

Behavioral Interventions for the Control of Tuberculosis Among Adolescents

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SYNOPSIS

Objectives. Activation of latent tuberculosis infection into tuberculosis disease (TB), the primary killer among infectious diseases worldwide, can be prevented with six months of anti-TB medication. A large percentage of adolescents started on medication, however, fail to complete their treatment. The authors developed and tested the effects of innovative educational strategies on infected adolescents at two health centers serving ethnically diverse populations.

Methods. The authors used a randomized experimental four-group design to assess the independent and combined effects of peer counseling and a participant-parent contingency contract intervention.

Results. A total of 794 adolescents were recruited into the study, for a 79% participation rate. The overall rate of treatment completion was 79.8%. Self-efficacy for medication-taking behavior at post-test correlated strongly with completion of care ($R = 0.367$, $p = 0.002$). Participants randomized to the peer counseling groups demonstrated significantly greater improvements in self-efficacy and mastery than the usual care control group. Based on the study results, continuing education seminars and workshops were implemented for TB control staff at the two health clinics and for all TB Control Division staff at the Los Angeles County Health Department. Educational materials and a training manual for enhancing completion of treatment of latent TB infection through tailored educational approaches were developed and disseminated to the clinics.

Conclusions. Health education and incentives are helpful adjuncts to the completion of treatment for latent tuberculosis infection in adolescents.

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Activation of latent tuberculosis infection into tuberculosis disease (TB), the primary killer among infectious diseases worldwide, can be prevented with six months of anti-TB medication when infection is detected. However, an estimated 21% to 36% of patients receiving treatment in 1993–1998 failed to complete the treatment regimen within one year.¹ Although the TB case rate in the United States has decreased since its height in 1992, the rate (5.8 cases per 100,000 people in 2000) is still above the national goal for the year 2000 of 3.5 per 100,000.² Furthermore, despite decreases in the total number of cases in the United States, the proportion of cases among people born abroad is increasing, with a 1998 rate of infection four to six times higher than among people born in the United States.^{3–6}

As TB, a treatable and curable disease, continues to be a health problem in the United States, strategies to increase adherence to TB treatment need to be identified and implemented. Adherence to anti-TB medication is of particular concern in geographic areas and populations with high TB prevalence rates.

California ranks first among states, with the highest annual number of reported TB cases. Among cities, Los Angeles ranks second, after New York.¹ Los Angeles County Department of Health data show that rates of TB in the county were more than double the national rate from 1989 through 1996 and continued to be well above the national rate of 5.8 cases per 100,000 people in 2000.¹ The majority of the cases (71%) in Los Angeles County are among people born in foreign countries.

Although only active TB cases are reported in the statistics, TB control treatment is given for both TB disease and latent TB infections. About 10% of people with latent TB infection will develop active TB disease at some point in their lives.⁷

Adolescents are more susceptible to developing TB disease than younger children, because of hormonal changes and altered protein and calcium metabolism associated with adolescent growth.^{8,9} The time interval between initial infection and the development of active disease is also shorter for adolescents than for other age groups.⁹ Despite this higher risk for disease, however, many adolescents who are prescribed therapy for latent TB infection fail to complete it: for example, among adolescents who initiated treatment for latent TB infection in 1992–1996 in Los Angeles County, only 55.4% completed care, according to 1997 Department of Public Health data.

From 1995 through 1998, the UCLA School of Public Health and California State University, Long Beach,

conducted a joint research project with the Los Angeles County Department of Health Services and the Long Beach Department of Health and Human Services. The purpose of the project was to test the effectiveness of two interventions—peer counseling and contingency contracting (incentives)—on adolescent adherence to treatment for latent TB infection. Adolescents were divided into four groups and assigned different interventions: (a) peer counselor, (b) incentive contract, (c) combined use of peer counselors and incentives, and (d) usual care. By involving the parents of the adolescent clients and peer counselors (who reflected the age and background of the client population), the peer counselor and contingency contracting components were designed to meet the needs of adolescents with TB infection through social support and positive reinforcement.

Peer counselors—people of “equal standing or similar age to the recipient”¹⁰—have been effective in influencing positive health behaviors. At the University of Iowa, peer counselors were successful in increasing adherence to TB treatment among students receiving care with the student health services. Before implementing the peer counselor program, completion of treatment rates ranged from 5% to 14%. Following its implementation, completion rates increased to 62% to 79%.¹¹

Programs attempting to increase adherence to treatment among young people have also recognized the importance of parental involvement. Parents provide social support in chronic care activities. While responsibility for treatment management will shift to the adolescent, parents can act as “adherence observers” and provide support for adolescents learning new skills of treatment management and adherence.¹² For example, a previous study found that young people whose parents were involved in a training intervention experienced significantly higher rates of therapeutic adherence and more self-responsibility in the management of their chronic health condition than those whose parents were not.¹³

METHODS

This study was conducted at two clinics in Los Angeles County serving large numbers of adolescents receiving care for latent TB infection. One of these clinics was run by the Los Angeles County Department of Health; the other was run by the City of Long Beach Department of Health and Human Services. All eligible adolescents who were recommended for treatment of latent TB were invited to participate in the

research study. The majority of the adolescents had been screened for TB as a requirement for entering school.

The adolescents were recruited after their first clinic appointment, before receiving treatment. Prospective participants and their parent/guardian(s) were informed of the study and were asked to sign an informed consent form that explained the nature, purpose, and procedures of the study. All participants received treatment and medical follow-up visits according to the standard clinic protocol, which included monthly supplies of medication (typically isoniazid) for at least six months.

Interventions

After providing informed consent, participants completed a baseline interview and were randomly assigned to one of four intervention groups. Where possible, a baseline survey was also conducted with a parent or guardian. A second questionnaire assessing issues related to the first month of treatment was also completed by participants who returned for their initial follow-up clinic visit, and a post-test questionnaire was completed at the final clinic visit or after six months for those who dropped out of treatment. Participants received \$15 as reimbursement for their time spent completing the baseline and post-test interviews.

Peer counseling intervention. Adolescents who had completed therapy for latent TB infection were recruited as peer counselors. All peer counselors were extensively trained in their roles and responsibilities (including the necessity for strict confidentiality) and followed a standardized protocol. Under the supervision of the site coordinator, peer educators contacted by telephone all participants assigned to them during the first week after randomization. Subsequent contacts were scheduled to take place at least every two weeks. The initial contact was introductory, designed to establish rapport, explain the role of the peer educator, and stress the importance of clinic attendance and medication-taking. Later telephone contacts addressed information collected in the baseline interview, such as behavioral and normative beliefs, and any problems or concerns identified by the participant during subsequent contacts.

Parent-participant contingency contract intervention. In the contingency contract component, with the assistance of program staff, parents and adolescents negotiated an incentive provided by the parent to be received if the adolescent adhered to the prescribed TB treatment. Adherence included keeping appointments with the TB clinic and taking the TB medica-

tion every day. To promote early adherence, it was recommended that one or more incentives be provided within the first couple of months of treatment and one at the completion of treatment. Parents and adolescents, however, were asked to set a schedule for awarding the incentives. Examples of suggested incentives included a special meal at home, going out to eat, clothing, going to the movies or renting a video, or anything agreeable to both the parent and the adolescent.

Combined intervention. Participants in this group received both peer counseling and parental contingency contracting interventions.

Usual care. Participants in this group received all of the treatment and educational services customarily provided by the clinic. Included in usual care were health education from TB clinic staff and assessment of the adolescent's physical health in response to the TB medication.

Measures

Variables hypothesized to influence completion of care included self-efficacy for medication taking, mastery, self-esteem, and medication-taking behavior. Self-efficacy for medication-taking behavior was measured using a 12-item scale that included items such as "I will be able to remember to take my TB medication every day" (Cronbach's alpha reliability coefficient = 0.80).¹⁴ Mastery was assessed using a seven-item scale measuring control over situations (Cronbach's alpha reliability coefficient = 0.65). Items included "There is really no way I can solve some of the problems that I have" and "What happens to me in the future mostly depends on me." Self-esteem was assessed using a 10-item scale (Cronbach's alpha = 0.79).¹⁵ Examples of this construct included "I am able to do things as well as most other people" and "I take a positive attitude toward myself."

Medication-taking behavior was assessed with a three-item scale (Cronbach's alpha = 0.59). Questions included "People sometimes miss taking their medication. Thinking over the past seven days, were there any days when you did not take your medicine?" and "During the past month, how often did you have difficulty remembering to take your medication?" The outcome variable—completion of treatment—was measured using the discharge summary recorded in the patient's medical chart. For patients to complete their medical treatment, they must have been under treatment for at least six months.

We employed an intention-to-treat model. There-

fore, all patients who did not have a measure regarding completion of care were assumed to have discontinued therapy and were coded as having not completed care (exceptions were patients whose treatment was discontinued by the physician or who informed the clinics that they were moving). All participants who remained in care received a follow-up assessment before the sixth month of care.

RESULTS

The age of the participants ranged from 11 to 19, with a mean age of 15.2 (standard deviation = 1.9). The sample was equally divided between females (51%) and males (49%). Hispanic Americans made up the largest ethnic group (77.8%), followed by Asians (9.4%) and African Americans (8.1%), according to demographic data collected at baseline. We included race/ethnicity as a variable because it provides information about the population receiving treatment for latent tuberculosis infection in Los Angeles County. (See Table 1.) Across the four study groups, there were no significant differences in age, sex, education,

or ethnicity, supporting the effectiveness of randomization.

Table 2 identifies the relationships between the three mediating variables and medication-taking behavior. Participants who scored high in self-efficacy with medication-taking behavior at both baseline and exit interviews were significantly more likely than those who reported lower self-efficacy to have higher levels of medication-taking behavior at post-test ($R = 0.254$, $p < 0.0001$). Self-esteem at baseline and post-test was also correlated with medication-taking behavior at post-test ($R = 0.103$, $p = 0.006$). Mastery at baseline and exit interview was correlated with medication-taking behavior at post-test ($R = 0.103$, $p = 0.006$).

As expected, medication-taking behavior displayed concurrent as well as predictive validity with respect to completion of care. The baseline measure was collected one month after enrollment in the study to allow patients the opportunity to have some experience with taking the medication. Participants who scored high on the self-reported measure were significantly more likely to complete medical care than participants with lower scores ($R = 0.150$, $p = 0.039$). Among

Table 1. Self-reported demographic characteristics of sample, by type of intervention (N = 794)

Characteristic	Peer counseling		Contingency contracting		Peer counseling and contingency contracting		Usual care	
	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Sex								
Male	51.3	102	50.0	102	52.6	103	51.8	101
Female	48.7	97	50.0	102	47.4	93	48.2	94
Race/ethnicity								
African American	8.0	16	10.8	22	6.1	12	7.2	14
Asian	8.0	16	8.8	18	12.8	25	8.2	16
Latino	80.9	161	77.0	157	75.0	147	78.5	153
White and other	3.1	6	3.4	7	6.1	12	6.2	12
Country of birth (n = 793)								
United States	21.1	42	19.1	39	19.9	38	23.1	45
Other	78.9	157	80.0	165	80.1	157	76.9	150
Educational level								
Primary school	5.5	11	3.0	6	4.6	9	6.2	12
Middle school	49.0	97	50.2	102	44.6	87	46.7	91
High school	45.5	90	46.8	95	50.8	99	47.2	92
Site								
Inglewood	52.8	105	52.0	106	49	96	51.8	101
Long Beach	47.2	94	48.0	98	51	100	48.2	94
Age (n = 791)								
Mean		15.23		15.44		15.21		15.35
Standard deviation		1.87		1.90		1.95		1.91

Table 2. Relationship between medication-taking behavior and three mediating variables

Variable	Pre-test		Post-test	
	R	p-value	R	p-value
Self-efficacy for medication-taking ^a	0.103	0.006	0.254	0.002
Mastery ^b	0.092	0.014	0.103	0.006
Self-esteem ^c	0.076	0.043	0.081	0.042

^an at pre-test = 718; n at post-test = 632

^bn at pre-test = 712; n at post-test = 716

^cn at pre-test = 718; n at post-test = 716

participants who scored high on the medication-taking behavior, 90.1% completed their medical treatment, compared with only 77.6% of participants who scored low to medium.

Four demographic indicators were found to be predictive of completion of care (Table 3). Asians were more than three times as likely to complete their treatment regimen as other participants. Participants receiving treatment in the Long Beach site were more likely to complete treatment than participants treated at the Inglewood site. Individuals who were not born in the U.S. were 1.75 times as likely to complete care as individuals who were born in the U.S. Participants younger than 15 years old were significantly more likely than older participants to complete their six-month treatment program.

Table 3. Predictors of completion of care

Predictor	Completed care		Did not complete care		Odds ratio
	Percent	Number	Percent	Number	
Ethnicity (n = 769)					
Asian	93.0	66	7.0	7	3.63 ^a
Non-Asian	78.4	546	21.6	150	
Site (n = 767)					
Long Beach	85.9	323	14.1	53	2.15 ^a
Inglewood	73.9	289	26.1	102	
Country of birth (n = 766)					
United States	71.8	112	28.2	44	0.57 ^b
Other	81.8	499	18.2	111	
Age (n = 754)					
<15	85.3	237	14.7	41	1.68 ^b
≥15	76.5	372	23.5	104	

^ap < 0.01

^bp < 0.05

Completion of care rates did not vary significantly across study groups (Table 4). Overall, 79.8% of participants completed their treatment. Treatment was completed by 84.8% of participants in the combined intervention group, 80.3% in the peer counseling group, 77.8% receiving usual care, and 76.4% in the incentive group. Although the differences in these results were not statistically significant, participants who received the combined intervention had a slightly higher rate of treatment completion than participants in other groups.

A regression model was constructed to assess the main effects of the intervention on mediating variables and completion of care. For the peer counseling group, main effects were found for medication-taking behavior measured at post-test ($F = 30.70$, $p < 0.001$), mastery measured at post-test ($F = 4.5$, $p = 0.035$), and self-efficacy ($F = 6.41$, $p = 0.012$).

DISCUSSION

Based on the study's findings, we recommend that clinicians consider incorporating the two components of this program into the usual care procedures of TB control for adolescents. Particularly important is peer counseling, which had a significant impact on self-efficacy for medication taking and on medication-taking behavior. While less effective than peer counseling, contingency contracting also had a significant effect on medication-taking behavior. This is especially important, as participants assigned to both interven-

Table 4. Completion of care by type of intervention (n = 767)

Outcome	Peer counseling		Contingency		Peer combined		Usual care	
	Percent	Number	Percent	Number	Percent	Number	Percent	Number
Completed care	80.3	151	76.4	152	84.8	162	77.8	147
Did not complete care	19.7	37	23.6	47	15.2	29	22.2	42

tion groups displayed significant improvements in medication-taking behavior, which correlated strongly with completion of care.

This is the first study to use a randomized design to assess the effects of tailored educational strategies on completion of treatment among adolescents diagnosed with latent TB infection. A retrospective needs analysis of patients receiving care at the two study clinics before the study began indicated that 71.3% had completed six-month treatment. This rate is lower than that experienced by the usual care group in the present study, indicating a potential Hawthorne effect as a result of pre-testing study participants.

The study identified the effects of predictors of completion of care, including ethnicity, origin of birth, and age. Demographic characteristics may be markers for other causal factors, such as access to care and level of knowledge about the disease. The differences in compliance by ethnicity and age group support the argument that a TB prevention program should consist of various strategies and should be tailored to the patient population.

Several limitations of the study can be identified. One is the effect of the interviews on participants. All participants, including those in the usual care group, were interviewed three times during the six months of their treatment. Their participation in the interviews and the monetary incentives provided to them may have heightened their awareness of their treatment and encouraged them to complete treatment. The interviews might thus be viewed as an intervention that influenced behavior toward treatment adherence.

A limitation related to the contingency contracts was the lack of assurance that the adolescents in the study actually received the incentives their parents agreed to provide; no proof was required.

Limitations also occurred with the Spanish translations of the questionnaires. Several participants had difficulty understanding the response scales, which ranged from strongly agree to strong disagree in English and did not have exact equivalents in Spanish. As a result, the validity of those data may have been compromised.

Age differences

Care providers should take into consideration the patient's age at the initiation of treatment. Some researchers have found that although they may have higher problem-solving skills and cognitive development, older adolescents (ages 17–18) have lower rates of adherence than younger ones (ages 12–14).¹⁶ This difference in adherence may reflect the fact that older adolescents have different social and emotional needs and are concerned with different issues, such as acceptance by peers.

Previous studies have revealed that agreement between the parent and adolescent regarding who is responsible for care is associated with adherence.¹⁷ Those findings revealed that younger patients tended to live with both parents and had more support in remembering medications and appointments. Younger patients were more likely to have parents remind them to take their medication, whereas older patients tended to be solely responsible for remembering their medication. In addition, older patients were more likely to report having events that got in the way of taking TB medication.

The results of the present study demonstrate that parental support in medication-taking can positively influence adolescent adherence. Where the adolescent and the parents have an open communication style and interact freely, health care providers should enlist the assistance of parents to help remind patients to take their medication.

Country of origin

The majority of the patients in our study were born outside the United States; half of all immigrants had immigrated within the past five years. Several issues require attention regarding health care among immigrants. Many patients may be unfamiliar with the local health care system and the services available, creating a barrier to adherence. Additional education may be necessary to orient immigrant patients to the care offered at a clinic. Patients may also come from cultures that have different beliefs and attitudes about TB and its treatment. Health care providers should be

aware of these beliefs and sensitive in addressing them and their relationship to treatment.

Collaborative research partnerships

An important aspect of this study was the cooperation exhibited between academicians and health department personnel. The two health department clinics involved provided space for study staff, and clinic staff helped identify and refer potential study participants. Clinic staff also helped design the interventions and study procedures and recruit the peer educators.

For their part, study staff provided assistance to the clinic by providing patient management and follow-up. In addition, upon completion of the study, researchers provided feedback about the study results to the TB control managers and staff. Seminars were presented to the TB clinic staff at both sites as well as to a countywide meeting of employees involved in county TB control activities. Detailed booklets about the interventions and the results of the study were printed and provided to all interested staff.

Implementation and integration

This study provided a case example of the capacity for academic-practice partnerships to improve health status. It offered specific interventions designed to address the impact of a serious health problem in a young, vulnerable population. Patients assigned to the intervention groups experienced higher behavioral and health status indicators as well as greater compliance with treatment, compared to patients in the control group.

Implementing change outside a research setting is problematic, even where the desire to change exists. Changes in treatment protocol are often determined by a wider system, not unilaterally by a single clinic. The interventions implemented during this study could easily be incorporated into the usual care procedures of health clinics serving adolescents—at minimal or no additional monetary cost. Clinics intending to implement these components should designate a staff member responsible for coordinating the peer counseling and contingency contract programs.

The contribution of this type of research goes beyond the clinic level, extending to public health practice in general. Benefits include increased contact and follow-up, improved surveillance systems within public health clinic environments, opportunities to assess TB rates across ethnic groups and geographic districts, and more efficient and effective program management.

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