



Sustained reduction in tuberculosis incidence following a community-based participatory intervention

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<http://dx.doi.org/10.5588/pha.11.0023>

Background: Rates of latent tuberculosis infection (LTBI) and tuberculosis (TB) disease are elevated in the rural southeastern United States and among US- and foreign-born Black residents. To prevent TB and reduce TB transmission, community-based strategies are essential.

Objective: To describe a community-based participatory intervention for improving the detection and treatment of LTBI and TB and reducing TB incidence.

Design: In rural Florida, we carried out a community educational TB campaign from 1997 to 2000, including presentations at community events, a media campaign and working with local community groups to develop culturally appropriate prevention messages. The campaign was implemented concurrently with a population-based LTBI survey.

Results: The annual TB incidence rate in the intervention area decreased from 81 per 100 000 in 1994–1997, to 42/100 000 in 1998–2001, and to 25/100 000 in 2002–2005 ($P = 0.001$). This decrease was not observed in communities where the intervention was not implemented. There was no decrease in the TB incidence rate ratio between Blacks and non-Blacks in either region during the study period.

Conclusions: We conclude that community participation in LTBI screening and TB education was associated with a substantial reduction in TB rates. Although the TB incidence rate ratio did not decrease between Blacks and non-Blacks, TB incidence fell in all racial groups.

Rates of latent tuberculosis infection (LTBI) and tuberculosis (TB) disease are known to be high in the southeastern United States.¹ These elevated rates have persisted over many decades, and have been associated with racial disparities.² Both TB and LTBI are more common among Blacks, who represent an increased proportion of the population in the Southeast compared to other regions of the country.³ Western Palm Beach County, Florida, a predominantly agricultural area, has previously been documented to have a substantial burden of TB disease.⁴

The communication of health information and social mobilization have been historically recognized as key components for TB control.⁵ More recently, community involvement in the formation and promotion of health messages has been identified as a way to promote culturally appropriate health communications and reduce stigma.^{6–13} Such interventions have been most successful when they involved community resi-

dents in the design and implementation of the intervention, a strategy known as 'community-based participatory research' (CBPR).¹⁴

To improve participation in TB and LTBI screening and ultimately reduce TB incidence rates in the community, we designed and implemented a community-based participatory intervention campaign to promote knowledge about and participation in TB prevention activities. One focus of the campaign was a community survey of LTBI prevalence (results reported elsewhere¹⁵).

The objectives of the present study were to assess the effect of our campaign on the incidence of TB disease and to assess if the intervention reduced the disparity in TB incidence between Blacks and non-Blacks. To do this, we examined surveillance data from before and after the campaign and compared western Palm Beach County, a predominantly agricultural area, with the more urban eastern section of the county, where the campaign did not take place.

METHODS

Study area and population

Western Palm Beach County (WPB) Florida, defined as the area including postal zip codes 33430, 33438, 33476 and 33493, is a predominantly agricultural area in the southern part of Florida. It has a population of nearly 35 000, of whom 15% are White, 50% are African American, 25% are Hispanic and 10% are Haitian.¹⁶

Community intervention

The Glades Health Survey, a survey to examine the prevalence of TB and human immunodeficiency virus (HIV) in WPB, was initially proposed in October 1994. A subsequent pilot study indicated a likely 50% participation rate, which would not be high enough to yield valid results. Community interviews identified a lack of trust that health officials would maintain patient confidentiality as a substantial roadblock to participation. At a subsequent meeting of a local umbrella organization of representatives from political, public and private health-related enterprises, a TB study group was formed. This study group decided that the survey should be performed by a local non-governmental organization, and they formed the Glades Health Survey Board (GHSB) to undertake the task.

The creation of the GHSB, an ethnically, racially and geographically representative group including social service workers and three pastors, spurred active community engagement in the survey and community

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ACKNOWLEDGEMENTS

The authors thank D Garsik of the Palm Beach County Health Department for providing grouped numerator data for the analyses presented in this paper. MRO was supported by the National Institute of Health, F32 AI52074 (National Institute of Allergy and Infectious Diseases), and an American Thoracic Society Fellows Career Development Award. These funding sources played no role in the study design or data analysis.

KEY WORDS

racial disparities; HIV/AIDS; tuberculosis; southeastern United States; rural health

Received 10 November 2011
Accepted 12 February 2012

PHA 2012; 2(1): 23–26
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mobilization.⁴ In 2000, the GHSB became Glades Health Initiatives Inc (GHI), to clarify that its purpose extended beyond the survey and that it included a broad spectrum of health promotion activities in WPB.

The survey was approved by the human subjects committees of the Florida Department of Health, Emory University, Boston University, Dartmouth Medical School and the Centers for Disease Control and Prevention (CDC).

Education interventions

GHI staff members included individuals fluent in English, Spanish and Haitian Creole, and all materials for the educational effort were prepared in the above three languages. Materials were prepared in conjunction with community leaders, who approved all content. Health messages included information about the signs and symptoms of TB and HIV, the availability of free treatment for TB and HIV, the rationale for the survey, and the importance of participation in overall community health.

TB cases

Cases reported from 1 January 1994 to 31 December 2009 to the Palm Beach County Health Department were included in the analysis. TB cases reported to the Health Department were stratified by zip code, date and race for the analyses included in this report.

Statistical analysis

To estimate the effectiveness of the community campaign in reducing TB rates, we compared rates of TB disease in WPB before and after the community intervention, among Blacks and non-Blacks, with TB rates in the areas of Palm Beach County that were not one of the five zip codes in WPB, referred to as eastern Palm Beach County (EPB). Tests for trend were performed using the χ^2 test using Epi Info (Version 3.5.1, CDC, Atlanta, GA, USA).

RESULTS

The campaign was initiated with a press conference at the city hall in Belle Glade, Florida, indicating support by local politicians. Booths promoting awareness of TB and HIV status were staffed at over two dozen community events during the 3-year intervention period. GHI staff, and in some cases a consulting physician, appeared on radio talk shows and on television on three occasions promoting participation in the survey and awareness about TB and HIV. GHI staff visited churches, schools, and Lions, Rotary and Womens' Clubs in the area; they also reached out directly to high-risk sub-populations, such as sex workers and active drug users. Health messages included information about the signs and symptoms of TB and HIV, the availability of free treatment for TB and HIV, the rationale for the survey, and the importance of participation to overall community health. During the intervention period, researchers and community advocates addressed a number of important issues, including fear of personal stigmatization, concerns about confidentiality and the potential for negative publicity for the community.

While the survey was in progress, a resident with smear-positive TB was identified in a rooming house known to be inhabited by drug users. Prompt intervention by GHI, working together with the local health department, resulted in identification and treatment of 17 drug users who were tuberculin skin test positive contacts of the source case. In our study, we increased survey participation, which included TB screening, from <50% in the pilot period to 80% in the intervention period, with 2.4% of the total catchment area population participating in the survey. GHI and the C. L.

TABLE 1 TB case rates in Palm Beach County, 1994–2009

Year	Western Palm Beach County*		Eastern Palm Beach County†	
	TB cases <i>n</i> (%)	Average annual TB case rate /100 000‡	TB cases <i>n</i> (%)	Average annual TB case rate /100 000§
1994–1997	122 (23.5)	81	397 (76.5)	9.1
1998–2001	58 (16.9)	42	286 (83.1)	6.5
2002–2005	35 (9.3)	25	340 (90.7)	7.8
2006–2009	26 (9.4)	19	250 (90.6)	7.2

*Zip codes 33430, 33438, 33476 and 33493.

†All other zip codes in Palm Beach County.

‡ χ^2 test for trend, $P < 0.0001$.

§ χ^2 test for trend, $P = 0.69$.

TB = tuberculosis.

Brumback Health Center in Belle Glade received the Davis Productivity Award from the Florida Department of Health for this collaborative intervention.

As shown in Table 1, in the 4 years before the survey the average annual TB case rate in WPB was 81/100 000 per year; at the time of the survey, the average rate was 42/100 000/year; while after completion of the survey it was 25/100 000/year (χ^2 test for trend $P < 0.001$). The decline in the TB case rate in WPB was significantly greater than in other parts of the county where the community education intervention was not performed ($P = 0.001$, χ^2 test for trend).

Although there was a substantial reduction in TB rates in the survey area after the community intervention, this did not result in a reduction in disparities in TB incidence in Blacks. As seen in Table 2, TB in Blacks in WPB fell from 136/100 000 before to 40/100 000 after the community intervention ($P < 0.001$, χ^2 test for trend). TB rates in non-Blacks also decreased, from 25/100 000 before the community intervention to 6.6/100 000 after the intervention ($P = 0.01$, χ^2 test for trend). However, the incidence rate ratio (IRR) comparing Blacks with non-Blacks before and after the intervention was respectively 5.47 and 5.96 (Table 3), indicating that there was no reduction in disparities in TB incidence between Blacks and non-Blacks in WPB.

DISCUSSION

The community intervention described in this report was followed by a sustained period of decreased incidence of TB disease

TABLE 2 TB case rates in Palm Beach County, 1994–2005, by racial group

Year	Western Palm Beach County*				Eastern Palm Beach County†			
	Non-Blacks		Non-Blacks‡		Non-Blacks		Non-Blacks§	
	TB cases <i>n</i>	Average annual TB case rate/100 000	TB cases <i>n</i>	Average annual TB case rate/100 000	TB cases <i>n</i>	Average annual TB case rate/100 000	TB cases <i>n</i>	Average annual TB case rate/100 000
1994–1997	107	15	136	25	213	184	34	4.7
1998–2001	50	8	64	13	143	143	23	1.0
2002–2005	31	4	40	6.6	153	187	25	1.2

*Zip codes 33430, 33438, 33476 and 33493.

†All other zip codes in Palm Beach County.

‡ χ^2 test for trend, $P < 0.0001$.

§ χ^2 test for trend, $P < 0.01$.

¶ χ^2 test for trend, $P = 0.22$.

‡ χ^2 test for trend, $P = 0.87$.

TB = tuberculosis.

TABLE 3 Ratio of TB incidence among Blacks to that among non-Blacks in Palm Beach County

Year	TB incidence among Blacks/non-Blacks	
	Western Palm Beach County* (95%CI)	Eastern Palm Beach County† (95%CI)
1994–1997	5.47 (3.17–10.11)	8.15 (6.66–9.98)
1998–2001	4.79 (2.25–11.70)	7.04 (5.54–8.94)
2002–2005	5.94 (2.10–23.17)	5.75 (4.62–7.17)

*Zip codes 33430, 33438, 33476 and 33493.

†All other zip codes in Palm Beach County.

TB = tuberculosis; CI = confidence interval.

in the intervention area. While we cannot conclude with certainty that this decline was causally related to the educational intervention, there are several reasons why such a conclusion is likely. First, elevated rates of TB and sexually transmitted disease had persisted in this area for many years despite standard control efforts.¹⁷ Second, similar declines were not seen in areas of the county where the intervention did not take place. Third, aside from the intervention, the local health department TB control program was not specifically augmented during the study period. Fourth, in addition to raising community awareness about TB and performing the survey, GHI staff actually assisted the local health department in administering LTBI treatment to recently infected high-risk contacts of persons with infectious TB, an intervention known to reduce TB incidence in the short term.¹⁸ This opportunity to partner with the health department arose because GHI had developed community trust, such that it was seen as an honest broker between health officials and a marginalized community population.

Promotion of TB screening among primary care practices was recently demonstrated to be effective in a study in London, United Kingdom,¹⁹ in which an outreach program increased participation in TB screening from 0.4% to 57%. In our study, we increased survey participation, which included TB screening, from <50% in the pilot period to 85% in the intervention period.²⁰ After completion of the survey, GHI continued to build trust in the community by initiating HIV prevention programs for both HIV-infected and at-risk non-HIV-infected community residents.

Limitations of this study include the difficulty in selecting an appropriate control community and the effect of unmeasured confounding factors. In terms of the control (non-intervention) population, there may have been differences due to TB risk factors, including demographic factors, socio-economic factors and other differences between the populations. While the other parts of Palm Beach County are urban rather than rural, they include a number of communities with low socio-economic status and substantial rates of TB and HIV. In addition, the fact that the survey was carried out in the intervention area may have increased case-finding bias by raising awareness of signs and symptoms of TB. Moreover, persons living in the non-intervention area may have been exposed to the health education or other CBPR interventions, biasing the result toward a null hypothesis. Second, a possible confounding factor could be the decreased prevalence of HIV infection in the community or better control of HIV disease with antiretroviral therapy (ART). Annual prevalence data on HIV infection are not available for the intervention or control areas; however, between 1986 and 2000, HIV prevalence in WPB changed more slowly than the decrease in TB rates reported here.¹⁶ Third, it is possible that lower TB incidence is, in part, due to better

control of HIV with ART; however, despite the availability of ART after 1998, not all eligible persons with HIV infection in the community were receiving it. Fourth, it is possible that TB incidence decreased among persons who did not receive the intervention (e.g., ecological fallacy).

Although TB and HIV rates at the beginning of the intervention period were higher than in many other communities, we believe that our results may be generalizable to rural communities in the southeastern United States with racial and ethnic disparities in TB. Such communities should develop specific culturally appropriate tools for US-born Blacks and persons with HIV infection, as such persons are at increased risk of TB.²¹ Targeting of interventions by using culturally tailored tools and strategies is meant to increase access to groups that are traditionally difficult to reach, but should not be used to single out (and thus potentially stigmatize) particular population subgroups. Our intervention targeted all segments of the community, and as such achieved reductions in TB across the board. This was as expected, as our community-based education intervention was spearheaded by an ethnically diverse community-based organization and targeted the entire population. We conclude that a highly effective way to achieve sustained reductions in TB in a community is through a community-based participatory intervention program that targets the entire community.

References

- 1 Institute of Medicine. Ending neglect: the elimination of tuberculosis in the United States. 1st ed. Washington DC, USA: National Academy Press, 2000.
- 2 Centers for Disease Control and Prevention. Racial disparities in tuberculosis—selected southeastern states, 1991–2002. *MMWR Morb Mortal Wkly Rep* 2004; 53: 556–559.
- 3 US Census Bureau. Annual estimates of the population by race alone and Hispanic or Latino origin for the United States and States: July 1, 2004 (SC-EST2003-04). Washington DC, USA: US Census Bureau, 2004. http://www.census.gov/popest/data/historical/2000s/vintage_2004/state.html. Accessed February 2012.
- 4 Stratford D, Chamblee S, Ellerbrock T V, et al. Integration of a participatory research strategy into a rural health survey. *J Gen Intern Med* 2003; 18: 586–588.
- 5 Davies R, Hedberg G A, Fischer M. A complete community survey for tuberculosis: a second report on effectiveness of the procedure as a method of tuberculosis control. *Am Rev Tuberc* 1948; 58: 77–84.
- 6 Norris S L, Chowdhury F M, Le K V, Horsley T, et al. Effectiveness of community health workers in the care of persons with diabetes. *Diabet Med* 2006; 23: 544–556.
- 7 Nemcek M A, Sabatier R. State of evaluation: community health workers. *Public Health Nurs* 2003; 20: 260–270.
- 8 Wolff M, Young S, Maurana C A. Community advocates in public housing. *Am J Public Health* 2001; 91: 1972–1973.
- 9 Andrews J O, Felton G, Wewers M E, Waller J, Tingen M. The effect of a multi-component smoking cessation intervention in African American women residing in public housing. *Res Nurs Health* 2007; 30: 45–60.
- 10 Corkery E, Palmer C, Foley M E, Schechter C B, Frisher L, Roman S H. Effect of a bicultural community health worker on completion of diabetes education in a Hispanic population. *Diabet Care* 2007; 20: 254–257.
- 11 Levy J L, Brugge D, Peters J L, Clougherty J E, Saddler S S. A community-based participatory research study of multifaceted in-home environmental interventions for pediatric asthmatics in public housing. *Soc Sci Med* 2006; 63: 2191–2203.
- 12 Mock J, McPhee S J, Nguyen T, et al. Effective lay health worker outreach and media-based education for promoting cervical cancer screening among Vietnamese American women. *Am J Public Health* 2007; 97: 1693–1700.
- 13 Wolff M, Young S, Beck B, et al. Leadership in a public housing community. *J Health Commun* 2004; 9: 119–126.
- 14 Faridi Z, Grunbuam J A, Gray B S, Franks A, Simoes E. Community-based participatory research: necessary next steps. *Prev Chronic Dis* 2007; 4: 1–5.
- 15 O'Donnell M R, Chamblee S, von Reyn C F, et al. Racial disparities in primary and reactivation tuberculosis in a rural community in the southeastern United States. *Int J Tuberc Lung Dis* 2010; 14: 733–740.
- 16 Ellerbrock T V, Chamblee S, Bush T J, et al. Human immunodeficiency virus infection in a rural community in the United States. *Am J Epidemiol* 2004; 160: 582–588.

- 17 Grey M R. Syphilis and AIDS in Belle Glade, Florida, 1942 and 1992. *Ann Intern Med* 1992; 116: 329–334.
- 18 Onorato I M. Tuberculosis outbreaks in the United States. *Int J Tuberc Lung Dis* 2000; 4 (Suppl 2): S121–S126.
- 19 Griffiths C, Sturdy P, Brewin P, et al. Educational outreach to promote screening for tuberculosis in primary care: a cluster randomised controlled trial. *Lancet* 2007; 369: 1528–1534.
- 20 Stratford D, Chamblee S, Ellerbrock T V, et al. Integration of a participatory research strategy into a rural health survey. *J Gen Intern Med* 2003; 18: 586–588.
- 21 Goldberg S V, Wallace J, Jackson J C, Chaulk C P, Nolan C M. Cultural case management of latent tuberculosis infection. *Int J Tuberc Lung Dis* 2004; 8: 76–82.

Objectifs : Les taux d'infection tuberculeuse latente (LTBI) et de maladie tuberculeuse (TB) sont élevés dans le Sud-Est rural des Etats-Unis ainsi que chez les résidents Noirs nés aux Etats-Unis ou à l'étranger. Pour prévenir la TB et réduire la transmission de la maladie, des stratégies basées sur la collectivité sont essentielles. Nous décrivons une intervention de participation basée sur la collectivité en vue d'améliorer la détection et le traitement de la LTBI et de la TB et de réduire l'incidence de la TB.

Schéma : En Floride rurale, nous avons mené entre 1997 et 2000 une campagne d'éducation de la collectivité au sujet de la TB, comportant des présentations lors d'événements de la collectivité, une campagne dans les médias et le travail avec des groupes locaux de la collectivité pour élaborer des messages de prévention appropriés au niveau culturel. La campagne a été menée parallèlement à une enquête sur la LTBI basée sur la population.

Objetivos: Las tasas de infección tuberculosa latente (LTBI) y de enfermedad tuberculosa son altas en las regiones rurales del sureste de los Estados Unidos y en los residentes de etnia negra nacidos en el país o en el extranjero. Es primordial introducir estrategias comunitarias con el fin de prevenir la tuberculosis (TB) y disminuir su transmisión. En el presente artículo se describe una intervención comunitaria participativa encaminada a mejorar la detección y el tratamiento de la LTBI y la TB y a disminuir la incidencia de la TB.

Método: Entre 1997 y el año 2000 se llevó a cabo en zonas rurales del estado de Florida una actividad educativa comunitaria que consistió en presentaciones en los eventos de la comunidad, una campaña en los medios de comunicación y el trabajo con grupos comunitarios locales con el propósito de elaborar mensajes de prevención culturalmente adaptados. La campaña tuvo lugar en forma concomitante con una encuesta poblacional sobre la LTBI.

Résultats : Le taux d'incidence annuel de la TB dans la zone d'intervention a diminué de 81/100 000 en 1994–1997 à 42/100 000 en 1998–2001 et à 25/100 000 en 2002–2005 ($P = 0,001$). Cette décroissance n'a pas été observée dans les collectivités où l'intervention n'a pas été réalisée. Il n'y a pas eu de diminution du ratio de taux d'incidence de la TB entre les Noirs et les non-Noirs dans aucune région au cours de la période de l'étude.

Conclusions : La participation de la collectivité au dépistage de la LTBI et à la formation en matière de TB est en association avec une réduction substantielle des taux de TB. Bien que le ratio de taux d'incidence de la TB n'ait pas été réduit entre les Noirs et les non-Noirs, on a noté une décroissance de l'incidence de la TB dans tous les groupes raciaux.

Resultados: La tasa de incidencia anual de TB en la zona de la intervención disminuyó de 81 por 100 000 habitantes entre 1994 y 1997 a 42/100 000 entre 1998 y el 2001 y a 25/100 000 del 2002 al 2005 ($P = 0,001$). No se observó ninguna disminución de la incidencia en comunidades por fuera de la zona de intervención. No se operó ninguna disminución del cociente de la tasa de incidencia entre personas de etnia negra y de otras etnias en ninguna región durante el período del estudio.

Conclusiones: Se concluye que la participación comunitaria en la detección de la LTBI y la educación en materia de TB se asocian con una disminución considerable de la incidencia de TB. Aunque no hubo una disminución en el cociente de la tasa de incidencia entre personas de etnia negra y de otras etnias, sí se observó una disminución de la incidencia de TB en todos los grupos étnicos.