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Global Tuberculosis Institute
NEW JERSEY MEDICAL SCHOOL

The U-Shaped Curve of Concern: Where Are We 26 Years Later?

Commemorating World TB Day

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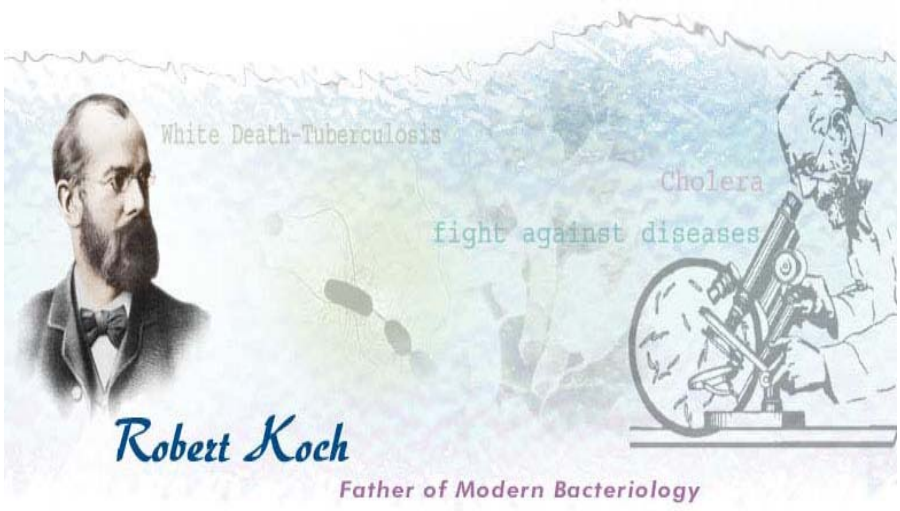

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The World Is Different Now – 1

- The world changed on the evening of March 24, 1882, when a thin, nearsighted, 38 year-old German physician, Robert Koch, read a paper to the Physiological Society in Berlin
- On that March evening in Berlin, Koch noted that "one seventh of all human beings die of tuberculosis and . . . if one considers only the productive middle-age groups, tuberculosis carries away one-third and often more of these."

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The World Is Different Now – 2

- Reading his brilliant paper through his thick glasses, Koch told his audience that tuberculosis was an infectious disease caused by a bacterium. He spelled out the scientific evidence to prove this in meticulous detail. It was astonishing news. At last, the cause of the disease that had terrified humanity possibly more than any other disease for millennia had been identified. When Koch finished his presentation, the audience sat in stunned silence.

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The World Is Different Now – 3

- Koch's news was just as shattering to his listeners as the news that the earth was round, not flat, had been to their ancestors.
- This was a profound change, a revolution in scientific thinking. The doctors and scientists in that Berlin hall had just heard that the major killer disease of their time was not inherited and was not mysterious. It was an infectious disease that was spread through the air by bacteria. That meant that one day it might be prevented and cured.

Timebomb: The Global Epidemic of Multi-Drug Resistant Tuberculosis
Reichman, LB; Hopkins Tanne, J, McGraw Hill, 2002

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BERLINER

KLINISCHE WOCHENSCHRIFT.

Organ für practische Aerzte.

Mit Berücksichtigung der preussischen Medicinalverwaltung und Medicinalgesetzgebung nach amtlichen Mittheilungen.

Verlag von August Hirschwald in Berlin.

Redacteur: Professor Dr. C. A. Ewald.

№ 15.

Neunzehnter Jahrgang.

Montag, den 10. April 1882.

Inhalt: I. Koch: Die Aetiologie der Tuberculose. — II. Müller: Ueber einen Fall von Wanderleber. — III. Küster: Ueber antiseptische Pulververbände (Schluss). — IV. Verhandlungen ärztlicher Gesellschaften (Berliner medicinische Gesellschaft). — V. Feuilleton (Maximaldosentabelle der Pharmacopoea Germanica, ed. II. — Tagesgeschichtliche Notizen). — VI. Amtliche Mittheilungen. — Literatur.

I. Die Aetiologie der Tuberculose.

(Nach einem in der physiologischen Gesellschaft zu Berlin am 24. März cr. gehaltenen Vortrage.)

Von

Dr. Robert Koch,

Regierungsrath im Kaiserl. Gesundheitsamt.

Die von Villemin gemachte Entdeckung, dass die Tuberculose auf Thiere übertragbar ist, hat bekanntlich vielfache Bestätigung, aber noch anscheinend wohlbegründeten Widerspruch gefunden, so dass es bis vor wenigen Jahren unentschieden bleiben musste, ob die Tuberculose eine Infectionskrankheit sei oder nicht. Seitdem haben aber die zuerst von Cohnheim und von Baumgarten ausgeführten Inhalations-

und die zum Zwecke der Isolirung und Züchtung des Tuberkel-Virus angestellten Versuche konnten bis jetzt nicht als gelungen angesehen werden, so dass Cohnheim in der soeben erschienenen neuesten Auflage seiner Vorlesungen über allgemeine Pathologie „den directen Nachweis des tuberculösen Virus als ein bis heute noch ungelöstes Problem" bezeichnen musste.

Bei meinen Untersuchungen über die Tuberculose habe ich mich anfangs auch der bekannten Methoden bedient, ohne dass mit eine Aufklärung über das Wesen der Krankheit zu erlangen. Aber durch einige gelegentliche Beobachtungen wurde ich dann veranlasst, diese Methoden zu verlassen und andere Wege einzuschlagen, die schliesslich auch zu positiven Resultaten führten.

Das Ziel der Untersuchung musste zunächst auf den Nachweis von irgend welchen, dem Körper fremdartigen, parasitischen Gebilden gerichtet sein, die möglicherweise als Krankheitsursache gelang werden konnten. Dieser Nachweis gelang

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World TB Day

- Proposed by Mali in 1991
- March 24, 2017 is the 135th anniversary of discovery of tubercle bacillus
- IUATLD (UNION), WHO, CDC, ATS; GTBI crusaders against TB world wide celebrate March 24 or World TB day to call attention to the embarrassing fact that TB will kill more people in 2017 than in 1882 when Koch discovered the bacillus

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A Bit of Personal History

In early 1991, I was asked by the editor of the then *American Review of Respiratory Disease*, Robert Klocke of Buffalo, NY, to write an editorial to accompany an article that I had very favorably referreed: Karen Brudney and Jay Dobkin: *Resurgent Tuberculosis in New York City.*

I humbly accepted Dr. Klocke's invitation and after several fits and starts, and thought back to a talk I gave on March 28, 1972 at the National Communicable Disease Control Conference held in Houston. The talk was entitled *TB Incidence: a prisim through which to view deficiencies in healthcare*. I used this talk to ultimately pen *The U Shaped Curve of Concern*, which was published in October 1991, a bit more than 25 years ago. I sincerely thank David Ashkin for calling this anniversary to my attention.

- This talk will review Brudney and Dobkin's findings, my original editorial, and some lessons still to be learned today

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Resurgent Tuberculosis in New York City -1

- Reported TB cases in New York City have been increasing since 1979 after decades of steady decline
- The epidemic of infection with HIV is often blamed for this resurgence
- Significant social, economic, and historical factors contributed to increasing tuberculosis rates several years before the full force of HIV infection was felt
- The growth of homelessness among urban drug abusers in the 1980s paralleled the spread of HIV infection, greatly complicating tuberculosis treatment and probably promoting further spread

Karen Brudney & Jay Dobkin
Resurgent Tuberculosis in New York City - Human Immunodeficiency Virus, Homelessness, and the decline of Tuberculosis Control Programs
Am Rev Respir Dis 1991; 144:745-749

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Resurgent Tuberculosis in New York City -2

- Analyzed a cohort of 224 consecutive patients recently admitted to a large, sophisticated university affiliated urban hospital center
  - 53% alcoholic, 64% intravenous drug and/or crack cocaine users, 68% homeless or unstable housing, and 50% HIV infected
- Ultimately, 178 patients were discharged on TB treatment
  - 159 (89%) were lost to follow-up, failing to complete therapy
  - Of these, 48 patients were readmitted within 12 months with confirmed active TB; 40 of these were discharged on treatment, and another 35 were lost

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Am Rev Respir Dis 1991; 144:745-749

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Resurgent Tuberculosis in New York City -3

- Central Harlem has been the area in New York City with the highest rate of TB since before 1960, having seen a more dramatic increase in TB than any other area and has been an area of unemployment, poverty, and high rates of drug and alcohol abuse and AIDS
- Prospectively studied all patients with TB admitted to Harlem Hospital; all inpatients at Harlem Hospital Center with suspected or confirmed TB were evaluated. Only patients with culture-confirmed *Mycobacterium tuberculosis* were included

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Resurgent Tuberculosis in New York City - 4

- Tuberculosis was diagnosed in 224 patients from January through September 1988
  - Predominantly male (79%)
  - High rates of alcoholism (53%)
  - Homelessness or unstable housing (68%)
  - Unemployment (82%)
  - 50 (26%) previously treated for TB
  - Nearly all stated that they had never completed treatment
  - Two-thirds reported HIV risk factors
  - 80% were positive for HIV

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Resurgent Tuberculosis in New York City - 5

- 178 patients were discharged, and 46 died during hospitalization
  - Of those discharged, 89% failed to complete treatment
  - 99 never returned for outpatient follow up
  - 49 failed to complete 3 months of treatment
  - 19 patients (11%) were cured, died of other causes while on treatment, or remained on therapy at the end of the study period
  - Within 12 months of discharge, 48 of 178 (27%) patients were readmitted with confirmed active tuberculosis at least once
  - Almost all of those discharged were again lost to follow-up, with 20% admitted a third time

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Am Rev Respir Dis 1991; 144:745-749

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Historical Perspective for Handling TB in NYC -1

- In 1968, a special task force appointed by then Mayor John Lindsay published a comprehensive report detailing the strengths, weaknesses, and future priorities of the New York City TB Program
- The task force recommended: earlier discharge, elimination of l00 TB beds annually, and an expanded effective outpatient program that would have $18 million/year to spend by 1973, given the projected closure of 500 beds by that time; clinic hours should be adjusted to the needs of the patient; include trained residents of poverty areas in clinic and home care staffs; provide domiciliary care and chronic disease care facilities and appropriate living quarters for TB patients who need them and integrate the care of TB drug addicts and TB alcoholics in the developing community programs for addiction and alcohol control

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Historical Perspective for Handling TB in NYC -2

- Ten years after the Lindsay Task Force report was issued, amidst New York City's fiscal crisis, the nearly 1,000 designated TB beds were virtually gone, and the private sector now diagnosed more than one-half of all new TB cases
- The combined city and state expenditures for the outpatient activities so strongly recommended 10 yr earlier were less than $2 million

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Historical Perspective for Handling TB in NYC -3

- In 1980, another task force was appointed by the Council of Lung Associations of New York. It reported “it must be strongly suspected that the increase in newly reported cases in New York City is in part the result of fiscal neglect of the TB problem in the State's largest city”
- “The resurgence of the disease, a bitter reversal of the expected trend, is related to a failure of both health authorities and government at all levels to muster a public health program. . . “
- “At federal, state and local levels, public health funds allocated to TB are inadequate, in some instances so grievously inadequate as nearly to amount to dereliction and default on legal mandates”
- New York City's fiscal crisis in the mid 1970s led to a drastic cut in appropriations for all public health programs

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Historical Perspective for Handling TB in NYC -4

- New York State progressively cut back its contract, terminating it entirely as of September, 1979
- Federal support by Public Health Service grants decreased 80%, from $1.4 million in 1974 to $283,000 in 1980
- The previously suggested dramatic decrease in beds and inpatient days had been accomplished, but outpatient expenditures were, cut
- None of the outpatient services recommended by the earlier task force were being offered
- The number of health department chest clinics had been cut from 22 to 9

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Historical Perspective for Handling TB in NYC -5

- Since the mandated staff increase had not occurred, neither public health nurse home visits nor health aide home visits were taking place The number of contacts identified per TB case had dropped
- Drug treatment programs to which patients reported daily for their methadone had received no impetus to screen or treat patients for TB

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Historical Perspective for Handling TB in NYC -6

- In 1980, the federal government funded a new pilot project beginning, the Supervised Treatment Program (STP), in response to the increasing number of TB patients failing to complete treatment
- A group of patients was identified who were clearly at high risk for treatment failure
- The program mandated daily visits to the homes of patients who met these criteria, with direct observation of the patient ingesting his or her medication; had a 90 to 95% success rate
- Unfortunately, the federal government failed to increase funding to enable expansion, and neither the state nor the city contributed significantly to enlarge its scope in the intervening years

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Brudney and Dobkin's Conclusions

- The resurgence of TB in the AIDS era is surrounded by ironies. Increasingly potent anti-tuberculosis agents are powerless to overcome massive noncompliance
- Tuberculosis, among all the serious complications of AIDS, stands out simultaneously as both the most curable and the most contagious to the HIV-negative population
- Regaining control of epidemic tuberculosis will be difficult and will require effective approaches to hardcore issues also common to the AIDS epidemic: poverty, homelessness, and substance abuse
- The AIDS epidemic has created severe financial stress on the health care system in many communities. It would be a tragic mistake to divert vital resources to AIDS activities from essential public health programs like tuberculosis control

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Am Rev Respir Dis 1991; 144:745-749

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The Original Editorial -1

- The rise of TB in New York City and by analogy other urban areas of the US is not due only to the HIV or homeless problems usually cited by the media
- It reflects the total failure of a public health system
- The Brudney-Dobkin experience precisely reflects what seems to be a ubiquitous occurrence in public health practice
- First, evaluation indicators of a public health program show improvement leading to diminishment of compelling need
- Then resources providing fuel and direction for the program are removed
- Finally, the incidence of the disease "controlled" begins to rise in proportion to the diminished resources
- This phenomenon has been called "the U-shaped curve of concern"

- Reichman LB, The U Shaped Curve of Concern *Am Rev Respir Dis.*, 1991; 144:741-742

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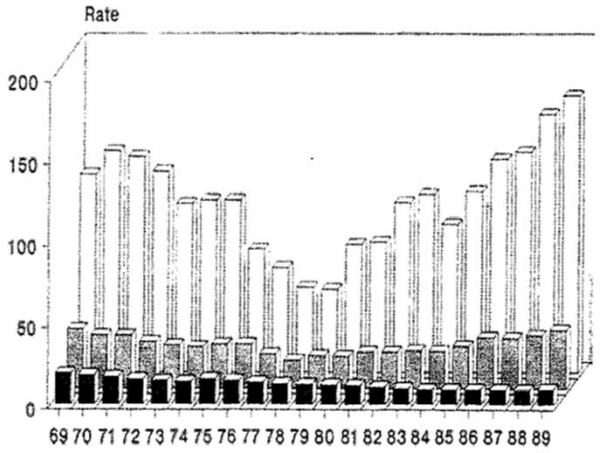

Fig. 1. Tuberculosis case rates for the United States, New York City, and central Harlem from 1969 to 1989 per 100,000 population. Closed bars = United States; hatched bars = New York City; shaded bars = Harlem.

- Brudney and Dobkin, *ARRD* 1991

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The U Shaped Curve of Concern

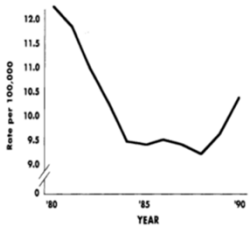

Fig. 1. USA National Tuberculosis Rate/100,000 population 1980 to 1990 (see text).

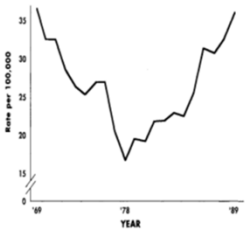

Fig. 2. New York City Tuberculosis Rate/100,000 population 1969 to 1989 (adapted from [4]) (see text).

- Reichman LB, The U Shaped Curve of Concern *Am Rev Respir Dis.*,1991; 144:741-742

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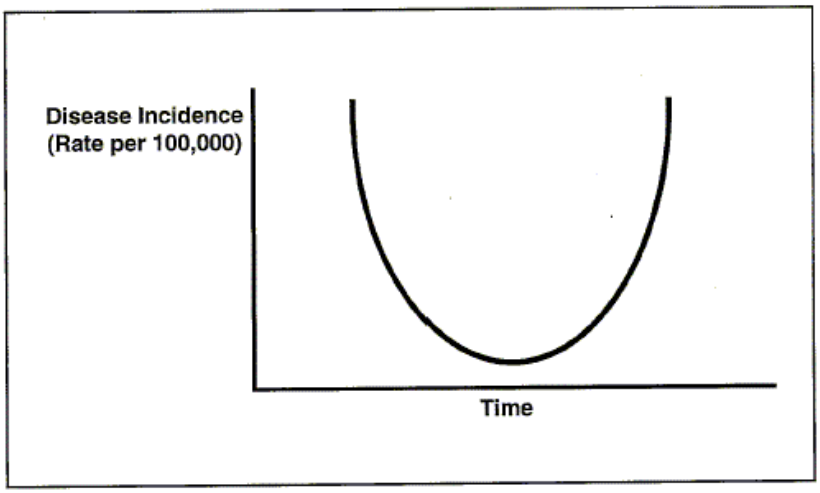
The U-Shaped Curve of Concern



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The Original Editorial -2

- Brudney and Dobkin document that the rise in TB rates in their center is largely caused by the failure of the system although the knowledge and technology to reverse this trend have been readily available
- This is the state of TB control in the United States in the 1990's
- The problem is amply defined and well documented, and the solution attainable with dedication, resources and commitment
- Many programs have long demonstrated they have the dedication. Unfortunately and urgently, we still await the resources and commitment

- Reichman LB, The U Shaped Curve of Concern *Am Rev Respir Dis.*,1991; 144:741-742

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TB – United States 2016

Case Count			
	2015	**2016**	**% Change**
United States	9546	9287	-2.7%
Florida	602	639	+6.1%

Incidence			
	2015	**2016**	**% Change**
United States	3.0	2.9	-3.4%
Florida	3.0	3.1	+4.3%

Tuberculosis – United States 2016
MMWR, March 24, 2017 66(11); 289-294

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- In 2016, a total of 9,287 new tuberculosis (TB) cases were reported in the United States; the lowest number of US TB cases on record and a 2.7% decrease from 2015

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- State-specific TB incidence in 2016 ranged from 0.2 cases per 100,000 persons in Wyoming to 8.3 in Hawaii
- Twelve states (Alaska, Arkansas, California, Florida, Georgia, Hawaii, Maryland, Minnesota, New Jersey, New York, North Dakota and Texas) and DC reported incidence higher than the national incidence
- Four states (California, Florida, New York and Texas) reported >500 cases each in 2016, accounting for 50.9% of reported cases
- US-born persons accounted for 2,935 (31.6%) cases
- 6,307 (67.9%) cases occurred among foreign-born persons
- TB incidence among US-born persons (1.1 cases per 100,000) decreased 8.4% from 2015
- Incidence among foreign-born persons decreased 3.2% from 2015, but was approximately 14 times the incidence among US-born persons

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- The top five countries of origin for foreign-born persons reported with TB disease in the United States were Mexico (1,194 cases, 18.8% of all foreign-born cases), the Philippines (795, 12.6%), India (593, 9.4%) Vietnam (496, 7.9%), and China (383, 6.1%)
- Cases in persons born in these countries accounted for 54.9% of all cases among foreign-born persons
- 5.8% had documented HIV co-infection
- 4.6% of patients reported having experienced homelessness in the year preceding diagnosis
- 1.8% were reported as residing in a long-term care facility
- 3.5% were reported as being confined in a correctional facility

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- In 2015, 88 cases of multi-drug resistant TB occurred
- Among the 88 multi-drug resistant TB cases, 72 (81.8%) occurred in persons with no reported prior history of TB disease
- One case of extensively drug-resistant TB was reported

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Lessons for Today -1

- Last year on World TB Day, CDC released ominous new data showing that TB was on the rise in the US for the first time in more than two decades
- This year cases and rates are down slightly but have risen in 18 states
- The rise in TB in these states, and perhaps the slowing of the decrease, shows that a usually ignored principle in public health has once again reared its ugly head – The “U” shaped curve of concern

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Lessons for Today - 2

- Again, as the incidence of the disease plummets, the program is eliminated rather than the disease – and a graph of the disease incidence resembles the letter “U”

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Lessons for Today - 3

- TB is an airborne, communicable disease caused by a bacterial infection
- While it's curable in the vast majority of cases, it can be fatal without proper treatment
- Globally, according to WHO, it has passed AIDS as the largest infectious disease killer
- The last time TB rates rose significantly in the US was in the late 1980's through early 1990's. Before then, TB rates had been falling nationally every year since states began reporting cases to the federal government in 1953. Even though warned by advocates, Congress declared victory, cut funding, and the labor intensive but cost effective programs that had sustained the drop, were abolished

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Lessons for Today - 4

- Just as the "U" shaped curve predicted, national TB rates surged between 1985-1992, leading to the largest rise in any industrialized country, ever: 20% in adults, and 35% in children
- This unprecedented resurgence was attributed to the perfect storm of HIV/AIDS infection, an increase in cases in the homeless and foreign born, and increased transmission among people in the US, all at a time of funding cuts to control TB
- The next year, hundreds of millions of federal dollars had to be appropriated to reverse these new case increases

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Lessons for Today - 5

- Since then, the national TB rate has been falling by around 5% per year until it reached a historically low level in 2016 but the fall has slowed after last year's increase to only 2.7%
- But predictably, even with that fall has come complacency, diminished attention, flat congressional funding for TB programs and the federal across the board sequestration of funds
- According to a survey by the National TB Controllers Association (NTCA), 60% of public health TB programs have been forced to eliminate staff and 25% have restricted key activities, reducing their capacity to respond to TB outbreaks

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Lessons for Today - 6

- The recent tragedy of the Flint, Michigan water supply is the most visible reminder of how tenuous public health can be
- Just as we are seeing with TB, politicians cut public health programs to save money, which inevitably leads to an emergency that is more costly to fix than prevent in the first place
- Now CDC has announced that tuberculosis is on the rise again in the US at least in 18 states; and the national decrease in cases totally was only 2.7%. When will our policymakers learn the simple truth that cutting public health essentials like water supply or TB control invariably requires fixing that is far, far more expensive than the savings from the original funding cut
- How many more people need to contract TB before we focus and sustain sufficient resources on eliminating the disease – not the public health programs fighting it?

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