

KNOWLEDGE AND PERCEIVED RISK OF TUBERCULOSIS: US RACIAL AND REGIONAL DIFFERENCES

The purpose of this study is to report the findings of the 2004 National Health Interview Survey (NHIS) questions on tuberculosis (TB) knowledge and perceived risk of contracting TB. Tuberculosis (TB) continues to be a major health threat in the United States, but minimal effort is made on public education to increase knowledge about TB. Using data from the 2004 NHIS, this study examined knowledge and perceived risk of TB of 26,136 US respondents. Results showed that nationally, how much a respondent knew about tuberculosis, knowing someone with tuberculosis, being 18–34 years old, and being Black were most strongly associated with perceived high to medium risk of getting TB. Black respondents were nearly twice as likely to perceive a high to moderate risk compared to other races in the Northeast and South. Knowing someone with tuberculosis or having a lot or some knowledge of the disease was strongly associated with perceived risk in all regions of the nation. Conclusions were to increase efforts targeted toward broad health promotion education activities on TB risk. (*Ethn Dis.* 2006;16:468–475)

Key Words: National Health Interview Survey, Tuberculosis, US Regions

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INTRODUCTION

In the past decade, tuberculosis (TB) has resurfaced as a public health problem in the United States. Tuberculosis (TB) was once thought to have been eradicated in the United States, but the disease has resurfaced, especially among immigrants, persons with HIV infection, prisoners, children, and US-born Blacks.¹ During 2002, 15,075 cases (5.2 cases per 100,000 population) of TB were reported to the Centers for Disease Control and Prevention (CDC) from the 50 states and the District of Columbia (DC).¹ This rate was higher than the 2000 interim goal of 3.5 per 100,000 people set as part of the national strategic plan for TB elimination (<1 case per 1,000,000 by 2010).¹ Furthermore, US-born Blacks had the highest rate of any US-born racial/ethnic population and represented 46% of TB cases in US-born persons and nearly one fourth of all cases.^{1,2} Tuberculosis (TB) morbidity varies by geographic location. In 2001, 23 states had a case rate at or below the Healthy People 2000 target rate of 3.5 cases per 100,000 people. On the other hand, seven states (California, Florida, Georgia, Illinois, New Jersey, New York, and Texas) that were above the national average accounted for 60% of the national total of TB cases.¹

During 1991–2002, seven southeastern states reported 32,414 TB cases, including 18,038 (56%) among non-Hispanic Blacks and 11,506 (35%) among non-Hispanic Whites. In 2002, the TB rate for non-Hispanic Blacks in the region was 11.3 per 100,000 in the population, 4.7 times greater than the rate of 2.4 for non-Hispanic Whites.

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Tuberculosis (TB) rates among non-Hispanic Blacks in the southeastern states continued to exceed those among non-Hispanic Whites but were similar to rates among non-Hispanic Blacks in the rest of the country. In addition, non-Hispanic Blacks with TB in the southeastern states were more likely than non-Hispanic Whites to report certain risk factors, which suggests that regional differences in socioeconomic status and ethnicity might create barriers to diagnosis and treatment.³ The continued disparity in TB cases underscores the need for effective, targeted strategies that consider the racial and regional differences of populations at risk for TB.

In 2002, for the first time, TB cases among foreign-born persons accounted for most (51.0%) TB cases in the United States. The number of states with >50% of TB cases among foreign-born persons increased from four states in 1992 to 22 states in 2002.¹ This finding is consistent with the reported TB infection rate worldwide and a growing foreign-born population in the United States.^{4,5} Given the current status of TB in the United States, to reduce the number of cases emphasis

must be placed on increasing access to information about TB and the factors associated with exposure and infection for the public.

The literature documents a scarcity of studies examining the role of knowledge, socioeconomic factors, and race on preventing TB in the United States. Most of the studies examined a small segment of the population exposed to TB⁶⁻¹¹ within the context of these variables. The National Health Interview Survey (NHIS) is the only nationwide survey documenting knowledge about TB and its risk factors. A previous study used questions about knowledge and perceptions of risk of TB from the 1994 NHIS,¹² which documented that major gaps existed in the US population with respect to knowledge of TB as well as the presence of TB within US communities.¹²

The present study examined knowledge and perceived risk of TB of 26,136 US residents who took part in the 2004 NHIS.¹³ The study is unique because of the large national representative sample and its emphasis on understanding regional and racial/ethnic differences in knowledge and perceived risk of TB. To meet the goal of reducing TB in the United States, we must create health education and outreach activities in communities at risk for or disproportionately affected by TB.¹⁴

METHODS

Data Source

The National Health Institute Survey (NHIS) is a principal source of information on the health of the US noninstitutionalized, civilian household population collected through a personal household interview by the US Census Bureau.¹⁵ This study used data collected in the sample adult questionnaire,² which contains an AIDS knowledge and attitudes section that includes six questions about perceived risk and knowledge of tuberculosis. For the

sample adult questionnaire, adults ≥ 18 years of age were randomly selected to respond to a computer-assisted personal interview questionnaire. The questionnaire was administered to 31,326 adults. The response rate was 72.5%.¹⁵ With appropriate sampling weights, NHIS data can be generalized to the civilian adult population of the United States. Detailed methods of the 2004 NHIS has been described elsewhere.¹⁶

Study Sample

The study group answered yes to the question, "Have you ever heard of tuberculosis?" Those who had never heard of tuberculosis were not asked additional questions about tuberculosis and were excluded from analysis. Adults who had ever heard of tuberculosis were then stratified by US census regions, Northeast, Midwest, South, West, and by race/ethnicity, Hispanic, non-Hispanic White (hereafter referred to as White), or non-Hispanic Black (hereafter referred to as Black). Excluding those who reported other race ($n=812$), our analysis included 26,136 respondents: 4086 Hispanics, 18,347 Whites, and 3703 Blacks.

Study Variables and Measures

Sociodemographic and geographic variables (age, sex, education, annual household income, employment status, and census region) were taken from the sample adult questionnaire. Missing data for household income accounted for 7% ($n=1966$) of the study population.

A measure of perceived risk of tuberculosis was obtained from the question, "What are your chances of getting tuberculosis?" Respondents indicated their chances of getting tuberculosis as high, medium, low, or none. Several variables measured knowledge of tuberculosis. Respondents were asked if they knew anyone personally with tuberculosis (yes/no) and if they believed the disease could be cured (yes/

no). Respondents were also asked how much they knew about tuberculosis with the following responses: a lot, some, a little, or nothing.

To determine misconceptions about tuberculosis among those who indicated that they knew a lot, some, or a little about tuberculosis, respondents were also asked how tuberculosis was spread. Responses included that tuberculosis could be spread by breathing air around a person sick with tuberculosis, sharing eating/drinking utensils, through semen or vaginal secretions during sexual intercourse, from smoking, and from mosquito or other insect bites.

Statistical Analysis

Sociodemographic variables were stratified by census region and by race/ethnicity. Chi-square analysis was used to test for significant differences between races within each region. Likewise, variables related to perceived risk of tuberculosis and knowledge of tuberculosis were stratified by census region and race with chi-square tests used to determine significant differences between races.

For each census region, multiple logistic regression analysis was used to calculate the adjusted odds ratio (AOR, with 95% confidence intervals) of the association between perceived risk of tuberculosis and knowledge of tuberculosis after adjusting for sociodemographic characteristics to include race and variables that differed by race. For all models, perceived risk of tuberculosis was treated as a dichotomized variable (high to medium risk vs low to no risk), and the independent variable that measures how much knowledge the respondent had of tuberculosis was also dichotomized (a lot to some knowledge versus a little to no knowledge). All analyses were conducted by using SAS-callable SUDAAN version 8.02 to account for the complex sampling design.^{17,18}

Table 1. Sociodemographic characteristics of respondents in the 2004 National Health Interview Survey by race and census* region

	Northeast			<i>P</i> value	Midwest			<i>P</i> value
	Hispanics	Whites	Blacks		Hispanics	Whites	Blacks	
	<i>n</i> =535	<i>n</i> =3470	<i>n</i> =543		<i>n</i> =299	<i>n</i> =5330	<i>n</i> =744	
	Weighted %				Weighted %			
Sex								
Male	45.5	46.5	42.2	.3075	50.1	46.9	39.6	.0127
Female	54.5	53.5	57.8		49.9	53.1	60.4	
Age (years)								
18–34	47.8	23.5	30.4	<.0001	48.8	27.7	39.4	<.0001
35–54	38.1	40.8	41.9		38.1	40.9	37.5	
>54	14.1	35.7	27.7		13.1	31.4	23.1	
Education								
Less than high school	61.4	42.2	44.8	<.0001	60.0	41.3	47.1	<.0001
Some college/technical	19.3	15.9	20.5		19.8	20.3	26.5	
College	19.3	41.9	34.7		20.2	38.4	26.4	
Employment								
Currently working	68.1	60.4	58.7	.0175	65.6	63.2	60.1	.2586
Not currently working	31.9	39.6	41.3		34.4	36.8	39.9	
Income								
≥\$20,000	74.6	86.8	76.8	<.0001	80.1	84.8	68.2	<.0001
<\$20,000	25.4	13.2	23.2		19.9	15.2	31.8	
	South			<i>P</i> value	West			<i>P</i> value
	Hispanics	Whites	Blacks		Hispanics	Whites	Blacks	
	<i>n</i> =1428	<i>n</i> =6114	<i>n</i> =2086		<i>n</i> =1824	<i>n</i> =3433	<i>n</i> =330	
	Weighted %				Weighted %			
Sex								
Male	49.6	47.5	44.9	.1282	49.1	46.7	49.6	.2621
Female	50.4	52.5	55.1		50.9	53.3	50.4	
Age (years)								
18–34	41.5	26.9	34.5	<.0001	44.8	27.8	36.5	<.0001
35–54	39.8	38.5	42.8		37.8	39.8	38.8	
>54	18.7	34.6	22.7		17.4	32.4	24.7	
Education								
Less than high school	64.3	42.6	53.4	<.0001	68.0	30.7	35.8	<.0001
Some college/technical	15.6	20.9	22.0		15.6	25.4	30.6	
College education	20.1	36.5	24.6		16.4	43.9	33.6	
Employment								
Currently working	65.3	59.6	60.9	.0004	61.7	60.0	60.0	.5345
Not currently working	34.7	40.4	39.1		38.3	40.0	40.0	
Income								
≥\$20,000	73.5	83.1	69.8	<.0001	74.0	86.0	73.9	<.0001
<\$20,000	26.5	16.9	30.2		26.0	14.0	26.1	

P value based on chi square test.

* US Census regions: Northeast=Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania; Midwest=Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota; South=Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Louisiana, Oklahoma, Texas, Arkansas; West=Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawaii, Oregon, Washington.

RESULTS

Population Characteristics

Sociodemographic characteristics of respondents by region are shown in Table 1. A higher proportion of Hispanics and a higher proportion of

Blacks were younger, less educated, and earned <\$20,000 annually compared to Whites within each region. Significantly higher proportions of Blacks and Whites were not currently working when compared to Hispanics in all regions.

Perceived Risk and Knowledge of Tuberculosis

Though most respondents (*n*=26,136) answered yes to the question, "Have you ever heard of tuberculosis," a higher proportion of Whites (91% to 93%) and Blacks (81% to 93%) had

Table 2. Weighted proportions of survey responses to questions about perceived risk and knowledge of tuberculosis (TB) by race and Census region from the 2004 National Health Interview Survey

Northeast				P value	Midwest			P value
Hispanics	Whites	Blacks	Hispanics		Whites	Blacks		
n=535	n=3470	n=543	n=299		n=5330	n=744		
Weighted %			Weighted %					
PERCEIVED RISK								
What are your chances of getting TB?								
High to medium	8.9	4.9	9.9	<.0001	8.3	4.9	8.2	.0006
Low to none	91.1	95.1	90.1		91.7	95.1	91.8	
KNOWLEDGE								
Have you ever known anyone who had TB?								
Yes	22.6	20.7	22.9	.5403	13.5	20.7	22.5	.0118
No	77.4	79.3	77.1		86.5	79.3	77.5	
Can TB be cured?								
Yes	63.3	54.7	61.6	.0098	51.1	51.0	55.4	.3713
No	36.7	45.3	38.4		48.9	49.0	44.6	
How much do you know about TB?								
A lot to some	39.6	32.8	45.4	<.0001	32.2	29.9	35.2	.0570
A little to nothing	60.4	67.2	54.6		67.8	70.1	64.8	
South				P value	West			P value
Hispanics	Whites	Blacks	Hispanics		Whites	Blacks		
n=1428	n=6114	n=2086	n=1824		n=3433	n=330		
Weighted %			Weighted %					
PERCEIVED RISK								
What are your chances of getting TB?								
High to medium	8.0	5.5	9.4	<.0001	8.0	5.9	8.6	.0507
Low to none	92.0	94.5	90.6		92.0	94.1	91.4	
KNOWLEDGE								
Have you ever known anyone who had TB?								
Yes	17.9	25.1	18.8	<.0001	19.0	22.0	19.8	.0513
No	82.1	74.9	81.2		81.0	78.0	80.2	
Can TB be cured?								
Yes	59.1	52.2	51.2	.0180	63.4	53.1	62.6	<.0001
No	40.9	47.8	48.8		36.6	46.9	37.4	
How much do you know about TB?								
A lot to some	28.6	33.0	31.1	.0144	26.1	32.8	34.8	<.0001
A little to nothing	71.4	67.0	68.9		73.9	67.2	65.2	

P value based on chi-square test.

heard of the disease as compared to Hispanics (72% to 75%) within each region (chi-square *P* values <.001). Weighted proportions of survey responses to questions about perceived risk of tuberculosis and knowledge of tuberculosis among Hispanics, Whites, and Blacks are presented by region in Table 2. Nationwide, 93.9% of respondents indicated that they perceived low

risk or no risk of getting tuberculosis, 67.7% reported little or no knowledge about the disease, and 45.7% indicated that no cure for tuberculosis existed. In most regions of the nation, significantly more Blacks perceived a high to moderate risk of tuberculosis, reported that they knew someone with the disease, and indicated they had a lot or some knowledge of the disease compared to

other races. In the South, a higher proportion of Whites reported knowing someone with the disease and reported knowing a lot or some about tuberculosis compared to other races. In each region, however, most respondents who indicated a cure existed for tuberculosis were Hispanics, whereas most respondents who indicated no cure existed for tuberculosis were Whites and Blacks.

Table 3. Multivariate associations with perceived risk of tuberculosis (TB) by census region and nation obtained from the 2004 National Health Interview Survey

	High to Moderate Perceived Risk of TB vs Low to No Perceived Risk of TB				
	Northeast (n=4548)	Midwest (n=6373)	South (n=9628)	West (n=5587)	Nation (n=26,136)
	AOR† (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Have you ever known someone with TB?					
Yes	1.75 (1.26–2.42)*	2.10 (1.52–2.90)*	1.88 (1.43–2.47)*	1.89 (1.37–2.62)*	1.87 (1.60–2.20)*
No	1.00	1.00	1.00	1.00	1.00
Can TB be cured?					
Yes	.57 (.43–.76)*	.63 (.46–.87)*	.88 (.69–1.11)	.75 (.55–1.04)	.73 (.63–.84)*
No	1.00	1.00	1.00	1.00	1.00
How much do you know about TB?					
A lot to some	2.32 (1.56–3.46)*	3.73 (2.60–5.37)*	1.74 (1.39–2.19)*	2.06 (1.50–2.84)*	2.25 (1.93–2.61)*
A little to nothing	1.00	1.00	1.00	1.00	1.00
Race					
Hispanic	1.79 (1.04–3.08)*	1.56 (.84–2.90)	1.42 (1.02–1.97)	1.32 (.90–1.93)	1.49 (1.21–1.84)*
Black	1.91 (1.27–2.85)*	1.43 (.95–2.14)	1.82 (1.43–2.32)*	1.31 (.67–2.55)	1.71 (1.44–2.05)*
White	1.00	1.00	1.00	1.00	1.00
Sex					
Male	.73 (.52–1.02)	.88 (.67–1.16)	.91 (.72–1.15)	.98 (.69–1.39)	.88 (.76–1.02)
Female	1.00	1.00	1.00	1.00	1.00
Age					
18–34	1.58 (.91–2.74)	3.42 (2.07–5.65)*	2.36 (1.59–3.48)*	1.72 (1.19–2.48)*	2.22 (1.77–2.80)*
35–54	1.41 (.88–2.26)	2.39 (1.39–4.13)*	1.80 (1.26–2.58)*	1.56 (1.00–2.43)	1.76 (1.40–2.21)*
>54	1.00	1.00	1.00	1.00	1.00
Education					
Less than high school	1.11 (.70–1.74)	1.13 (.76–1.68)	1.32 (1.03–1.69)	1.29 (.89–1.87)	1.21 (1.01–1.44)
Some college or technical school	1.01 (.60–1.70)	.86 (.58–1.30)	1.24 (.93–1.65)	1.07 (.75–1.53)	1.05 (.87–1.27)
College education	1.00	1.00	1.00	1.00	1.00
Employment					
Currently working	1.85 (1.27–2.70)*	1.11 (.79–1.55)	1.39 (1.03–1.88)	1.86 (1.32–2.63)*	1.46 (1.23–1.74)*
Not currently working	1.00	1.00	1.00	1.00	1.00
Income					
≥\$20,000	1.18 (.71–1.96)	1.09 (.74–1.60)	1.11 (.84–1.48)	.85 (.59–1.23)	1.07 (.88–1.29)
<\$20,000	1.00	1.00	1.00	1.00	1.00

* *P* value <.01.

† Adjusted odds ratios (AOR) were derived from a simultaneous logistic regression equation including TB-related survey responses and covariates.

Table 3 shows the AORs to reveal multivariate associations between knowledge of tuberculosis and perceived risk of tuberculosis. Regional and national logistic models included race and other sociodemographic variables that differed by race. How much the respondent knew about tuberculosis and race of the respondent were strongly associated with perceived risk of tuberculosis in every region. Respondents with a lot or some knowledge of the disease were 1.7 to 3.7 times more likely to perceive a high to medium risk as compared to respondents with a little or

no knowledge. Black respondents were 1.8 to 1.9 times more likely to perceive a high to moderate risk compared to other races in the Northeast and South. In all regions, knowing someone with tuberculosis was strongly associated with perceived risk. Knowing about a cure for tuberculosis was related to perceived risk in the Northeast and Midwest. In all regions except the Northeast, respondents 18–34 years old were 1.7 to 3.4 times more likely to perceive a high to moderate risk compared to older age groups. Nationally, how much a respondent knew about tuberculosis, knowing

someone with tuberculosis, being 18–34 years old, and being Black were most strongly associated with perceived high to medium risk of getting the disease.

Figure 1 represents weighted proportions of survey responses to the question, “How is tuberculosis spread?” Most (76% to 87%) respondents in each region indicated that tuberculosis could be spread by air, yet 30% to 46% of all races in each regional population indicated that the disease could be spread by sharing eating or drinking utensils.

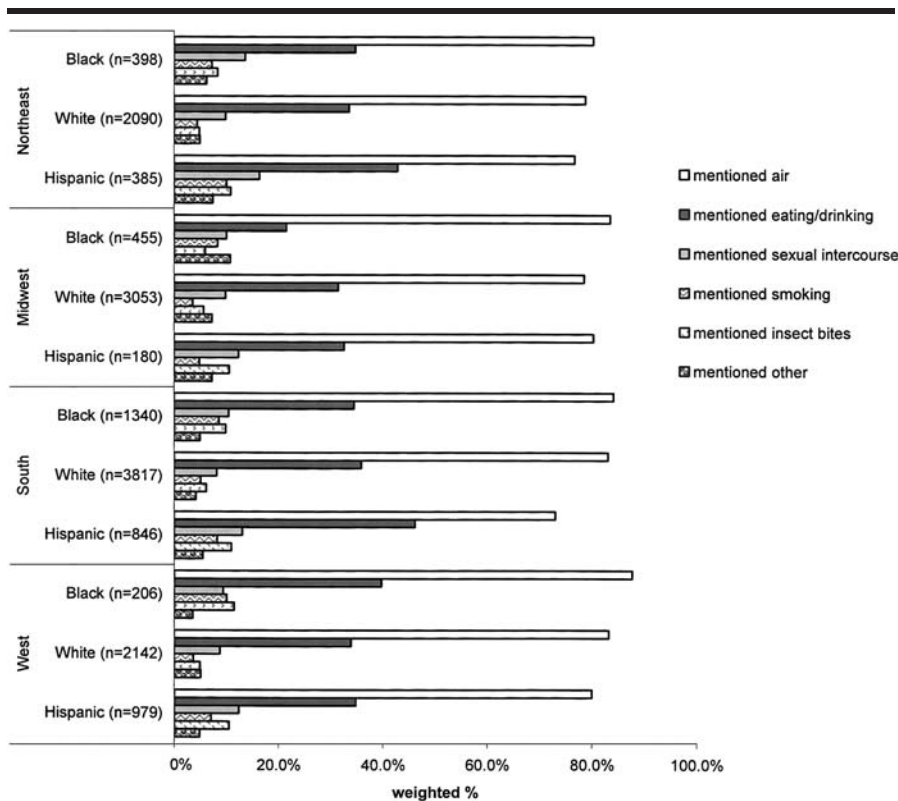


Fig 1. Weighted proportions of survey responses to the question, "How is tuberculosis spread?"* by race and census region from the 2004 National Health Interview Survey. *Respondents who indicated either a lot, some, or a little knowledge about tuberculosis were asked the question, "How is tuberculosis spread?" Note: sum of population does not equal the total study population because of nonresponders

DISCUSSION

Although other studies^{18,19} have explored patients' attitudes and knowledge about TB, we identified only one other study¹² in which health perceptions of TB were examined for the US general population. Most significantly, the study documents that 66.8% of the US general population has little or no knowledge of tuberculosis. This finding represents a 5.1% decrease in knowledge of tuberculosis from the 1994 NHIS figure of 61.7%.¹² The perception of risk increased slightly (94.4% compared to 90.1%), although Blacks were more likely to perceive a risk of TB compared to other groups, which may be explained by the fact that they were also more likely to know somebody with TB. These differences were identified in

both regional and national populations. When regional differences did occur, the South often differed from the rest of the nation. These differences may be a function of regional differences associated with the demographic distributions among states with high numbers of Blacks and the presence of socioeconomic disparities.

This finding is supported by the disproportionate rates of TB among Blacks in the southeastern United States.² Continued declines in TB cases in the United States mask large disparities between the majority of US residents and those most severely affected by TB: Blacks and foreign-born individuals. In 2002, TB case rates among African Americans remained nearly eight times higher than rates among Whites and two times higher

than rates among Latinos. Furthermore, the gap in TB rates between US-born and foreign-born individuals has doubled over the last decade, with half of new cases occurring among foreign-born individuals. These figures document a health disparity between those at greatest risk for TB and the general US population. Since Blacks and foreign-born individuals accounted for three fourths of 2002 TB cases, narrowing the gap in TB rates is a critical factor in eliminating TB.¹

The South is home to 19 million Blacks, 55% of the nation's Black population. While foreign-born individuals make up slightly more than 11%, they tended to reside in one of six states: California (31%), New York (13%), Florida (10%), Texas (8%), New Jersey (4%), and Illinois (4%). Approximately one third of all foreign-born residents live in California. These regional demographic differences and the findings of this study support the need for targeted interventions that address diverse populations.

If sensing risk and prevention are related to knowledge levels, then raising knowledge levels will help eliminate disease. Although knowing about a cure for TB resulted in a lower perception of risk, the knowledge of a cure for TB may be related to increased attentiveness to symptoms, increased perception of severity, and seeking health care. Effective health education programs are grounded in theories that are suitable for reaching the expected outcomes; and diseases that are influenced by lifestyle are largely the result of behavior and can often be altered by positive changes in behavior. Behavior is not merely changed by increasing knowledge; it is one of several components required of an effective behavior change and disease prevention model. Success of the intervention depends on careful consideration of levels of knowledge, behaviors that influence risk, attitudes, perceptions and socio-cultural factors among others.

The findings support a renewed health education emphasis to inform the general US population that TB remains a public health hazard.

Broad interventions that aim to increase knowledge about TB to acceptable levels nationally will result in reducing a growing health disparity among racial and ethnic groups and the foreign-born. Tuberculosis is a disease that is preventable and treatable. To make progress and ultimately eliminate TB, policymakers and healthcare practitioners must consider which factors contribute to this health disparity. In so doing, interventions must meet the need for information of individuals, institutions, communities, and practitioners. Each will play important roles in preventing TB by creating social environments that are free of prejudice and encourage discussing tuberculosis and suitable responses that result in full treatment of TB cases.

Public health practitioners and other professionals have an opportunity to eliminate TB. It will require a focus on what we do not know regarding how to prevent TB, what socio-economic determinants are amenable to intervention, and how to make changes on what we do know. The fact that the US general public has limited knowledge about TB and the potential public health threat that this poses must be the focus of public health practitioners.

The present study is not without limitations. The study was limited to the noninstitutionalized population and thus did not capture data on people in nursing homes, state hospitals, board and care homes, and other institutional settings. Including these institutionalized populations and foreign-born,

newly immigrated individuals in the NHIS sample population would have expanded the contribution of the study to an understanding of groups who are at high risk for tuberculosis.¹ The scope and nature of the available data from the NHIS provided only five questions on TB knowledge and perceived risk, which may have limited the contributions from this study.¹² Despite these limitations, this study provides insight into the knowledge level and perceived risk for tuberculosis in the general US population.

This study has clinical and public health related implications. Although tuberculosis has been declining in the United States, it is increasing among certain high-risk groups, and regional variations reflect demographic trends.¹ The emphasis on eliminating TB has concentrated on treatment at the expense of prevention efforts. The findings support a renewed health education emphasis to inform the general US population that TB remains a public health hazard. Although it is reassuring that the total numbers of new, active TB cases continue to decline, the lack of knowledge and perceived risk of TB requires renewed education efforts. State TB control programs must increase their efforts to eliminate TB as part of their work on health disparities. If funding for TB programs is based solely on the total number of new cases, programs will be under funded and TB will remain a growing problem. Funding must be available to expand health promotion and education activities. Healthcare practitioners must be willing to take the lead in the battle to eliminate TB. Further research examining knowledge of TB and perception of risk would be valuable in designing effective public health education programs for the general and targeted populations.

ACKNOWLEDGMENTS

The authors thank Kathy Mayfield-Smith, MA, MBA of the Institute for Families in Society at the University of South Carolina

and the external reviewers for their insightful comments on the draft of this manuscript.

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