

Dynamics of TB Transmission in New York City, 2001-2006

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Today's talk

- **How we use universal genotyping data to examine dynamics of TB transmission in NYC**
- **Discuss a rapidly growing TB cluster with few links and unclear transmission patterns**
- **Discuss nosocomial TB exposures in NYC in 2006**

Background

- 1990's – Dramatic epidemic of MDR-TB in NYC, many nosocomial outbreaks
- DNA analysis by *IS6110*-based RFLP system useful in NYC for:
 - Identifying TB cases with same infecting organism or strain to assess extent of ongoing transmission in communities
 - Investigating transmission in large outbreaks of TB, nosocomial and other facilities
 - Identifying laboratory cross-contamination (~2-3%)

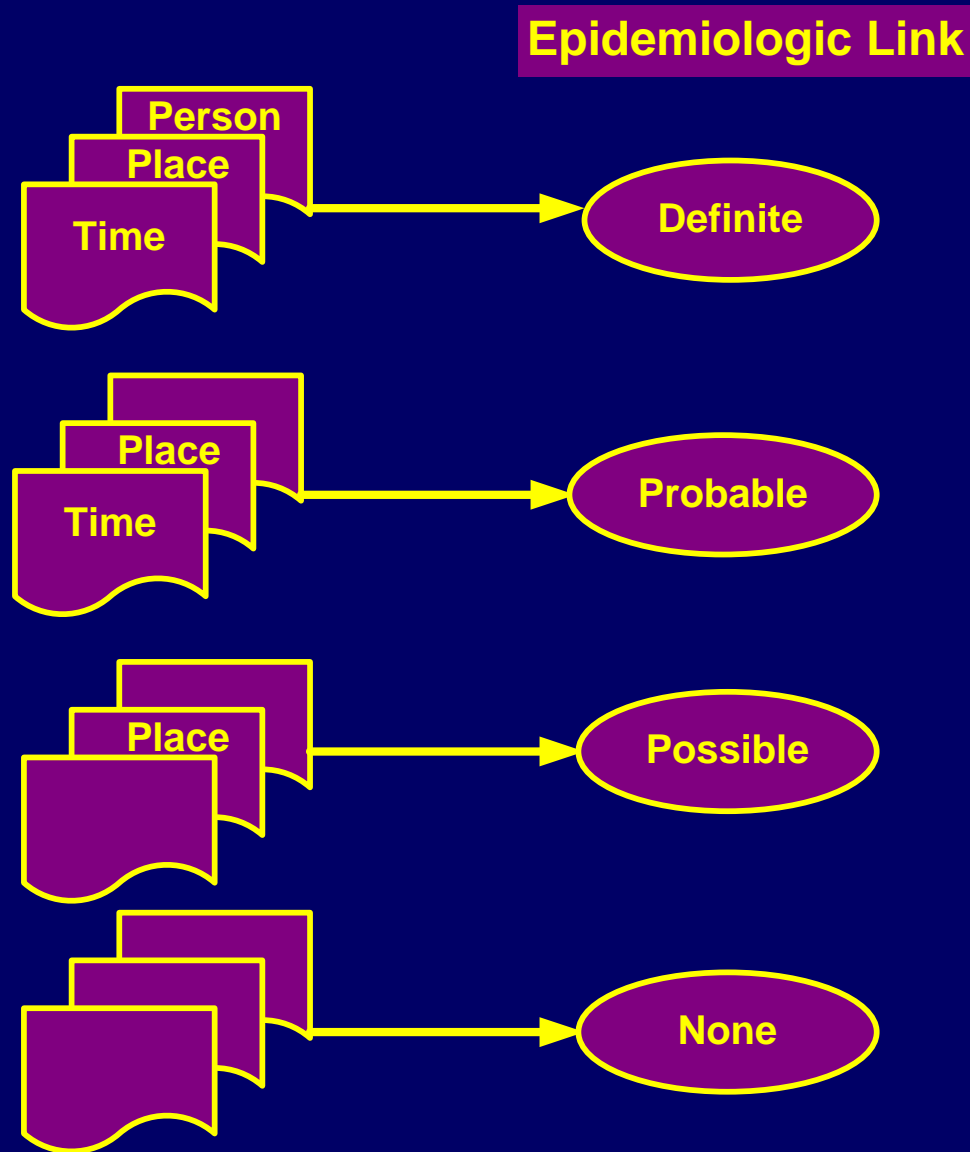
Background

- **1997- Use of new genetic fingerprint technique: Spoligotyping**
 - Requires little genetic material
 - Relatively inexpensive
 - Increases discriminatory power of RFLP in low-band strains
 - Useful as a preliminary screening tool: results available in 1 to 2 days
- **Spoligotype and RFLP results together have provided strongest evidence for**
 - Identifying lab contamination
 - Studying transmission based on clustering

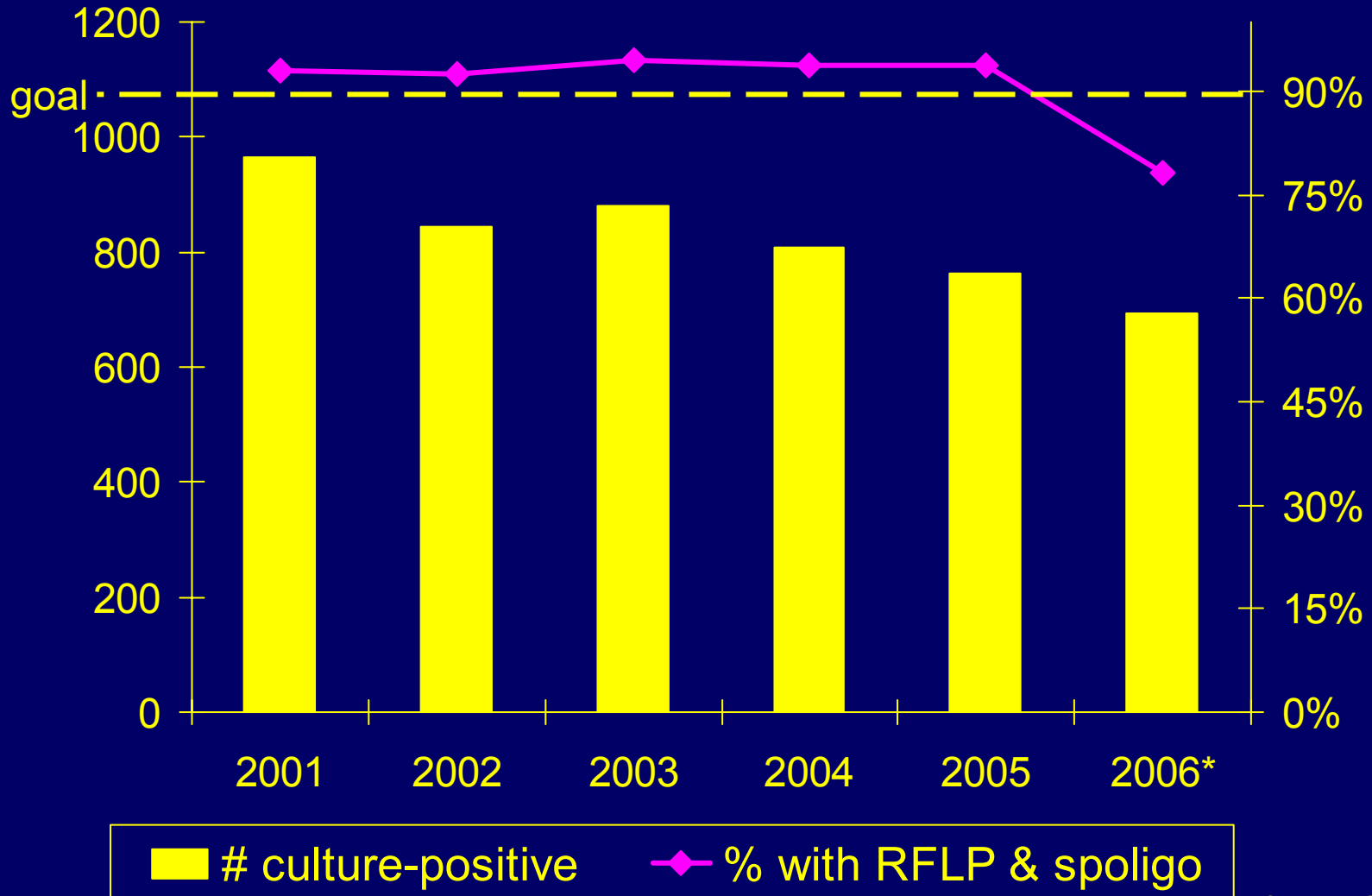
NYC Definition of Cluster

- **Genotype (molecular) Cluster:**
 - **>2 cases with identical IS6110-based RFLP banding pattern and spoligotype, regardless of the number of IS6110 copies**
- **Recent transmission??**
 - **Epidemiologic links—person, place and time**
 - **Historical vs. Recent strain**
 - **Cluster growth**

Epidemiologic Link Classification

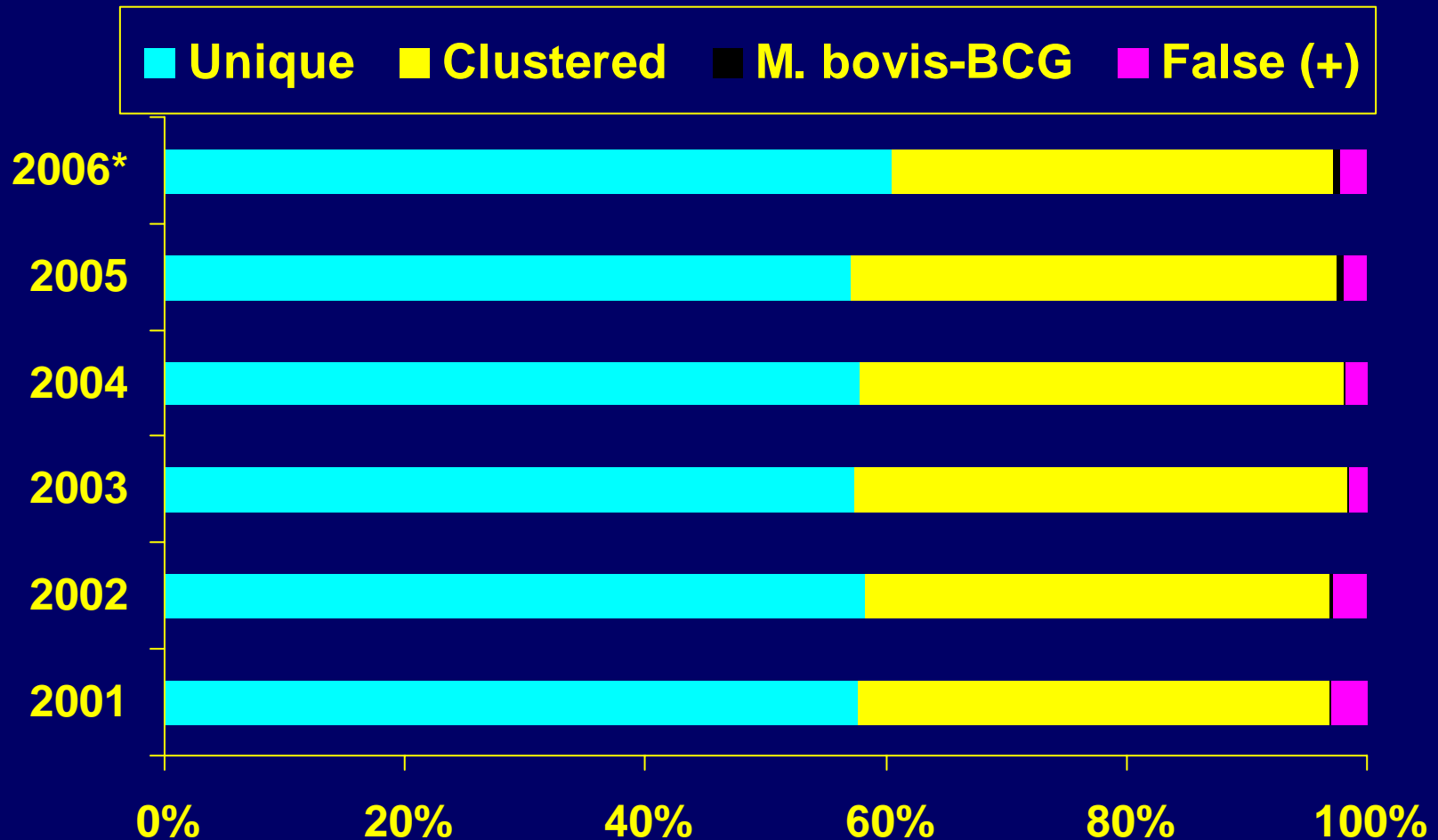


Specimen Collection and Analysis, 2001-2006

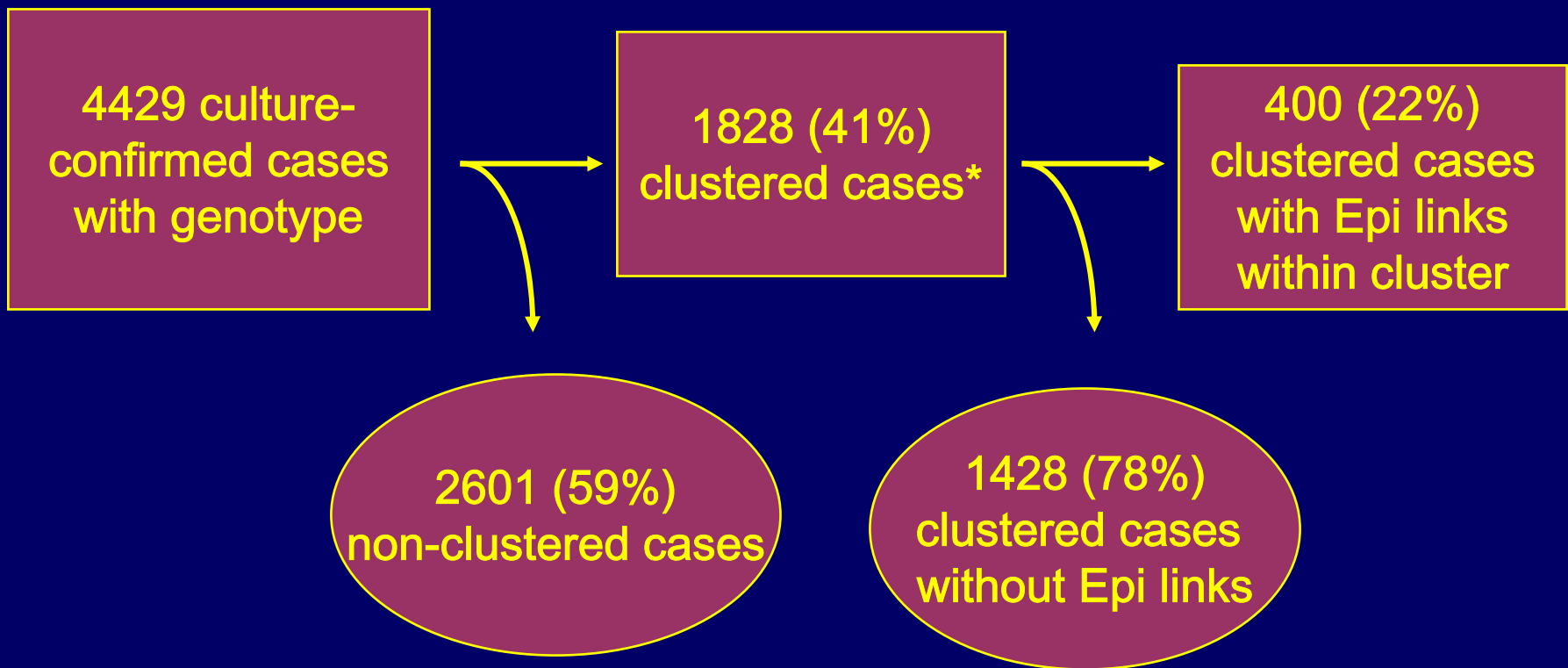


*As of 1/2007

Cases with RFLP & Spoligotype, 2001-2006

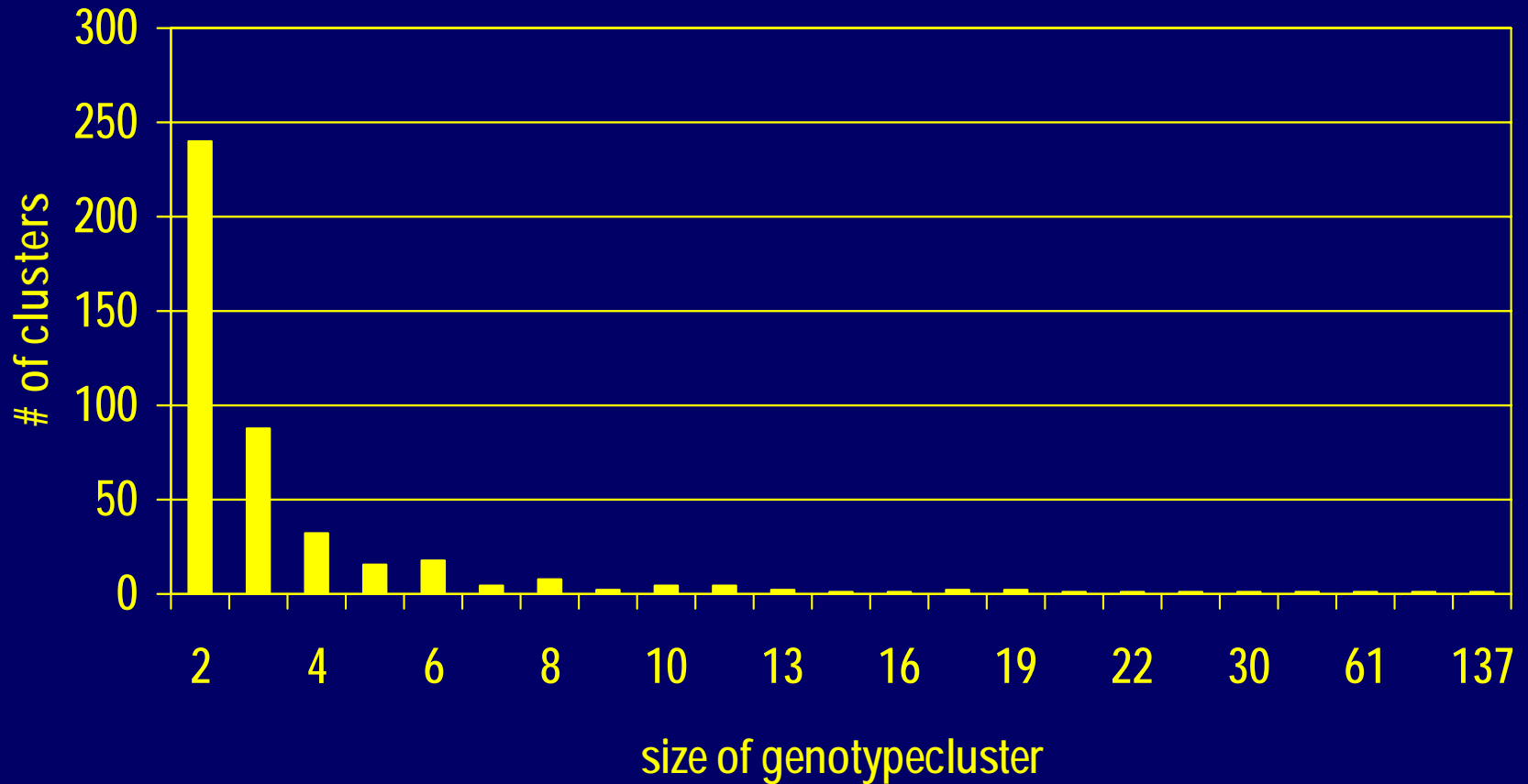


Genotype Clustering Among NYC TB Cases, 2001-2006



*Cases with genotyped (RFLP and spoligotype) isolate matching that of another case counted in New York City between January 1, 2001- December 31, 2006.

Number and Size of Genotype Clusters, 2001-2006 (N=434 clusters)



Factors associated with Genotype Clustering, NYC, 2001-2005

Characteristics	RRadj	95% CI
Age		
0-18	3.44	2.68-5.74*
18-34	1.81	1.37-2.40*
35-44	1.67	1.20-2.20*
45-54	1.73	1.30-2.31*
55-64	1.44	1.04-1.99*
>65	ref	-
Race/Ethnicity		
Asian	0.73	0.51-1.07
Hispanic	1.72	1.21-2.45*
Black	1.59	1.15-2.22*
Other	1.33	0.50-3.55
White	ref	-
Country of birth		
US	2.28	1.76-2.95*
Unknown	1.55	0.64-3.75
Non-US	ref	-

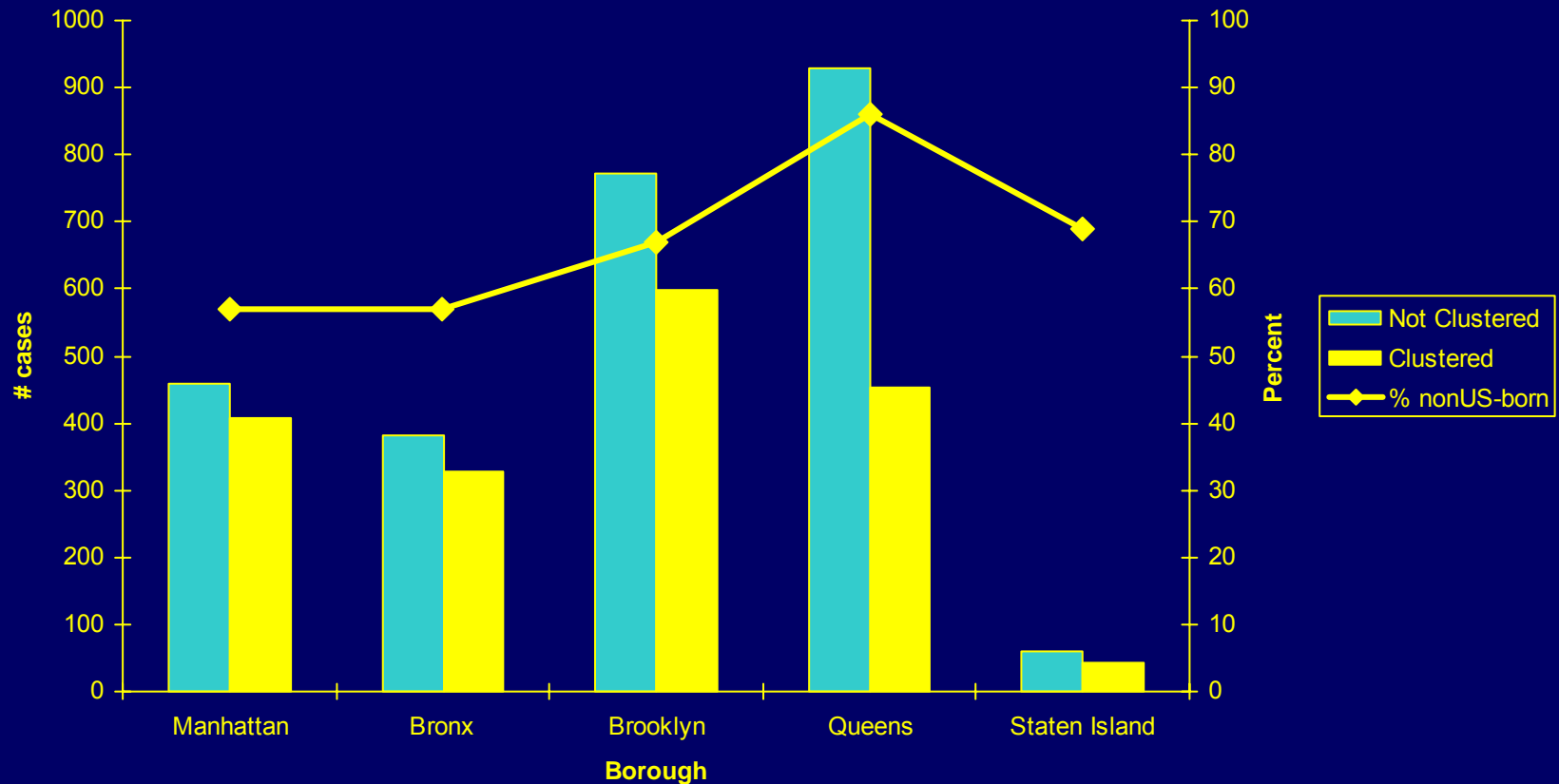
* Factors significantly associated with genotype clustering

Factors associated with Genotype Clustering, NYC, 2001-2005

Characteristics	RRadj	95% CI
Homeless	2.00	1.39-2.89*
Substance abuse	1.89	1.48-2.20*
Site of disease		
Pulmonary	1.30	1.03-1.63*
Both	1.02	0.75-1.38
Extrapulmonary	Ref	-
Resp AFB smear+	1.11	0.95-1.3
HIV serostatus		
Infected	1.07	0.84-1.36
Unknown	0.90	0.76-1.07
Uninfected	Ref	-

* Factors significantly associated with genotype clustering

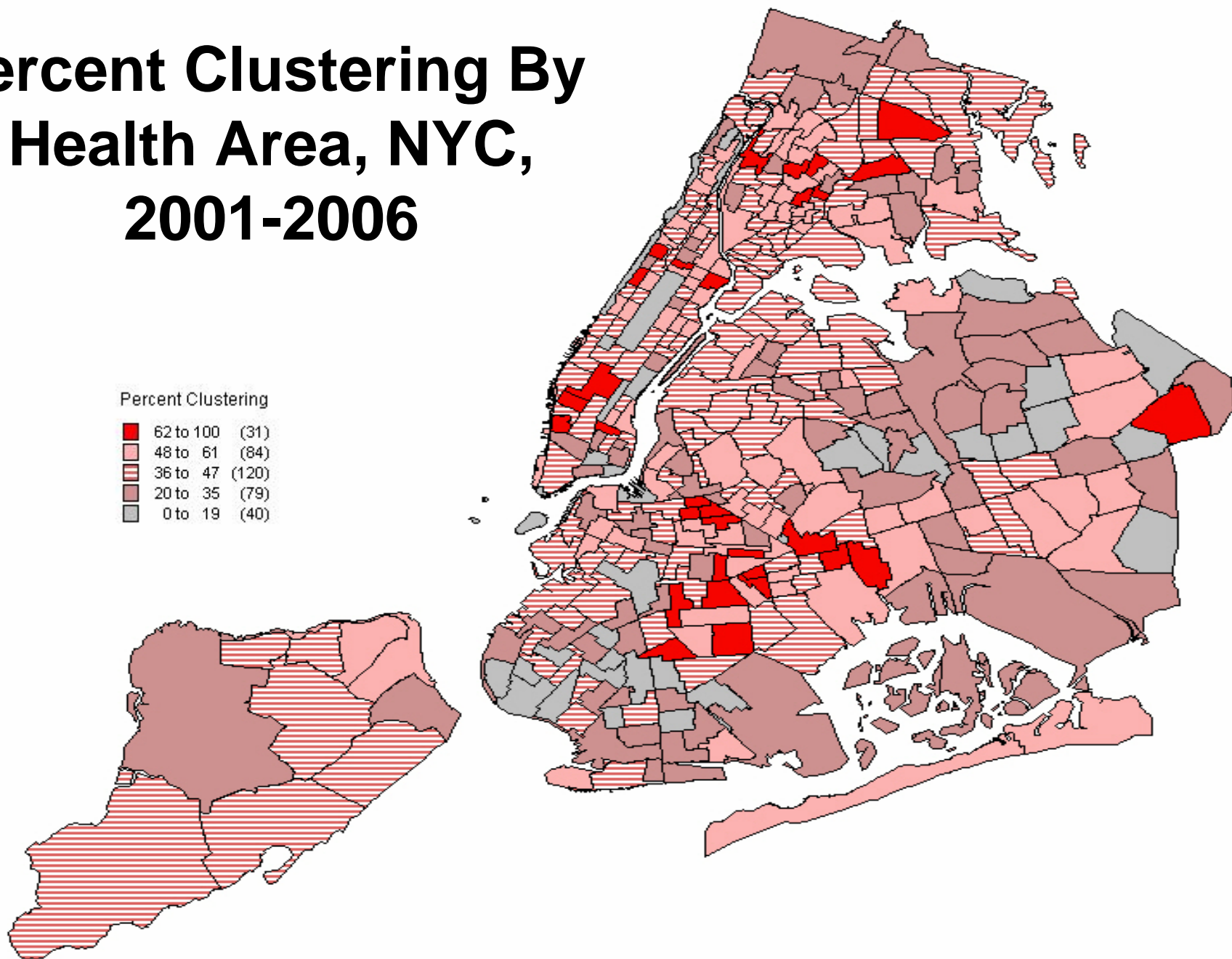
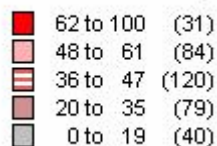
Genotype Clustering by Borough NYC, 2001-2006



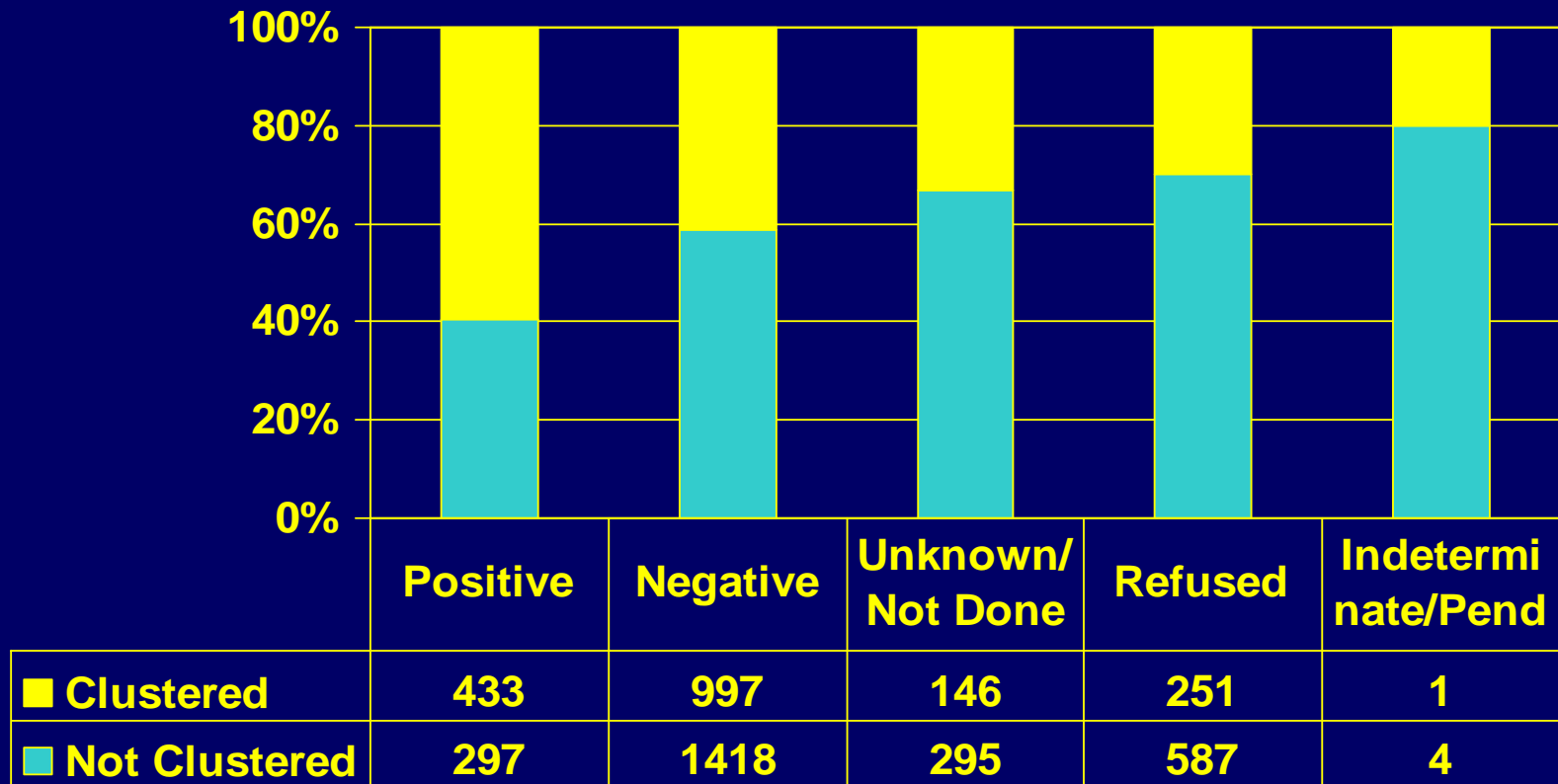
*Among 93.8% of Culture-Positive TB cases with genotype

Percent Clustering By Health Area, NYC, 2001-2006

Percent Clustering



Genotype Clustering by HIV-Status, NYC 2001-2006*



*Among 93.8% of Culture-Positive TB cases with genotype

Age-adjusted* TB case rate (per 100,000 PLWHA), New York City, 2001 - 2004

	2001	2002	2003	2004
Total TB case rate	207	212	191	180
Race/Ethnicity				
White, NH	69	45	19	56
Black, NH	284	309	284	258
Hispanic	173	182	156	159
Asian	1238	686	914	219
Sex				
Female	240	207	164	184
Male	197	218	208	182

*Age distribution of 2001 PLWHA was the standard for age-adjusted rate computation.

Age-adjusted TB case rate (per 100,000 PLWHA) by race and sex, New York City, 2001 - 2004

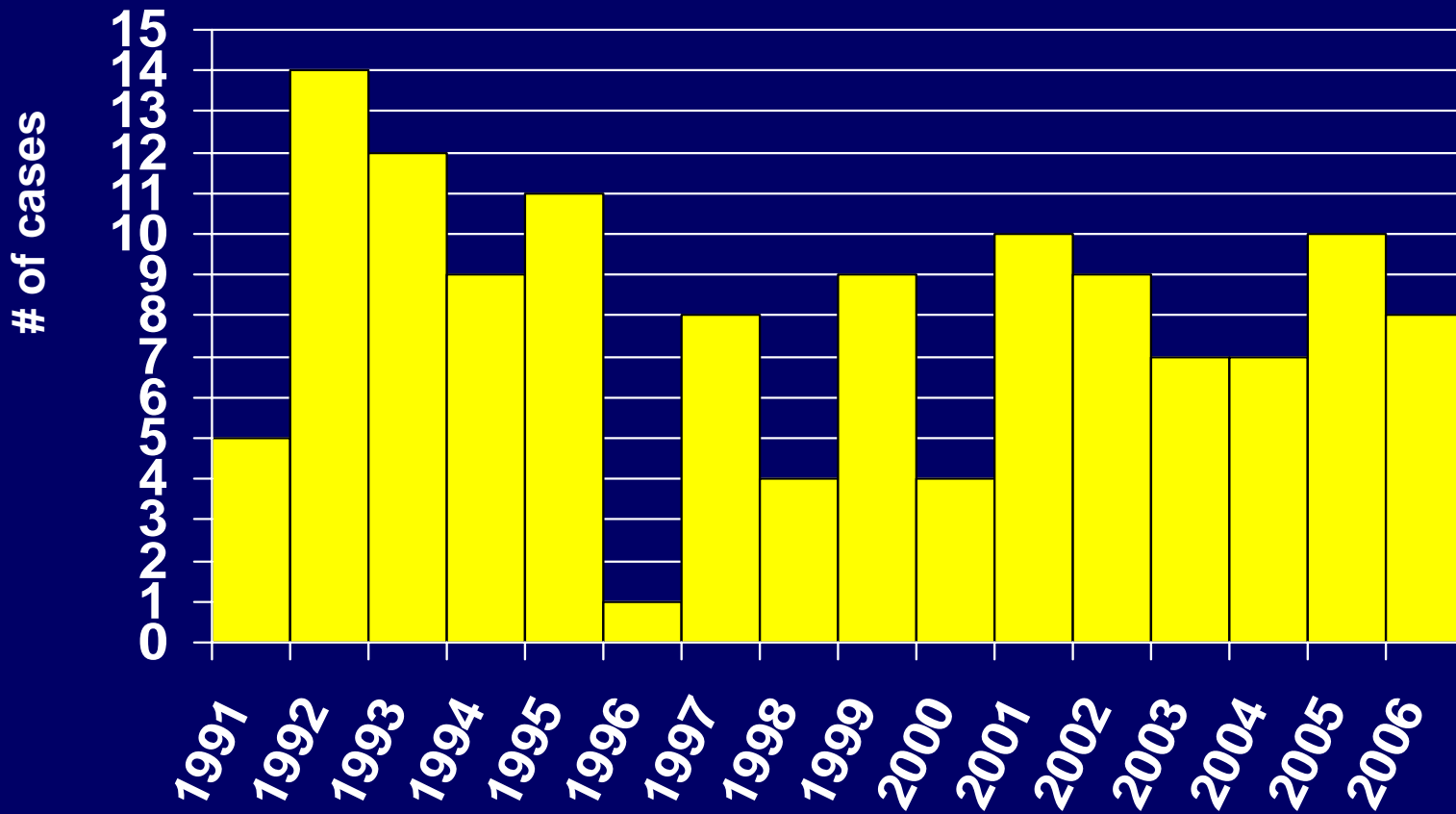
	2001	2002	2003	2004
Total TB case rate	207	212	191	180
% change	--	2%	-8%	-13%
Black, NH				
Female	270	265	219	223
Male	293	338	329	284
Rate Ratio of M:F	1.1	1.3	1.5	1.3
Hispanic				
Female	184	134	95	127
Male	169	204	140	173
Rate Ratio of M:F	0.9	1.5	1.5	1.4
Rate ratio of Black female to Hispanic female	1.5	2.0	2.3	1.8

TB Transmission in the Community

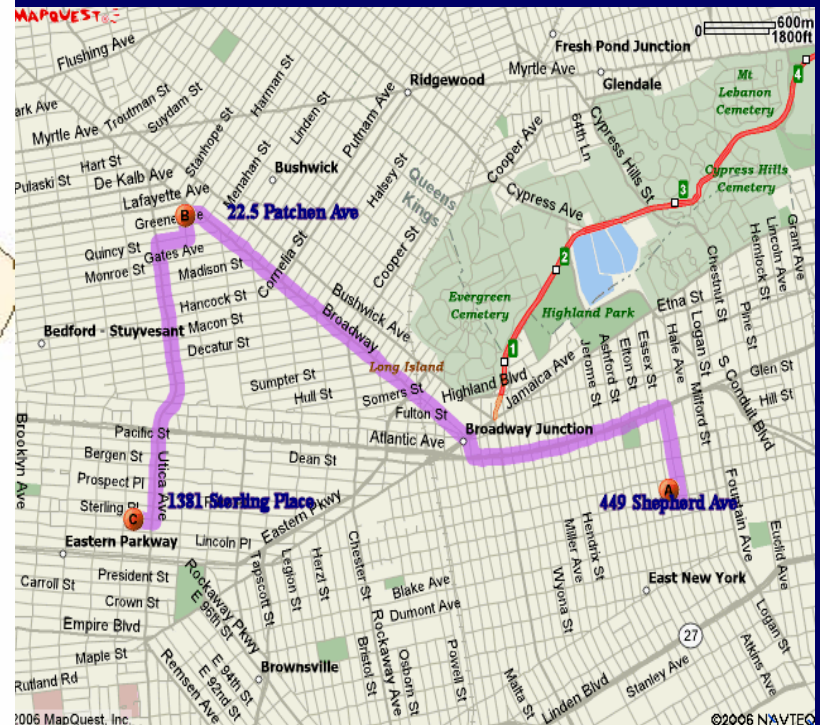
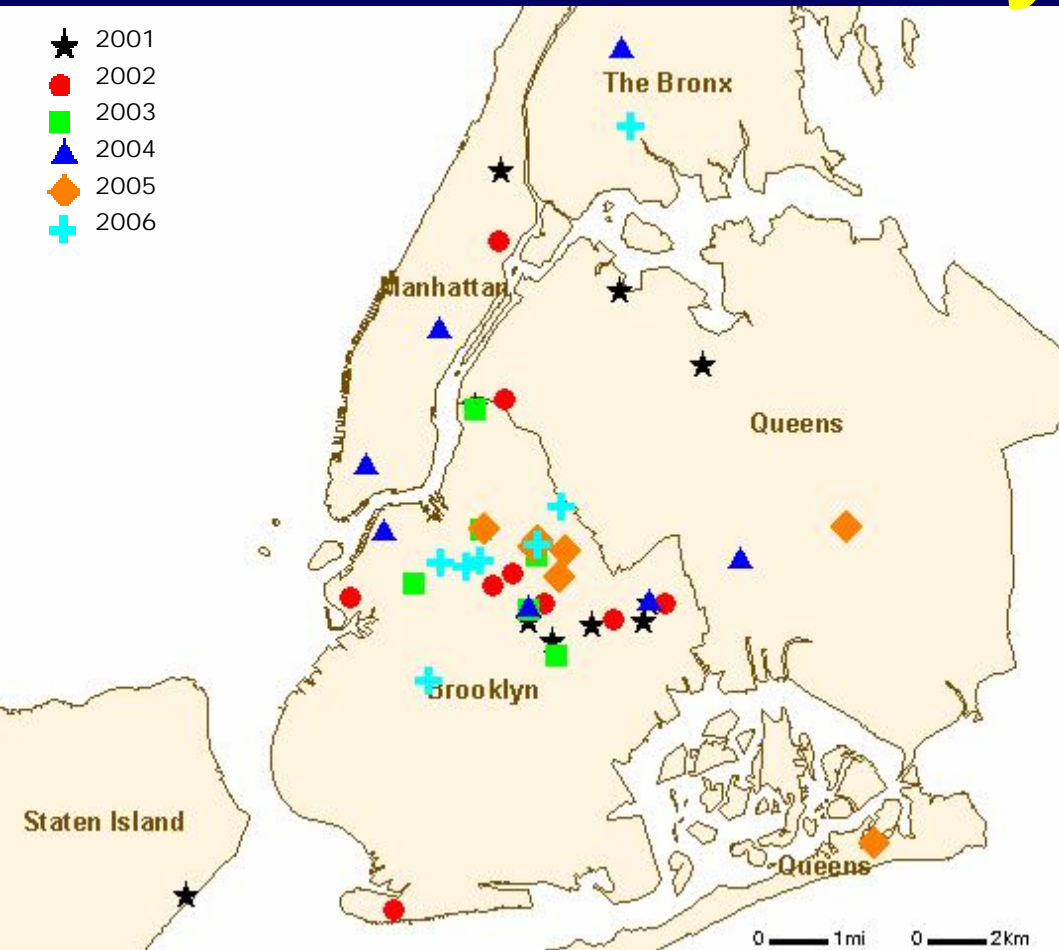
Cluster of TB cases in Brooklyn

- **Historical strain: first case identified in 1991**
- **48 cases identified since 2001(excludes one relapse case)**
 - 71% male
 - 94% pulmonary
 - 83% US-born
 - 83% Non-Hispanic Black
 - 42% HIV
 - 21% homeless
 - 48% substance abusers (predominantly alcohol use)
 - 60% live in Brooklyn
- **24 have epidemiologic links (4 linked to a single transitional housing facility)**

Cluster of TB cases in Brooklyn (N=125)



Cluster of TB cases in Brooklyn



Cluster of TB cases in Brooklyn

- **Hypothesis:** Recent cases are a result of ongoing transmission in a Brooklyn community
- **Interventions to date**
 - Re-interviewed patients for additional contacts/sites
 - Screening at SRO
 - Site visits and screenings at transitional housing facility (4 cases linked)
 - Notifications sent to church parishioners
 - Plans for TB awareness campaigns

Cluster of TB cases in Brooklyn

- **TB awareness campaign in the Bedford Stuyvesant area and increase cooperation with DPHO**
 - **1 year program evaluation to assess effect of intervention**
 - **Frequency of TB cases in area**
 - **Prevalence of V strain**

TB Brochure Insert

1 IN 3 NEW
YORKERS WITH
TB DISEASE
IS AFRICAN-
AMERICAN!



- TB is 3 times more common in Bedford-Stuyvesant/Crown Heights than in the rest of the country.
- In NYC, almost 1/2 of TB patients under 5 years old are African-American.
- People who have HIV, diabetes, or alcohol and drug problems are more likely to get sick from TB.

PROTECT YOURSELF...
PROTECT YOUR FAMILY...

You can get tested for TB *and* HIV at:

Bedford Chest Center
485 Throop Avenue, 3rd Floor
Brooklyn, NY 11221

Call 311 for more information.

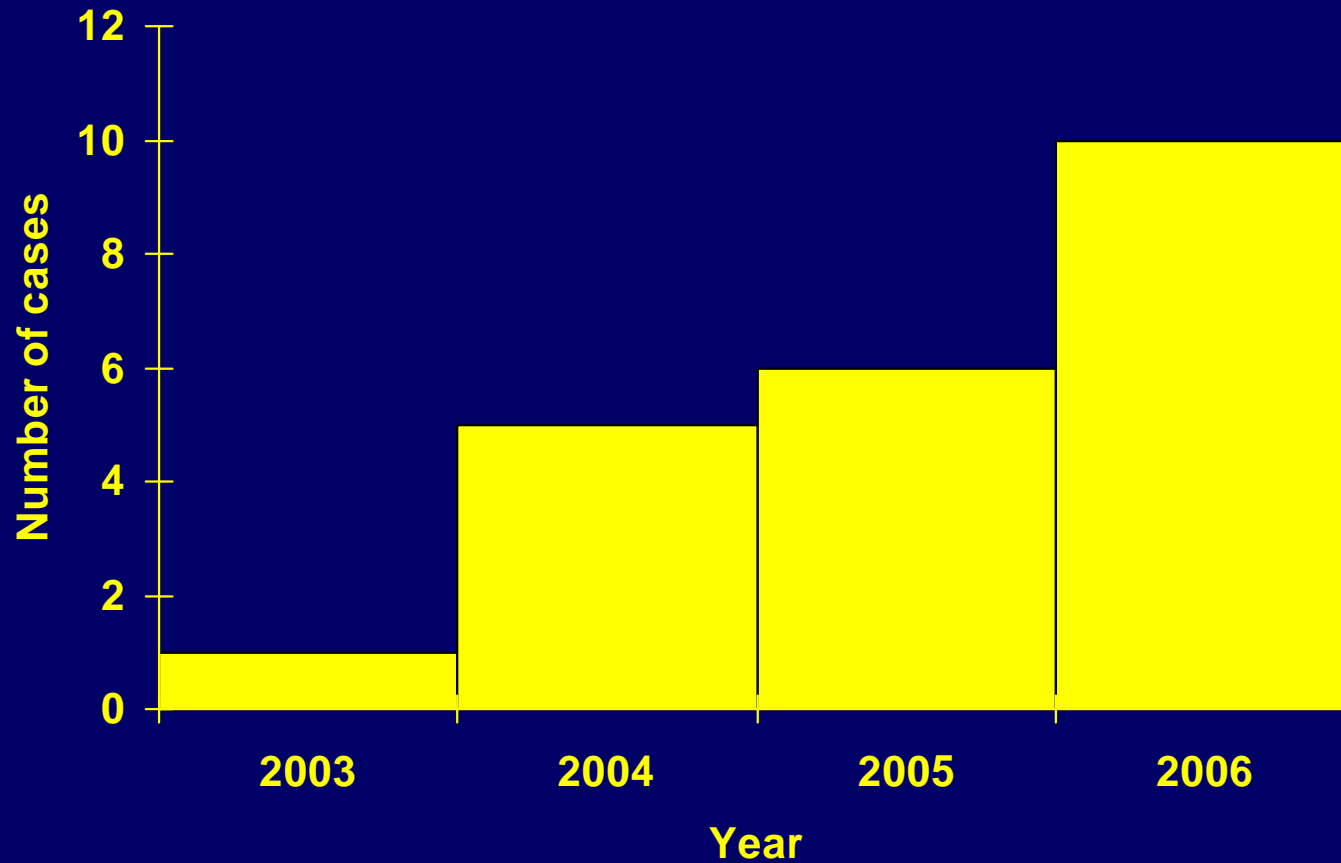
Cluster of TB cases in Brooklyn

- **Social network analysis: re-interview cases/contacts to establish relatedness**
- **Assess the feasibility of conducting routine targeted testing at transitional housing facility**
- **Challenges:**
 - **Historical strain; many cases may have been infected long ago**
 - **Difficult population to screen/treat for LTBI**

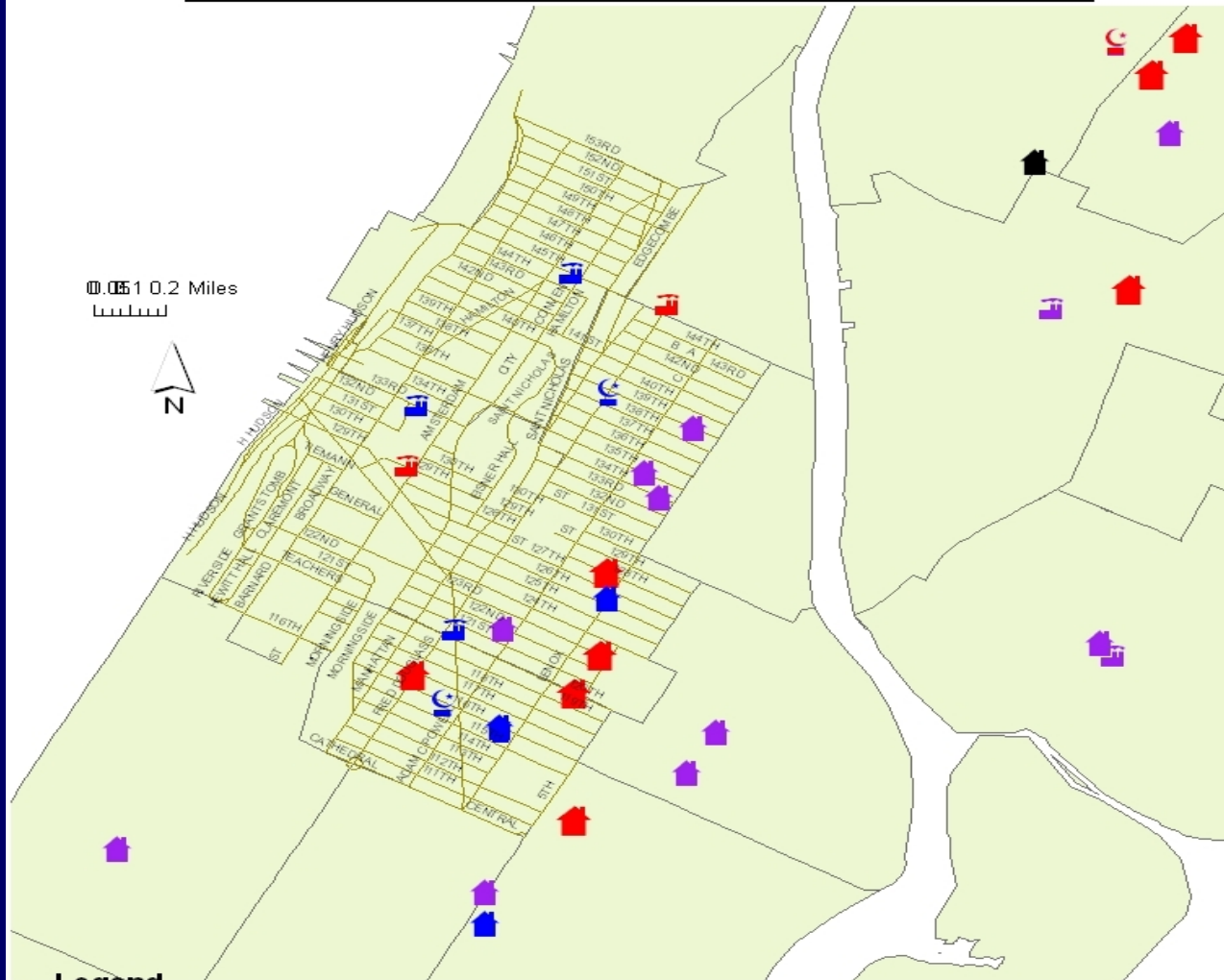
Cluster of TB cases in Upper Manhattan/Bronx

- **Recent strain; first seen in 2003, 22 cases since**
 - 95% live in Upper Manhattan (Harlem) and South Bronx
 - 77% male
 - 50% US-born; 55% of non US-born are from Africa and Middle East
 - 36% HIV infected
 - 41% have substance abuse histories
- **Epidemiologic links are based on geographic proximity**

Cluster of TB cases in Upper Manhattan/Bronx (N=22)

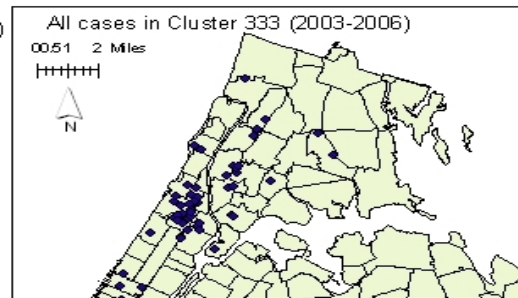


Cluster 333 Sites in Upper Manhattan and South Bronx ('03-'06)



Legend

- | | | | |
|--|----------------------|--|-------------------------------------|
| | 2006 Worksites | | 2005 Detox Facility (not in Harlem) |
| | 2006 Residences | | 2004 Worksites |
| | 2006 Religious Sites | | 2004 Residences |
| | 2005 Worksites | | 2004 Religious Sites |
| | 2005 Residences | | 2003 Residences |
| | 2005 Religious Sites | | Streets |
| | | | clinics1 Events |



Cluster of TB cases in Upper Manhattan/Bronx

- **Hypothesis: Ongoing recent transmission in Harlem and South Bronx.**
- **Interventions to date**
 - **Re-interviewed all 2005 & 2006 cases**
 - **Screening at a transitional facility**
 - **Working with CBO for testing at a house of worship**
 - **Visited area and identified potential sites of transmission**

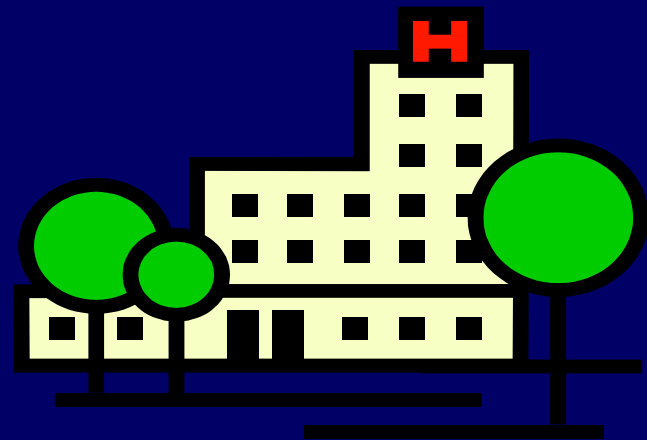
Cluster of TB cases in Upper Manhattan/Bronx

- **Action Plan**
 - Provider outreach with partners
 - Enlist help of community leaders
 - Community outreach
 - Screen at sites of potential transmission
 - Potentially interview contacts
- **Challenges**
 - Many cases do not identify contacts
 - Different demographic subgroups

Challenges in understanding TB transmission in the community

- Largest TB genotype clusters partially reflect historical strains circulating in community
- Clustered cases may reflect expected level of reactivation disease, not necessarily recent transmission. However, recent transmission also taking place.
- Need method to detect growth in clusters beyond the expected
- Need to examine ME and field epidemiologic data together

Nosocomial Exposures in New York City



Nosocomial Exposures, NYC

- **Epidemiologists communicate with ICNs to find out if patients isolated upon admission; if not, nosocomial exposures investigated**
- **Work with ICNs and EHNs to identify contacts and classify according to exposure status**
- **Facility tests exposed employees and patients in-house**

Nosocomial Exposures, NYC

- **Epidemiologist gather line-lists of exposed and test results**
- **DOH tests exposed discharged patients**
- **2006 began systematically collecting data on number and types of nosocomial exposures**

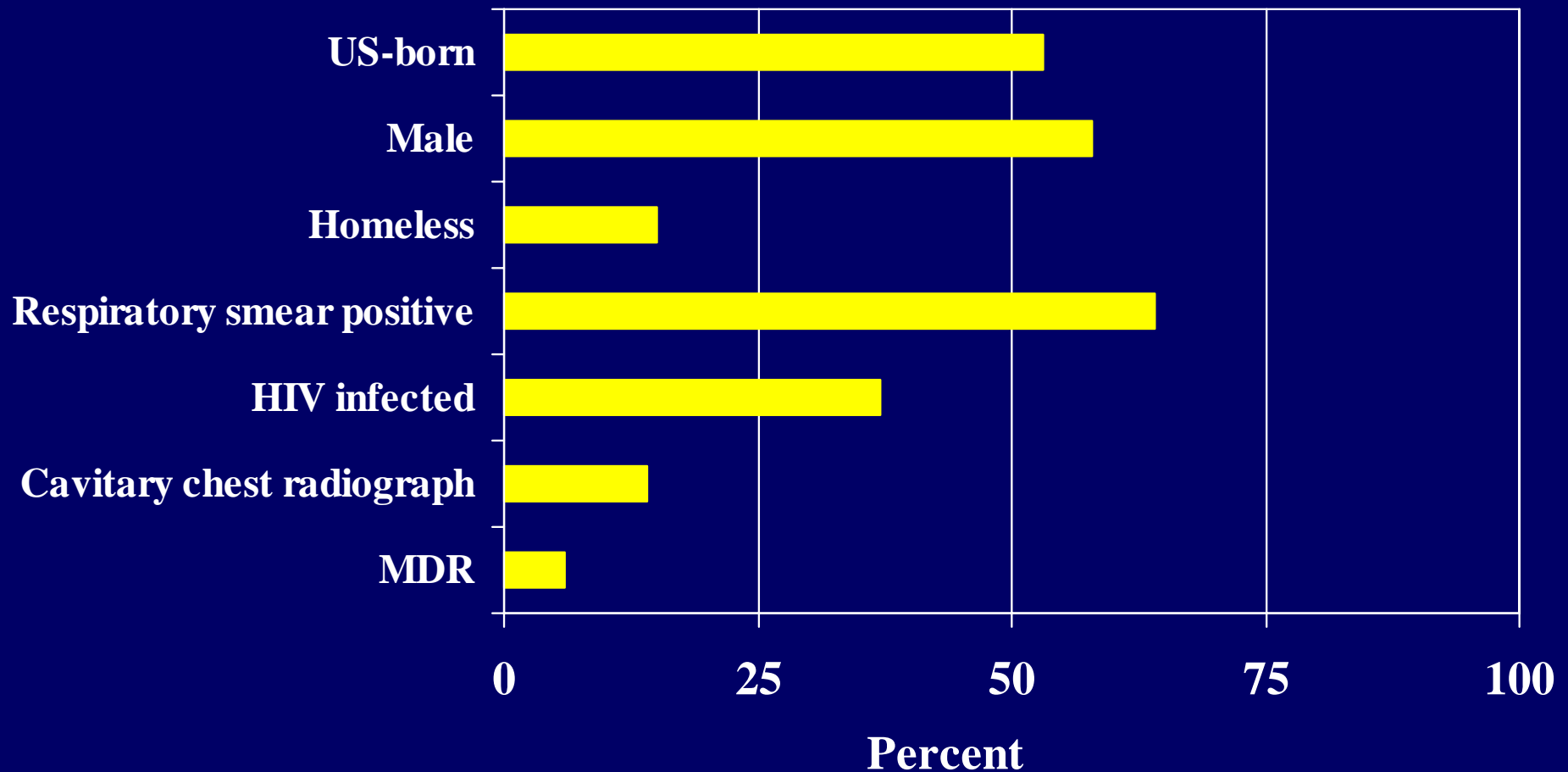
TB exposures at HCF, NYC 2006

Preliminary data

- **81/649 (12%) culture-positive pulmonary TB cases contributed to TB exposures in 92 NYC HCF**
 - **6 (7%) HCW**
 - **4 (67%) provided direct patient care, 1 (16%) security guard, 1 (16%) clerical worker**
 - **3 (50%) had previous + TST but no TLTBI**
 - **75 (93%) patients**
- **Median exposure was 10 days (range 1-84)**
- **14/92 (15%) HCF had evidence of TB transmission**
 - **2 HCW index case**
 - **12 patient index case**

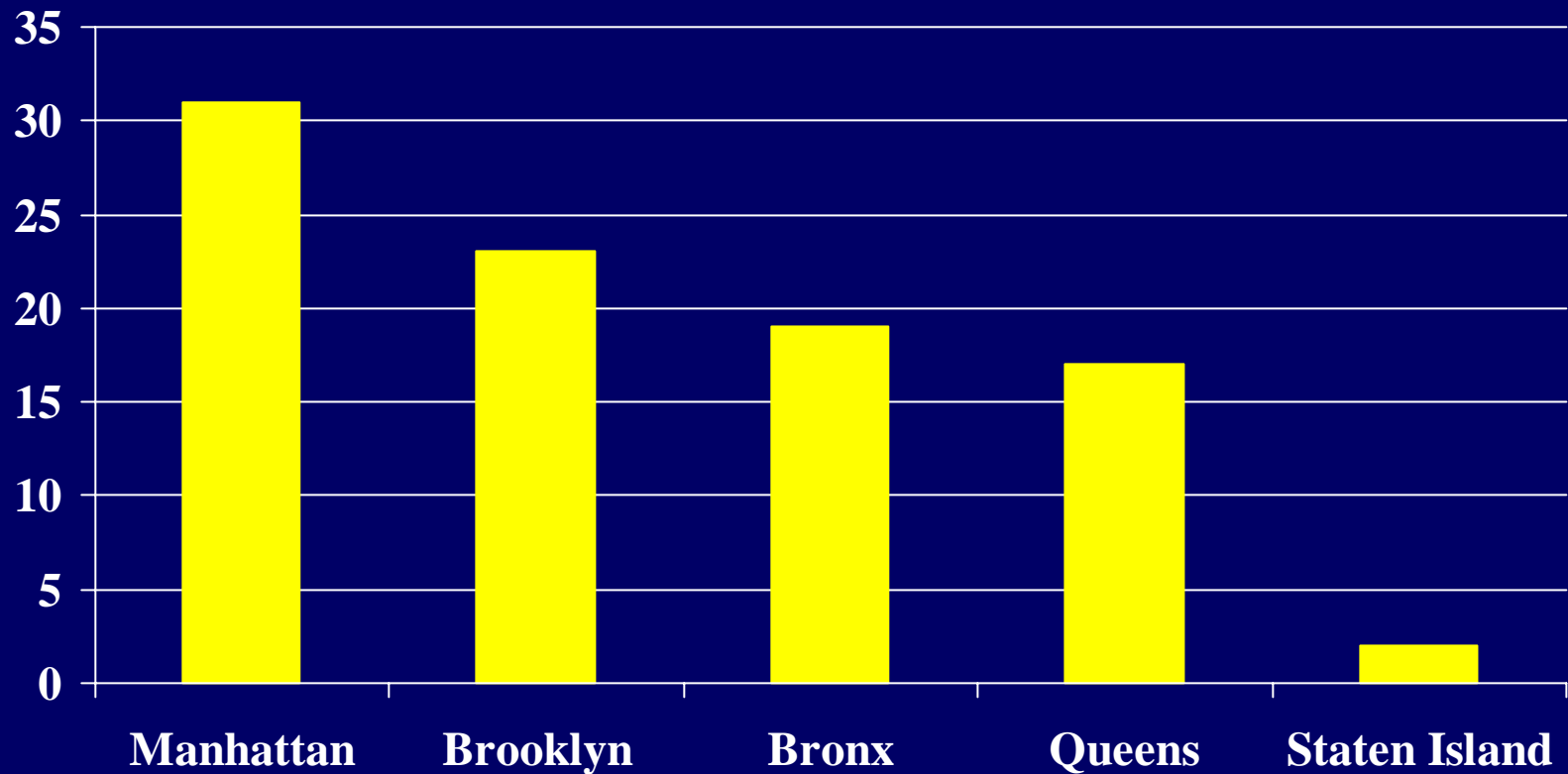
Characteristics of TB cases with exposures at HCF, NYC 2006

Preliminary data



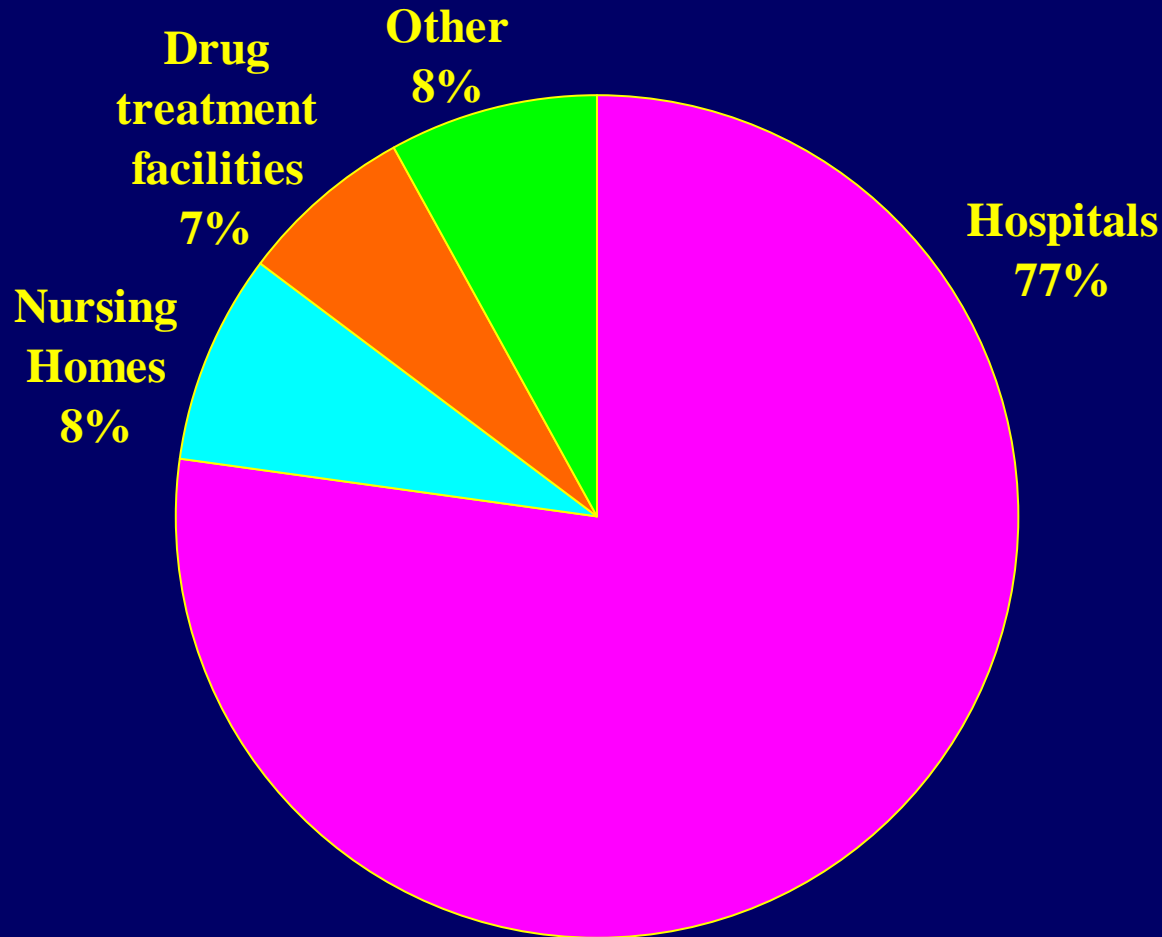
Location of HCF with TB exposures, NYC 2006

Preliminary data



HCF with TB exposures, NYC 2006

Preliminary data



TB Incidence Rate*, NYS, 2002

- **Health Care Workers**

US-born	2.0
Non-US-born	17.5

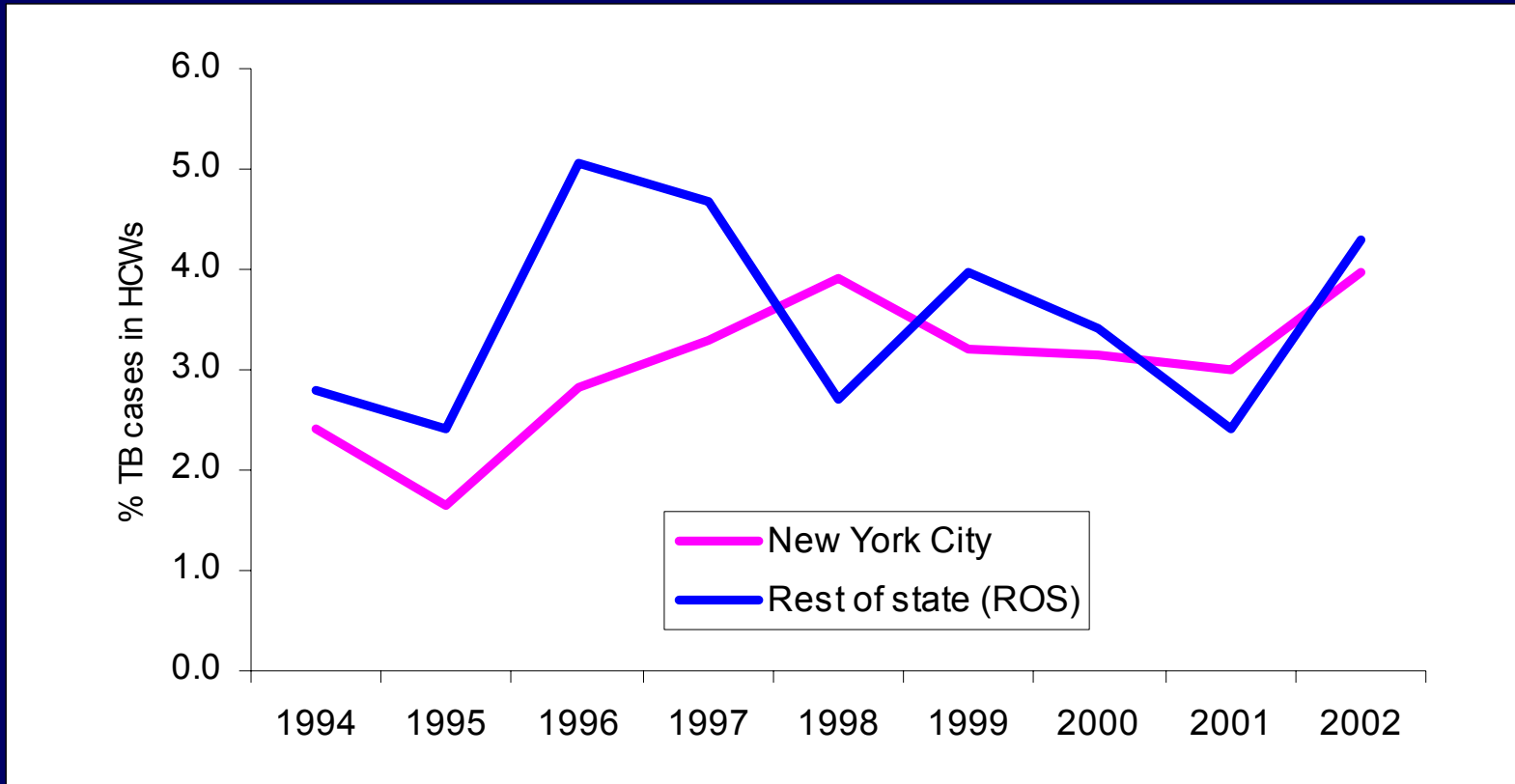
- **General Population**

US-born	3.2
Non-US-born	23.8

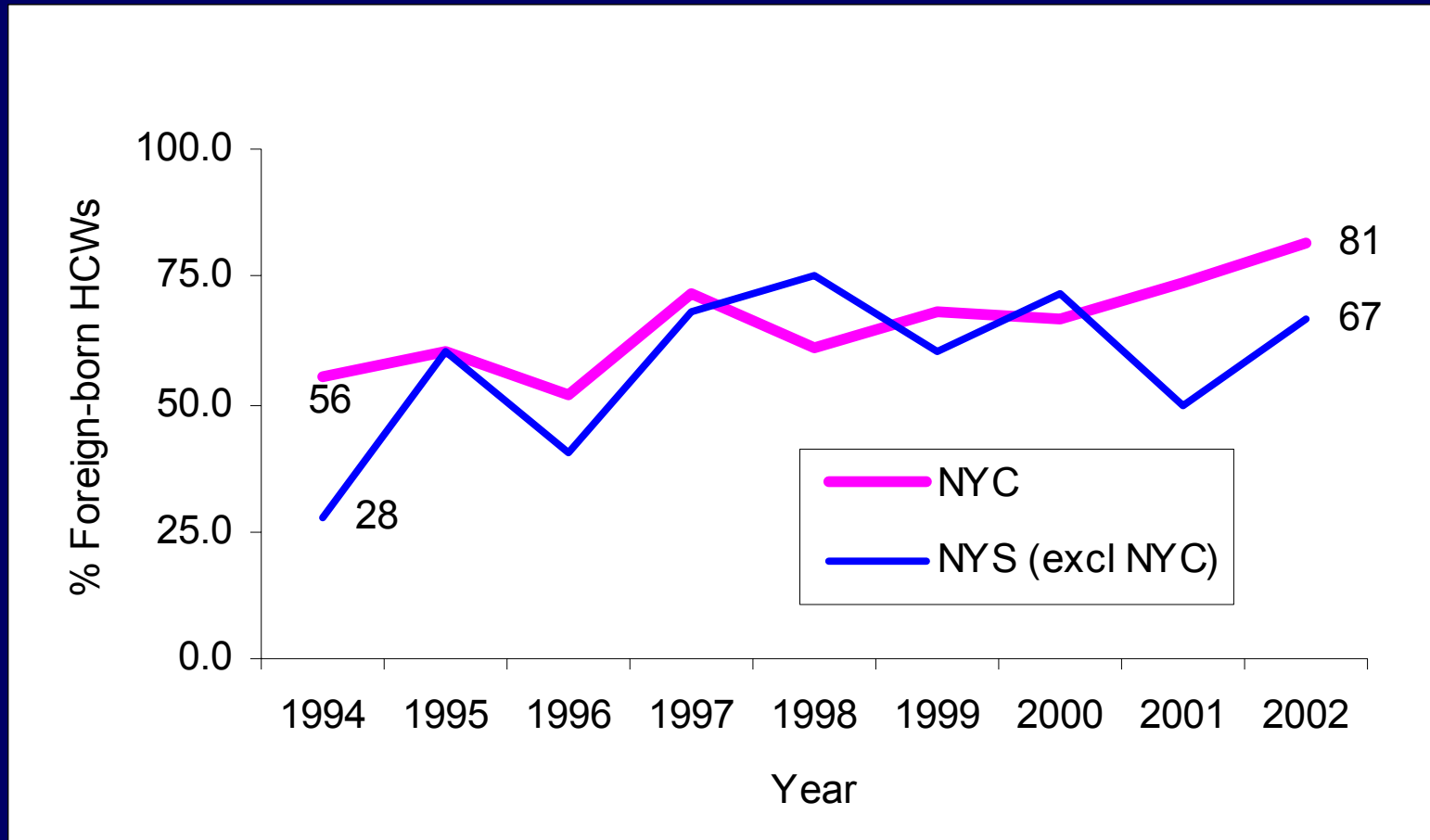
*Per 100,000 population

Driver CR, Strikof R, Granville K, et al. Tuberculosis in health care workers during declining tuberculosis incidence in New York State. Am J Infect Control. 2005 Nov;33(9):519-26.

Percent TB cases in HCW



Percent HCW TB in Foreign-born



Missed Opportunity for Prevention among HCW TB Patients, NYS

- **297 TB HCW cases (1998-2002)**
 - 55% TST-positive at hire
 - 21% had unknown TST result at hire
- **221 TST-positive at hire or after and met guidelines for TLTBI**
 - 23% received TLTBI

Investigation at HCF A

- **October 2005, Patient A, diagnosed with smear +, pulmonary TB**
- **HIV-infected**
- **Patient died 1 month post diagnosis**
- **MDR-TB; resistant to INH and RIF**
- **Patient lived at HCF A, long-term care facility for HIV-infected, homeless persons in Bx**

Investigation at HCF A

- **HCF A began CI activities**
 - TST/CXR for all HIV-infected exposed residents
 - TST for all staff
- **Patient B identified February 2006**
 - Lived on same floor as Pt A
 - Converted TST; abnormal CXR
 - Smear negative, non-cavitary, pulmonary MDRTB
- **Patient C identified (by outside HCF) March 2006**
 - Diagnosed in other HCF, BTBC notified
 - Lived on same floor as Pt A
 - Left HCF A in January 2006
 - Smear positive, non-cavitary, pulmonary MDRTB

TB Cases at HCF A



Living In HCF A
 Infectious Period
 X Date of Death, if applicable
 Working In Residence A

Investigation at HCF A

- **Infectious period July 2005-February 2006**
- **Case Finding for Residents**
 - Post-window TST
 - CXR
 - 3 sputum
 - Medical exam
 - TLTBI with PZA and moxifloxacin regardless of TST
- **Contact Tracing for Staff**
 - Post-window TST
 - TB signs and symptoms check
 - TLTBI only if newly TST + or converter

Investigation at HCF A

- **142 close contacts at HCF A**
 - 45 current residents
 - 42 discharged residents
 - 55 staff worked on same floor as Pt A

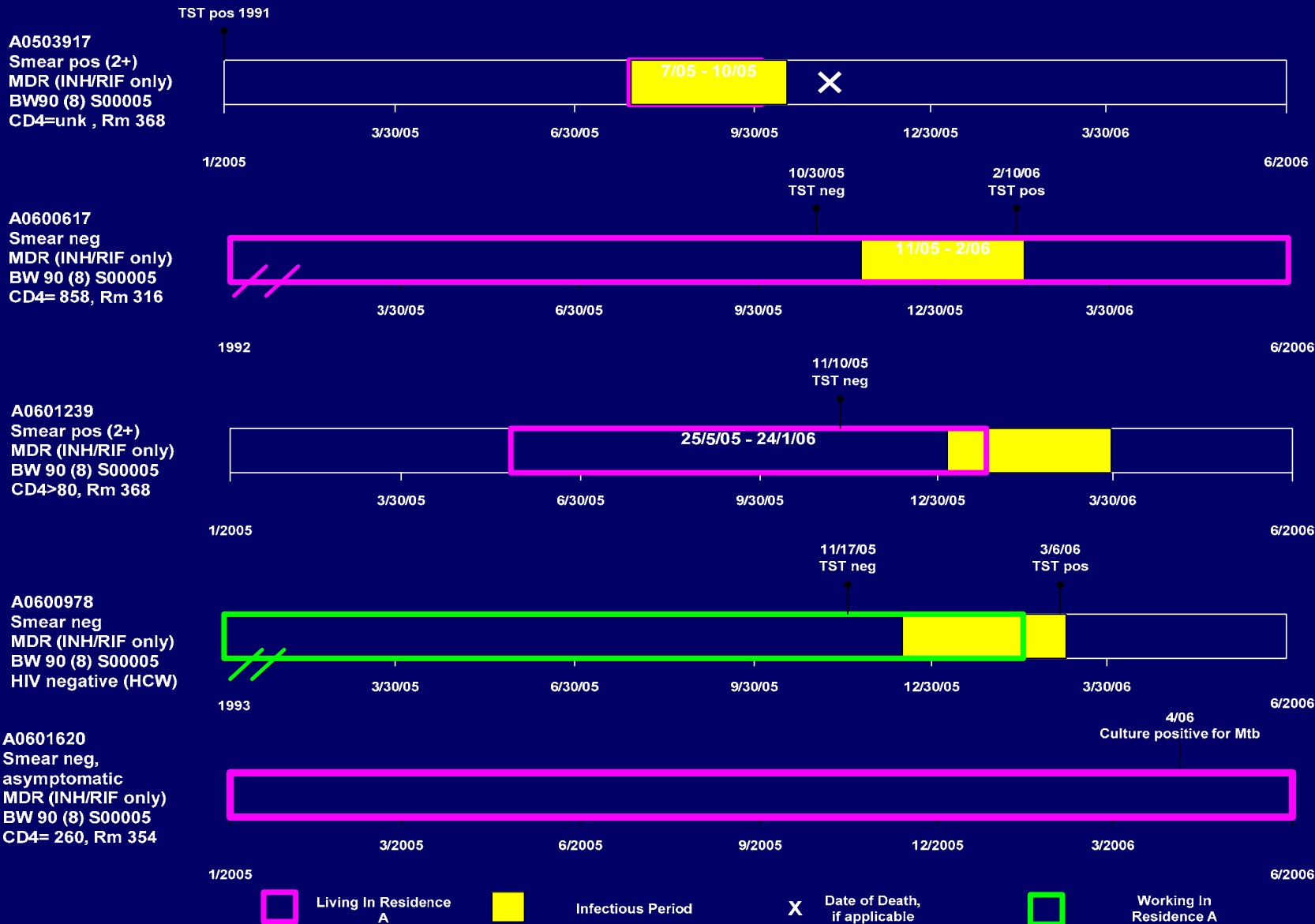
Investigation at HCF A

	Residents n=45		Located Discharged Residents n=8		Staff n=55	
	n	%	n	%	n	%
Prior positive	8	18%	1	13%	26	47%
TST negative	34	76%	6	74%	27	49%
TST positive	0	0%	0	0%	0	0%
TST conversion	1	2%	1	13%	1	2%
3 sputa	38	84%	0	0%	N/A	N/A
At least 1 sputum	40	89%	4	50%	N/A	N/A
Culture positive	1	2%	0	0%	1	2%
Chest radiograph	44	98%	6	74%	26	100%*
Treatment for LTBI indicated	44	98%	8	100%	N/A	N/A
Started treatment	38	86%	2	25%	N/A	N/A

Investigation at HCF A

- **Patient D**
 - HCW directly cared for Pt A
 - Converted TST
 - HIV-negative
 - Smear negative, pulmonary MDRTB, March 2006
- **Patient E**
 - HIV-infected resident
 - Lived on same floor as Pt A, B and C
 - Smear negative, pulmonary TB, April 2006
- **All 5 patients had same genotype and isolates were resistant to INH and RIF**

TB Cases at HCF A



Investigation at HCF A

Summary

- **Case finding activities useful in settings with exposed HIV-infected contacts where TB transmission seen**
- **Highly successful with initiating TLTBI in HIV-infected contacts**
 - **Currently being followed by HCF A and MCC**
- **Difficult to find discharged exposed residents**
 - **Limited resources**
 - **Cross-matching (death registry, prison, HASA)**

Challenges Investigating Nosocomial Exposures

- **Difficult to obtain demographic, screening result information from HCFs**
- **Difficult to locate exposed, discharged patients**
 - **Communicate with multiple providers**
- **Difficult to assess transmission**
 - **High percent of HCW with prior positive TST**
 - **High percent of HCW do not get evaluation**
- **In facilities with HIV-infected, exposed patients, rapid progression to disease**

Summary

- **Despite decreasing cases, transmission of TB continues in NYC**
- **Universal genotyping and investigations of clusters aid in identifying outbreaks, and linking cases to outbreaks**
- **However, links between cases often not obvious or identified despite extensive investigations**
- **Nosocomial exposures common in NYC facilities**
 - **Challenge to increase TLtBI acceptance in HCWs**
- **Current control measures can limit outbreak size**
- **Vigilance for TB needs to be maintained**