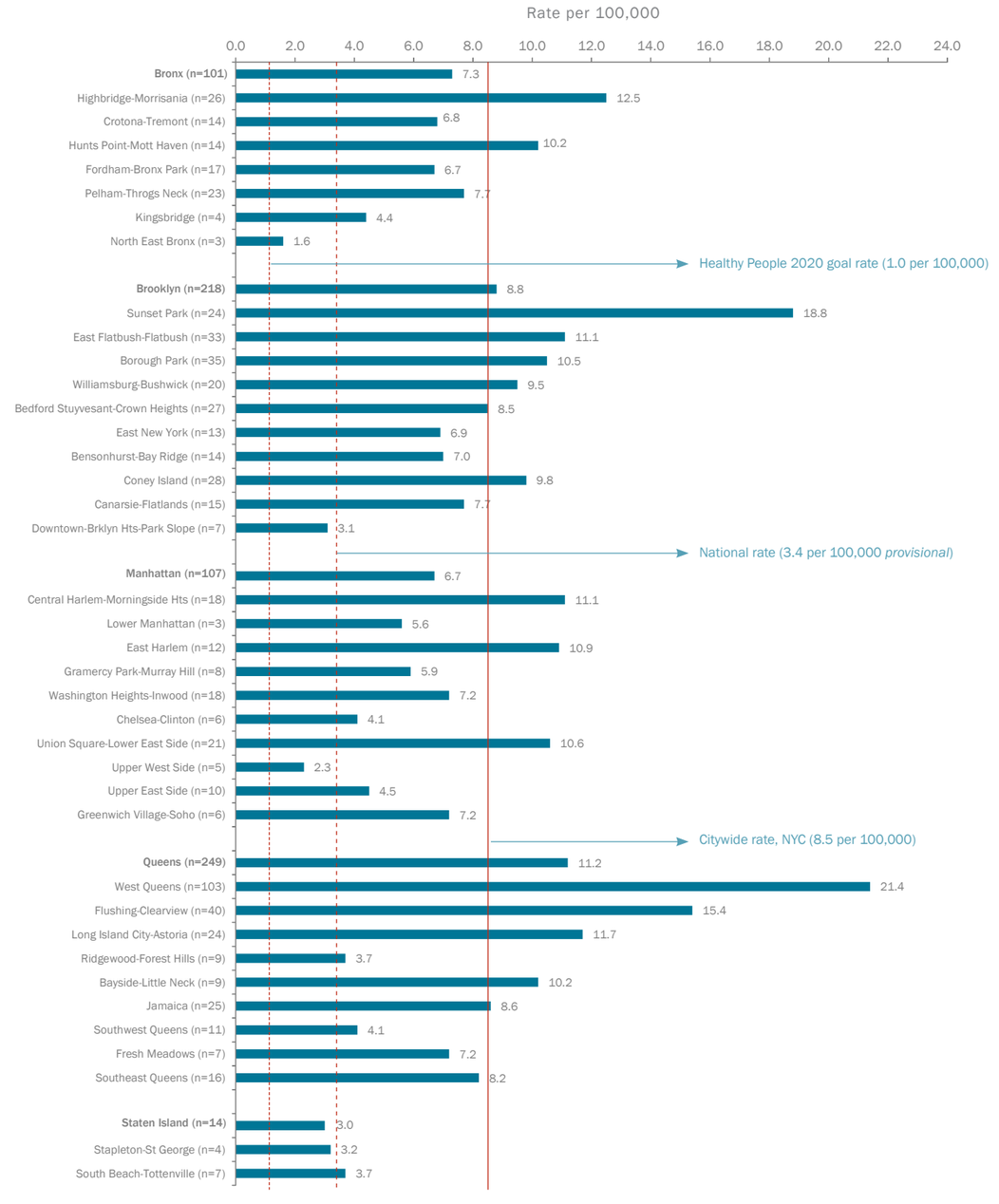
1. Rates are based on 2010 Census data

FIGURE 6: Tuberculosis cases by borough and birth in the United States[1] (U.S.), New York City, 2000-2011



1. Puerto Rico and U.S. Virgin Islands are included as U.S.-born

FIGURE 7: Tuberculosis rates[1] by borough and United Hospital Fund (UHF) neighborhood,[2,3] New York City, 2011



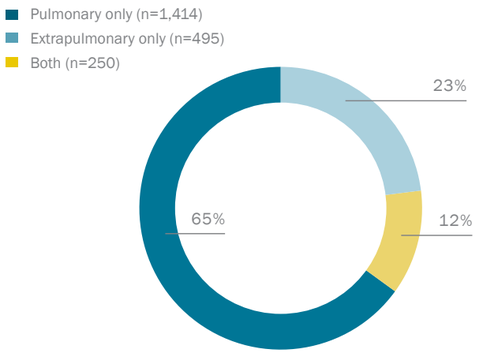
1. Rates per 100,000 population are based on 2010 Census data. Caution should be used in interpreting case rates for neighborhoods with a small number of cases
2. There were two cases with missing ZIP code information in 2011
3. Neighborhoods with two or fewer cases counted during this period are not shown

Clinical Characteristics

SITE OF DISEASE

The proportion of patients with a pulmonary disease site only between 2009 and 2011 was 65%, while the proportion with an extrapulmonary site only was 23%. There was an increase from 10% to 13% among cases with both a pulmonary and extrapulmonary site of disease during this time period. Among cases with extrapulmonary TB only, the lymphatic system was the most common site of disease in all three years (Figure 8).

FIGURE 8: Tuberculosis cases by disease site, New York City, 2009-2011



DISEASE SITE AMONG CASES WITH EXTRAPULMONARY TB DISEASE ONLY, NEW YORK CITY, 2009-2011

Disease Site[1]	2009	2010	2011
Lymphatic	93	72	64
Pleural	24	39	20
Peritoneal	7	14	6
Bone/joint	21	11	19
Meningeal	12	9	9
Genitourinary	16	9	9
Other	18	14	26

1. Categories are not mutually exclusive

HIV CO-INFECTION

The number of TB cases with HIV co-infection declined from 68 in 2009 to 58 in 2011, a 15% decrease (Figure 9). The proportion of TB patients with HIV co-infection has declined over time, from 18% in 2000 to 8% in 2011.

Among TB cases with known HIV status information in 2011, 518 (95%) had a verified test result, 17 (3%) were self-reported and 8 (1%) were unknown.

CULTURE AND SMEAR RESULTS

More than 70% of TB cases had isolates that were culture positive for *M. tuberculosis* during 2009-2011. Among cases with a pulmonary disease site, the proportion of cases with a specimen that was acid-fast bacilli sputum smear positive decreased from 48% to 42% between 2009 and 2011.

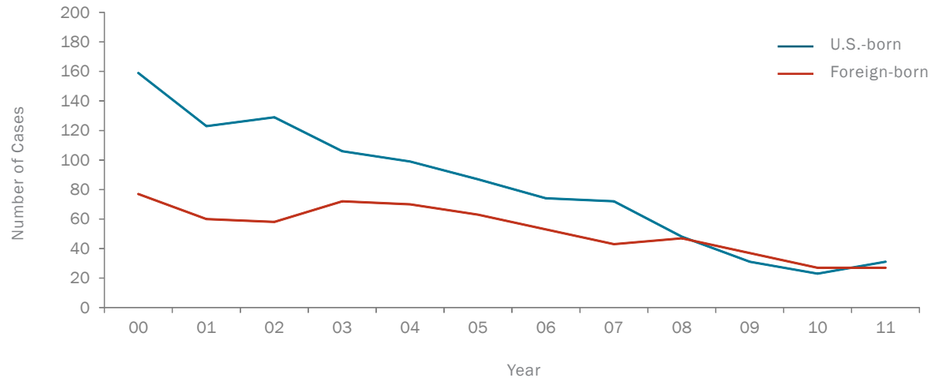
DRUG RESISTANCE

Drug susceptibility testing for first-line drugs was performed for more than 99% of culture-positive cases in 2009 and 2010 and for 98% in 2011. Of those, 90 (17%) were drug-resistant in 2009, 96 (19%) in 2010, and 85 (17%) in 2011.

In 2011, the number of multidrug resistant (MDR TB: resistant to at least isoniazid and rifampin) cases was 16, an increase of 78% from 2009 (Figure 10). Two had extensively drug-resistant TB (XDR TB: resistance to isoniazid and rifampin plus resistance to any flouroquinolone and to an injectable second-line anti-TB medication, e.g. amikacin, kanamycin or capreomycin). No XDR TB cases were reported in the previous two years.

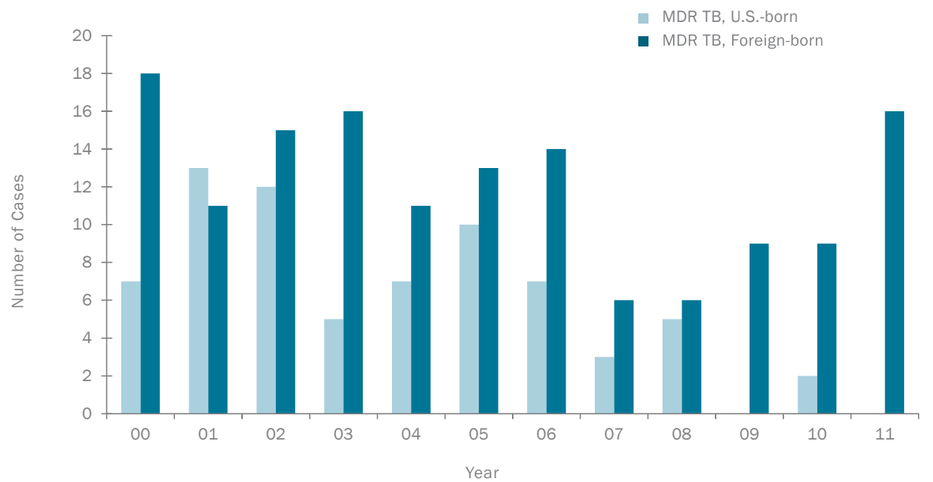
In 2011, 58% (40/69) of TB cases with other drug resistance (ODR) patterns were resistant to isoniazid only, compared to 41% (35/85) in 2010 and 36% (29/81) in 2009.

FIGURE 9: HIV co-infection among tuberculosis cases by birth in the United States[1] (U.S.), New York City, 2000-2011[2]



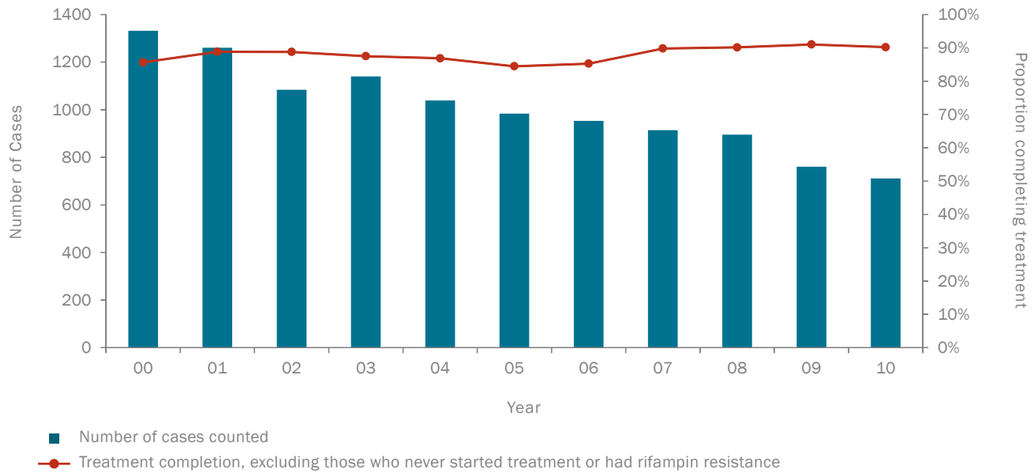
1. Puerto Rico and U.S. Virgin Islands are included as U.S.-born
2. Total number of HIV-infected cases may be more than the sum of U.S.- and foreign-born HIV-infected cases because area of birth is unknown for some cases

FIGURE 10: Multidrug resistance (MDR TB)[1,2] by birth in the United States[3] (U.S.), New York City, 2000-2011



1. Multidrug-resistant TB is defined as a TB strain resistant to at least isoniazid and rifampin
2. Multidrug-resistant TB includes extensively drug-resistant TB (XDR TB), defined as resistance to isoniazid and rifampin plus resistance to any flouroquinolone and to an injectable second-line anti-TB medication, (e.g., amikacin, kanamycin or capreomycin)
3. Puerto Rico and U.S. Virgin Islands are included as U.S.-born

FIGURE 11: Tuberculosis treatment completion[1,2], New York City, 2000-2010



1. Treatment completion is analyzed with one year of delay to allow sufficient time for completion, therefore, data for 2011 is not presented
2. Treatment completion is calculated as per World Health Organization (WHO) and does not exclude patients who died

Treatment Outcomes

Overall, 90% of patients diagnosed with TB in 2010 who initiated treatment completed, compared to 91% among those initiating treatment in 2009 and 90% among those starting treatment in 2008 (Figure 11).

The proportion of eligible TB patients who completed treatment within one year *(see footnote 1, at right)* was 91% in 2008 and 92% in both 2009 and 2010.

OUTCOMES FOR CONFIRMED TUBERCULOSIS CASES COUNTED IN 2008, 2009 AND 2010, NEW YORK CITY

Treatment outcome	2008	2009	2010
Treatment completed (regardless of 365 days)	786	667	617
Treatment completed in 365 days[1]	724	624	592
Treatment completed in more than 365 days[2]	56	37	20
Still in treatment	2	2	12
Died (any cause)	55	40	27
Lost	16	9	17
Moved[3]	12	7	7
Refused/stopped treatment	5	9	3
Other	2	2	5
Total	878	736	688

1. Excluding patients never started on anti-TB medications, those who died before completion; those with rifampin resistance; and children <15 years old with bone or meningeal TB. *(Denominators used for 2008, 2009, 2010 were 806, 681, 644, respectively)*
2. Excluding patients who never started on anti-TB medications and those who died before treatment completion *(Denominators used for 2008, 2009, 2010 were 816, 692, 654, respectively)*
3. Patients are categorized as moved only if their transfer to another jurisdiction is confirmed and no further follow-up information is available

Appendices

TABLE 1: Tuberculosis incidence, New York City, 1900-2011

Year[1]	Number of TB cases[2,3]	Rate per 100,000[4]	Culture + cases	Sputum-smear + cases[5]	Sputum smear + rate per 100,000	Multidrug-resistant cases[6]	Other drug-resistant cases[7]	Deaths attributable to TB[8]	Death rate per 100,000
1900	11,997	348.1						9,630	279.5
1910	32,065	670.0						10,074	210.5
1920	14,035	246.9						7,915	144.1
1930	11,821	170.2						4,574	68.2
1940	9,005	120.8						3,680	50.0
1950	7,717	97.8						2,173	27.4
1960	4,699	60.4						824	10.6
1970	2,590	32.8						432	5.5
1971	2,572	32.9						316	4.0
1972	2,275	29.4						335	4.3
1973	2,101	27.5						259	3.4
1974	2,022	26.7						215	2.8
1975	2,151	28.7						208	2.8
1976	2,151	29.1						187	2.5
1977	1,605	21.9						175	2.4
1978[6]	1,307	18.1						188	2.6
1979	1,530	21.4						121	1.7
1980	1,514	21.4						143	2.0
1981	1,582	22.3						155	2.2
1982	1,594	22.4						168	2.4
1983	1,651	23.1						151	2.1
1984	1,629	22.7	1,527					168	2.3
1985	1,843	25.6	1,785					155	2.2
1986	2,223	30.8	2,181					186	2.6
1987	2,197	30.3	2,157					219	3.0
1988	2,317	31.9	2,241					246	3.4
1989	2,545	34.9	2,405					236	3.2
1990	3,520	48.1	3,372					256	3.5
1991	3,673	49.7	3,484	1,772	24.0	366		245	3.3
1992	3,811	51.1	3,442	1,856	24.9[9]	441	442	200	2.7
1993	3,235	43.0	2,854	1,526	20.3	296	328	166	2.2
1994	2,995	39.4	2,479	1,265	16.7	176	245	133	1.8
1995	2,445	31.9	2,014	989	12.9	109	216	94	1.2
1996	2,053	26.5	1,721	837	10.8	84	216	67	0.9
1997	1,730	22.2	1,401	665	8.5	56	162	55	0.7
1998	1,558	19.8	1,255	558	7.1	38	135	52	0.7
1999	1,460	18.4	1,143	515	6.5	34	131	49	0.6
2000	1,332	16.6	1,066	467	5.8	25	114	44	0.5
2001	1,261	15.7	964	453	5.7	24	129	33	0.4
2002	1,084	13.4	823	429	5.4	27	102	30	0.4
2003	1,140	14.1	872	427	5.3	21	103	34	0.2
2004	1,039	12.8	798	391	4.9	18	117	30	0.4
2005	984	12.1	745	373	4.7	24	98	21	0.3
2006	953	11.6	708	354	4.4	21	94	17	0.2
2007	914	11.2	709	380	4.7	9	123	19	0.2
2008	895	11.0	688	338	4.2	11	109	18	0.2
2009	760	9.3	539	276	3.4	9	81	25	0.3
2010	711	8.7	512	241	3.0	11	85	26	0.3
2011	689	8.5	501	229	2.8	14	69	31[10]	0.4

1. TB became reportable on January 19, 1897. **2.** For "phthisis," or pulmonary cases, 1920-1940; thereafter, all forms of tuberculosis. **3.** Case definition revised in 1978 to include persons who had verified disease in the past and were discharged or lost to supervision for more than 12 months and had verified disease again. **4.** Rates before 2000 are based on official Census population data. Rates since 2000 are based on population estimates. For 2007 to 2011, rates are based on American Community Survey 3-year estimates (2008-2010); **5.** Patients with a sputum-smear positive for acid-fast bacilli regardless of culture result. **6.** Resistant to at least isoniazid and rifampin. Mandatory drug susceptibility reporting became effective during 1991; number from that year is not complete. **7.** Definition for 'Other-drug-resistant cases' changed in 2004 to include all non-MDR cases with a resistant result reported for a first-line drug, regardless of drug susceptibility testing method. All historical data has been updated to reflect this definition. **8.** TB deaths are obtained from vital statistics records and may include cases diagnosed in previous years. **9.** This information was estimated for 1992; exact figures are not available. **10.** Preliminary data

TABLE 2: Tuberculosis cases with HIV co-infection by age in years, New York City, 2000-2011

Year	Age 0-19		Age 20-44		Age 45-64		Age 65+		Total	
	n	%	n	%	n	%	n	%	n	%
2000	2	2%	147	23%	86	25%	6	3%	241	18%
2001	0	0%	121	29%	59	18%	4	2%	184	15%
2002	2	3%	109	20%	78	26%	4	3%	193	18%
2003	1	1%	112	19%	64	20%	1	<1%	178	16%
2004	1	1%	94	18%	72	24%	2	1%	169	16%
2005	3	4%	83	18%	61	22%	4	2%	151	15%
2006	1	1%	64	14%	59	21%	3	<1%	127	13%
2007	0	0	58	13%	55	21%	3	2%	116	13%
2008	1	2%	44	11%	48	17%	2	1%	95	11%
2009	1	2%	39	11%	25	12%	3	2%	68	9%
2010	0	0	27	9%	25	10%	1	<1%	50	7%
2011	0	0	23	7%	30	15%	5	4%	58	8%

TABLE 3: Tuberculosis cases by age in years and area of birth, New York City, 2000-2011

Year and Area of Birth	Age 0-19		Age 20-44		Age 45-64		Age 65+		Total	Rate/100,000[1]
	n	%	n	%	n	%	n	%		
2009										
Foreign-born	38	7%	288	57%	160	26%	101	20%	587	19.6
Caribbean and Latin America[2]	18	8%	123	53%	59	26%	31	13%	231	14.9
Asia[3]	15	6%	121	44%	82	30%	57	21%	275	33.8
Africa[4]	4	8%	32	64%	12	24%	2	4%	50	42.5
Europe[5]	1	3%	12	39%	7	23%	11	36%	31	6.6
United States (U.S.)[6]	27	16%	53	31%	48	28%	41	24%	169	3.3
Unknown	0	0%	1	25%	3	75%	0	0%	4	-
Total	**65**	**9%**	**342**	**45%**	**211**	**28%**	**142**	**19%**	**760**	**9.3**
2010										
Foreign-born	38	7%	269	58%	181	26%	86	20%	574	19.2
Caribbean and Latin America[7]	18	8%	112	52%	70	32%	17	8%	217	14.0
Asia[8]	15	5%	127	43%	90	31%	61	21%	293	36.0
Africa[9]	4	9%	25	56%	14	31%	2	4%	45	38.3
Europe[10]	1	6%	4	22%	7	39%	6	33%	18	3.8
Northern America	0	0%	1	100%	0	0%	0	0%	1	-
United States (U.S.)[6]	19	14%	43	32%	43	32%	31	23%	136	2.6
Unknown[11]	1	0%	0	0%	0	0%	0	0%	1	-
Total	**58**	**8%**	**312**	**44%**	**224**	**32%**	**117**	**17%**	**711**	**8.7**
2011										
Foreign-born	24	4%	275	60%	147	26%	106	21%	552	18.5
Caribbean and Latin America[12]	13	6%	111	52%	57	27%	33	15%	214	13.8
Asia[13]	9	3%	132	48%	76	28%	59	21%	276	33.9
Africa[14]	2	6%	20	61%	9	27%	2	6%	33	28.1
Europe[15]	0	0%	12	41%	5	17%	12	41%	29	6.1
United States (U.S.)[6]	14	10%	43	32%	52	38%	27	20%	136	2.6
Unknown	0	0%	0	0%	0	0%	1	100%	1	-
Total	**38**	**6%**	**318**	**46%**	**199**	**29%**	**134**	**19%**	**689**	**8.5**

1. Rates are based on American Community Survey 3-year estimates (2008-2010)
2. Mexico (43), Ecuador (42), Dominican Republic (39), Haiti (29), Guyana (13), Honduras (12), Guatemala (9), Peru (8), Colombia (7), Other (29)
3. China (110), India (32), Philippines (25), Bangladesh (22), Nepal (18), South Korea (13), Pakistan (12), Hong Kong (11), Myanmar (Burma) (6), Hong Kong (5), Vietnam (5), Other (27)
4. Guinea (9), Nigeria (6), Other (35)
5. Ukraine (6), Poland (5), Other (20)
6. Includes the US Virgin Islands, other US territories and Puerto Rico.
7. Ecuador (41), Dominican Republic (41), Mexico (35), Haiti (23), Guyana (16), Peru (16), Guatemala (10), Jamaica (10), Honduras (9), Other (32)
8. China (104), Bangladesh (30), Philippines (28), India (26), Pakistan (20), South Korea (15), Nepal (12), Hong Kong (11), Myanmar (Burma) (7), Hong Kong (7), Vietnam (7), Indonesia (6), Uzbekistan (6), Other (13)
9. Nigeria (6), Ivory Coast (5), Other (34)
10. Other (18)
11. Other (1)
12. Ecuador (30), Dominican Republic (31), Mexico (49), Haiti (30), Guyana (12), Jamaica (9), Honduras (9), Other (44)
13. China (104), Bangladesh (33), Philippines (16), India (30), Pakistan (10), South Korea (11), Nepal (19), Myanmar (Burma) (11), Hong Kong (7), Other (35)
14. Nigeria (4), Senegal (5), Other (24)
15. Ukraine (10), Poland (4), Russia (4), Other (11)

TABLE 4: Tuberculosis rates by United Hospital Fund (UHF) neighborhood, New York City, 2000-2011

United Hospital Fund Neighborhood	Rate per 100,000 population[1,2]											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BRONX	**16.2**	**12.7**	**12.2**	**13.0**	**12.9**	**11.7**	**12.2**	**11.5**	**10.9**	**9.9**	**8.3**	**7.3**
Highbridge-Morrisania	21.0	17.1	15.8	21.7	17.7	17.2	19.1	14.9	18.8	15.4	9.6	12.5
Crotona-Tremont	23.0	12.8	17.0	13.5	15.5	15.5	14.5	9.6	12.9	12.1	9.7	6.8
Fordham-Bronx Park	19.9	13.4	16.0	16.7	11.3	9.4	13.4	15.6	12.9	9.9	11.9	6.7
Hunts Point-Mott Haven	13.8	18.2	15.5	12.2	18.4	13.8	13.0	16.6	12.1	11.0	8.8	10.2
Pelham-Throgs Neck	11.7	12.7	5.8	9.6	11.9	11.3	8.5	9.5	8.8	8.4	7.4	7.7
Northeast Bronx	7.6	5.4	8.0	6.4	8.0	5.9	7.5	5.9	3.7	4.2	3.7	1.6
Kingsbridge	16.9	6.8	6.9	8.1	6.9	7.0	8.2	8.2	3.5	7.7	4.4	4.4
BROOKLYN	**18.1**	**15.8**	**13.9**	**14.7**	**12.7**	**13.0**	**11.6**	**11.2**	**10.4**	**8.2**	**9.3**	**8.8**
Sunset Park	33.1	27.0	18.6	19.3	21.8	29.0	28.0	22.3	21.5	14.9	22.7	18.8
Williamsburg-Bushwick	22.1	25.0	21.8	24.3	19.5	23.0	23.2	16.5	17.5	8.1	11.4	9.5
Borough Park	10.5	10.5	10.5	13.7	13.1	12.1	12.2	10.0	13.8	11.7	13.3	10.5
East New York	14.9	16.5	11.3	11.3	13.7	11.9	10.7	11.3	11.3	7.5	8.5	6.9
East Flatbush-Flatbush	31.2	18.9	14.1	18.5	14.7	19.5	12.8	12.5	11.2	12.5	9.4	11.1
Bensonhurst-Bay Ridge	13.4	10.8	10.8	8.8	7.6	6.0	7.4	10.2	10.7	7.5	11.5	7.0
Coney Island	11.5	12.9	15.4	10.5	10.7	9.9	7.7	10.0	9.0	5.6	6.3	9.8
Bedford Stuyvesant-Crown Heights	23.6	17.9	18.5	18.5	14.3	13.4	11.1	12.4	8.3	7.8	9.1	8.5
Canarsie-Flatlands	9.1	12.1	9.1	12.7	9.6	5.6	7.6	7.0	5.5	5.1	6.7	7.7
Greenpoint	15.3	9.7	5.7	9.8	4.8	6.3	4.7	6.9	4.6	4.7	1.6	0.8
Downtown Brooklyn-Park Slope	15.4	15.3	14.4	12.1	9.3	8.3	7.3	7.2	3.6	3.1	2.7	3.1
MANHATTAN[3]	**17.9**	**16.6**	**14.7**	**15.4**	**12.7**	**11.5**	**10.2**	**11.3**	**9.6**	**7.6**	**5.7**	**6.7**
East Harlem	27.6	28.5	17.5	28.5	24.1	15.8	14.7	22.4	18.7	10.0	8.2	10.9
Central Harlem	28.4	20.6	31.7	21.7	25.4	24.0	14.4	24.3	16.7	9.2	8.0	11.1
Lower Manhattan	12.9	12.8	9.3	3.1	18.5	11.7	14.4	8.5	14.1	7.5	5.6	5.6
Union Square-Lower East Side	22.2	20.5	20.4	19.1	17.2	13.9	17.9	12.1	14.0	7.5	8.0	10.6
Washington Heights-Inwood	19.0	17.5	16.1	19.3	12.7	12.0	13.6	13.8	11.5	9.7	7.2	7.2
Greenwich Village-Soho	19.1	16.5	8.2	9.3	15.0	10.1	6.6	8.6	10.7	3.6	6.0	7.2
Gramercy Park-Murray Hill	20.1	15.1	14.4	19.1	13.5	11.5	9.1	12.6	8.2	10.4	5.9	5.9
Chelsea-Clinton	16.3	23.3	11.2	10.3	6.2	15.8	7.4	9.5	6.6	9.7	4.1	4.1
Upper West Side	9.9	12.4	8.4	12.7	7.0	3.8	5.4	5.4	3.7	4.5	3.2	2.3
Upper East Side	8.3	5.0	6.7	4.0	2.2	4.7	2.9	2.9	2.9	4.5	2.3	4.5
QUEENS[3]	**16.2**	**18.6**	**14.4**	**14.7**	**14.2**	**13.5**	**13.4**	**11.7**	**13.2**	**12.4**	**11.6**	**11.2**
West Queens	25.3	32.1	25.1	29.8	24.9	21.7	26.5	22.6	25.8	22.9	20.2	21.4
Flushing	21.8	22.1	17.0	15.4	17.1	16.6	13.8	12.9	11.8	17.3	14.6	15.4
Jamaica	11.9	18.9	13.6	8.0	12.6	12.2	10.8	10.1	11.5	9.0	7.9	8.6
Southeast Queens	10.3	13.3	6.4	8.9	7.9	8.5	7.5	7.5	11.5	4.6	7.2	8.2
Long Island City-Astoria	16.8	19.1	21.1	12.9	14.2	11.5	8.7	9.6	10.0	12.7	11.7	11.7
Fresh Meadows	17.2	10.8	10.8	13.1	17.3	7.6	12.9	6.4	9.6	6.2	12.4	7.2
Southwest Queens	10.0	11.5	4.8	9.7	9.3	11.9	7.7	5.9	9.2	7.9	7.5	4.1
Ridgewood-Forest Hills	12.9	10.1	7.6	11.6	5.9	11.1	10.7	8.5	6.8	9.8	8.5	3.7
Rockaway	10.3	11.3	10.5	1.0	7.6	7.5	6.5	4.6	5.5	0.0	4.3	3.5
Bayside-Little Neck	11.3	6.8	6.9	10.4	8.0	3.4	6.8	5.6	3.4	10.2	4.5	10.2
STATEN ISLAND	**7.2**	**6.0**	**5.5**	**6.3**	**6.0**	**3.7**	**5.9**	**4.8**	**4.8**	**3.8**	**2.8**	**3.0**
Port Richmond	11.1	17.0	7.6	7.4	8.8	4.4	7.0	5.5	11.0	6.8	7.1	2.8
Stapleton-St. George	15.4	9.2	8.2	16.2	9.7	6.4	7.0	6.2	4.6	6.9	4.9	3.2
Willowbrook	5.9	3.5	4.6	4.6	5.7	4.6	3.4	3.3	3.3	0.0	2.3	1.2
Southbeach-Tottenville	1.1	1.1	3.3	0.0	2.7	1.1	5.8	4.2	3.2	2.1	0.0	3.7
TOTAL NEW YORK CITY[4]	**16.6**	**15.7**	**13.4**	**14.1**	**12.8**	**12.1**	**11.6**	**11.2**	**11.0**	**9.3**	**8.7**	**8.5**

1. Rates are based on intercensal estimates for 2000 to 2008. Rates for 2009 to 2011 are based on 2010 Census data
2. There were two cases in 2001, one case in 2007, four cases in 2008, four cases in 2009, two cases in 2010 and two cases in 2011 with missing ZIP code information that are not included in the borough totals but are included in the NYC total
3. One patient in 2009 had a ZIP code which covers Manhattan and Queens but was included under the Queens
4. Rates for 2000-2006 are based on intercensal estimates. Rates for 2007 to 2011 are based on American Community Survey 3-Year estimates (2008-2010)

TABLE 5: Select characteristics of U.S.-and foreign-born tuberculosis cases, New York City, 2009-2011

Characteristics	2009						2010						2011					
	U.S.-born		Foreign-born		Total[1]		U.S.-born		Foreign-born		Total[1]		U.S.-born		Foreign-born		Total[1]	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
DEMOGRAPHICS																		
Age Group (years)																		
0-19	27	16%	38	6%	**65**	**9%**	19	14%	38	7%	**58**	**8%**	14	10%	24	4%	**38**	**6%**
20-44	53	31%	288	49%	**342**	**45%**	43	32%	269	47%	**312**	**44%**	43	32%	275	50%	**318**	**46%**
45-64	48	28%	160	27%	**211**	**28%**	43	32%	181	32%	**224**	**32%**	52	38%	147	27%	**199**	**29%**
65+	41	24%	101	17%	**142**	**19%**	31	23%	86	15%	**117**	**16%**	27	20%	106	19%	**134**	**19%**
Sex																		
Female	73	43%	232	40%	**307**	**40%**	53	39%	213	37%	**267**	**38%**	65	48%	227	41%	**293**	**43%**
Male	96	57%	355	60%	**453**	**60%**	82	60%	361	63%	**443**	**62%**	71	52%	325	59%	**396**	**57%**
Transgender	0	0%	0	0%	**0**	**0%**	1	1%	0	0%	**1**	**<1%**	0	0%	0	0%	**0**	**0%**
Race/ethnicity																		
Black Non-Hispanic	87	51%	95	16%	**183**	**24%**	72	53%	95	17%	**167**	**23%**	62	46%	89	16%	**151**	**22%**
White Non-Hispanic	24	14%	44	7%	**68**	**9%**	19	14%	34	6%	**53**	**7%**	28	21%	42	8%	**70**	**10%**
Hispanic	54	32%	179	30%	**234**	**31%**	39	29%	162	28%	**201**	**28%**	40	29%	150	27%	**191**	**28%**
Asian	4	2%	259	44%	**263**	**35%**	5	4%	267	47%	**272**	**38%**	4	3%	257	47%	**261**	**38%**
Multiple	0	0%	3	1%	**3**	**<1%**	1	1%	8	1%	**9**	**1%**	2	1%	6	1%	**8**	**1%**
Other	0	0%	0	0%	**0**	**0%**	0	0%	6	1%	**6**	**1%**	0	0%	8	0%	**8**	**1%**
Unknown ethnicity or race	0	0%	7	1%	**9**	**1%**	0	0%	2	0%	**3**	**0%**	0	0%	0	1%	**0**	**0%**
Borough of residence[2]																		
Manhattan	33	20%	86	15%	**120**	**16%**	23	17%	67	12%	**90**	**13%**	38	28%	69	13%	**107**	**16%**
Bronx	41	24%	95	16%	**137**	**18%**	39	29%	76	13%	**115**	**16%**	28	21%	73	13%	**101**	**15%**
Brooklyn	51	30%	153	26%	**205**	**27%**	49	36%	183	32%	**232**	**33%**	48	35%	169	31%	**218**	**32%**
Queens	33	20%	242	41%	**276**	**36%**	21	15%	237	41%	**259**	**36%**	19	14%	230	42%	**249**	**36%**
Staten Island	10	6%	8	1%	**18**	**2%**	3	2%	10	2%	**13**	**2%**	3	2%	11	2%	**14**	**2%**
Time in the U.S.																		
Less than1 year	n/a	n/a	71	12%	**71**	**12%**	n/a	n/a	95	17%	**95**	**17%**	n/a	n/a	71	13%	**71**	**13%**
1-5 years	n/a	n/a	147	25%	**147**	**25%**	n/a	n/a	157	27%	**157**	**27%**	n/a	n/a	149	27%	**149**	**27%**
Greater than 5 years	n/a	n/a	364	62%	**364**	**62%**	n/a	n/a	317	55%	**317**	**55%**	n/a	n/a	321	58%	**324**	**59%**
Unknown	n/a	n/a	5	1%	**5**	**1%**	n/a	n/a	5	1%	**5**	**1%**	n/a	n/a	11	2%	**8**	**1%**
CLINICAL CHARACTERISTICS																		
Ever smear positive (any site)	67	40%	249	42%	**316**	**42%**	61	45%	224	39%	**285**	**40%**	65	48%	214	39%	**279**	**40%**
Sputum smear positive	53	31%	223	38%	**276**	**36%**	53	39%	188	33%	**241**	**34%**	44	32%	185	34%	**229**	**33%**
NAA positive[3]	46	82%	190	94%	**236**	**91%**	54	92%	180	95%	**234**	**94%**	50	85%	175	94%	**225**	**91%**
Culture positive	92	54%	443	75%	**539**	**71%**	92	68%	419	73%	**512**	**72%**	92	68%	408	74%	**501**	**73%**
Clinical case[4]	77	46%	144	25%	**221**	**29%**	44	32%	155	27%	**199**	**28%**	44	32%	144	26%	**188**	**27%**
Pulmonary-only site of disease	117	69%	377	64%	**496**	**65%**	94	69%	375	65%	**469**	**66%**	88	65%	361	65%	**449**	**65%**
Extrapulmonary-only site of disease	36	21%	152	26%	**190**	**25%**	24	18%	131	23%	**156**	**22%**	26	19%	122	22%	**149**	**22%**
Both pulmonary and extrapulmonary	16	9%	58	10%	**74**	**10%**	18	13%	68	12%	**86**	**12%**	22	16%	68	12%	**90**	**13%**
Cavitary chest x-ray[5]	22	13%	85	14%	**107**	**19%**	17	15%	77	17%	**94**	**17%**	23	21%	83	19%	**106**	**20%**
Multidrug resistance[6]	0	0%	9	2%	**9**	**2%**	2	2%	9	2%	**11**	**2%**	0	0%	16	4%	**16**	**3%**
Other drug resistance[7]	11	12%	69	16%	**81**	**15%**	15	17%	69	17%	**85**	**17%**	12	13%	57	14%	**69**	**14%**
History of prior TB	6	4%	10	2%	**16**	**2%**	4	3%	8	1%	**12**	**2%**	5	4%	10	2%	**15**	**2%**
HIV Status																		
Positive	31	18%	37	6%	**68**	**9%**	23	17%	27	5%	**50**	**7%**	31	23%	27	5%	**58**	**8%**
Negative	96	57%	423	72%	**520**	**68%**	83	61%	453	79%	**537**	**76%**	77	57%	408	74%	**485**	**70%**
Refused	25	15%	99	17%	**125**	**16%**	16	12%	73	13%	**89**	**13%**	17	13%	97	18%	**114**	**17%**
Not offered/done or unknown	17	10%	28	5%	**47**	**6%**	14	10%	21	4%	**35**	**5%**	11	8%	20	4%	**32**	**5%**
Last medical provider type[8]																		
DOHMH chest center	78	46%	270	46%	**348**	**46%**	67	49%	280	49%	**347**	**49%**	52	38%	227	41%	**279**	**40%**
HHC hospital	30	18%	167	28%	**197**	**26%**	22	16%	160	28%	**183**	**26%**	18	13%	149	27%	**167**	**24%**
Private hospital	38	22%	56	10%	**97**	**13%**	25	18%	48	8%	**73**	**10%**	32	24%	64	12%	**96**	**14%**
Private physician	12	7%	69	12%	**81**	**11%**	16	12%	71	12%	**87**	**12%**	27	20%	102	18%	**130**	**19%**
Other provider	11	7%	25	4%	**37**	**5%**	6	4%	15	3%	**21**	**3%**	7	5%	10	2%	**17**	**2%**
Started on four first line anti-TB drugs[9]	148	88%	533	91%	**683**	**90%**	112	82%	517	90%	**629**	**88%**	122	90%	505	91%	**627**	**91%**
SOCIAL CHARACTERISTICS																		
Homeless[10]	11	7%	15	3%	**26**	**3%**	7	5%	8	1%	**15**	**2%**	5	4%	9	2%	**14**	**2%**
Employed[11,12]	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	28	21%	163	30%	**191**	**28%**
Health care worker	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	4	3%	16	3%	**20**	**3%**
Injection drug use[11]	6	4%	4	1%	**11**	**1%**	7	5%	0	0%	**7**	**1%**	8	6%	1	<1%	**9**	**1%**
Non-injection drug use[11]	26	15%	10	2%	**36**	**5%**	14	10%	12	2%	**26**	**4%**	22	16%	17	3%	**39**	**6%**
Alcohol abuse[11,12]	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	4	3%	8	1%	**12**	**2%**
Any drug or alcohol abuse[11,12]	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	27	20%	25	5%	**52**	**8%**
Resident of correctional facility[13]	5	3%	4	1%	**10**	**1%**	3	2%	7	1%	**10**	**1%**	5	4%	3	1%	**8**	**1%**
Resident of long-term care facility[13]	4	2%	8	1%	**12**	**2%**	8	6%	26	5%	**34**	**5%**	9	7%	14	3%	**23**	**3%**
TOTAL	**169**	**22%**	**587**	**77%**	**760**		**136**	**19%**	**574**	**81%**	**711**		**136**	**20%**	**552**	**80%**	**689**	

1. There were four cases in 2009, one in 2010 and one in 2011 with unknown country of birth that are included in the total column only; **2.** Four patients in 2009 and two in 2010 had non-NYC addresses but were confirmed as NYC cases; **3.** Of patients with any pulmonary disease site and positive respiratory acid-fast bacilli (AFB) smears; **4.** As per CDC clinical case definition; **5.** Percent of cases with pulmonary disease; **6.** Multidrug-resistant is defined as resistant to at least isoniazid and rifampin. Percent is among those with positive culture and susceptibility done; **7.** Other-drug-resistance is defined as not multidrug-resistant, but resistant to one or more first-line drugs. Percent is among those with positive culture and susceptibility done; **8.** Facility or provider where/by whom the patient was last evaluated at the time of data extraction. Other providers include correctional facilities, Veterans Affairs hospitals, out-of-NYC, and psychiatric providers; **9.** Patients who started on isoniazid, rifampin, ethambutol, and pyrazinamide. 10. At time of diagnosis; **11.** In past 12 months before TB diagnosis; **12.** Not available for 2009 and 2010 due to differences in data collection in the new BTBC surveillance system; **13.** At time of diagnosis

APPENDIX I: TABLES

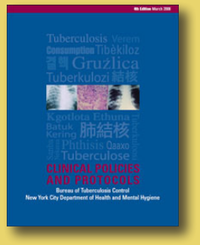
TABLE 6: Drug resistance by birth in the United States (U.S.)[1], New York City, 2009-2011

	U.S.-born		Foreign-born		Total[2]	
	n	%	n	%	n	%
2009						
Positive culture for *M. tuberculosis*	92	-	443	-	539	-
Tested for susceptibility to first-line drugs (% of those with positive culture for *M. tuberculosis*)	91	99%	439	99%	534	99%
Susceptibility results among culture-positive cases (% of those tested for susceptibility to first-line drugs):						
Multidrug-resistant (MDR TB) (resistant to at least isoniazid and rifampin)	0	0%	9	2%	9	2%
Extensively drug-resistant	0	0%	0	0%	0	0%
Resistant to any first-line drugs, excluding MDR TB	11	12%	69	16%	81	15%
Isoniazid resistance only	6	7%	23	5%	29	5%
Rifampin resistance only	2	2%	1	<1%	3	<1%
Susceptible to all first-line drugs	78	86%	353	80%	434	81%
Unknown result for one or more first-line drugs	2	2%	8	2%	10	2%
2010						
Positive culture for *M. tuberculosis*	92	-	419	-	512	-
Tested for susceptibility to first-line drugs (% of those with positive culture for *M. tuberculosis*)	89	97%	415	99%	505	99%
Susceptibility results among culture-positive cases (% of those tested for susceptibility to first-line drugs):						
Multidrug-resistant (resistant to at least isoniazid and rifampin)	2	2%	9	2%	11	2%
Extensively drug-resistant	0	0%	0	0%	0	0%
Resistant to any first-line drugs, excluding MDR TB	15	17%	69	17%	85	17%
Isoniazid resistance only	9	10%	25	6%	35	7%
Rifampin resistance only	0	0%	3	<1%	3	<1%
Susceptible to all first-line drugs	70	79%	328	79%	398	79%
Unknown result for one or more first-line drugs	2	2%	9	2%	11	2%
2011						
Positive culture for *M. tuberculosis*	92	-	408	-	501	-
Tested for susceptibility to first-line drugs (% of those with positive culture for *M. tuberculosis*)	89	97%	399	98%	489	98%
Susceptibility results among culture-positive cases (% of those tested for susceptibility to first-line drugs):						
Multidrug-resistant (resistant to at least isoniazid and rifampin)	0	0%	16	4%	16	3%
Extensively drug-resistant	0	0%	2	<1%	2	<1%
Resistant to any first-line drugs, excluding MDR TB	12	14%	57	14%	69	14%
Isoniazid resistance only	9	10%	31	8%	40	8%
Rifampin resistance only	0	0%	2	<1%	2	<1%
Susceptible to all first-line drugs	77	87%	324	81%	404	83%

1. Includes Puerto Rico, U.S. Virgin Islands and other U.S. territories
2. Totals include drug resistance for patients with unknown country of birth

APPENDIX II: EDUCATIONAL MATERIALS

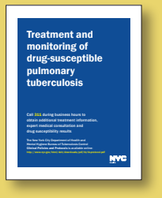
The following is a selection of culturally, technically and linguistically appropriate TB education materials available to patients, the general public and health care providers. Materials are available at nyc.gov, search “tb-hcp kit”, or by calling 311.



CLINICAL POLICIES AND PROTOCOLS

4th Edition.

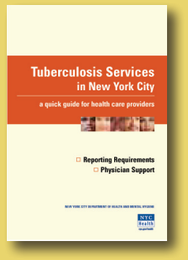
Describes policies, protocols and recommendations for the prevention, treatment and control of tuberculosis



POCKET-SIZED REFERENCE GUIDE FOR PROVIDERS

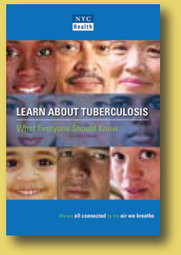
Treatment and monitoring of drug-susceptible pulmonary tuberculosis

Provides concise information about treatment and monitoring for pulmonary TB



PROVIDER BROCHURE

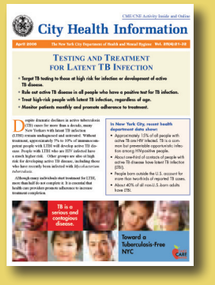
Tuberculosis Services in New York City: a Quick Guide for Health care Providers



PATIENT BROCHURE

Learn About Tuberculosis: What Everyone Should Know

General information in easy-to-read format for all audiences. Available in English, Spanish, Chinese, Korean, French and Haitian Creole



GUIDELINES

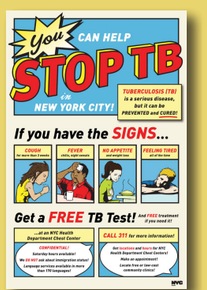
Testing and Treatment for Latent TB Infection

Recommended steps for LTBI testing and treatment to improve both diagnosis and treatment of LTBI

REFERENCE GUIDE

The Mantoux Tuberculin Skin Test: A Guide for Providers

Step-by-step guide to administering and reading TST



EDUCATIONAL POSTER

Provides basic TB information and includes illustrations with captions. Available in English, Spanish, French, Haitian Creole, Hindu, Urdu, Bengali, Tibetan, Tagalog and Chinese. Please email to request information: tbtraining@health.nyc.gov

Reporting suspected and confirmed TB cases

Medical providers and infection control practitioners are required by the NYC Health Code Article 11, in particular, Sections 11.03, 11.05 and 11.21, to report all patients suspected and confirmed with TB to the BTBC within 24 hours of diagnosis or clinical suspicion. Medical providers must report these patients even though microbiologists and pathologists are also required to report findings consistent with TB. Note that the reports must be received by the BTBC within 24 hours, whether by express or overnight mail, fax, telephone, or electronically.

It is mandatory to report patients who meet any of the following criteria:

- Smear (from any anatomic site) positive for acid-fast bacilli (AFB)
- Nucleic acid amplification (NAA) test (e.g., Roche's AMPLICOR®, Genprobe's MTD™)[1] result positive for *Mycobacterium tuberculosis* (*M. tuberculosis)* complex
- Culture positive for *M. tuberculosis* complex including: *M. tuberculosis, M. africanum, M. bovis-BCG, M. caprae, M. canetti, M. microti, M. pinnipedii, M. bovis*
- Biopsy, pathology, or autopsy findings consistent with active TB, including but not limited to caseating and necrotizing granulomas in biopsy of lung, lymph nodes, or other specimens
- Treatment with two or more anti-TB medications for suspected or confirmed active TB
- Clinical suspicion of pulmonary or extrapulmonary TB such that the physician or other health care provider has initiated or intends to initiate isolation or treatment for TB
- Continuation, discontinuation, completion, or other outcomes of treatment for active TB
- Any child younger than five years old (up to the day of the fifth birthday) who has a positive tuberculin skin test (TST) or a positive U.S. Food and Drug Administration (FDA) approved blood-based test for TB infection [such as QuantiFERON®-TBGold In-Tube][1,2]
- In addition, Section 47.21 requires that Day Care staff report those with LTBI to the Bureau of Day Care

When an individual has an AFB-positive smear or has started treatment for TB, reporting should never be delayed pending identification of *M. tuberculosis* with a NAA test. Patients should be reported whenever TB is suspected, even if bacteriologic evidence of disease is lacking or treatment has not been initiated. Additionally, when requested by the BTBC, a physician shall report the results of any examination of a contact to a TB case.

MICROBIOLOGY AND PATHOLOGY LABORATORIES

The NYC Health Code also requires laboratories to report as per Articles 11 and 13, Sections 11.03, 11.05, and 13.03, all of the following within 24 hours of identification to the BTBC:

- AFB-positive smears (regardless of anatomic site)
- Cultures positive for *M. tuberculosis* complex
- NAA test results that identify *M. tuberculosis* complex (e.g. AMPLICOR®, MTD™)
- Results of susceptibility tests performed on *M. tuberculosis* complex cultures
- Biopsy, pathology, or autopsy findings consistent with active TB, including but not limited to presence of AFB on smear and caseating and/or necrotizing granulomas that are consistent with TB in the lung, lymph nodes, or other specimens
- Any culture or NAA result associated with an AFB-positive smear (even if negative for *M. tuberculosis* complex)

1. Product names are provided for identification purposes only; their use does not imply endorsement by the NYC DOHMH.
2. To report a positive test for TB infection in a child less than 5 years old, use the Universal Reporting Form. For guidelines for interpreting skin test results, see City Health Information: Testing and Treating for Latent TB Infection, April 2006, www.nyc.gov/html/doh/downloads/pdf/chi/chi25-4.pdf

PROVIDER REPORTING

Health care providers are encouraged to report suspected and confirmed TB patients electronically. To do so, providers must first create an account on NYC-MED at nyc.gov, search /nycmed. Assistance is available by calling 1-888-692-6339. Alternatively, providers may report by telephone to the TB Hotline, 347-396-7400. The URF should be completed online or faxed to BTBC at 212-788-4179 with the original mailed to the Bureau of TB Control, DOHMH at: 42-09 28th Street CN#22, Long Island City, NY 11101

Information reported on the URF should be as complete as possible. The following essential information must be included when the report is submitted to the New York City DOHMH:

- Information needed to identify and locate the individual (e.g., name, telephone, address, and date of birth)
- Provider information (e.g., physician's name and telephone number, reporting facility)
- Results of smear for AFB (including date specimen obtained and accession number, if available)
- Results of chest radiographs
- Any treatment information

Laboratories are required to report via the Electronic Clinical Laboratory Reporting System (ECLRS) as of July 1, 2006. In addition, within 24 hours of observing growth of *M. tuberculosis* complex in a culture from any specimen, the New York City Health code mandates that a portion of the initial culture be sent for DNA analysis to the NYC DOHMH Public Health Laboratory (455 First Avenue, Room 236, NY, NY 10016).

PATIENT FOLLOW-UP

The treating physician should also report whether the patient completed treatment and the outcome of the patient (cured, failed, relapsed, lost, moved, refused) or whether treatment was discontinued if the patient was found not to have TB. Physicians must assist the DOHMH in its efforts to evaluate persons suspected of having TB and in patient follow-up. Case managers will be in contact with the treating physicians to request updates and ensure that appropriate treatment and monitoring is being conducted. A Report of Patient Services Form (TB 65) may need to be completed.

REPORTING TB-RELATED EVALUATION AND TREATMENT OF CONTACTS

Medical providers are required, under Section 11.21(b) of the NYC Health Code, to report to the DOHMH, when requested, all information on the evaluation, testing, and treatment of individuals who have been in contact with a person with active TB disease.

NEW REPORTING REQUIREMENTS

In June 2010, the NYC Health Code was amended to require health care providers to submit a discharge plan to BTBC for review and approval prior to discharging infectious TB patients from the hospital [New York City Health Code Article 11 Section 21(4)].

The Hospital Discharge Approval Request Form (TB354 -pdf) must be submitted to BTBC 72 hours before the planned discharge date and must be approved by the bureau prior to discharge. For further details, and to find these forms or documents, go to: nyc.gov, search hospital discharge. Providers must also submit to the BTBC a proposed treatment plan within one month of treatment initiation for all persons newly diagnosed with active TB [NYC Health Code Article 11 Section 21(4)]. The BTBC will provide the form to the treating physician of record.

INQUIRIES AND FORMS

To inquire further about reporting procedures, please call the Surveillance Unit at the BTBC at 347-396-7400. To order copies of the Report of Patient Services Form (TB 65) call 347-396-7402.

Publications in Peer-reviewed Journals

2009

Jenny-Avital ER, Joseph K. Rifamycin-resistant *Mycobacterium tuberculosis* in the highly active antiretroviral therapy era: a report of 3 relapses with acquired rifampin resistance following alternate-day rifabutin and boosted protease inhibitor therapy. *Clin Infect Dis* 2009; 48:1471-4.

Laraque F, Griggs A, Slopen M, et al. Performance of nucleic acid amplification tests for diagnosis of tuberculosis in a large urban setting. *Clin Infect Dis* 2009;49:46-54.

Li J, Munsiff SS, Tarantino T, et al. Adherence to treatment of latent tuberculosis infection in a clinical population in New York City. *Int J Infect Dis* 009; 14:e292-7.

2010

Anger HA, Dworkin F, Sharma S, et al. Linezolid use for treatment of multidrug-resistant and extensively drug-resistant tuberculosis, New York City, 2000-06. *J Antimicrob Chemother* 2010; 65:775-83.

Harris TG, Li J, Hanna DB, et al. Changing sociodemographic and clinical characteristics of tuberculosis among HIV-infected patients, New York City, 1992-2005. *Clin Infect Dis* 2010; 50:1524-31.

King L, Munsiff SS, Ahuja SD. Achieving international targets for tuberculosis treatment success among HIV-positive patients in New York City. *Int J Tuberc Lung Dis* 2010; 14:1613-20.

Silin M, Laraque F, Munsiff SS, et al. The impact of monitoring tuberculosis reporting delays in New York City. *J Public Health Manag Pract* 2010;16:E09-17.

Thomas JA, Laraque F, Munsiff S, et al. Hospitalizations for tuberculosis in New York City: how many could be avoided? *Int J Tuberc Lung Dis* 2010; 14:1603-12.

Trieu L, Li J, Hanna DB, et al. Tuberculosis rates among HIV-infected persons in New York City, 2001-2005. *Am J Public Health* 2010; 100:1031-4.

Winters A, Agerton TB, Driver CR, et al. Congenital tuberculosis and management of exposure in three neonatal intensive care units. *Int J Tuberc Lung Dis* 2010; 14:1641-3.

2011

Banach DB, Harris TG. Indeterminate QuantiFERON®-TB Gold results in a public health clinic setting. *Int J Tuberc Lung Dis* 2011; 15:1623-30.

Factor SH, Sackoff JE, Raj-Singh S, et al. Street-outreach improves detection but not referral for drug users with latent tuberculosis, New York City. *Subst Use Misuse* 2011; 46:1711-5.

Kerker BD, Bainbridge J, Kennedy J, et al. A population-based assessment of the health of homeless families in New York City, 2001-2003. *Am J Public Health* 2011; 101:546-53.

Perri BR, Proops D, Moonan PK, et al. *Mycobacterium tuberculosis* cluster with developing drug resistance, New York, New York, USA, 2003-2009. *Emerg Infect Dis* 2011; 17:372-8.

Slopen ME, Laraque F, Piatek AS, et al. Missed opportunities for tuberculosis prevention in New York City, 2003. *J Public Health Manag Pract* 2011; 17:421-6.

Weisenberg SA, Gibson AL, Huard RC, et al. Distinct clinical and epidemiological features of tuberculosis in New York City caused by the RD(Rio)Mycobacterium tuberculosis sublineage. *Infect Genet Evol* 2011.

Presentations

Between 2009 and 2011, numerous presentations and abstracts showcasing NYC TB data were presented at the following national and international annual meetings and conferences:

- American Society for Microbiology 46th Annual Region I (Northeast Branch) Meeting
- American Thoracic Society Annual Conference
- IGRA Echo Symposium
- Infectious Disease Society of American Annual Meeting
- International Union for Tuberculosis and Lung Disease–North American Regional Meeting
- National TB Controller's Workshop
- NYC Annual Genotyping Update
- NYC Annual World TB Day Conference
- Public Health Prevention Service Annual Conference
- Screening for TB Infection: Putting Interferon Gamma Release Assays into Practice Symposium
- Society for Epidemiologic Research Annual Meeting
- TB Education and Training Network Annual Conference
- The Union World Conference
- Tuberculosis Screening using a Whole Blood Interferon Gamma Release Assay Symposium

Bureau of Tuberculosis Control Chest Center Locations:

BRONX
Morrisania Chest Center
1309 Fulton Avenue, First Floor
Bronx, NY 10456

MANHATTAN
Washington Heights Chest Center
600 West 168th Street, Third Floor
New York, NY 10032

QUEENS
Corona Chest Center
34-33 Junction Blvd., Second Floor
Queens, NY 11372

BROOKLYN
Fort Greene Chest Center
295 Flatbush Ave. Ext., Fourth Floor
Brooklyn, NY 11201

STATEN ISLAND
Richmond Chest Center
51 Stuyvesant Place, Fourth Floor
Staten Island, NY 10301

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