Impact of Diabetes on Treatment Outcomes among Maryland Tuberculosis Cases, 2004-2005

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PHASE Symposium

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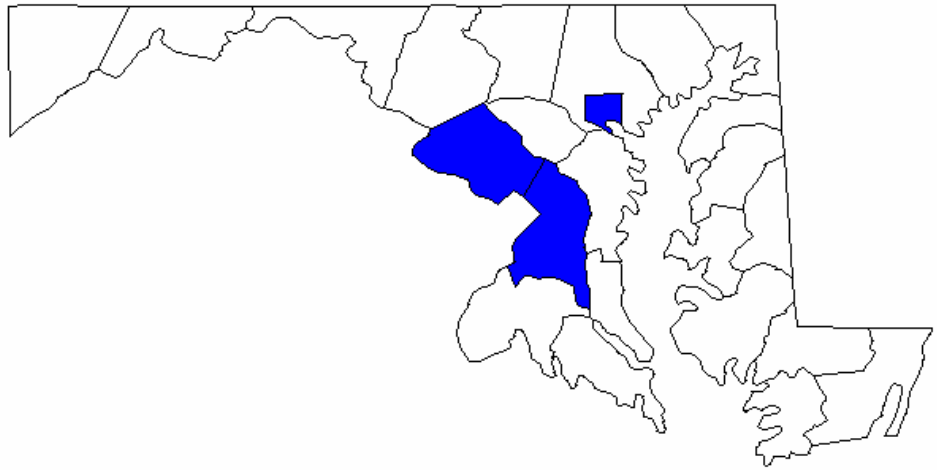
Presentation Outline

- Background
- Research Questions
- Methods
- Results
- Discussion
- Public Health Importance and Implications

Background: TB in brief

- Infectious disease spread by airborne droplets produced by active case
- Following infection, TB can exist in either a latent or active state
- Risk factors for developing active TB include but are not limited to:
  - Older age
  - Immunosuppression
  - Foreign place of birth
  - Diabetes mellitus

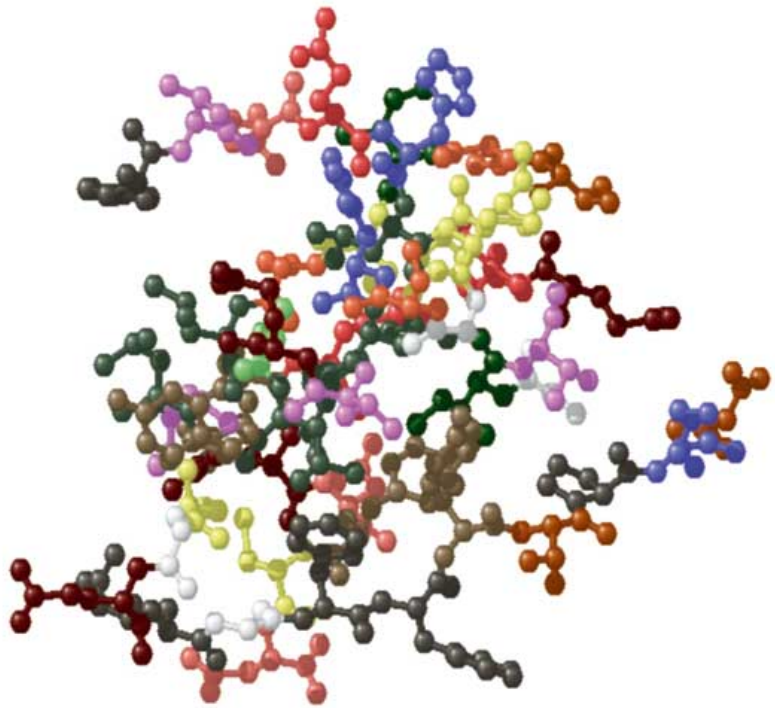
TB in Maryland



- Incidence (2005) per 100,000 population
  - U.S. overall: 4.5
  - MD state: 5.1
- High-incidence Jurisdictions
  - Montgomery County: 8.8
  - Baltimore City: 10.6
  - Prince George's County: 6.7

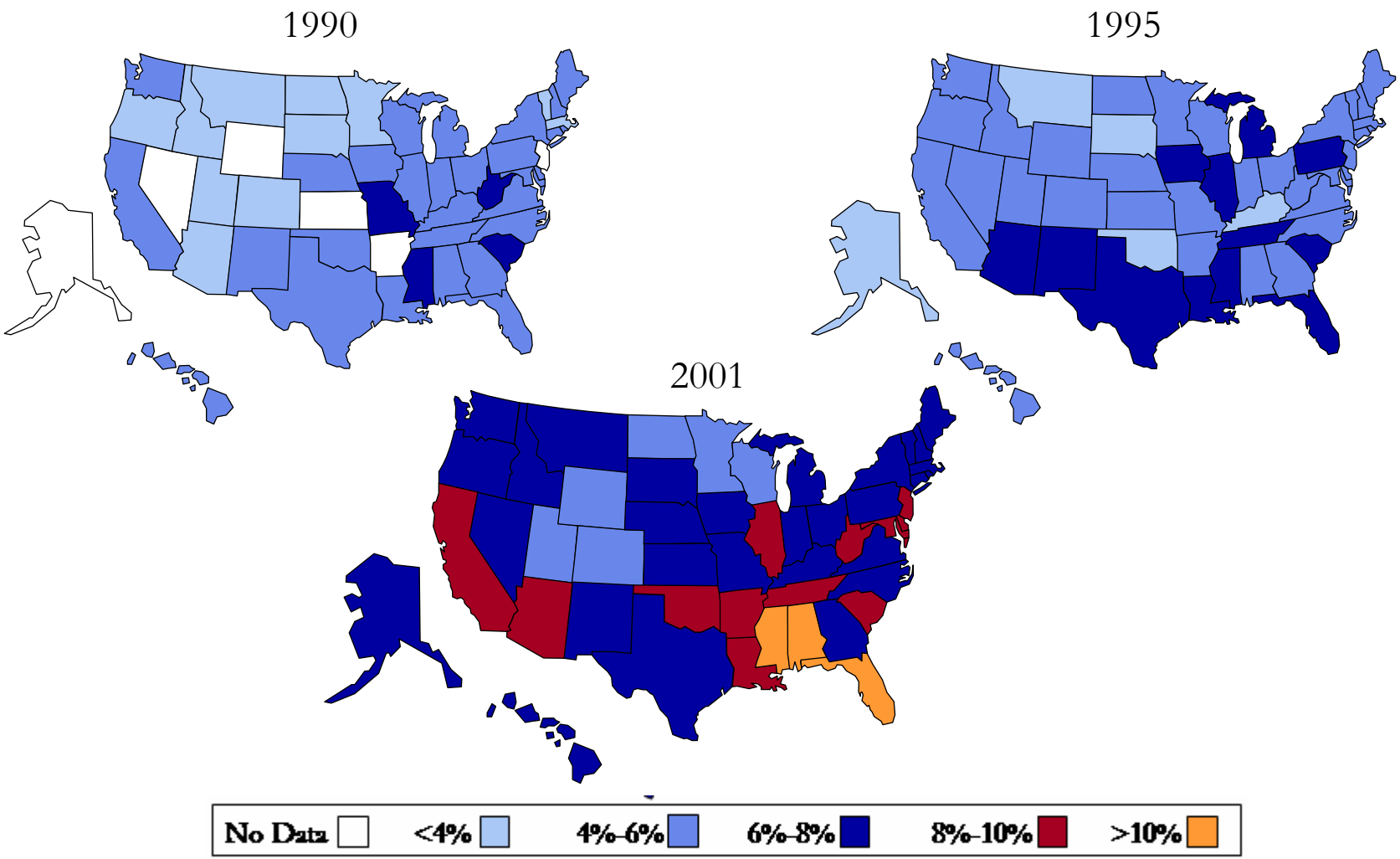
Background: Diabetes in brief

- Type I DM (5-10%)
  - Insulin-dependent
- Type II DM (90-95%)
  - Non-insulin-dependent
- Gestational diabetes
- Other specific types (1-5%)



Diabetes Trends, U.S. Adults

BRFSS, 1990,1995 and 2001



Source: Mokdad et al., *Diabetes Care* 2000;23:1278-83; *J Am Med Assoc* 2001;286:10. CDC

Research Questions

- What is the impact of DM on treatment outcomes among Maryland TB cases?
  - Treatment failure (culture conversion >4 mos)
  - Prolonged treatment (longer than 6 mos)
  - Development of drug resistance
  - Death during treatment
- Does race/ethnicity or place of birth modify the association between diabetes and treatment outcome?
- What are the epidemiologic and clinical characteristics associated with each of four TB treatment outcomes?

Methods: Study Population

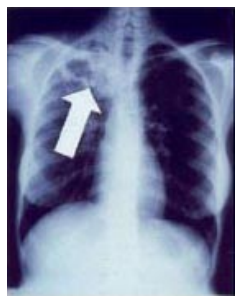
- Retrospective Cohort:
  - 419 incident TB cases
  - 3 jurisdictions (Baltimore City, Montgomery and Prince George's Counties)
  - 81% of TB cases in 2004-2005
  - Identified by routine surveillance (TIMS)
- Exclusions:
  - 6 were deceased at report of TB
  - Final study cohort = 413 cases

Methods: Data Collection

- Public health clinical chart abstraction
  - Diabetes, related clinical and epidemiologic exposures (e.g., blood glucose, HbA1C, renal failure)
- Routine Surveillance data (TIMS)
  - Baseline demographic variables
  - Laboratory results
  - Risk factors (e.g., HIV serostatus, previous diagnosis of TB, severity of disease)

Methods: Model-Building

- Covariates:
  - Age
  - Sex
  - Race
  - Hispanic ethnicity
  - Country of birth
  - HIV serostatus
  - Previous TB diagnosis
  - Severity of TB disease



Source: http://en.wikipedia.org/wiki/Tuberculosis

- Outcomes:
  - Treatment Failure
  - Prolonged Treatment
  - Drug Resistance
  - Death during treatment

- Stratified Analysis
- Multivariable Logistic Regression (likelihood-ratio testing, effect modification, collinearity, goodness-of-fit, sensitivity analyses)

Table 1. Baseline Characteristics of 406 Maryland Tuberculosis Patients by Diabetes Status*, 2004-2005

Characteristic	Diabetes		No Diabetes		p-value‡
	N	%	N	%	
Age at Report of TB (years)					
0-14	0	0	21	5.9	<0.0005
15-24	0	0	56	15.8	
25-44	9	4.9	170	47.9	
45-64	29	56.9	71	20.0	
65 and over	13	25.5	37	10.4	
Sex					
Male	33	64.7	186	52.4	0.168
Female	18	35.3	169	47.6	
Race					
White	13	25.5	76	21.4	0.748
Black	25	49.0	206	58.0	
Asian	13	25.5	73	20.6	
Ethnicity					
Hispanic or Latino	7	13.7	58	16.3	0.523
Not Hispanic or Latino	44	86.3	297	83.7	
Place of Birth					
Foreign-born	30	58.8	232	65.4	0.643
U.S.-born	21	41.2	122	34.4	
Unknown	0	0	1	0.28	

Table 1. Baseline Characteristics of 406 Maryland Tuberculosis Patients by Diabetes Status*, 2004-2005

Characteristic		Diabetes		No Diabetes		p-value‡
		N	%	N	%	
HIV status						
	Negative	39	76.5	234	65.9	0.235
	Positive	4	7.8	54	15.2	
	Unknown	8	15.7	67	18.9	
Previous Diagnosis of TB						
	Yes	6	11.8	18	5.1	0.003
	No	45	88.2	334	94.1	
	Unknown	0	0	3	0.8	
Site of TB Disease						
	Pulmonary	40	78.4	205	57.8	0.006
	Extrapulmonary	5	9.8	101	28.4	
	Both	6	11.8	49	13.8	
Sputum Smear at Baseline						
	Positive	23	45.1	111	31.3	0.024
	Negative	21	41.2	190	53.5	
	Not Done	7	13.7	54	15.2	
Cavitary X-ray						
	Positive	16	31.4	86	24.2	0.546
	Negative	26	50.9	187	52.7	
	Not TB	2	3.9	10	2.8	
	Unknown	7	13.7	72	20.3	

Results: Death during treatment

- Univariate analyses:
  - Associated with older age, US birth, HIV infection, and having a prior TB diagnosis
  - Not associated with Diabetes
- Multivariable analyses:

Characteristic	Adjusted OR	95% CI	p-value
Aged 65+	6.5	1.3-32.7	.022
Unknown HIV status	12.0	3.2-44.6	<.0005

Results: Prolonged Treatment

- Univariate analyses:
  - Associated with older age, Hispanic ethnicity, and unknown HIV status
  - Not associated with Diabetes
- Multivariable analyses:

Characteristic	Adjusted OR	95% CI	p-value
Unknown HIV status	0.40	0.20-0.80	0.010
More severe TB disease	1.76	1.02-3.05	0.042

Results: Drug Resistance

- Univariate analyses:
  - Associated with Hispanic ethnicity and Black race
  - Not associated with Diabetes
- Multivariable analyses:
  - None of the covariates were statistically significant

Characteristic	Adjusted OR	95% CI	p-value
Previous TB diagnosis	3.39	0.91-12.6	0.068

Conclusion

- Diabetes was not shown to be associated with any of the four adverse treatment outcomes studied
- Other predictors were identified
- Overall prevalence of diabetes in study population (12.4%) is higher than the overall MD prevalence of diabetes* (7.2%)

* Behavioral Risk Factor Surveillance System (BRFSS), 2005

Public Health Impact and Importance

- Builds upon limited existing data on diabetes and TB treatment outcomes
- Uses a large, diverse, community-based cohort representing a high-TB-incidence area
- TB remains a significant public health issue; combined with increasing diabetes, poses public health challenges
- May help guide TB control in high-DM-incidence setting

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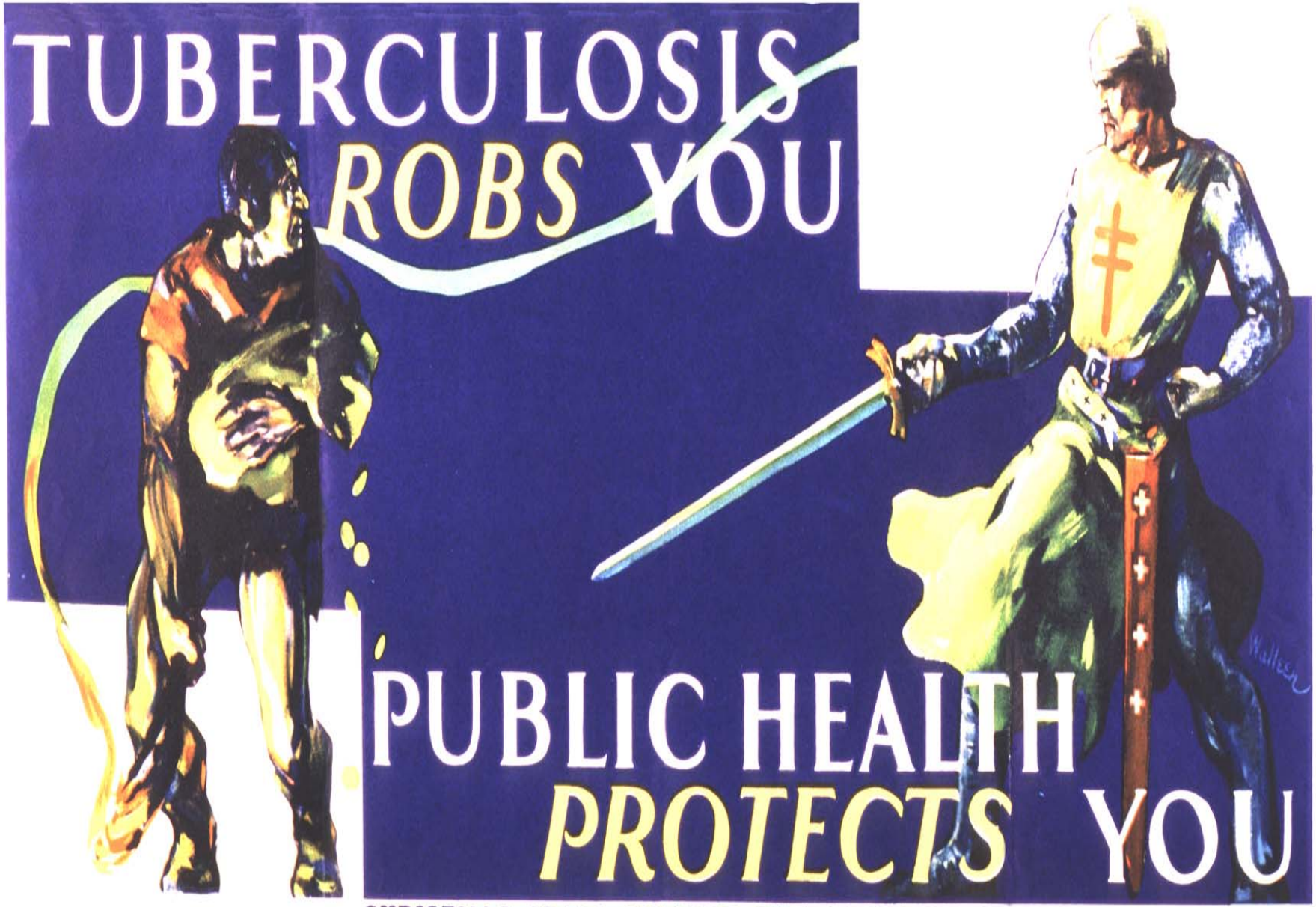
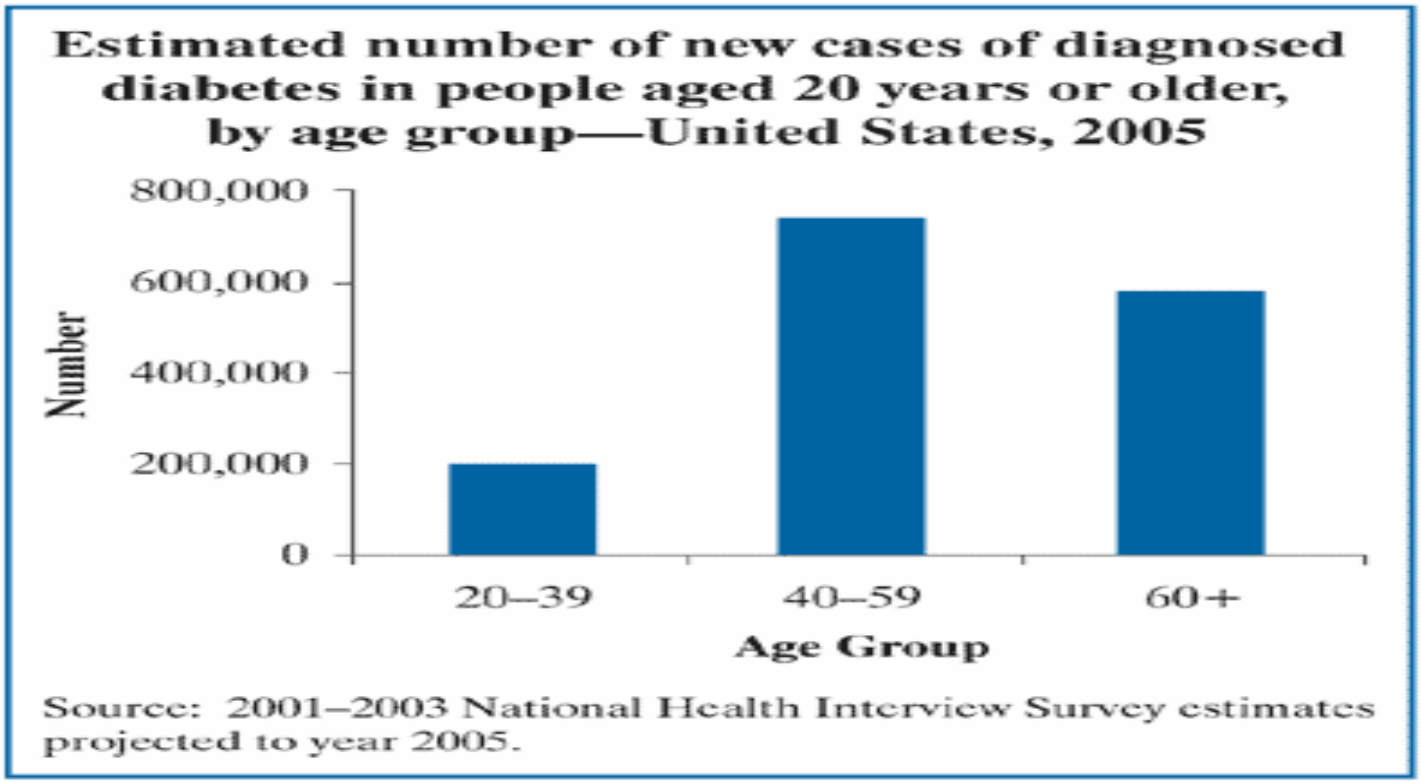


CHRISTMAS SEALS FINANCE THE CAMPAIGN AGAINST TUBERCULOSIS

Diabetes by age group



Diabetes occurs in higher proportions in older adults than in younger adults.