Increasing Latino Adolescents' Adherence to Treatment for Latent Tuberculosis Infection: A Controlled Trial

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Education, screening, and treatment for tuberculosis (TB) declined from 1985 to 1991,[1] contributing to an epidemic of 26 283 new US cases of *Mycobacterium tuberculosis* in 1992.[2] Reduced TB control resources, inadequate medication adherence, and AIDS contributed to the resurgence[3,4] and emergence of multidrug-resistant TB.[5–7] The increased incidence of the multidrug-resistant form of the disease in the United States[8] has led to a need to ensure adherence to treatment regimens.

Although TB rates in the United States have decreased as a result of renewed aggressive treatment of active cases, goals for reduced incidence have not been realized in ethnic minorities and foreign-born individuals.[9,10] The 2010 national goal calls for an overall case rate of less than 1 per 100 000.[11] In 1998, the overall case rate in the United States was 6.8 per 100 000, with Asians/Pacific Islanders having the highest rate (34.9 per 100 000), followed by African Americans/Blacks (17.4 per 100 000), Latinos/Hispanics (13.6 per 100 000), and Whites (3.8 per 100 000).[12]

Progression from latent TB infection (LTBI) to the active form of the disease accounts for most cases, and about 10% of infected individuals develop active TB.[13,14] This suggests that LTBI treatment is important for populations at high risk of developing active TB.[15] Since about 50% of active and LTBI cases occur among immigrants to the United States and other developed nations,[16] and the San Diego–Tijuana border (the area of focus in the present study) is the busiest in the world[17] with about 9 million crossings per month,[18] TB control efforts along the US–Mexico border should include screening and treatment of LTBI and adherence support.

LTBI treatment requires balancing possible risks of developing disease versus medication side effects.[19] Because completed LTBI treatment conveys nearly (90%) lifetime prevention of active TB,[20] and because adolescents face

Objectives. We sought to determine the efficacy of coaching Latino adolescents with latent tuberculosis infection to adhere to isoniazid treatment.

Methods. Participants (n=286) were randomly assigned to adherence coaching, attention control, or usual care groups. Adherence was measured via interviews and validated with urine assays.

Results. Coaching resulted in significant increases in adherence compared with attention and usual care groups. Bicultural adolescents were more likely to be adherent than those most or least acculturated. Age and risk behavior were negatively related to adherence.

Conclusions. Coaching can increase Latino adolescents' adherence to treatment for latent tuberculosis infection and should contribute to tuberculosis control for adolescents at high risk of contracting the disease. (*Am J Public Health.* 2003;93:1871–1877)

the lowest risk of isoniazid (INH) side effects,[21] adolescence is the optimal period for treatment in terms of safety and number of "protected" years of life. Another important reason for directing treatment toward this group is that the distribution of active TB cases has shifted toward individuals of younger ages.[22]

Across all categories of disease, both adults and children demonstrate poor adherence with medication regimens. Depending on the regimen, nonadherence rates have been shown to range from 20% to 80%,[23] and adolescents have exhibited more difficulties than those in other age groups in terms of adhering to various regimens.[24]

Low adherence is a significant barrier to TB control.[25,26] *Healthy People 2010* calls for 90% of LTBI patients to complete treatment.[27] However, across a variety of measures (e.g., self-report, chart review, pill count, electronic monitor) rates of reported adherence to self-administered LTBI treatment for usual care participants range from 5% to 50% in adults[20,28–38] and 50% to 72% for adolescents.[39–42] Observed treatment completion rates as low as 5% among adults and 50% among adolescents suggest that the nation's objectives will not be met without specific interventions.

A number of interventions aimed at increasing adherence to LTBI treatment have

been reported. They have generally focused on adult high-risk populations including drug users,[28,29,43,44] foreign-born immigrants,[37,45] homeless people,[46] recently released inmates,[34,35] HIV-positive individuals,[47,48] and contacts of active cases.[48,49] Discerning the effectiveness of these interventions is complicated by significant variation in adherence measures and definitions of adherence. Nonetheless, postintervention studies primarily using patient education have reported adherence rates between 23% and 68%[34,38]; those using peer counseling, rates between 60% and 78%[28,37,43]; those using incentives such as cash, clothing, or transportation or food vouchers, rates between 71% and 89%[28,29,34,46,50]; and those using directly observed preventive therapy, rates between 54% and 94%.[29,38,46,48,51]

Limited data are available on adherence interventions targeting adolescents with LTBI. Kohn et al.[42] demonstrated a significant increase in INH adherence in a twice-weekly directly-observed preventive therapy group (88%) compared to a self-administered daily INH treatment group (50%). Morisky et al.[40] assessed the effects of peer counseling, contingency contracts, and a combination of peer counseling and contingency contracting. Participants in the combined intervention group showed the highest (80%) treatment comple-

tion rate, followed by the peer counseling group (74%) and those in usual care (72%).

Following Sumartojo's recommendations to use a theoretical model and multiple and reliable measures,[26] we designed an experimental intervention based on learning theory and our Behavioral Ecological Model.[52–54] These approaches assume that adherence is influenced by interactions between an individual and his or her social and physical environment.[55–57] The present study was designed to determine whether counseling/coaching, compared to attention control or usual medical care, could increase adherence to INH treatment regimens among Latino adolescents with LTBI.

METHODS

Design

Two hundred eighty-six Latino adolescents with LTBI were randomly assigned to one of the following conditions: usual medical care, usual care in combination with adherence coaching, or usual care in combination with self-esteem (attention control) counseling. INH was prescribed for 6 to 9 months and 12 intervention sessions (mean length of 23 minutes per condition) were provided over 6 months. Mean numbers of sessions completed were equivalent in the adherence (11.8) and self-esteem (11.4) conditions. Adherence to INH treatment was measured via monthly interviews and validated with urine assays. The dependent variable was total number of INH pills taken.

Trained research assistants conducted interviews and were blind to conditions. In addition, self-esteem counselors were blind to adherence coaching procedures, and vice versa. All staff were trained and supervised by senior research assistants and investigators. Investigators, staff, and treating physicians were blind to outcome data until all measures had been completed. "Intent-to-treat" procedures were used in conducting analyses. Sequential recruitment, interventions, and measurement took place from October 1996 through January 2000.

Screening

Screenings were conducted at 10 middle and high schools with large proportions of Latino students. Mantoux skin tests were placed

and read 48 to 72 hours later by nurses. Following the guidelines of the Centers for Disease Control and Prevention (CDC),[58,59] we classified adolescents with induration reactions of 10 mm or above as infected and referred them for chest x-rays. Adolescents with negative chest x-rays were referred for LTBI treatment.

Recruitment

Test results and treatment resources were explained to students and their parents. The study was described by telephone to Latinos aged 12 to 19 years who were interested in obtaining INH treatment from a community clinic, had no medical contraindications, spoke English or Spanish, and planned to remain in the San Diego–Tijuana area for 12 months. Bilingual staff obtained signed consent forms during home visits. Adolescents and parents were told that the study was designed to test approaches to enhance medication adherence, that it would require 1 year of participation, and that those who took part would receive incentives for completing measures.

Participants

Of 2698 adolescents screened, 486 (18%) exhibited induration reactions of at least 10 mm; of these adolescents, 413 were eligible for the study. In addition, 122 adolescents had previously tested positive but had not completed treatment. Among these 535 adolescents, 302 (56%) were recruited, and 286 (95%) were retained for analyses. Reasons for not remaining in the trial included refusal, pregnancy, learning disabilities, or an atypical INH regimen in Mexico. The mean age of the 286 adolescents was 15.6 years (SD=1.64), 55.6% were male, 64.7% were foreign-born (1 in Argentina and the remainder in Mexico), and 52.5% were bicultural.[60] About 76% of these participants had no insurance coverage, and both mothers and fathers of participants had completed approximately 7 years of education.

Usual Medical Care

Adolescents received care from community clinics and were prescribed 300 mg of INH (1 pill) per day. At the time, the CDC/American Thoracic Society (ATS) guidelines called for 6 to 9 months of treatment for healthy in-

dividuals.[59] At physicians' discretion, adolescents were placed on 6 or more months of INH therapy; adolescents returned to the clinic monthly for evaluations and new prescriptions, or they were provided 3 months of medication and returned when they needed a prescription refill or had experienced symptoms or side effects.

Adherence Coaching

Coaches were bilingual Latino college students. All were trained and supervised to provide education concerning TB infection and treatment, including the difference between active TB and LTBI. Monthly case review meetings were held in which coaching procedures and adherence advice were discussed in relation to specific participants. On the basis of similar procedures employed in tobacco studies,[61,62] coaches used interviewing, contingency contracting, and shaping procedures (the latter involving gradual, "small-step" solutions to adherence problems).

Coaching began with an overview of LTBI treatment and the setting of adherence goals. Subsequent sessions involved an interview regarding pills taken or missed, a review of conditions leading to adherence or nonadherence, and a discussion of changes that could be made to enhance adherence. Coaches praised successful adherence and suggested that participants use adherence cues (e.g., taking INH when brushing their teeth). Coaches encouraged participants to obtain assistance from family and friends for pill taking and provided help in planning compensating adherence strategies to overcome potential barriers. In addition, they assisted with physician appointments and, sometimes, with transportation. Five 30-minute, in-person sessions (conducted in participants' homes, at clinics, or at other locations) and seven 15-minute telephone sessions were conducted over 6 months.

Self-Esteem Counseling

Bilingual Latino college students served as self-esteem counselors. Adolescents were encouraged to discuss problems affecting their self-esteem. Topics included relationships and communication with family, friends, and cultural identity. Counselors encouraged goal setting and changes in relationships or skills (e.g., assertiveness) to enhance self-esteem, and

used shaping procedures similar to those employed in adherence coaching. However, the self-esteem counselors provided no advice regarding TB; all questions about TB were referred to physicians.

Measures

Bilingual interviewers (blind to condition) were undergraduate students or members of the Latino community. Interviews were conducted in English or Spanish according to youths' preference.

Baseline interview. The baseline interview (about 90 minutes in duration) was conducted in participants' homes. Information was gathered on demographic characteristics, acculturation,[60] health care barriers, risk behaviors, parenting practices, past health care use, medication-taking behavior, social support, self-esteem, TB knowledge and exposure, and use of adherence aids for medical regimens. Most items involved 5-point ordinal scales with explicit anchors (e.g., *never* through *always*).

Monthly interviews. Unannounced monthly interviews were conducted to obtain reported INH adherence. Interviews (and urine collection) were unscheduled to prevent participants from adjusting their adherence practices. We assessed adherence by asking each youth how many pills he or she had taken in the past 8 days and the past 30 days. The 8-day and 30-day measures were compared to assess measurement reliability.

Interviewers asked participants to report the number of pills taken in the last 8 days, using a follow-back procedure, where the consumption in each previous day is reviewed in sequence.[63–67] They also asked about the pills taken in the last 30 days using the question "In the last 30 days, how many days have you taken your INH, or tuberculosis medication?" Responses to the 30-day measure were summed across months to obtain the total number of pills taken over 6 to 9 months. The monthly interview also included questions regarding alcohol use, possible side effects, somatic complaints, and adherence barriers and enhancers. Interviews were approximately 20 minutes in duration.

Urine assays. A clean-catch urine sample was collected for analyses of INH metabolites using the Arkansas method (simple colorimetric test). Details and validity information have been provided elsewhere.[68–70] Positive tests indicated ingestion of INH in the past 72 hours and served as validity checks for reported measures, but were not sensitive to cumulative monthly adherence.

Participants were informed that the purpose of the urine assays was to confirm adherence to INH treatment and that their urine would not be tested for any other drug. This procedure was designed to enhance the validity of the reported adherence measures.[71] If urine collection was not possible after 3 attempts to locate participants, interviews were conducted via telephone without obtaining urine samples. Over the 9 months of the study, 82% to 97% of interviews completed had associated urine samples.

Reliability and Validity of Adherence Measures

Reliability tests comparing 8-day and 30-day adherence measures yielded significant ($P<.001$) Pearson correlation coefficients ranging from 0.71 to 0.93. As a means of assessing validity, correlations were computed between urine assays and both the 8- and 30-day recall measures. Point biserial coefficients were significant ($P<.001$) in each case (8-day recall: rs$=0.56–0.72$; 30-day recall: rs$=0.39–0.71$).

Statistical Analyses

SPSS 6.1.3 for Windows[72] was used to conduct analyses. Analysis of variance (ANOVA) was used to test for group differences in baseline characteristics to confirm random assignment and to assess differences in cumulative mean adherence to INH treatment by group. Outcome analyses were recomputed (as analysis of covariance [ANCOVA]) adjusting for alcohol use as a possible confounding variable, and again using multivariate regression procedures to control for various demographic and social factors.

RESULTS

Group Comparability

No significant baseline differences among groups were found for gender, foreign-born status, acculturation, age (Table 1), highest level of education completed for mothers and fathers, medical insurance, alcohol use, school grades, medication adherence history, number of people prescribed INH in the home, and number of other individuals known to have taken INH. These results suggested that random assignment was successful.

Primary Test of Intervention

Table 2 shows the mean cumulative number of pills taken and the ANOVA results, by group, for 9 and 6 months. Although the primary analyses were conducted for 9-month data, secondary analyses were also completed for 6 months in order to test effects during the intervention. There was a significant group main effect for both 9- and 6-month analyses. For both time periods, the coaching condition had the highest cumulative mean number of pills consumed, and pairwise comparisons

TABLE 1—Demographic Characteristics, by Group

	Usual Care (n = 96; 33.6%), No. (%)	Attention Control (n = 98; 34.3%), No. (%)	Adherence (n = 92; 32.2%),No. (%)
Gender			
Males	51 (53)	58 (59)	50 (54)
Females	45 (47)	40 (41)	42 (46)
Place of birth			
US	32 (33)	32 (33)	37 (40)
Mexico	64 (67)	66 (67)	55 (60)
Acculturation level			
Hispanic	26 (27)	36 (37)	24 (26)
Bicultural	58 (60)	47 (49)	61 (67)
American	12 (13)	14 (14)	6 (7)
Age, y, mean ± SD	15 ± 1.62	16 ± 1.63	16 ± 1.73
Range	12-18	12-19	12-19

TABLE 2—Results of Experimental Intervention: 9- and 6-Month Data

	Sum of INH Pills, Months 1–9, by Condition[a]					Sum of INH Pills, Months 1–6, by Condition[b]				
	Control (n = 96)	Attention (n = 98)		Adherence (n = 92)		Control (n = 96)	Attention (n = 98)		Adherence (n = 92)	
Cumulative mean (SD)	150.98 (73.75)	155.37 (69.91)		179.93 (57.01)		113.09 (51.26)	112.02 (47.44)		129.27 (41.20)	
Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	45 551.89	2	22,775.95	5.010	.007	17 502.30	2	8751.14	3.979	.020
Group	45 551.89	2	22 775.95	5.010	.007	17 502.30	2	8751.14	3.979	.020
Explained	45 551.89	2	22 775.95	5.010	.007	17 502.30	2	8751.14	3.979	.020
Residual	1 286 508.34	283	4 545.97			622 396.32	283	2199.28		
Total	1 332 060.24	285	4 673.90			639 898.60	285	2245.26		

Note. Sig. = significance.
[a]Effect size (between adherence and control conditions) for 9-month data: .43.
[b]Effect size (between adherence and control conditions) for 6-month data: .34.

using the Tukey honestly significant difference test indicated that members of the adherence coaching group took significantly ($P<.05$) more pills than members of the usual care and self-esteem groups, respectively.

Test of Intervention Controlling for Alcohol Use

Two ANCOVAs (for 9- and 6-month data) examining adherence by group were conducted, including alcohol as a covariate to control for possible self- or physician-imposed treatment suspension among youths who reported alcohol use, and possible side effects from combining alcohol and INH.[59,73] The two covariates represented number of months using alcohol over either 9 months or 6 months, respectively.

In the 9-month analysis, the covariate alcohol use was significantly related to number of pills taken ($F_{1,282}=12.68, P<.001$). After adjustment for alcohol use, the significant main effect for group remained ($F_{2,282}=5.69, P<.01$) and both controls were still significantly lower than the adherence group. The alcohol use covariate was not significant in the 6-month analysis. Thus, during both periods, adherence coaching was effective regardless of alcohol use.

Strength of Intervention Effects

A 2-block hierarchical regression analysis was conducted to examine the robustness of the experimental findings (Table 3). The dependent variable was total number of INH pills taken over 9 months. The group assign-

TABLE 3—Final Stage in a Hierarchical Regression of Cumulative Number of Pills Over 9 Months (n = 249)

Predictor	B	SE	95% Confidence Interval	β	t	P
Age	−10.829	2.696	−16.141, −5.517	−0.249	−4.017	.0001
Gender	9.333	8.690	−7.788, 26.455	0.066	1.074	.2839
Country of origin	0.533	9.234	−17.659, 18.726	0.004	0.058	.9540
Insurance	14.321	10.042	−5.464, 34.105	0.089	1.426	.1552
Grades	4.943	2.619	−0.216, 10.104	0.125	1.888	.0603
Parental strictness	3.845	3.554	−3.158, 10.848	0.065	1.082	.2805
Agreement with parental rules	−0.600	3.538	−7.570, 6.371	−0.010	−0.169	.8656
Parental involvement	−1.618	1.128	−3.840, 0.603	−0.083	−1.435	.1526
Hispanic	10.027	14.341	−18.228, 38.281	0.066	0.699	.4851
Bicultural	31.693	12.969	6.140, 57.247	0.224	2.444	.0153
Risk behaviors	−7.763	3.210	−14.088, −1.439	−0.166	−2.419	.0164
Perceived peer adherence	−0.242	0.167	−0.571, 0.087	−0.085	−1.446	.1494
TB consequences (adherence expectations)	7.575	5.110	−2.493, 17.643	0.093	1.482	.1396
Self-efficacy	8.798	5.322	−1.688, 19.285	0.102	1.653	.0997
Barriers	−5.571	3.399	−12.267, 1.125	−0.094	−1.639	.1025
Experimental	25.286	8.823	7.902, 42.671	0.169	2.866	.0045
Constant	223.652	54.793	115.696, 331.608	4.082		

ment variable (block 2) was entered after controlling for 15 demographic, cognitive, family, and peer-related variables (block 1). The first block significantly explained 22% of the variance in total pills taken ($F_{15,233}=4.53, P<.001$). The second block, including only the experimental group (compared to the other 2 groups combined), added a significant additional 3% (F change=8.21, $P<.01$) to the explained variance in adherence ($F_{16,232}=4.89, P<.001$), $R=0.50$, $R^2=0.25$.

Treatment Completion

At the time of this study, the ATS's clinical standards[58] defined completion of LTBI treatment as taking 180 pills within 270 days (9 months). Accordingly, χ^2 tests were conducted to explore possible differences in completion rates among groups. Although results showed that 51.1% of coached youths completed treatment, as opposed to only 41.8% and 37.5% of youths in the self-esteem and usual care groups, respectively, these differ-

DISCUSSION

This study gives special attention to adherence, following the advice of a previous study of LTBI treatment.[25] Our theoretically based coaching increased adolescents' cumulative medication use more than our control conditions. This resulted in an average completion rate of 180 pills over 9 months or about the amount targeted for a 6-month regimen, according to CDC standards at the time. This finding proved remarkably robust, remaining statistically significant after control for alcohol use, and separately for 15 demographic and social factors potentially related to INH adherence. Thus, coaching adolescents to complete INH regimens appears to be a valid intervention.

In addition, the coaching group achieved the greatest rate of treatment completion, 51%, and this rate exceeded that of at least one other study in which patients were provided similar behavioral services.[38] This result suggests that more powerful interventions are needed to achieve at least 90% LTBI treatment completion rates among Latino adolescents. Coaching of longer duration might result in substantially higher completion rates.

Questions have been raised about the validity of TB adherence measures.[50] Biomarkers are not recommended as outcome measures because their utility is limited by individual differences in drug absorption, distribution, metabolism, and excretion.[74–76] In addition, the half-life of a medication can obscure true adherence rates, resulting in both false-positive and false-negative outcomes. These limitations apply to the Arkansas method, which can detect the presence of INH metabolites in urine only if pills have been taken within a few hours to 3 days of urine collection.[68,69,77]

A review of the use of self-report measures, pill counts, electronic monitors, and biomarkers to assess INH adherence among control participants in published studies reveals limitations with each of these approaches. In terms of self-report measures, memory may compro-

mise reported estimates. Pill counts may be incorrect due to pharmacy errors, shared use by family members, or leftover pills being combined with newly prescribed medications. Electronic monitors can fail or can provide erroneous information when more than one pill is removed at a time. In addition, all of these measures may be subject to "false reporting"; patients can provide false information about amounts of medication taken, discard medication to alter pill counts, "dump" medication to confound electronic monitors,[78] and take medication immediately before undergoing testing so as to confound biomarkers. Thus, none of the available measures are free of error.

Given concerns that false reporting leads to overestimates of adherence, measures that result in the lowest overall average rates may be viewed as the most "conservative" and are presumably more accurate estimates of adherence. We reviewed the ranges of adherence associated with the measures typically used to assess INH adherence and found that self-reported rates ranged from 38% to 89%[28,33,38,79] among adults, and from 33% to 50%[42,80] among adolescents. Rates associated with use of electronic monitors ranged from 49% to 73%[28,81] among adults, and a rate of 66%[41] was observed among adolescents. Finally, rates derived from pill count measures ranged from 73% to 96% ($\pm15\%$)[36,81] among adults, and a 91%[41] rate was observed among adolescents. None of the studies reviewed used biomarkers as outcome measures.

These patterns suggest that self-report measures of INH adherence produce the most conservative estimates. Moreover, the lowest (33%) estimate of adolescents' adherence to INH was that obtained in the present study. Both the validity of our interview measures and this relatively low level of adherence may have been due to our systematic use of unannounced urine assays.[61,67,68,71,82] Thus, we believe that the combination of random urine assays and detailed interview measures provides the most accurate estimate of INH adherence.

As a result of several features of the present study—use of a multiple-blind design with separate staff for measures, attention control, and adherence counseling conditions; all investigators blind to results; unannounced urine assays; and high rates of cohort retention—our findings may represent lower but

more accurate estimates of adherence than is the case with other studies. We recommend that future studies and treatment protocols should use similar urine assays to confirm reported adherence to TB treatment, consistent with recommendations[25] for concurrent use of multiple measures.

The present study included an analysis of possible predictors of adherence designed to test the robustness of the experimental findings. The results of this analysis suggest intervention components that might enhance adherence beyond that achieved by coaching. Adolescents who were bicultural tended to adhere to INH more than those in the most or least acculturated groups. This finding suggests that acculturation status could be used in identifying higher risk adolescents and providing additional support for adherence accordingly.

Older adolescents were less likely to adhere to treatment. This suggests that age should be employed as a risk factor and older adolescents provided with more aggressive coaching or treatment. Similarly, adolescents who engaged in fewer risk practices (e.g., drug use) were more likely to adhere to INH treatment, suggesting that risk practices could be used to triage youths into more intensive interventions. This finding also suggests that interventions that decrease risk practices might increase adherence.

Anecdotal observations suggest that poverty plays an important role in adherence. Few participants had an established medical provider at the beginning of the study. In addition, transportation to and from clinics and medical care costs were barriers to initiation and completion of treatment. Rates of INH treatment completion could be enhanced via increased access to care, which could be facilitated by reducing the costs associated with prevention services. More complete public health interventions should be directed toward structural changes that alter social barriers to TB control.[57,83]

The current ATS/CDC recommendations for LTBI treatment call for 2 to 4 months of a multidrug regimen or 9 to 12 months of one INH pill per day.[19] However, in the case of adolescents, the differing effects of short-term but complex regimens and longer term but simple regimens are unknown.[19] One study of immigrants compared usual care among

adults prescribed 4 drugs and age-matched patients prescribed INH for 12 months. Approximately 68% and 69%, respectively, of the patients in the 2 conditions completed treatment. Patients on the 4-drug regimen reported 3 times the side effects and 4 times the medical cares costs of those prescribed INH. Results suggest that 12-month INH regimens may be safer and less expensive than the shorter, multidrug regimens.[83] In absence of disease risks (e.g., HIV infection) or known exposure to drug-resistant strains of TB, 9- to 12-month INH regimens appear preferable. Since the multidrug regimens can compromise contraceptive use, INH regimens are even more preferable for adolescents.[19]

If 90% completion rates are to be obtained, more powerful and efficient interventions are needed to sustain adherence to LTBI treatment. Extending coaching procedures and combining coaching with greater support for medical care are promising directions for study. Future research should determine the extent to which coaching could be implemented by peers as a means of reducing costs. In addition, future studies should incorporate cost-effectiveness analyses, including examination of potential societal benefits, to direct public health policies that support more aggressive services for racial/ethnic minorities and immigrants at risk for LTBI. Such refinements may result in increased TB control. ∎

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Contributors

M.F. Hovell was responsible for the overall study design and oversight and for article content. C.L. Sipan was responsible for project coordination and management. E.J. Blumberg was involved in analysis planning and wrote key sections of the article. C.R. Hofstetter contributed to the completion of the statistical analyses, and D. Slymen was responsible for oversight of all of the analyses. L. Friedman served as an adolescent medicine specialist and conducted continuing medical education for practitioners providing treatment to study participants. K. Moser assisted with the study design, supervised all of the screenings, and provided medical treatment to a subset of participants. N.J. Kelley was responsible for data management and analyses. A.Y. Vera supervised the experimental intervention and completed literature searches. All authors were involved in the interpretation of results and contributed to the writing and editing of the article.

Human Participant Protection

The consent forms (and informed consent procedures), protocols, and interview measures used for this study were approved by the San Diego State University institutional review board.

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