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Surveying Tuberculosis Screening Practices of South Carolina Hospital Employees

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Surveying Tuberculosis Screening Practices of South Carolina Hospital Employees

by

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ABSTRACT

BACKGROUND: Every year tuberculosis causes over 10 million cases globally and in recent years has caused over 9,000 cases annually in the United States. TB can be transmitted in hospital settings, and South Carolina hospitals, like hospitals elsewhere in the country, maintain a responsibility to test their employees for this disease. Nosocomial infections of active TB among patients and healthcare workers can be burdensome on hospital resources. Testing healthcare workers and implementing prevention strategies are examples of administrative controls provided in the 2005 guidelines by the Centers for Disease Control and Prevention (CDC). Implementation of administrative controls are considered the most important and are the first tier of the hierarchical control strategies for preventing TB transmission in healthcare settings.

OBJECTIVE: The purpose of this study was to review current employee TB screening practices in South Carolina hospitals, in particular to assess (i) whether they screen using the traditional tuberculin skin test or the newer Interferon Gamma Release Assay; and (ii) whether they have (or have not) performed a formal TB risk assessment following suggested administrative prevention controls from guidelines by the CDC.

METHODS: Utilizing the TB Risk Assessment for healthcare facilities, a questionnaire was designed and distributed via Survey Monkey with the assistance of the South Carolina Hospital Association (SCHA) to member South Carolina healthcare facilities (n=100).

RESULTS: Fifty-one health care facilities participated in the study. Forty-one facilities (84%) reported using the guidelines as a basis for employee TB testing, yet only thirty-four facilities (68%) stated that a formal risk assessment had been performed prior to the survey.

CONCLUSION: The majority of South Carolina hospitals surveyed are adhering to CDC testing guidelines for healthcare employees and conducting a formal risk assessment. Additional training and guidance with all hospital employees would be beneficial in providing consistency of policy implementation across the state. Implementation of administrative controls is critical in preventing TB transmission in hospitals.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

BCG .....Bacillus Calmette - Guérin

CDC .....Centers for Disease Control and Prevention

DOT .....directly observed therapy

ELISA .....enzyme-linked immunosorbent assay

EMB.....ethambutol

FDA.....Federal Drug Administration

HIV .....human immunodeficiency virus

IFN-γ..... interferon gamma

IGRA.....interferon gamma release assay

INH .....isoniazid

LTBI.....latent tuberculosis infection

MDR-TB.....multi-drug resistant tuberculosis

PBMC .....peripheral blood mononuclear cells

PPD .....protein purified derivative

PZA.....pyrazinamide

QFT..... Quantiferon

QFT-G..... Quantiferon Gold

QFT-GIT.....Quantiferon Gold Intube

RIF .....rifampin

SCHA.....South Carolina Hospital Association

SE.....sensitivity

SP ..... specificity

TB ..... tuberculosis

TST ..... tuberculin skin test

WHO ..... World Health Organization

CHAPTER 1

INTRODUCTION

Section 1.1: Statement of the Problem

Global TB incidence in 2017 was 130 cases per 100,000 (The World Health Organization 2018). The number of new cases in the United States was 2.9 per 100,000 persons (CDC 2018). At the local level, South Carolina reported 2 new cases per 100,000 of tuberculosis in the state in 2017 (SCDHEC 2018). Although prior to 2009, South Carolina TB incidence rates were greater than the national TB incidence rates, recent data show the reverse to be true (Arden 2013) [Figure 1.1].

Infections spread in healthcare settings require not only time and investigation but also tracking and treating those possibly infected. This can become especially difficult when a healthcare facility is in a large metropolitan area in which the population (including healthcare workers and patients) is continually changing. Nosocomial TB infections which are latent or present asymptomatically can be burdensome on patients, healthcare workers, and resources.

Historically, occupational exposure among US healthcare workers placed them at higher risk for TB disease and LTBI; however, recent data suggest that like TB rates in the general population, rates among healthcare workers have also declined. (MMWR 2019). In fact, the incidence rates among healthcare workers are similar to the general population. Similarly, a study by Mongkolrattanothai et al found no difference in incidence rates between U. S. healthcare workers and the general population but reported

significant differences in the incidence rates between foreign- born healthcare workers (10.8 cases per 100,000) and US born healthcare workers (0.8 new cases per 100,000) (2019).

While, there have been no reported cases of TB exposure or transmission in South Carolina healthcare facilities in recent years, TB investigations in Greenwood, Rock Hill, and Charleston school districts have resulted in the discovery of at least 2 cases of active TB. High profile incidents of tuberculosis exposure in health care facilities in New York and Texas also emphasized the need to assess guidelines provided to healthcare facilities to prevent transmission of the disease among healthcare patients and workers.

Section 1.2 Purpose of the Study

The purpose of this study is to describe global, national, and local TB incidence and to assess the utilization of administrative controls outlined in the CDC 2005 guidelines by healthcare facilities in South Carolina hospitals. Administrative controls reduce the risk of exposure to infectious TB. These preventive measures include but are not limited to establishing and implementing an infection control program, educating, training, and counseling personnel, patients, and visitors about TB, screening staff, and conducting a risk assessment of the facility. This study focused specifically on the following administrative controls: hospital TB screening tests, hospital employee TB screening procedures, and completion of a hospital risk assessment. Evaluating these administrative controls could have implications to re-evaluate current recommendations and to modify recommendations to reduce unnecessary testing of healthcare workers.

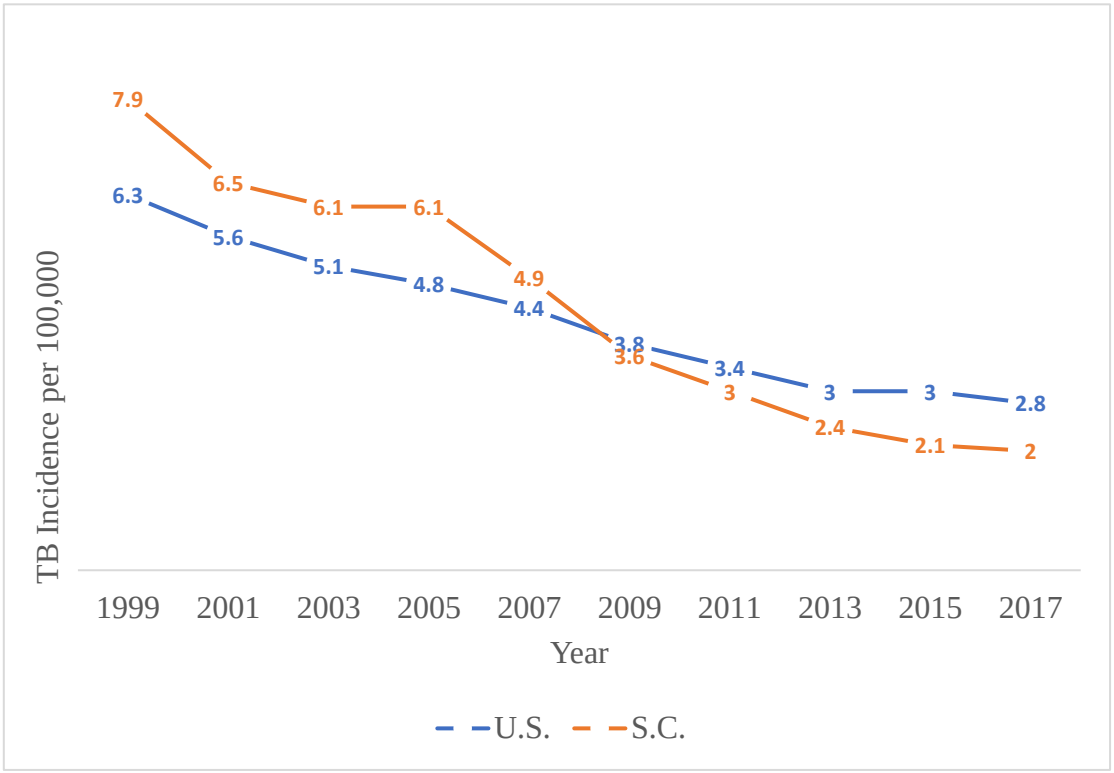

Figure 1.1 TB Incidence per 100,000 Persons for South Carolina and United States, 1999 - 2017

CHAPTER 2

LITERATURE REVIEW

Mycobacterium tuberculosis (MTB), a tubercle bacilli, is the causal agent for tuberculosis (TB). The mycobacterium is resistant to drying and water-based bacterial agents. TB is an airborne disease spread through droplet nuclei from an infectious person and is transmitted primarily through the respiratory tract, although it can also enter the body through mucous membranes and breaks in the skin (Belknap and Daley 2014). Clinical manifestations of TB are presented in three forms: pulmonary, extra pulmonary, and miliary. Pulmonary TB is found in 80% of cases which occur in immunocompetent persons. Symptoms include chest pain, productive cough with or without a bloody sputum, anorexia, fatigue, fever, and chills. Extrapulmonary TB is common in children and immunocompromised persons, and the symptoms are fatigue, night sweats, and issues with the organ system infected. Miliary TB is also found in children and the immunosuppressed; it essentially produces small nodules that infect every organ.

Symptoms of miliary TB are also dependent upon the organs affected in the body. Although TB usually affects the lungs, any tissue or organ of the body (i.e. spine, lymph nodes, heart, or brain) (Golub et al, 2014) may be infected. Once bacteria-laden droplet nuclei reach the alveoli of the lungs, multiplication occur causing latent tuberculosis infection and tuberculosis disease. Latent tuberculosis infection (LTBI) refers to being infected with TB bacteria but the body's immune system prevents sickness and

infectiousness from occurring in an individual. If the body discontinues fighting the bacteria, the bacteria can multiply, and the individual can develop TB disease.

Currently, the tuberculin skin test (TST) and interferon gamma release assays (IGRAs) are used for routine screening for LTBI. TST and IGRAs are also used in conjunction with chest x-rays and sputum collection to test for TB infection in patients being evaluated for LTBI or the actual disease. Treatment of all three forms of TB disease consists of treatment in two phases with a combination of isoniazid, rifampin, pyrazinamide, and ethambutol for 6 to 9 months [Table 2.1] . Observation of each dose of medication, also known as directly observed therapy (DOT) is the now universally recognized as the "standard of care" for treatment of TB disease. In 1921, tuberculosis became one of the first diseases to have a vaccine. The vaccine, created by Albert Calmette and Camille Guérin named Bacillus Calmette-Guérin or BCG, was used quite commonly in Europe to lessen the burden of the disease (Golub, Coberly, & Chaisson, 2014). BCG is still used in many developing countries today to vaccinate infants and healthcare workers.

Section 2.2 Screening Tests

Many of the signs and symptoms of TB disease are nonspecific, and LTBI is asymptomatic, which makes diagnosing TB reliant on screening test to identify those who have disease. Multiple screening tests have been developed over the years, and some screening tests have been used at the same time. Current screening tests include a) the tuberculin skin test (TST), b) Quantiferon Gold Intube (QFT-GIT), c) and T-spot. The sensitivity and specificity of these tests, as documented by the CDC, are provided in Table 2.2 (MMWR 2010). There are two variations of the TST test, one-step TST and the two-step TST. The two-step TST is used to test new employees that will be tested periodically

for TB infection. Two-step TST screening requires persons who test negative during first TST to then have another TST test. While the single or one-step TST test, is the one-time injection of PPD and then a follow-up visit to have the test read.

Several factors affect the agreement of these tests including test interpretation criteria, prevalence of infection, prior BCG vaccination, and co-infection of other diseases.

Some health care facilities use IGRAS in serial testing of workers since CDC guidelines state that in all circumstances in which TST is the current testing method, IGRAS can be substituted in place of the TST. However, serial testing health care workers in low incidence areas with IGRAS results in a decrease in the predictive value of a positive test (Slater 2013). With the availability of multiple tests for screening, deciding which test to utilize can add to the complexity of screening healthcare workers.

Section 2.3: Tuberculosis in Healthcare Settings

Hospitals in the U.S. have experienced TB transmission from healthcare workers to patients. TB transmission occurred in 2003 in the maternity ward and nursery at a New York hospital. Approximately 1500 patients were exposed to infectious pulmonary TB disease by a foreign-born nurse who had been diagnosed with latent TB infection but refused treatment (MMWR 2005). The majority of those exposed could not be located for testing, but it was found that four infants had positive TST results (2005). In Texas in 2014, over 700 infants and 40 employees were exposed to TB by a nurse with TB disease working in an El-Paso hospital. Subsequent testing found five babies tested positive for TB. It was later found that four of the five babies who tested positive were also vaccinated with BCG, which may have resulted in false positives (Bailey 2014).

Section 2.4: South Carolina Hospital Association

Created to set and reach appropriate standards of care, the South Carolina Hospital Association (SCHA) aims to keep patients in the state safe and healthy. SCHA is a private non-profit organization comprised of 100 member hospitals and health systems (e.g. substance abuse centers). Member healthcare facilities range in size from 14 beds to 864 beds. As of 2018, there are 104 hospitals in the state.

Section 2.5: CDC TB Transmission Guidelines

'Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings, 2005', the TB transmission guidelines for healthcare facilities published by the CDC, were a result of several factors (MMWR 2005). Previous guidelines issued first in 1992 and updated in 1994 suggested controlling TB in healthcare facilities through a risk assessment process that corresponded to environmental and respiratory protection. Because of the successful implementation of the 1994 recommendations, TB transmission within healthcare facilities declined.

The guidelines were restructured in 2005 to reflect the changing TB trends in the US, changes in medical practice, and current understanding of the disease. The 2005 CDC guidelines included updates to improve risk assessments, frequency and criteria for testing of healthcare employees, and the types of facilities covered (MMWR 2005). The guidelines provided recommendations primarily for inpatient facilities where healthcare is provided. Divided into hierarchical tiers (administrative controls, environmental controls, and respiratory-protection controls), the guidelines aimed to maintain momentum and to eliminate the threat of nosocomial transmission. These controls were essential in the reduction of TB transmission in health care facilities however notable differences in rates

within geographic areas remained. Thus, depending upon the region, the risk associated with tuberculosis transmission among health care workers would vary.

Per 2005 CDC guidelines, environmental controls consist of ventilation and filtration in healthcare settings to control and to minimize the spread of infectious droplets, and respiratory protection controls limit the risk of exposure in high risk situations through respiratory equipment. This study focused on administrative controls (testing practices specifically). The goal of administrative controls is to reduce the risk of TB infection (MMWR 2005). Administrative controls include conducting facility risk assessments, screening employees, and training employees.

Table 2.1 Tuberculosis Treatment Regimens

	Intensive Phase		Continuation Phase			
Regimen	Drugs	Interval and Dose (minimum duration)	Drugs	Interval and Dose (minimum duration)	Comments	Regimen Effectiveness
1	INH RIF PZA EMB	7 days/week for 8 weeks (56 doses) *Or* 5 days/week for 8 weeks (40 doses)	INH RIF	7 days/week for 18 weeks *Or* 5 days/week for 18 weeks	Preferred regimen for patients with newly diagnosed pulmonary TB.	Greater
2	INH RIF PZA EMB	7 days/week for 8 weeks *Or* 5 days/week for 8 weeks	INH RIF	3 times weekly for 18 weeks	Preferred alternative regime in situations in which more frequent DOT during continuation phase is difficult to achieve	
3	INH RIF PZA EMB	3 times weekly for 8 weeks	INH RIF	3 times weekly for 18 weeks	Use with caution in persons with HIV and/or cavitary disease; Missed doses can lead to relapse and drug resistance	
4	INH RIF PZA EMB	7 days/week for 14 doses then twice weekly for 12 doses	INH RIF	Twice weekly for 18 weeks (36 doses)	Not for persons with HIV or cavitary disease; Missed doses = ineffective.	Lesser

Table 2.2: Tuberculosis Screening Tests

Tests	Testing Process	Limitations	Year Available	SE	SP
Tuberculin Skin Test (TST)	Injection of protein purified derivative (PPD)	Proper administration; Inter-reader inaccuracy and bias; Follow-up visit; False positives due to BCG and nontuberculosis mycobacteria contact	1907 (current method)	95%	85%
Quantiferon TB (QFT)	ELISA measures cell mediated response of IFN-y released in response to PPD	Specificity less than TST	2001(no longer available)		
Quantiferon TB Gold (QFT-G)	Fresh whole blood incubated with controls and separate peptides	Requires trained clinicians and laboratories to test; Time sensitive	2005 (no longer available)		
Quantiferon Gold Intube (QFT-GIT)	Special tubes with control materials and antigens to allow direct testing of fresh blood; IFN-y measured in plasma	Varied interpretation criteria in other countries prior to US FDA approval	2007	84%	99%
T-Spot	PBMCs incubated with controls and peptides; ELISA detects increase in number of cells that secrete IFN-y	Varied interpretation criteria in other countries prior to US FDA approval	2008	91%	88%

CHAPTER 3

METHODS

In order to determine hospital compliance with the 2005 CDC TB guidelines, we needed to contact all 100 health care facilities in South Carolina. We developed questions for use as part of a questionnaire (Appendix A). Specifically, survey questions focused on a) which employees were being screened for TB, b) the frequency of employee testing, and c) whether the hospital had performed a risk assessment (Appendix B) in accordance with the 2005 CDC guidelines. Initial draft of questions was from the risk assessment (Appendix D). SCHA expressed concerns in regards privacy of facilities' data and survey length. The questions were redrafted and restructured to shorten the survey and address privacy whilst still probing for the information that was of interest to the study. Six questions stemmed from the TB risk assessment and 4 questions were the product of the study and the SCHA. Facilities were also asked for suggestions or comments that would be beneficial for TB control in the facility. Although the response rate was high (51%) , data were missing for some questions.

We collaborated with the South Carolina Hospital Association (SCHA) in the survey development and administration, because they were familiar to hospitals in South Carolina and had greater access to this population. Once survey questions were developed, the SCHA edited, formatted and organized the 11 questions into a questionnaire administered via Survey Monkey®. The SCHA Director wrote a letter which accompanied

our questionnaire, notifying the infection control employee completing the questionnaire of the study purpose, how the information would be used, and that participation was voluntary. Survey Monkey® was used, because the SCHA had used this website previously to collect information from hospitals. The survey was deployed in April 2015. The data were compiled by the SCHA who provided the final data in an Excel spreadsheet. A calculator was also developed in Microsoft Excel to calculate the specificity, sensitivity, positive predictive value, negative predictive value, and kappa statistic from screening data.

CHAPTER 4

SOUTH CAROLINA HOSPITAL ASSOCIATION STUDY

BACKGROUND: Seven hundred babies were exposed to TB in a Texas hospital nursery by a hospital employee from August 2013 to September 2014 (Arden 2013), and a nursery and maternity ward in New York City in 2003 reported TB transmission from a nurse to 4 infants (Santora 2005). With Centers for Disease Control (CDC) guidelines to prevent TB transmission in health care settings and advancements in testing, these isolated incidents highlight a deficiency in infection control measures. Implementation of CDC guidelines are important in sustaining the decline of TB in United States especially in South Carolina which often historically ranked in the top ten states with the highest TB case rates.

PURPOSE: The purpose of this study is to determine the use of the Centers for Disease Control and Prevention guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005 in South Carolina health-care facilities.

METHODS: A voluntary questionnaire was compiled in collaboration with the South Carolina Hospital Association (SCHA) and administered via Survey Monkey by the SCHA.

RESULTS: Fifty-one percent (51%) of member facilities of the South Carolina Hospital Association completed the survey. Eighty-four percent of participating facilities were aware of the CDC TB Risk Assessment Guidelines. Furthermore, sixty-eight percent of responding facilities conducted formal risk assessments to assess the need for annual employee

testing. Eighty percent of facilities thought periodic TB training for hospital staff would be beneficial. Sixty-four percent facilities reported that outside assistance for didactic informational sessions on infectious diseases for employees would be useful.

CONCLUSION: The majority of South Carolina healthcare facilities are currently performing risk assessments and utilizing the CDC Risk Assessment Guidelines (2005) for employee TB screening. Despite being classified as low risk facilities, there is continued annual testing of all employees. This may be indicative of some difference in policy at facility level and national level. A few facilities reported having policies issued to them from outside sources. Implementing informational sessions for all employees regarding TB and other infectious disease is not only desired by facilities but would also be beneficial preventing nosocomial transmission.

BACKGROUND

Preventing nosocomial tuberculosis transmission through the screening of health care workers is fundamental for infection control programs. The southern United States has historically had high incidence rates of tuberculosis. South Carolina until 2009 had case rates above the national case rate of TB (Arden 2013). The CDC has had guidelines for the prevention of TB transmission but had to modify those guidelines in the 1994 due to a resurgence of TB, lapses in infection control measures, and co-infection of HIV (MMWR 2005). Although there have been no recent TB outbreaks in a health care facility in South Carolina there have been high profile exposure incidents in Texas and New York health care facilities. A state that only recently fell below the national case rate is a relevant concern, and TB control practices in health care settings should be assessed. The objective

of this study was to assess SC health care facilities and their compliance with the 2005 CDC TB Guidelines.

METHODS

A survey was composed through a collaboration the South Carolina Hospital Association. The survey was administered via Survey Monkey® and sent to 100 member facilities of the South Carolina Hospital Association. Questions in the survey focused on the facility's current testing practices of employees and if the facility utilized the 2005 CDC Risk Assessment as a basis for the facility's testing policies. Facilities were also asked for suggestions or comments that would be beneficial for TB control in the facility.

RESULTS

Fifty-one-member facilities responded to the survey of thirteen questions that probe the practices of South Carolina health care facilities. Thirty-four (68%) facilities reported conducting formal TB risk assessments per the 2005 CDC guidelines for preventing transmission in health care settings to assess whether all employees should be tested annually for TB. Sixteen (31%) of the facilities did not or were not sure if their facility conducted formal TB risk assessments. Although, 84% of the facilities stated that the CDC guidelines was used as a basis for the facility's TB policy. Nearly all respondents (91%) test all employees for TB upon hire and only 2 (4%) facilities do not perform subsequent testing of all employees citing that they are a low risk facility and deem annual testing of all employees unnecessary.

TB screening tests utilized by facilities were also relatively the same with only a few institutions using IGRAS solely for employee testing, although quite a few stated using IGRAS for subsequent testing for employees with positive TSTs. Some facilities also stated

using multiple tests for initial employee testing. Eleven facilities reported using the traditional TST and confirming positives with an IGRA. Majority of subsequent annual testing was performed using the TST and 69% of facilities reported subsequent annual testing of all employees. More than half of the facilities (64%) believe additional assistance would be useful training for employees on not only TB but other infectious diseases.

Surprisingly, the comments from facilities suggested a discord on the process for when an employee tests positive for TB. Some facilities stated having layers of steps while others only had a single step. One facility even stated that the steps would vary depending on whether the employee was diagnosed with LTBI, TB disease, or was felt to have a false positive test. Another facility noted that the guidelines that were adopted in their facility regarding TB control were provided from a corporate office of advisors.

DISCUSSION

Most health care facilities in South Carolina are performing formal TB transmission risk assessments per the 2005 CDC TB Guidelines. However, a few facilities were not or were unsure if their facility had conducted a formal risk assessment. Although most facilities followed up employees whose test results were positive with an IGRA and chest x-ray, the order of testing varied from facility to facility. Due to variations among facilities, it may prove beneficial to have a training or additional guidance at the state level for consistency across the state.

Although the 2005 guidelines do not recommend serial testing of employees in low risk settings, many facilities still conducted annual testing of all employees. This may be the result of "tradition" in that they have always tested everyone annually or possibly the fear of the consequence of not testing everyone yearly. Also, despite the TST's low

specificity, it is the most commonly used test for initial screenings and subsequent screenings in South Carolina facilities. The wide usage of the TST is possibly due to budget restraints of facilities as the TST is not as costly as the IGRAS.

Despite the 2005 guidelines recommendation of annual TB education for all healthcare workers, 64% of facilities indicated an interest in additional training for employees for a variety of infectious diseases including TB. There were also some questions unanswered by facilities which resulted in missing responses. The study is not sure if nonresponse to some questions was due to the individual answering the questions not knowing the response. This may be indicative of the possibility that the person the study wanted to target (infection control personnel and employee health personnel) was not the person responding to the survey.

Eliminating nonessential testing would be beneficial during the current nationwide shortage of one of the TST antigens used for screening (MMWR 2019). Although IGRAS can be used in place of the TST, 73% of SC hospitals reported using TST for annual employee testing. Furthermore, recent data suggests that incidence rates of TB disease and LTBI among healthcare workers are consistent with the incidence rates of the general population. Thus, updates to the 2005 have been provided by CDC to limit employee testing after baseline and the absence of on-going transmissions. Recommendations for 2019 include a personal risk assessment to be used in addition to the recommendations provided in 2005 (MMWR 2019). While nosocomial TB transmission is not eradicated, successful implementation of CDC 2005 guidelines has mitigated the threat. As the trends are followed, guidelines will continue to be modified to prevent TB transmission and protect hospital employees and patients.

Additional research should be done with health care facilities outside of the SCHA and with employee TB testing data to gain better representation of TB in health care workers in South Carolina. These factors were significant in deciding to collaborate with the organization however, some of the scope of the study was limited in that no demographic information was collected, non-response to some questions, and only member institutions of the SCHA were selected as participants.

Table 4.1: TB Testing Practices in South Carolina Hospitals

	Frequency	Percentage	No Response
Awareness of CDC Risk Assessment			
Yes	41	84	2
No	0		
Not Sure	8	16	
Perform formal TB Risk Assessment			
Yes	34	68	1
No	7	14	
Not Sure	9	18	
All employees tested upon hire			
Yes	47	94	1
No	3	6	
Not Sure	0		
Ambulatory setting employee testing			
Yes	37	100	14
No	0		
Not Sure	0		
Direct patient contact testing only			
Yes	12	27	6
No	33	73	
Not Sure	0		
Initial screening test			
Single TST only	2	4	6
Two-step TST only	33	73	
Quantiferon only	2	4	
T-spot only	1	2	
TST and IGRA	7	16	
Employees tested annually			
All employees	25	69	15
Subset (high-risk) employees	11	31	
Screening test used for annual testing			
TST only	20	91	29
IGRA only	2	9	
Periodic TB training			
Yes	36	80	6
No	5	11	
Not sure	4	9	
Additional assistance useful			
Yes	29	64	5
No	16	36	

Percentages calculated upon response obtained. N = 51 total respondents.

CHAPTER 5

DISCUSSION

Advanced in TB infection detection and guidelines for preventing transmission in health care settings have resulted in low risk for TB infection for health care workers in the United States and in South Carolina. Until 2019, the CDC had not updated the 2005 guidelines for tuberculosis transmission in healthcare settings. Differences in sensitivity and specificity of screening tests used to test hospital employees add to the complexity of preventing TB transmissions in hospitals as some hospitals reported using multiple tests within a facility. Serial testing with different tests can result in poor agreement among tests. In addition, the CDC has updated tuberculosis screening guidelines of health care workers in the United States [Appendix D]. While the new guidelines provide additional recommendations for screening healthcare employees, much of the old guidelines are still in effect. The new guidelines suggest the baseline testing of all healthcare workers in addition to an individual risk assessment being performed to reduce number of subsequent tests and not routinely screening workers without LTBI. Therefore, the new guidelines provide additional support that the 2005 guidelines needed to be re-assessed and modified to follow the trend of tuberculosis in healthcare facilities in the United States.

Furthermore, the CDC's 2005 guidelines for preventing TB transmission in health care facilities have been successful in preventing TB infection. With the new recommendations set forth in the 2019 CDC guidelines may allow for allocation of

resources for other purposes. Further research should seek to find whether healthcare facilities have additional or different guidelines at an institutional level and what similarities, or differences exist between them and the national guidelines. Consistency is key in order to prevent the spread of TB within the healthcare setting.

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APPENDIX A: THE SURVEY

The Arnold School of Public Health and the South Carolina Hospital Association, in a collaborative effort to determine M. Tuberculosis testing policies of South Carolina Hospital employees, request the participation of your facility.
All individual responses will be kept confidential and only aggregate data will be available. If there are any questions or concerns that you would like addressed, please contact Dr. Rick Foster of the South Carolina Hospital Association at rfoster@scha.org or (803) 744-3538.

We thank you in advance for your participation.

1. Please fill out the information below.
Name of Person completing survey:
Name of Facility:

2. **Please answer the questions below.**

2a. Does your facility use the CDC Risk Assessment Recommendations published in the MMWR of December 30, 2005 as the basis for its employee TB policy guidelines?

Yes No Not sure

2b. Has your facility conducted a formal "TB Risk assessment" (as per the MMWR 2005 guidelines) to help assess whether TB testing does or does not need to be conducted annually for all employees? Yes No Not sure

3. Are all employees tested for TB when initially hired ? Yes No
4. If your institution has physician clinics which are not hospital-based, do you require employees in these ambulatory care settings to have initial and/or subsequent annual TB testing? Yes No Not sure

5. Do you conduct initial or subsequent TB testing for employees only with direct patient contact? Yes No

5a. Please provide any additional comments if necessary.

6. How is you initial TB screening conducted? (select all that apply)
   a. single "tuberculin skin test"?
   b. 2-step" tuberculin skin testing?
   c. Quantiferon Test (an IGRA test)?
   d. T-Spot test (an IGRA test)?
   e. traditional tuberculin skin test, and "positive tests" are then "confirmed with one of the IGRA tests

7. Annual Testing (select all that apply)
   a. Subsequent annual testing is done for all employees
   b. Subsequent annual testing is done just for a subset of employees (e.g. just for "high-risk" employees)
   c. Subsequent annual testing is done with a traditional "tuberculin skin test"
   d. Subsequent annual testing is done just with the Quantiferon Test (an IGRA test)
   e. Subsequent annual testing is done just with the T-Spot test (an IGRA test)
   f. Subsequent annual testing is done with a traditional tuberculin skin test, and "positive tests" are then "confirmed with one of the IGRA

8. Please answer the following:
Does your facility conduct any periodic (e.g. annual or other?) information sessions to provide "basic information about TB" and to explain details about "employee TB testing"?
Yes No Not sure

9. Please answer the following:
Would outside assistance with a didactic session (e.g. annual) for employees providing information about infectious diseases in the hospital setting (e.g. concerning tuberculosis, influenza, hepatitis B, HIV, Ebola etc) be useful? Yes No

10. What is your hospital procedure if a staff member tests positive for TB?

11. What additional comments, questions or suggestions do you have concerning policies and training regarding infectious diseases of concern to employees (e.g. influenza, hepatitis B etc) in general or regarding tuberculosis in particular?

APPENDIX B: PRELIMINARY HOSPITAL QUESTIONNAIRE

1. Which of these best describes your hospital's policy?

a) All hospital employees are tested annually

b) Employees are tested upon hire only

c) All employees are tested upon hire and annually thereafter

d) Annual testing is limited to specific departments or workers (check all that apply)

__Physicians __Laboratory personnel __Mid-level practitioners (NPs and Pas)

__Nurses __Maintenance or engineering staff __ Janitorial staff

__Administrators __Transportation staff __Dietary staff

__Contract staff __Students __Service personnel

__Construction or renovation staff

__Other (specify) _____

2. Which test does your facility utilize for upon hire TB screening?
a) Two-step TST
b) Interferon Gamma Release Assay;
Which one:_____
c) Symptom screen

3. Which test does your facility utilize for annual testing?
a) Two-step TST
b) Interferon Gamma Release Essay;
Which one:_____
c) Symptom screen

4. How often are TB risk assessments conducted at this facility?
a) 1> year b) 1 per year c) 2 ≥ per year d) Facility does not conduct risk assessments

5. How often does this facility conduct training and education for employees regarding TB with focus on prevention, transmission, and symptoms?

a) 1> year
b) 1 per year
c) 2 ≥ per year
d) Facility does not conduct risk assessment

6. Does the facility utilize CDC's TB Risk Assessment Recommendations from MMWR December 30, 2005 for TB policy guidelines?
a)Yes; Facility utilizes all of the recommendations.
b) Yes; Facility utilizes some of the recommendations.
c) Not Sure
d) No; Facility utilizes none of the recommendations.

7. If you answered No to the previous question, which best describes why your facility does not utilize CDC's TB Risk Assessment Recommendations from MMWR December 30, 2005 for TB policy guidelines? (Check the one that best applies).

__Not helpful __Cumbersome __Cost ineffective

__Other (specify) _____

8. Have employees in your facility experienced conversion to TB disease among employees who previously tested negative?
a)Yes
b) No
9. If you answered yes to Question 8, please indicate the following:
a) Number of Employees:_____
b) Primary Test Used:_____
c) Secondary Test Used:_____
d) If second test is different from primary test, does your facility currently use the secondary test now as its primary test? Please select: _____ YES _____NO; why not?

_____
_____
_____
_____
_____
_____

10. What suggestions do you/your facility have in regards to controlling and preventing M.Tuberculosis transmission in your facility?

APPENDIX C: TB RISK ASSESSMENT WORKSHEET

This model worksheet should be considered for use in performing TB risk assessments for healthcare facilities and nontraditional facility-based settings. Facilities with more than one type of setting will need to apply this table to each setting.

Scoring √ or Y = Yes X or N = No NA = Not Applicable

1. Incidence of TB

What is the incidence of TB in your community (county or region served by the health-care setting), and how does it compare with the state and national average? What is the incidence of TB in your facility and specific settings and how do those rates compare? (Incidence is the number of TB cases in your community the previous year. A rate of TB cases per 100,000 persons should be obtained for comparison.)* This information can be obtained from the state or local health department. Community rate_____

State rate _____

National rate _____

Facility rate _____

Department 1 rate _____

Department 2 rate _____

Department 3 rate _____

Are patients with suspected or confirmed TB disease encountered in your setting (inpatient and outpatient)? Yes No

If yes, how many patients with suspected and confirmed TB disease are treated in your health-care setting in 1 year (inpatient and outpatient)? Review laboratory data, infection-control records, and databases containing discharge diagnoses. Year No. patients

Suspected Confirmed

1 year ago _____ _____

2 years ago _____ _____

5 years ago _____ _____

If no, does your health-care setting have a plan for the triage of patients with suspected or confirmed TB disease? Yes No

Currently, does your health-care setting have a cluster of persons with confirmed TB disease that might be a result of ongoing transmission of

Mycobacterium tuberculosis within your setting (inpatient and outpatient)? Yes No

2. Risk Classification

Inpatient settings

How many inpatient beds are in your inpatient setting?

How many patients with TB disease are encountered in the inpatient setting in 1 year? Review laboratory data, infection-control records, and databases containing discharge diagnoses. Previous year _____ 5 years ago _____

Depending on the number of beds and TB patients encountered in 1 year, what is the risk classification for your inpatient setting? (See Appendix C.) o Low risk o Medium risk o Potential ongoing transmission

Does your health-care setting have a plan for the triage of patients with suspected or confirmed TB disease? Yes No

Outpatient settings

How many TB patients are evaluated at your outpatient setting in 1 year? Review laboratory data, infection-control records, and databases containing discharge diagnoses.

Previous year _____ 5 years ago _____

Is your health-care setting a TB clinic?

(If yes, a classification of at least medium risk is recommended.) Yes No

Does evidence exist that a high incidence of TB disease has been observed in the community that the health-care setting serves? Yes No

Does evidence exist of person-to-person transmission of M. tuberculosis in the health-care setting? (Use information from case reports. Determine if any tuberculin skin test [TST] or blood assay for M. tuberculosis [BAMT] conversions have occurred among health-care workers [HCWs]). Yes No

Does evidence exist that ongoing or unresolved health-care–associated transmission has occurred in the health-care setting (based on case reports)? Yes No

Is there a high incidence of immunocompromised patients or HCWs in the health-care setting? Yes No

Have patients with drug-resistant TB disease been encountered in your healthcare setting within the previous 5 years? Yes No

Year _____

When was the first time a risk classification was done for your health-care setting? _____

Considering the items above, would your health-care setting need a higher risk classification? Yes No

Depending on the number of TB patients evaluated in 1 year, what is the risk classification for your outpatient setting? (See Appendix C) o Low risk o Medium risk o Potential ongoing transmission

Does your health-care setting have a plan for the triage of patients with suspected or confirmed TB disease? Yes No

Nontraditional facility-based settings

How many TB patients are encountered at your setting in 1 year? Previous year 5 years ago _____ _____

Does evidence exist that a high incidence of TB disease has been observed in the community that the setting serves? Yes No

Does evidence exist of person-to-person transmission of M. tuberculosis in the setting? Yes No

Have any recent TST or BAMT conversions occurred among staff or clients? Yes No

Is there a high incidence of immunocompromised patients or HCWs in the setting? Yes No

Have patients with drug-resistant TB disease been encountered in your healthcare setting within the previous 5 years? Yes No

Year _____

When was the first time a risk classification was done for your setting?

Considering the items above, would your setting require a higher risk classification? Yes No

Does your setting have a plan for the triage of patients with suspected or confirmed TB disease? Yes No

Depending on the number of patients with TB disease who are encountered in a nontraditional setting in 1 year, what is the risk classification for your setting?

(See Appendix C) o Low risk o Medium risk o Potential ongoing transmission

3. Screening of HCWs for M. tuberculosis Infection

Does the health-care setting have a TB screening program for HCWs? Yes No

If yes, which HCWs are included in the TB screening program? (Check all that apply.) o Physicians

o Mid-level practitioners (nurse practitioners [NP] and physician's assistants [PA])

o Nurses o Administrators o Laboratory workers o Respiratory therapists o Janitorial staff

o Maintenance or engineering staff o Transportation staff o Dietary staff o Receptionists

o Trainees and students o Volunteers

o Others_____

o Physical therapists o Contract staff

o Construction or renovation workers o Service workers

Is baseline skin testing performed with two-step TST for HCWs? Yes No

Is baseline testing performed with QFT or other BAMT for HCWs? Yes No

How frequently are HCWs tested for M. tuberculosis infection?

Are the M. tuberculosis infection test records maintained for HCWs? Yes No

Where are the M. tuberculosis infection test records for HCWs maintained? Who maintains the records?

If the setting has a serial TB screening program for HCWs to test for M. tuberculosis infection, what are the conversion rates for the previous years? †

1 year ago _____ 4 years ago _____

2 years ago _____ 5 years ago _____

3 years ago _____

Has the test conversion rate for M. tuberculosis infection been increasing or decreasing, or has it remained the same over the previous 5 years? (check one) o Increasing o Decreasing o No change

Do any areas of the health-care setting (e.g., waiting rooms or clinics) or any group of HCWs (e.g., lab workers, emergency department staff, respiratory therapists, and HCWs who attend bronchoscopies) have a test conversion rate for M. tuberculosis infection that exceeds the health-care setting's annual average? Yes No

If yes, list _____

_____ _____

For HCWs who have positive test results for M. tuberculosis infection and who leave employment at the health setting, are efforts made to communicate test results and recommend follow-up of latent TB infection (LTBI) treatment with the local health department or their primary physician? Yes No Not applicable

4. TB Infection-Control Program

Does the health-care setting have a written TB infection-control plan? Yes No

Who is responsible for the infection-control program?

When was the TB infection-control plan first written?

When was the TB infection-control plan last reviewed or updated?

Does the written infection-control plan need to be updated based on the timing of the previous update (i.e., >1 year, changing TB epidemiology of the community or setting, the occurrence of a TB outbreak, change in state or local TB policy, or other factors related to a change in risk for transmission of M. tuberculosis)? Yes No

Does the health-care setting have an infection-control committee (or another committee with infection control responsibilities)? Yes No

If yes, which groups are represented on the infection-control committee? (Check all that apply.) o Laboratory personnel o Physicians o Health and safety staff o Nurses o Administrator o Epidemiologists o Risk assessment o Engineers o Quality control (QC) o Pharmacists o Others (specify)_____

If no, what committee is responsible for infection control in the setting?

5. Implementation of TB Infection-Control Plan Based on Review by Infection-Control Committee

Has a person been designated to be responsible for implementing an infection-control plan in your health-care setting? If yes, list the name: _____ Yes No

Based on a review of the medical records, what is the average number of days for the following:

- Presentation of patient until collection of specimen _____
- Specimen collection until receipt by laboratory _____
- Receipt of specimen by laboratory until smear results are provided to health-care provider _____
- Diagnosis until initiation of standard antituberculosis treatment _____
- Receipt of specimen by laboratory until culture results are provided to health-care provider _____
- Receipt of specimen by laboratory until drug-susceptibility results are provided to health-care provider _____
- Receipt of drug-susceptibility results until adjustment of antituberculosis treatment, if indicated _____
- Admission of patient to hospital until placement in airborne infection isolation (AII) _____

Through what means (e.g., review of TST or BAMT conversion rates, patient medical records, and time analysis) are lapses in infection control recognized?

What mechanisms are in place to correct lapses in infection control?

Based on measurement in routine QC exercises, is the infection-control plan being properly implemented? Yes No

Is ongoing training and education regarding TB infection control practices provided for HCWs? Yes No

Which environmental controls are in place in your health-care setting? (Check all that apply and describe)

Environmental control Description o AII rooms _____

6. Laboratory Processing of TB-Related Specimens, Tests, and Results Based on Laboratory Review

Which of the following tests are either conducted in-house at your healthcare setting's laboratory or sent out to a reference laboratory? In-house Sent out

Acid-fast bacilli (AFB) smears

Culture using liquid media (e.g., Bactec and MB-BacT)

Culture using solid media

Drug-susceptibility testing

Nucleic acid amplification (NAA) testing

What is the usual transport time for specimens to reach the laboratory for the following tests?

AFB smears _____

Culture using liquid media (e.g., Bactec, MB-BacT) _____

Culture using solid media _____
Drug-susceptibility testing _____
Other (specify) _____
NAA testing _____

Does the laboratory at your health-care setting or the reference laboratory used by your health-care setting report AFB smear results for all patients within 24 hours of receipt of specimen? Yes No

What is the procedure for weekends?

7. Environmental Controls

o Local exhaust ventilation (enclosing devices and exterior devices) _____ o General ventilation (e.g., single-pass system, recirculation system.) _____

o Air-cleaning methods (e.g., high-efficiency particulate air [HEPA] filtration and ultraviolet germicidal irradiation [UVGI]) _____

What are the actual air changes per hour (ACH) and design for various rooms in the setting?

Room ACH Design

Which of the following local exterior or enclosing devices such as exhaust ventilation devices are used in your health-care setting? (Check all that apply) o Laboratory hoods o Booths for sputum induction

o Tents or hoods for enclosing patient or procedure

What general ventilation systems are used in your health-care setting? (Check all that apply) o Single-pass system o Variable air volume (VAV) o Constant air volume (CAV) o Recirculation system o Other_____

What air-cleaning methods are used in your health-care setting? (Check all that apply)

HEPA filtration o Fixed room-air recirculation systems o Portable room-air recirculation systems

UVGI

o Duct irradiation o Upper-air irradiation o Portable room-air cleaners

How many AII rooms are in the health-care setting?

What ventilation methods are used for AII rooms? (Check all that apply) Primary (general ventilation):

o Single-pass heating, ventilating, and air conditioning (HVAC) o Recirculating HVAC systems

Secondary (methods to increase equivalent ACH):

o Fixed room recirculating units o HEPA filtration o UVGI

o Other (specify) _____

Does your health-care setting employ, have access to, or collaborate with an environmental engineer (e.g., professional engineer) or other professional with appropriate expertise (e.g., certified industrial hygienist) for consultation on design specifications, installation, maintenance, and evaluation of environmental controls? Yes No

Are environmental controls regularly checked and maintained with results recorded in maintenance logs? Yes No

Are AII rooms checked daily for negative pressure when in use? Yes No

Is the directional airflow in AII rooms checked daily when in use with smoke tubes or visual checks? Yes No

Are these results readily available? Yes No

What procedures are in place if the AII room pressure is not negative? _____

Do AII rooms meet the recommended pressure differential of 0.01-inch water column negative to surrounding structures? Yes No

8. Respiratory-Protection Program

Does your health-care setting have a written respiratory-protection program? Yes No

Which HCWs are included in the respiratory protection program? (Check all that apply)

o Physicians

o Mid-level practitioners (NPs and PAs) o Nurses o Administrators o Laboratory personnel

o Contract staff

o Construction or renovation staff o Service personnel o Janitorial staff

o Maintenance or engineering staff

o Transportation staff o Dietary staff o Students

o Others (specify)_____ _____

Are respirators used in this setting for HCWs working with TB patients? If yes, include m model, and specific application (e.g., ABC model 1234 for bronchoscopy and DEF model contact with infectious TB patients).

Manufacturer Model Specific application Manufacturer, 5678 for routine

Is annual respiratory-protection training for HCWs performed by a person with advanced training in respiratory protection? Yes No

Does your health-care setting provide initial fit testing for HCWs? If yes, when is it conducted? _____ Yes No

Does your health-care setting provide periodic fit testing for HCWs?

If yes, when and how frequently is it conducted? _____ Yes No

What method of fit testing is used? Describe.

Is qualitative fit testing used? Yes No
Is quantitative fit testing used? Yes No

9. Reassessment of TB risk

How frequently is the TB risk assessment conducted or updated in the health-care setting?

When was the last TB risk assessment conducted?

What problems were identified during the previous TB risk assessment?

What actions were taken to address the problems identified during the previous TB risk assessment?

Did the risk classification need to be revised as a result of the last TB risk assessment?

Yes No

* If the population served by the health-care facility is not representative of the community in which the facility is located, an alternate comparison population might be appropriate.

† Test conversion rate is calculated by dividing the number of conversions among HCWs by the number of HCWs who were tested and had prior negative results during a certain period (see Supplement, Surveillance and Detection of M. tuberculosis infections in Health-Care Settings).

APPENDIX D: TUBERCULOSIS BASELINE PERSONNEL ASSESSMENT

BOX. Indicators of risk* for tuberculosis (TB) at baseline health care personnel assessment†

Health care personnel should be considered to be at increased risk for TB if they answer "yes" to any of the following statements.

1. Temporary or permanent residence (for ≥1 month) in a country with a high TB rate (i.e., any country other than Australia, Canada, New Zealand, the United States, and those in western or northern Europe)

Or

2. Current or planned immunosuppression, including human immunodeficiency virus infection, receipt of an organ transplant, treatment with a TNF-alpha antagonist (e.g., infliximab, etanercept, or other), chronic steroids (equivalent of prednisone ≥15 mg/day for ≥1 month), or other immunosuppressive medication

Or

3. Close contact with someone who has had infectious TB disease since the last TB test

Abbreviation: TNF = tumor necrosis factor.

* Individual risk assessment information can be useful in interpreting TB test results. Lewinsohn DM, Leonard MK, LoBue PA, et al. Official American Thoracic Society/Infectious Diseases Society of America/Centers for Disease Control and Prevention clinical practice guidelines: diagnosis of tuberculosis in adults and children. Clin Infec Dis 2017;64:111–5). https://academic.oup.com/cid/article/64/2/111/2811357external icon

† Adapted from a tuberculosis risk assessment form developed by the California Department of Public Health. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/TBCB-CA-TB-Risk-Assessment-and-Fact-Sheet.pdfpdf iconexternal icon.

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