Tuberculin Skin Test Screening Practices Among US Colleges and Universities

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Context.—Concern about transmission of Mycobacterium tuberculosis on college campuses has prompted some schools to institute tuberculin skin test screening of students, but this screening has never been evaluated.

Objective.—To describe tuberculin skin test screening practices and results of screening in colleges and universities in the United States.

Design and Setting.—Self-administered mail and telephone questionnaire in November and December 1995 to a stratified random sample of US 2-year and 4-year colleges and universities.

Main Outcome Measures.—Type of tuberculin screening required; types of schools requiring screening; number and rate of students with positive skin test results and/or diagnosed as having tuberculosis.

Results.—Of the 3148 US colleges and universities, 624 (78%) of 796 schools surveyed responded. Overall, 378 schools (61%) required tuberculin screening; it was required for all new students (US residents and international students) in 161 (26%) of 624 schools, all new international students but not new US residents in 53 (8%), and students in specific academic programs in 294 (47%). Required screening was more likely in 4-year vs 2-year schools, schools that belonged to the American College Health Association vs nonmember schools, schools with immunization requirements vs schools without, and schools with a student health clinic vs those without (P<.001 for all). Public and private schools were equally likely to require screening (64% vs 62%; P=.21). In the 378 schools with screening requirements, time or multiple puncture tests were accepted in 95 (25%); test results were recorded in millimeters of induration in 95 (25%); and 100 (27%) reported collecting results in a centralized registry or database. Of the 168 (27%) of 624 schools accepting only Mantoux skin tests and reporting results for school years 1992-1993 through 1995-1996, 3.1% of the 348,368 students screened had positive skin test results (median percentage positive, 0.8%). International students had a significantly higher case rate for active tuberculosis than US residents (35.2 vs 1.1 per 100,000 students screened).

Conclusions.—Widespread tuberculin screening of students yielded a low prevalence of skin test reactors and few tuberculosis cases. To optimize the use of limited public health resources, tuberculin screening should target students at high risk for infection.

M tuberculosis screening practices. Schools that did not respond by mail were surveyed by telephone. After all survey forms were received, they were reviewed by the authors. Schools with responses that appeared invalid or inconsistent were called, the questionnaire was reviewed with the person who completed the form, and corrections were made to responses as needed. Associations between school characteristics and having a tuberculin screening requirement were measured using the normal approximation for the comparison of 2 proportions.14

If schools reported any tuberculin skin test screening requirements, we collected data on the number of students screened and the number with positive skin test results from school years 1992-1993 through 1995-1996. The definition of a positive or negative skin test result was determined by each student’s health care provider. The percentage of students with positive skin test results was calculated using those schools that reported results of required screening and accepted the Mantoux skin test method only.

All schools were asked to report if they had any tuberculosis cases among their students from school years 1992-1993 through 1995-1996, regardless of whether any tuberculin screening was required. Additional information asked about the cases included how the student was diagnosed as having tuberculosis, whether the student was US born or foreign born, and whether the student was an international student or US resident. To measure the yield of required tuberculin skin test screening, we estimated the rate of tuberculosis cases identified through required screening for schools that required screening of all new students or new international students. As denominators for these rates, we used published figures of total enrollment for US residents and international students. For 4-year schools, we assumed that the number of international students screened per year was one quarter of the school’s total international student enrollment; the number of US residents screened per year was one quarter of the school’s total enrollment minus the international students. For 2-year schools, the same method was used, but we assumed that the number of students screened was half the total enrollment.11,12 School records and individual student medical records were not reviewed to verify reported tuberculin skin test results or diagnoses of active tuberculosis.

RESULTS

Of the 796 schools included in the survey, 624 (78%) responded: 402 (64%) by mail and 222 (36%) by telephone. There was no difference between schools that responded to the survey and those that did not with regard to any of the sampling strata, ie, whether they were a 2- vs 4-year school, public vs private school, or ACHA member. There were also no differences across the sampling strata by type of response (mail or telephone). Additionally, the response rates were uniform across strata; therefore, the proportions from this study represent a weighted proportion of schools nationwide. The characteristics of the schools responding to the survey are shown in Table 1. In 1995, the median total student enrollment at these schools was 1963 (range, 26-48963) and median international student enrollment was 33 (range, 0-4259).

Of the 624 schools that responded to the survey, 337 surveys (54%) were completed by staff from student health services, 284 (46%) by school administrators, and for 3 schools (0.5%) this information was unavailable. Of the 284 schools whose forms were completed by administrative staff, 245 (86%) did not have student health clinics and thus no clinic staff could have completed the forms.

Overall, 378 (61%) of the 624 schools required tuberculin skin test screening for some subset of their students. All new students (US residents and international students) were required to have tuberculin skin tests in 161 (26%) of the 624 schools and all new international students (but not new students from the United States) in 53 (8%) of the schools. Overall, 294 (47%) of the schools required tuberculin screening in specific academic programs; 251 (62%) of 373 schools with health care programs; 142 (32%) of 446 with education programs; and 42 (19%) of 221 with social work programs. Required tuberculin screening was more likely in 4-year schools, in ACHA member vs nonmember schools, schools with a student health clinic vs those without, and schools with immunization requirements.
vs those with no immunization require-
ments (P < .001). Public and private school
students were equally likely to have re-
quired tuberculin screening (64% vs 62%;
P = .21) (Table 2). When schools were di-
vided into quartiles by size of school, 41% of
the schools in the lowest quartile (ie, <852 students) had skin test screening
requirements while 68% to 72% of schools in
each of the other 3 quartiles had screening
requirements.

Reported tuberculin screening prac-
tices of the 378 schools with required
screening are shown in Table 3. Exemptions
from skin test screening were al-
lowed in 85% of the schools for various
reasons such as reports of prior positive skin test results, BCG vaccination, or re-
ligious or philosophical reasons. Tine or
multiple puncture tests were accepted in
25% of the schools. Skin test results
were required to be recorded in millime-
ters of induration in only 25% of the
schools and thus it was not possible to
analyze results by millimeters of indura-
tion. Of the 378 schools with required
screening, only 100 (27%) reported that
they collected all skin test results in a
centralized registry or database.

For new students, tuberculin skin
testing was part of a prematriculation
requirement and these skin tests were
done by each student’s health care pro-
vider and results submitted to the col-
lege or university prior to the student
enrolling. For colleges and universities
that required tuberculin skin testing for
students in specific academic programs
(e.g., nursing, elementary education), this
requirement would occur after the stu-
dent had enrolled, usually when the stu-
dent began working in a health care set-
ting or elementary school. The skin tests
for these students could be done on cam-
pus, if there was a health clinic. Overall,
42% of the 378 colleges and universities
required tuberculin skin tests reported
that no skin testing was done at the
school, 44% could do skin testing on cam-
pus and also accepted results from else-
where, 12% reported that required skin
testing was done on campus only, and 2%
had missing information.

An analyses of screening results were
limited to the 168 schools that required
screening, accepted Mantoux skin tests
only, and reported results of their re-
screening (Table 4). These 168 schools
represent 27% of all schools sur-
vveyed and 66% of schools with required
screening. For all 168 schools combined,
a total of 345 368 students were screened
and 3.1% of the students had positive tu-
berculin skin test results; the median
percent positive for the 168 schools was
0.8%. There was no difference in per-
centage of students with positive skin
test results between schools collecting
results in a central database and schools
using paper records; both found 3% of all
students to have positive skin test re-
sults. When analyzed by type of screen-
ing program, overall percentages of posi-
tive skin test results ranged from 2.1% for
the 16 schools that screened only new
students to 22.9% for the 4 schools that
screened only international students. All
168 schools reported that students with
positive skin test results were referred to
either the health department or their
private physician. Fifty-nine (35%) of
these 168 schools also referred students
to the student health clinic. No informa-
tion was available about any follow-up
for students with positive skin test re-
sults (e.g., chest radiographs, isoniazid
preventive therapy) because it was not
feasible to collect these data from each
student’s private health care provider.
However, 139 (82%) of the 168 schools
had student health clinics on campus and
of these, 52 (37%) reported they could
offer isoniazid at the clinic.

During the 4-year period studied, 114
cases of active tuberculosis disease in stu-
dents were reported from 68 (11%) of the
624 schools surveyed; no tuberculosis
cases were reported in 556 schools (89%).
Of the 114 cases, only 32 cases (26 [81%] of
whom were foreign born) were identified
as a result of required tuberculin skin test
screening; 13 were from schools that re-
quired screening of all new students, 11
from schools screening international stu-
dents, and 8 from screening students in
specific academic programs. Of the 214
schools that required screening of all new
US resident or new international stu-
dents (n = 161) or new international stu-
dents but not new US resident students
(n = 53), enrollment figures for interna-
tional students were not available for 20
schools. (No tuberculosis cases were iden-
tified through required screening at
these 20 schools.) Thus, analysis of rates
of tuberculosis cases identified through
required tuberculin screening was lim-
ited to the 194 schools with enrollment
figures available. Among these schools,
24 cases of tuberculosis were reported to
have been identified through required
screening, for an estimated overall rate of
4.7 per 100 000 students screened. When
analyzed by whether students were US residents or international stu-
dents, international students had mark-
edly higher estimated rates of tubercu-
losis identified through required screen-
ing: 35.2 per 100 000 vs 1.1 per 100 000
among US residents (Table 5). Tuber-
culosis cases rates could not be esti-
mated for the 8 cases (5 of whom were
foreign born) identified through re-
screening in specific academic programs
because no information was avail-
able to estimate the numbers of stu-
dents screened in these programs. Of
the remaining 82 cases of tuberculosis
among students that were not identified
as a result of required screening, 67 were
identified from symptoms or through
contact investigations, and the reason
the case was identified was unknown for
15. Thirty-nine of the 82 cases were US
born, 39 were foreign born, and the birth-
place was unknown for 4.

Table 2.—Factors Associated With Required Tuberculosis Screening

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. (%) of Schools That Require Screening</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Year school</td>
<td>131/254 (52)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>4-Year school</td>
<td>247/350 (71)</td>
<td></td>
</tr>
<tr>
<td>American College Health Assoc membership 160/195 (82)</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>American College Health Assoc nonmember 218/409 (53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public school</td>
<td>191/300 (64)</td>
<td>.21</td>
</tr>
<tr>
<td>Private school</td>
<td>187/304 (62)</td>
<td></td>
</tr>
<tr>
<td>Student health clinic on campus</td>
<td>283/359 (79)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No student health clinic</td>
<td>95/242 (39)</td>
<td></td>
</tr>
<tr>
<td>Immunizations required for school entry</td>
<td>255/333 (77)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No immunizations required</td>
<td>118/261 (45)</td>
<td></td>
</tr>
</tbody>
</table>

*P values computed using the normal approximation for the comparison of 2 proportions.

Table 3.—Reported Practices Among the 378 Schools With Required Tuberculosis Screening

<table>
<thead>
<tr>
<th>Screening Practices</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exempted from screening</td>
<td></td>
</tr>
<tr>
<td>Prior positive skin test results</td>
<td></td>
</tr>
<tr>
<td>BCG vaccine</td>
<td>227 (60)</td>
</tr>
<tr>
<td>Religious/philosophical reasons</td>
<td>123 (33)</td>
</tr>
<tr>
<td>No exemptions</td>
<td>58 (15)</td>
</tr>
<tr>
<td>Type of skin test accepted</td>
<td></td>
</tr>
<tr>
<td>Mantoux only</td>
<td>256 (68)</td>
</tr>
<tr>
<td>Tine (multiple puncture) or Mantoux</td>
<td>95 (25)</td>
</tr>
<tr>
<td>Unknown</td>
<td>27 (7)</td>
</tr>
<tr>
<td>Skin test results recorded as</td>
<td></td>
</tr>
<tr>
<td>Millimeters of induration only</td>
<td>95 (25)</td>
</tr>
<tr>
<td>Millimeters of induration or positive/negative</td>
<td>224 (59)</td>
</tr>
<tr>
<td>Results not recorded</td>
<td>29 (8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>30 (8)</td>
</tr>
<tr>
<td>Central database of skin test results includes</td>
<td></td>
</tr>
<tr>
<td>All students required to be screened</td>
<td>100 (27)</td>
</tr>
<tr>
<td>Only students screened at school</td>
<td>25 (7)</td>
</tr>
<tr>
<td>Only students with positive skin test results</td>
<td>20 (5)</td>
</tr>
<tr>
<td>Results not collected</td>
<td>209 (55)</td>
</tr>
<tr>
<td>Unknown</td>
<td>24 (6)</td>
</tr>
</tbody>
</table>
COMMENT

In the United States, tuberculin screening of the general population is not considered an effective method for identifying infection with *M tuberculosis* or active cases of tuberculosis and is not included as part of the strategy to eliminate tuberculosis from the United States. Studies have shown that widespread tuberculin screening of low-risk populations finds few persons with positive skin test results or active tuberculosis and that targeted screening of high-risk persons is a much more cost-effective approach. The CDC recommends screening only those persons at high risk for infection with *M tuberculosis*. This includes contacts of infectious tuberculosis cases, human immunodeficiency virus (HIV)-infected persons, injection drug users, health care workers, other immunocompromised persons, and foreign-born persons from countries with high tuberculosis rates. This strategy was adopted because tuberculin screening of low-risk persons diverts limited public health resources from higher-priority activities such as treating and following up tuberculosis cases and their contacts. Additionally, it is likely that many positive skin test results from widespread screening in low-risk persons do not represent infection with *M tuberculosis*.

Weighted analysis from our study found that approximately 60% of all US colleges and universities have some form of required tuberculin screening and that 3% of the general student population screened (including international students) had positive skin test results (median percentage of positive test results for these schools, 0.8%). In targeted screening programs, 23% of the international students had positive skin test results. Required tuberculin screening identified few tuberculosis cases. Overall, we estimated that 4.7 tuberculosis cases were identified for every 100,000 students screened. However, the rate of active tuberculosis identified through screening among international students was 32 times higher than among US residents. It is possible that these rates are underestimated if schools were not informed of all tuberculosis cases identified through tuberculin screening. Of the 5 tuberculosis cases identified through required screening who were US residents, 2 were foreign born. Data were not available to determine how many students who were US residents were US born. Because most of the tuberculosis cases among students were not identified as a result of required screening, additional studies examining risk factors for these students might indicate the missed opportunities for preventing the development of tuberculosis.

Our results were limited by the fact that survey questionnaires were not completed by all schools, were completed by a variety of personnel (eg, administrators, student health staff), and medical records were not reviewed by the authors to verify diagnoses. The estimated percentage of students with positive skin test results may be high if schools that instituted required screening did so because of a higher risk of tuberculosis on their campus. Conversely, because many schools exempted students from skin testing those students who had received BCG or reported prior positive skin test results, screening results could underestimate the true prevalence of infection in the student body. Despite these limitations, estimates of the percentage of positive skin test results among US residents are comparable with results of other studies of US populations of similar age.

Problematic screening practices were identified among some schools with required screening and should be highlighted for any institution with, or considering, a screening program. Despite published guidelines recommending only the use of the Mantoux method for skin testing, many schools accepted skin test results from tine tests. Multiple puncture devices are less specific than the Mantoux test and should not be used. Fifty-nine percent accepted skin test results as positive or negative. It is essential that millimeters of induration be recorded because interpretation of skin test results depends on a combination of millimeters of induration and risk factors for tuberculosis. For example, contacts of a tuberculosis case or persons infected with HIV are considered skin test positive at 5 mm induration; foreign-born persons at 10 mm; and persons with no risk factors for tuberculosis infection are considered positive at 15 mm induration. Because tuberculin reactivity as a result of receiving BCG vaccine wanes over time and rarely persists more than 10 years after vaccination, students with a history of BCG vaccination should be included in any tuberculosis skin test screening requirements, unless they provide documentation of a prior positive skin test result. Any student who had received BCG vaccine and has a tuberculin skin test reaction of 10 mm or more of induration should be considered to have a positive reaction and should be referred to a physician to rule out active tuberculosis and evaluate for preventive therapy. Only 25% of schools that required students to be screened collected all results in a database or central registry. Schools must collect and analyze data to determine if screening is necessary on their campus.

Decisions regarding tuberculosis screening in communities are usually based on local epidemiologic data. However, colleges and universities should have their own criteria based on the demographics of their students. If schools require screening for tuberculosis, then (1) the goals of any screening should be clearly defined and mechanisms must be in place to ensure that students receive any follow-up (eg, chest radiographs, medical evaluation, preventive therapy) that is needed; (2) widespread screening of the general student population should not be...
References