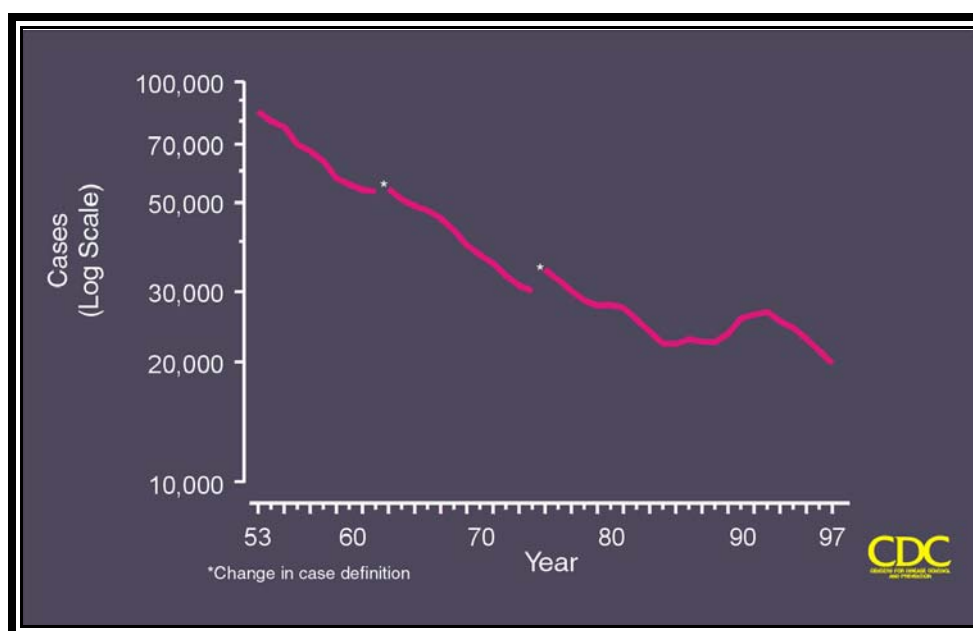


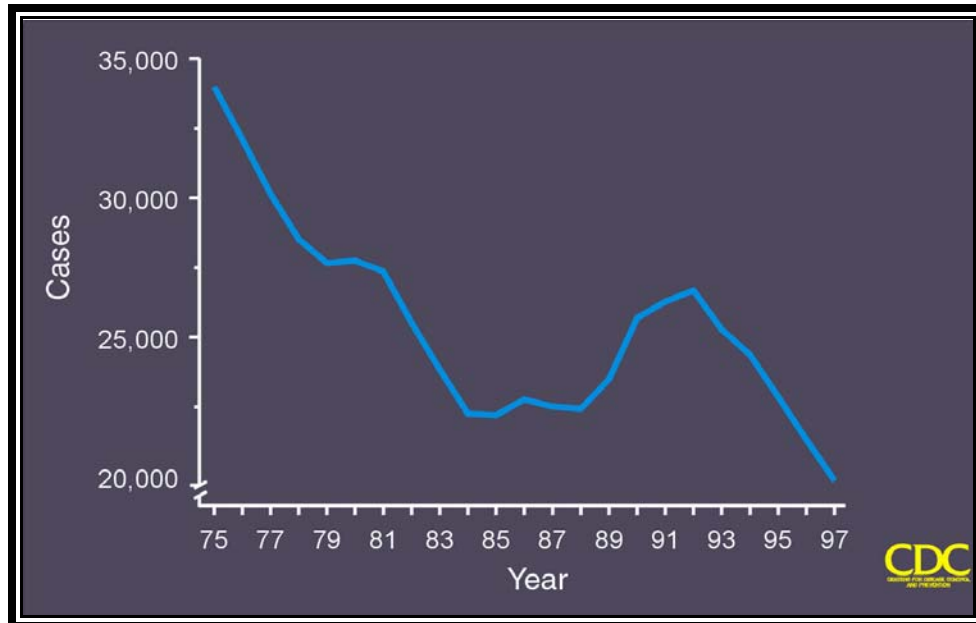
# Cost-Effectiveness of Preventing Tuberculosis in Prison Populations

Zachary Taylor, M.D., M.S., and Cristy Nguyen, M.P.H.

## Reported TB Cases, United States, 1953–97



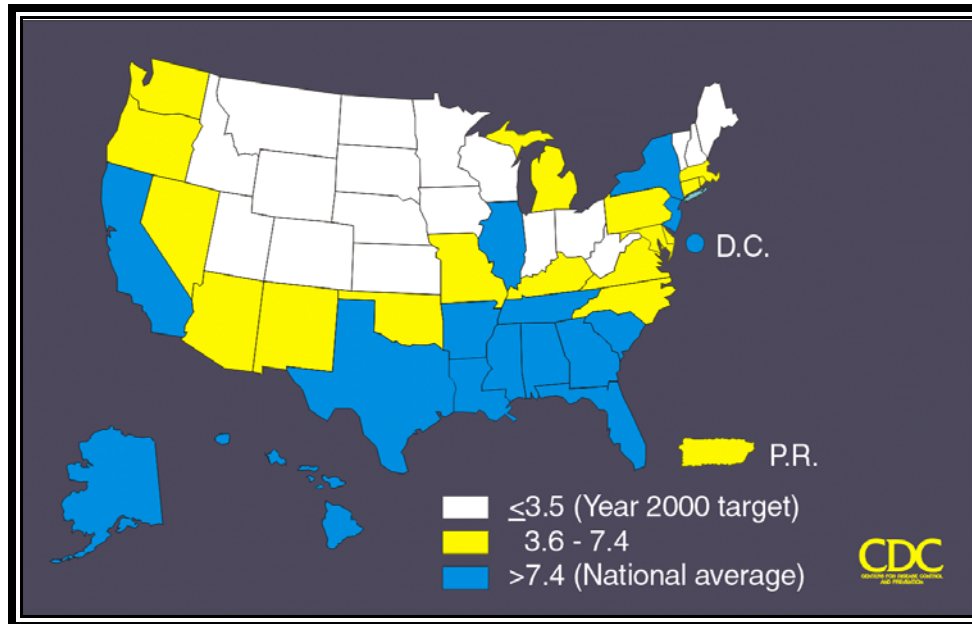
## Reported TB Cases, United States, 1975–97



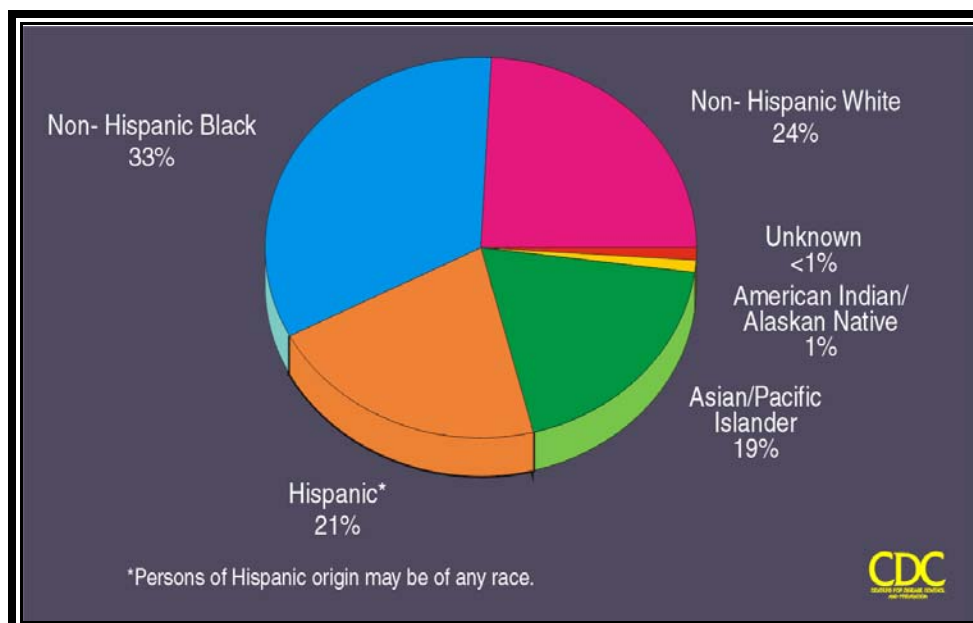
### Factors That Contributed to the Increase in TB Cases

- Deterioration of the tuberculosis (TB) control infrastructure
- Coinfection with TB and human immunodeficiency virus (HIV)
- Transmission of TB in congregate settings, including prisons
- Immigration from countries where TB is endemic

## TB Case Rates by State, United States, 1997




## Reported TB Cases by Race and Ethnicity, United States, 1997



## Reported TB Cases by Race and Ethnicity, United States, 1997

Race/Ethnicity	Cases	Percentage
Non-Hispanic white	4,872	24.5
Non-Hispanic black	6,610	33.3
Hispanic*	4,228	21.3
Asian/Pacific Islander	3,833	19.3
American Indian/ Alaskan Native	264	1.3
Unknown	44	0.2
<b>Total</b>	<b>19,851</b>	<b>100.0</b>


\*Persons of Hispanic origin may be of any race.



## Reported TB Cases by Race and Ethnicity, United States, 1996 and 1997


Race/Ethnicity	1996	1997	Change in Cases	% Change
Non-Hispanic white	5,506	4,872	-634	-11.5
Non-Hispanic black	7,106	6,610	-496	-7.0
Hispanic*	4,533	4,228	-305	-6.7
Asian/Pacific Islander	3,814	3,833	+19	+0.5
American Indian/ Alaskan Native	284	264	-20	-7.0
Unknown	94	44	--	--
<b>Total</b>	<b>21,337</b>	<b>19,851</b>	<b>-1,486</b>	<b>-7.0</b>

\*Persons of Hispanic origin may be of any race.




## Reported TB Cases by Race and Ethnicity, United States, 1985, 1992, and 1997

<u>Race/Ethnicity</u>	<u>% Change</u>	
	<u>1985 vs. 1992</u>	<u>1992 vs. 1997</u>
White, non-Hispanic	-9.9	-36.0
Black, non-Hispanic	+26.8	-31.3
Hispanic	+73.5	-22.2
Asian/Pacific Islander	+46.4	+5.0
American Indian/ Alaskan Native	-23.3	-11.7




## Reported TB Cases by Age, United States, 1996 and 1997

<u>Age</u>	<u>1996</u>	<u>1997</u>	<u>Change in Cases</u>	<u>% Change</u>
0-14 years	1,372	1,265	-107	-7.8
15-24	1,656	1,681	+25	+1.5
25-44	7,604	6,912	-692	-9.1
45-64	5,588	5,297	-291	-5.2
65+	5,103	4,691	-412	-8.1
Unknown	14	5	--	--
<b>Total</b>	<b>21,337</b>	<b>19,851</b>	<b>-1,486</b>	<b>-7.0</b>




### Change in TB Cases by Age, United States, 1985, 1992, and 1997

<u>Age</u>	<u>% Change</u>	
	<u>1985 vs. 1992</u>	<u>1992 vs. 1997</u>
0-14 years	+35.4	-25.9
15-24	+18.1	-14.8
25-44	+54.5	-33.8
45-64	+5.7	-18.3
65+	-5.2	-22.1

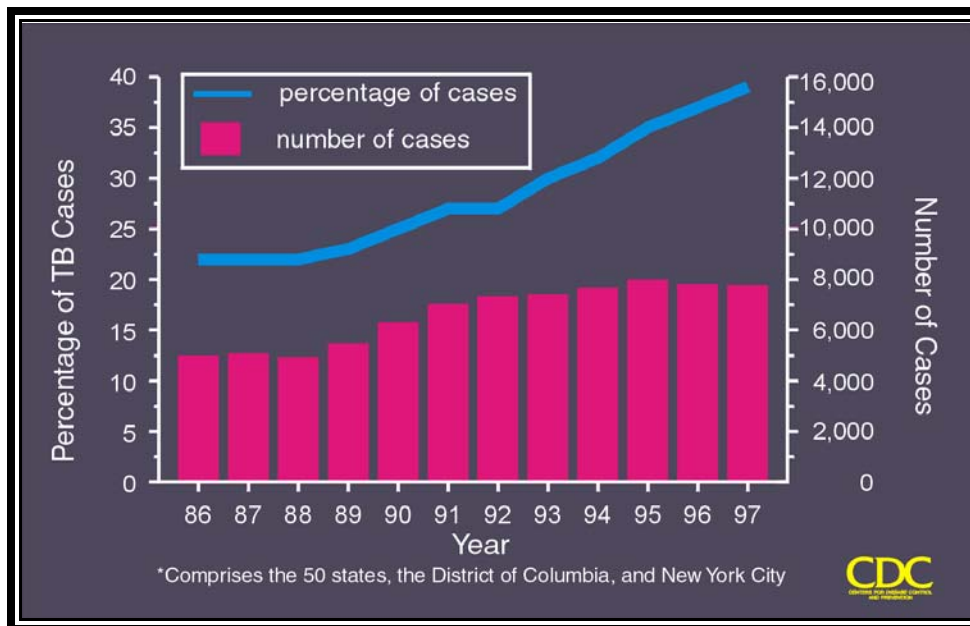


### TB Cases in Foreign-Born Persons, United States, 1986–97

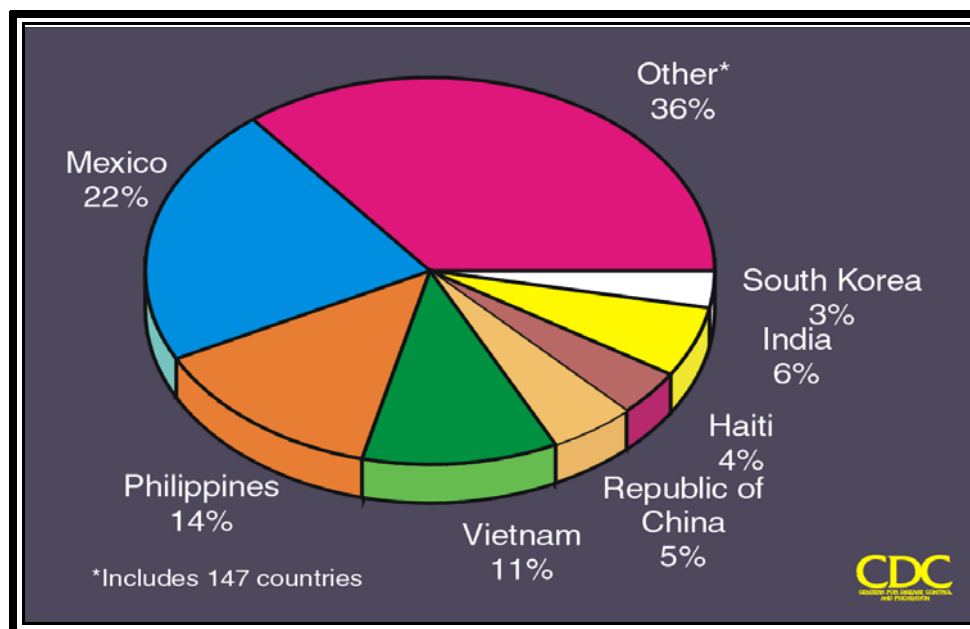
<u>Year</u>	<u>Cases</u>	<u>Percentage</u>
1986	4,925	22
1987	5,025	22
1988	4,868	22
1989	5,411	23
1990	6,262	25
1991	6,982	27
1992	7,270	27
1993	7,354	30
1994	7,627	32
1995	7,930	35
1996	7,704	37
1997	7,702	39



## Trends in TB Cases in Foreign-Born Persons, United States, 1986–97




## Country of Origin of Foreign-Born Persons with TB, United States, 1997



## Change in TB Cases by Country of Origin, United States, 1986, 1992, and 1997

<u>Country of Origin</u>	<u>% Change</u>	
	<u>1986 vs. 1992</u>	<u>1992 vs. 1997</u>
Foreign-born	+47.6	+5.9
U.S.-born	+8.5	-38.1



### TB in Correctional Facilities

- 1–22 percent of State/Federal prison inmates are infected with TB
- In 1997, 729 inmates were reported with active TB disease
- Reported TB outbreaks in correctional facilities



## Transmission of TB in Correctional Facilities

- Confined, congregate living
- Population at risk of TB infection
- Population at risk of HIV infection

## Recommendations for Screening

- Screening incarcerated populations for infection and disease
- Rapid diagnosis and treatment of active TB
- Surveillance of active TB disease and transmission of TB
- Preventive therapy for eligible inmates and correctional workers

## Objectives

- Determine the cost-effectiveness of screening for TB in prisons
- Examine the effect of the prevalence of HIV on the cost-effectiveness of screening inmates
- Compare the relative cost-effectiveness of screening correctional inmates with screening other high-risk populations

## Methods

- Markov-based decision model using DATA 3.0 by TreeAge
- Societal perspective
- 1-year time frame
- 20-year analytical horizon

## Outcomes

- Costs
- Health effects
- Effectiveness of screening and preventive therapy

## Results of Base-Case Analysis

Strategy	Total Cost (\$)	Active TB Cases	Incremental Cost (Savings) (\$)	Active TB Cases Prevented	QALYs Gained	Cost per TB Case Prevented (\$)	Cost per QALY Gained (\$)
No Screen	26,981,429	1,869	---	---	---	---	---
Screen	19,806,920	880	(7,174,509)	989	301	SAVINGS	SAVINGS

Results are per 100,000 inmates.

## Effect of HIV Prevalence on Effectiveness of TB Screening

% HIV Infection	Cost (Savings)	TB Cases Prevented
0	(\$2,841,000)	692
2.3 (Base Case)	(\$7,174,509)	989
5	(\$12,261,650)	1,336
7.85	(\$17,631,420)	1,704

## Secondary Health Outcomes

Strategy	TB Deaths	TB Deaths Averted*	INH Hepatitis Deaths
No Screen	12	---	0
Screen	6	6	1

\*Incremental from No Screen

## Sensitivity Analysis

Vary prevalence of latent *M. tuberculosis* infection

Incremental Cost per Active TB Case  
Prevented (\$)

	Low (0.050)	Base Case (0.122)	High (0.200)
Screen	SAVINGS	SAVINGS	SAVINGS

## Sensitivity Analysis, continued

Vary prophylaxis efficacy

Incremental Cost per Active TB Case  
Prevented (\$)

	Low (60%)	Base Case (73%: HIV+) (93%: HIV-)	High (93%)
Screen	SAVINGS	SAVINGS	SAVINGS

## Sensitivity Analysis, continued

Vary treatment cost per active TB case

Incremental Cost per Active TB Case  
Prevented (\$)

	Low (\$5,000)	Base Case (\$14,435)	High (\$20,000)
Screen	\$2,176	SAVINGS	SAVINGS

## Sensitivity Analysis, continued

Vary TB case rate without preventive therapy

Incremental Cost per Active TB Case  
Prevented (\$)

	Very low HIV+: (0.01) HIV-: (0.00066)	Base Case HIV+: (0.045) HIV-: (0.0007)	High HIV+: (0.079) HIV-: (0.0012)
Screen	SAVINGS	SAVINGS	SAVINGS

## Cost-Effectiveness of Screening in Various Target Populations

Target Group	Number of Active TB Cases Prevented	Cost (Savings) Per Active TB Case Prevented	Source
HIV-infected persons	68.6	(\$7,843)	Nguyen et al.
Prison inmates	98.9	(\$7,254)	Taylor et al.
Class B1/B2 immigrants	100.0	\$12,929	Nguyen et al.
Physicians	20.6	\$39,000	Nettleman et al.
20-year-old African-American men	30.7	\$110,865	Schechter et al.

## Cost-Effectiveness Ratio for Selected Interventions

Intervention	Comparator	Cost Per Qaly Saved
Lap/shoulder belts (50%)	No restraints	Cost saving
Screening inmates for latent TB infection	No screen	Cost saving
Annual colorectal screening (50–75 yr. old)	No screen	\$18,000
Annual mammography (Women 55–65 yr. old)	Annual clinical breast exam	\$150,000

## Conclusions

- Even with current limitations, screening and preventive therapy for TB in prison inmates are cost effective and cost saving compared to no screening and no preventive therapy
- Results of this analysis were quite robust to changes in most variables
- Screening prison inmates is favored compared to screening in other high-risk groups and to other preventive interventions