Toolkit for Responding to TB Exposures in Neonatal Hospital Settings

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1 CONTENTS

PART 1: BACKGROUND, METHODOLOGY, OVERVIEW

2 INTRODUCTION

Tuberculosis (TB) exposures can occur anywhere; contact investigations help public health workers identify groups of people or locations where tuberculosis might have been transmitted. When exposures occur in high-risk settings such as neonatal intensive care units or well-baby nurseries, the need to identify risk factors and exposed infants expediently is increased, as young infants infected with TB can progress quickly and develop severe disease. A thorough contact investigation is imperative and will require unique partners.

Early coordination with invested partners is important for a quick and thorough contact investigation. Partners in these investigations often include multiple individuals at the hospital such as: infection control, occupational health, building engineers, and risk management.

Healthcare settings are unique environments in which TB can spread, especially when infected individuals are undiagnosed for prolonged periods of time. Close contact between healthcare providers and patients, aerosolizing procedures, shared patient rooms, and potentially infected air spaces can all contribute to spread of tuberculosis. Because of these risks, the Centers for Disease Control and Prevention published in 1994 and updated in 2005 "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Settings, 2005"[1]. This guide reviews fundamentals of TB prevention and includes many recommendations for preventing transmission in health-care settings that include employee screening and education programs, environmental controls, and management of patients with suspected or confirmed tuberculosis.

The Occupational Safety and Health Administration (OSHA) additionally regulates TB standards for health-care workers, and in some cases, regulations might vary from state to state. Information on general TB standards can be found on the Occupational Safety and Health Administration website (https://www.osha.gov/tuberculosis/standards) with California-specific information available in Title 8 of the California Code of Regulations (https://www.dir.ca.gov/title8/5199.html) and Title 22; more information on California-specific laws for TB screening of healthcare personnel can be found on the California TB Controllers' website (https://ctca.org/guidelines/healthcarepersonnel/).

PURPOSE

The purpose of this toolkit is to provide information for responding to neonatal exposures in hospital settings.

INTENDED AUDIENCE

This toolkit is designed for use by local health departments that are coordinating tuberculosis contact investigations with hospitals in response to neonatal in-hospital TB exposures.

OVERVIEW

First, we review general hospital safeguards meant to limit spread of TB in hospitals and review the basic tenants of contact investigations with special considerations for neonatal hospital

settings and infants. Next, is a literature review and a summary of previous experience and infection rates detected in past exposures in California. In the next section, we review special characteristics of neonatal intensive care nurseries that will help determine the exposure risk posed to infants, their caregivers, and hospital employees. This section can help inform the basic initial steps you can take to gather transmission information in a timely manner. Finally, we provide editable checklists and spreadsheets to help organize your investigation, sample templates for notifications and press releases, and some brief educational documents on TB, testing results, and infant TB.

2.1 General Guidance

This document provides tools and general guidance for responding to potential exposures in healthcare settings with young infants (from birth until discharge from a nursery or neonatal intensive care nursery). The tools and guidance in this document were informed by the experience accumulated by CDPH, the California Pediatric expert network and evidence published in the literature. The published literature, experience, and data summaries were reviewed by the network and major steps for responding to exposures supported by the listed contributors.

2.2 Methods

- Literature Review
  We performed a retrospective review of the international literature since 1974 and reviewed available California state and local health department records between 2008-2018 on contact investigations involving neonatal intensive care units or newborn nurseries. We summarized reported latent LTBI and TB disease rates among exposed individuals in these settings.

- Resources and Tools
  Resources were gathered and edited from a variety of sources. Many resources had been developed internally at the California Department of Public Health (CDPH) during previous contact investigations. Some resources were designed by a pediatric infectious disease physician (Tara Greenhow) working with CDPH on local exposures in California. Other resources were adapted from publicly available resources from the Curry and Heartland Tuberculosis Centers and the Centers for Disease Control and Prevention (CDC).

2.3 Disclaimers

Some of the recommendations in this document are based on agreement among several pediatric TB experts and cannot necessarily be found in the evidence-based literature. Use of these resources are meant for local health jurisdictions and designed to be edited to meet the needs of the jurisdiction. Resources in this document can be modified according to local experience and specific situations.

2.4 Abbreviations

TB – tuberculosis

LTBI – latent tuberculosis infection

TST – tuberculin skin test

PPD – purified protein derivative, used in the tuberculin skin test. PPD/TST refer to the same test

IGRA – interferon gamma release assay

CXR – chest x-ray

PE – physical examination

CGA – corrected gestational age. This is the baby's age in weeks (since birth) MINUS the number of weeks the baby was born pre-term (i.e., number of weeks born before 40 weeks).

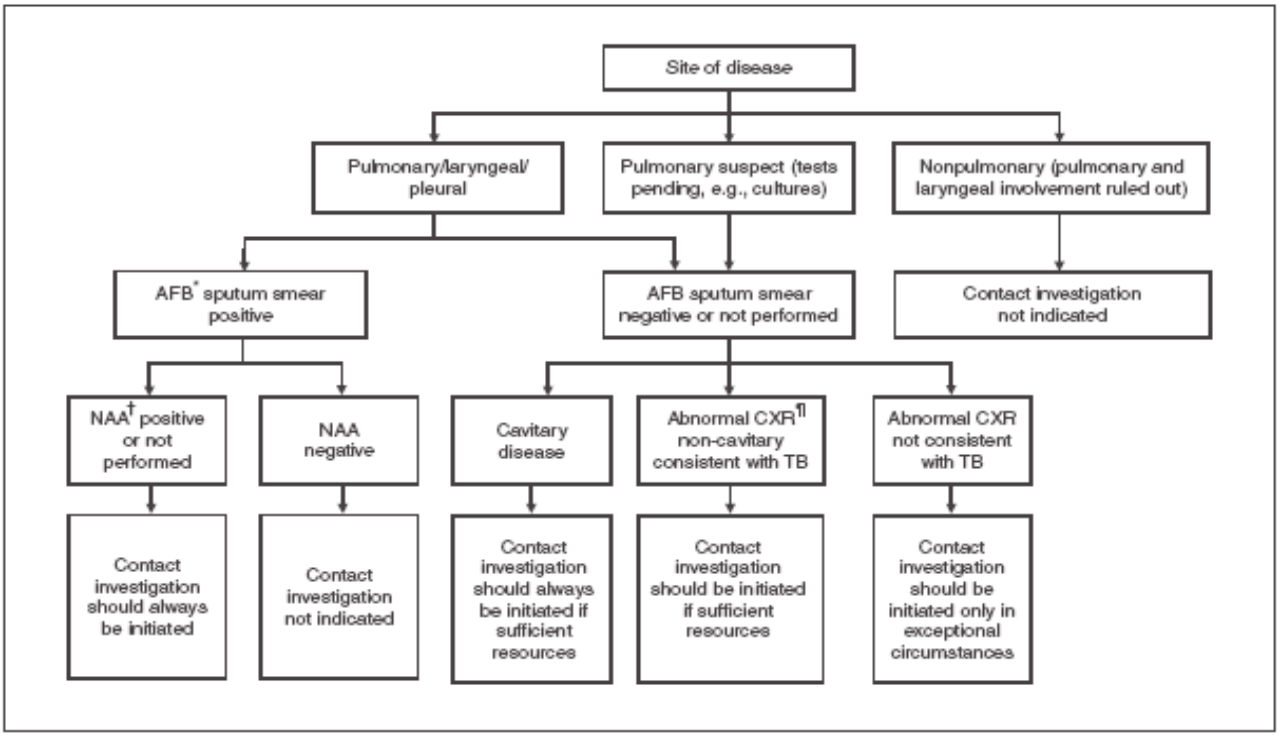
3 SPECIAL CONSIDERATIONS ~ DETERMINING NEED FOR AND EXTENT OF A CONTACT INVESTIGATION

3.1 CONTACT TRACING BASICS

The basic tenants of contact tracing are to identify contacts to an infected individual in order to 1) notify the contact of the exposure, 2) evaluate the contact for signs or symptoms of disease, 3) test the contact for evidence of infection, and 4) isolate and/or treat the contact, as needed to prevent further spread of disease in the community. CDC's "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis" is a useful tool that outlines the steps for contact tracing [2].

Overall, contact tracing in a hospital setting is similar to contact tracing in the community. The index patient's medical record should be reviewed to identify risk factors for infectiousness, and the patient should be carefully interviewed to identify close contacts both inside and outside of the work setting. Use of a nucleic acid amplification test (NAA) per the below table [2]), helps to more quickly identify TB disease and can help to differentiate between tuberculosis and other non-tuberculous bacteria. Patients with smear negative TB who are ultimately culture positive can sometimes be identified by NAA much earlier than waiting for culture growth. If a contact tracing is initiated, an infectious period should be determined (usually 3 months prior to onset of symptoms) and all contacts should be identified.

FIGURE 1. Decision to initiate a tuberculosis (TB) contact investigation



* Acid-fast bacilli.
† Nucleic acid assay.
§ According to CDC guidelines.
¶ Chest radiograph.

Source: Centers for Disease Control and Prevention (CDC) Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis. https://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf.

In the above Figure 1, patients with pulmonary or laryngeal disease who are sputum smear positive and NAA negative might not initially require a contact investigation as a non-tuberculous mycobacterial infection would be suspected. However, if TB grows on culture, a contact investigation should be initiated.

Household members are typically the highest priority for immediate evaluation, as they often have the most close and cumulative exposure. Testing of household members can provide quick information on extent of the index patient's infectiousness. The next highest risk group would be the non-household close contacts who spent a substantial time with the index patient during the infectious period. These contacts might be good friends, travel companions, or work colleagues. All contacts should be grouped by extent of exposure, and the evaluation of contacts should start with those with the most exposure. If there is evidence of spread in the groups with higher exposure, the evaluation of the group with the next highest level of exposure should begin. Continual expansion to additional contacts with less exposure, allows for contact tracing expansion in a graduated approach that is based on the findings at each stage of the investigation. As described in the CDC's general guidance for these investigations, particular attention should also be given to contacts at increased risk of TB progression.

3.2 CONTACT TRACING IN HOSPITALS

Decisions regarding whether or not to initiate contact investigations in health-care settings include several unique parameters. CDC notes general guidelines related to TB contact investigations within hospitals:

> *Infection control practitioners, although vital partners in these settings, might not be familiar with TB contact investigations. Multiple settings have engineers who can describe and test the environmental systems. Such an investigation should be planned jointly as a collaboration between the setting and the health department. Initial discussions should include data sharing and divisions of responsibilities. Liability, regulations, confidentiality, media coverage, and occupational safety are complex for health-care settings. Occupational Safety and Health Administration rules, which are interpreted differently by different jurisdictions, might require hospital administrators to report when employees are reported to be infected from occupational exposure. Public health officials should consider inviting legal counsel to the initial planning sessions with health-care administrators.*
>
> *The majority of health-care settings have policies for testing employees for M. tuberculosis infection at the time of employment and, in settings where exposure is anticipated, periodically thereafter. Test results are helpful as baseline data. The availability of baseline results for contacts*

who were patients or clients of the setting is variable; long-term care facilities might have these data [2]

3.2.1 Environmental Controls

As suggested by the CDC, an initial consideration in health-care settings include the environmental controls in the area(s) in which the source case was present. Variables such as the air volume, exhaust rate, and circulation greatly influence whether or not TB is transmitted within enclosed spaces. A review of the environmental controls can help determine the need or extent of a health-care related contact investigation. Building and/or HVAC engineers are typically necessary to help understand the airflow and air changes per hour (ACH) in a given building, or certain areas within a hospital. Typically, hospitals have very high air exchange rates that help limit the accumulation of TB. Knowledge of the ventilation system including single-pass air flow verses re-circulated air helps identify if and where exposures might have occurred. Additional systems such as HEPA filters and UV filtration help reduce risk of tuberculosis transmission where air is re-circulated. Many hospitals have high-quality ventilation that helps reduce the extent of tuberculosis exposures.

The Curry International Tuberculosis Center has a resource called "Tuberculosis Infection Control: A Practical Manual for Preventing TB" that contains a detailed chapter on environmental control that can help to reduce the risk of TB transmission. The guide can also be used to help determine risks associated with TB transmission depending on controls that might be present in a given hospital unit [3].

	Minutes required for removal efficiency†	
ACH	99%	99.9%
2	138	207
4	69	104
6	46	69
12	23	35
15	18	28
20	14	21
50	6	8
400	<1	1

* This table can be used to estimate the time necessary to clear the air of airborne *Mycobacterium tuberculosis* after the source patient leaves the area or when aerosol-producing procedures are complete.
† Time in minutes to reduce the airborne concentration by 99% or 99.9%.

Centers for Disease Control and Prevention (CDC) Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *Morbidity and Mortality Weekly Report*. 2005;54:1-141.

3.2.2 Neonatal ICU Layout

A tour of the neonatal area where an exposure has occurred is often required to understand associated risks. Increasingly, neonatal ICUs are moving from large pods where several beds are

in a single room, to single-occupancy rooms. Understanding of where an infectious individual might have been in relation to the infants and the airflow and environmental controls in those areas can help identify infants at highest risk of exposure.

3.2.3 High-level considerations to help determine TB risk to infants

In addition to consideration of the environment to determine if airborne TB might have circulated in neonatal areas, an infant's likelihood of becoming infected depends on exposure **intensity, frequency, and duration.** Whether an infant was in an open crib, closed isolette, or mechanically ventilated at the time(s) of exposure can greatly alter exposure risk. Closed isolettes share minimal air with the general room, and infants that are mechanically ventilated have a separate source of air. Closed isolettes and mechanical ventilation are generally considered protective against TB exposure; however, consideration should be given to whether the infectious individual directly cared for the infant, as direct care often can require opening of the isolette, although the duration of these encounters is usually brief. Similarly, an infectious individual's direct manipulation of an infant's respiratory equipment or frequent suctioning might provide rare opportunities for exposure.

As always, knowledge of the extent of direct contact between an infant and the infected individual is an important consideration. An infant's bedside nurse will often have the most direct contact with the infant in the intensive care unit, compared to a caregiver for a baby in the well-baby nursery. Respiratory therapists can also have close, direct, and sometimes prolonged contact with infants who require respiratory support. The more direct and prolonged the exposure, the larger the risk to the infant.

Thankfully, the risk for TB exposure to the infant is reduced by factors intrinsic to the infant. Infants have small lungs, and therefore move smaller amounts of air than adults each time they breathe. A full-term baby breathes about 0.7 L of air per minute compared to an adult who breathes about 7 L of air per minute. Because TB particles are suspended in the air, less air consumption even in affected areas can lead to less risk of exposure for infants compared to their adult caretakers.

Finally, young children with LTBI or TB disease provide helpful information for the investigator as they suggest recent exposure to tuberculosis; however, unlike older children and adults, negative TB testing or lack of symptoms in very young children is not reassuring. An infant's immune system does not work the same as an adult's, and TB testing with both IGRAs and TSTs is notoriously unreliable especially in infants younger than 3 months of corrected gestational age. Corrected gestational age (CGA) is an infant's age beyond their expected due date of 40 weeks' gestation. Many infants in the neonatal intensive care units were born weeks to months prior to their due date of 40 weeks gestation, and their immune systems are similarly immature. Premature infants who are less than 40 weeks + 3 months (or 3 months corrected gestational age) can be determined to have TB disease based on compatible symptoms or imaging findings, but infants with negative TB tests, no symptoms, and normal imaging cannot be excluded from having latent TB infection, or LTBI. TB testing typically occurs as soon after an infant is considered exposed, and if this occurs prior to 3 months CGA and there is no evidence of active TB disease, the infant should be treated with LTBI window therapy until definitive LTBI

testing can occur at least 10 weeks after the last exposure to TB AND after the infant is at least 3 months CGA. LTBI window therapy is the term used for LTBI treatment given during the "window period" between TB exposure and definitive LTBI testing (at least 10 weeks after the last exposure and when infant is at least 3 months CGA).

Young infants with LTBI have elevated risk of developing TB disease. Therefore, TB-exposed infants who have negative TB testing and are healthy with normal imaging still require LTBI window therapy until they are old enough for a reliable TB test or until completion of LTBI treatment. During contact investigations involving young infants who require TB testing, **typical guidance is to use the TST in infants <2 years old** [4]. For suspected cases of TB disease, or high risk young infants with extensive TB exposure, **consider using both IGRA and TST to increase the sensitivity of the testing** [4]; however, even when both tests are negative in infants younger than 3 months corrected gestational age, LTBI cannot be excluded. Therefore, it is imperative to spend time determining risk of exposure, in order to ensure that only babies at elevated risk of LTBI receive the potentially months-long treatment.

TB Testing in Young Infants

- Negative TB tests are unreliable in infants younger than 3 months of corrected gestational age (CGA). Once TB disease is excluded, exposed infants younger than 3 months CGA should receive LTBI window therapy until repeat TB testing at 3 months of age or older.
- TSTs are the preferred TB test in young, non-BCG vaccinated infants
- Combining the TST and IGRA can help improve overall sensitivity

4 REVIEW OF TB EXPOSURES AMONG HOSPITALIZED INFANTS

To understand the risk of TB infection for hospitalized infants given the considerations reviewed above, we reviewed reported data in California and conducted a comprehensive literature review of neonatal contact investigations and their outcomes.

4.1 SUMMARY OF OCCURRENCES IN CALIFORNIA

Methods:

We reviewed California state and local health department contact investigation records between 2008-2018 involving infant TB exposures in inpatient healthcare settings. Each of the TB exposures involved infants exposed to TB by a health-care worker or a patient or a visitor with infectious TB. We categorized these investigations by smear negative and smear positive index cases based on the expected differences in exposure risk.

For the purpose of this summary, an 'exposure' is defined as infants, healthcare workers, visitors, and other patients in the same physical space as the index case during the defined infectious period as per routine tuberculosis contact investigations. 'Evaluation' is defined as having been tested with TST or IGRA, received a chest x-ray, and/ or followed by a physician during the contact investigation.

This review was not comprehensive of all TB exposures in neonatal and nursery hospital settings in California during 2008-2018. Included in the review were only those investigations that were reported to CDPH or those that requested CDPH assistance in the investigation. The data reviewed was the data available for CDPH review and might not represent all data collected during these investigations.

Findings:

4.1.1 Smear-Negative Index Cases

In recent California history, there has only been one recorded TB exposure in a neonatal hospital setting in which the index case was smear-negative but culture positive. This exposure occurred in County A in 2015. The index case was the father of an infant who was in the Neonatal Intensive Care Unit (NICU) for two weeks. The father visited for 4-5 hours each night during this time. For purposes of the contact investigation, 16 infants were evaluated and 0 (0%) were found to have LTBI or TB disease. The infant of the index case was presumed to have developed TB based on clinical improvement with treatment, though the initial CXR was thought to be more consistent with a respiratory virus. Aside from hospital exposure, the infant also spent approximately three weeks before diagnosis at home with the source case. Three household contacts (mother and grandparents) were all IGRA negative. Because no infants in the hospital were infected and only the child of the index case was diagnosed with clinical TB, the exposure was presumed to be in the household rather than the hospital.

4.1.2 Smear-Positive Index Cases

Seven recorded TB exposures in neonatal hospital settings in California were identified in which the index cases were smear-positive and culture positive. Contact investigation data revealed a total of **1,311 infants were evaluated and 0 (0%) were found to be positive for LTBI and none developed active TB disease**. Through these seven contact investigations, 681 healthcare workers were evaluated, of whom 0 (0%) had LTBI or disease. Six hundred one visitors were evaluated and 0 (0%) had LTBI or disease. Among 1251 exposed post-partum mothers, 5 (0.4%) were found to have LTBI. All 5 of these mothers had TB test conversions documented, none were ill with TB, and it was unclear if they were truly exposed by in the index case in the hospital verses another TB source in their community setting.

Smear-Positive Index Cases: TB test conversions/ Evaluated (% Converted)

	County B 2008	County A 2009	Counties C/D 2012	County C 2012	County E 2015	County A 2018	County A 2018	**TOTALS**
Infants	0/851 (0)	0/17 (0)	0/25 (0)	0/7 (0)	0/335 (0)	0/42 (0)	0/34 (0)	**0/1311 (0)**
HCWs	0/180 (0)	0/42 (0)	0/114 (0)	n/a	0/196 (0)	0/117 (0)	0/32 (0)	**0/681 (0)**
Visitors	0/550 (0)	n/a	n/a	n/a	n/a	0/51 (0)	n/a	**0/601 (0)**
Mothers	0/879 (0)	n/a	n/a	n/a	5/334 (1.5)	n/a	0/38 (0)	**5/1251 (0.4)**

4.1.3 California Summary

Overall, no cases of LTBI or TB were reported among infants, health-care workers, or visitors during the 8 investigations. The only TB test conversions were found among mothers tested during the contact investigations; however, it was unknown whether these TB test conversions were related to the hospital exposure or other potential TB exposure within the community.

4.2 Summary of Literature Review Findings

Methods:

We conducted a literature review using the search terms 1) ("NICU" or "neonatal intensive care unit" or "nursery") and "tuberculosis" and 2) ("neonatal" or "neonate") and "hospital" and "tuberculosis" and ("contact investigation" or "contact tracing") in both PubMed and GoogleScholar to identify domestic and international publications from 1974-2020. We included publications with 1) a known or suspected adult source case, 2) TB exposure occurred within a hospital to newborn or hospitalized infants, and 3) with full text available in English. We excluded the following publications: 1) those without specific outcomes of exposed infants, 2) those that evaluated predominately BCG-vaccinated neonates and used TST test to determine LTBI status of the infants, and 3) those with an infant with congenital tuberculosis as the only source case. We also excluded one international study in which the results were conflicting, and the authors did not reply to our clarification requests. We examined the source case characteristics, setting, number of infants, visitors, and healthcare workers considered

exposed and their infection and disease status at conclusion of contact investigation. We grouped and describe infant exposures by smear negative and positive status of the source case.

For the purpose of this summary, 'exposure' is defined as infants, healthcare workers, visitors, and other patients defined as sharing the same air space as the index case during the defined infectious period; the degree and extent of the exposures varied across studies. Infants in single-occupancy NICU rooms who were not cared for by the index case and infants mechanically ventilated were not considered exposed in the majority of publications. 'Evaluation' is defined as having been tested with TST or IGRA, received a chest x-ray, or evaluated by a physician during the contact investigation. Infants were determined to have TB disease based on symptoms, clinical evaluation, and CXR regardless of TST results. Infants were determined to have LTBI based on having no symptoms, a normal CXR, and a positive TST. Most publications specified that for infants <3 months at the time of initial TST, repeat testing was performed at 3 months or older; a few publications did not specify the age at which TST was performed in infants, but based on the timing of the contact investigations reported, we presume that most of the infants would be 3 months or older at the time of TST placement.

Findings:

4.2.1 Smear-Negative Index Cases

Six studies reported the investigation of contacts exposed to smear-negative index cases in a neonatal hospital setting. One additional study included in this group did not report smear status of the healthcare worker, but reported that the worker was asymptomatic and identified incidentally (Persad). Among these studies, a total of 2,119 infants were evaluated and 6 (0.3%) had some form of TB identified. Two of the infants developed active TB disease, while 4 were diagnosed with LTBI. Also, among these studies, 386 healthcare workers were evaluated, of whom 9 (2.3%) had LTBI. One hundred fifty-six visitors were evaluated, 11 (7.1%) of whom had LTBI.

Smear-Negative Index Cases:

TB Test Conversions or TB disease/All Individuals Evaluated (% with TB disease or LTBI)

	Ahn [5] 2015	Berkowitz [6] 2006	Grisaru-Soen [7] 2014	Keim [8] 1974	Nania [9]~ 2007	Steiner^ [10] 1976	Persad [11] 2019	**TOTALS**
Infants	4/108 (3.7)	0/28 (0)	0/61 (0)	0/91 (0)	0/156 (0)	2/1649* (0.1)	0/26 (0)	**6/2119 (0.3)**
HCWs	6/59 (10.2)	NR	3/99 (3.0)	NR	0/228 (0)	NR	NR	**9/386 (2.3)**
Visitors	NR	NR	11/156 (7.1)	NR	NR	NR	NR	**11/156 (7.1)**
Country	South Korea	US	Israel	US	US	US	Canada	

**Active tuberculosis cases; ^second round TST testing likely occurred after age 3 months for infants, but age of tested infants not specified; ~no TSTs conducted for LTBI identification due to infants all considered very low risk and higher risk individuals were all TST-, only symptom screening +/- CXR during 20 months of follow-up*
NR= not reported

Two infants developed active TB disease. In this investigation, the two infants were the initial cases identified. Both infants were diagnosed with TB disease when they were several months old, but source case investigations for both infants found no cases in either household. The babies had been born 4 days apart in the same hospital. A later contact investigation in the hospital identified a nurse's aide with cavitary TB who had been a known tuberculin reactor at the beginning of employment but was never treated; this person was presumed to be the source case, although the retrospective contact investigation in the hospital was performed close to a year after the babies had been born. The nurse's aide also had four household contacts that developed active TB disease [10].

Four infants were diagnosed with LTBI after exposure to a nurse who had been symptomatic for 2 months and identified with TB following annual employee screening [5]. Of the 6 healthcare workers found to have LTBI in this investigation, three were noted to have prior TSTs that had been performed 1-7 years before exposure to the index case. One study included testing of hospital visitors and found 11 visitors to have +TSTs; all of those with +TSTs were non-US—born individuals [7].

4.2.2 Smear-Positive Index Cases

Ten studies reported on contact investigations of pediatric patients exposed to smear-positive index cases. Among these studies, a total of 1,634 infants were evaluated and 12 (0.7%) were found to have evidence of TB; 6 had active TB disease and 6 had LTBI. Seven hundred twenty-two healthcare workers were evaluated, of whom 9 (1.2%) had LTBI. Among 516 visitors evaluated, 16 (3.1%) had LTBI. Finally, among 324 exposed mothers of infants, 20 (6.2%) had LTBI; TST conversions of post-partum women were associated with foreign birth of the mother and not with the duration of contact or type of contact with the source case [12].

Smear-Positive Index Cases:

TB Test Conversions or TB disease/All Individuals Evaluated (% with TB disease or LTBI)

	Burk [13] 1978	Fisher [14] 2013	Fitzpatrick^ [12] 2005	Isaacs [15] 2006	Light^ [16] 1974	Nivin [17] 1998	Ohno^ [18] 2008	Po~ [19] 2010	Sen [20] 2005	Zenhausern~ [21] 2019	**TOTALS**
Infants	0/514 (0)	0/100 (0)	5/227 (2.2) (2)	1/17* (5.9)	1/398 (0.3)	3/80* (3.8)	0/107 (0)	0/24 (0)	0/119 (0)	2/23* (8.7)	**12/1609 (0.7)**
HCWs	0/119 (0)	1/120 (0.8)	0/32 (0)	0/40 (0)	4/130 (3.1)	NR	2/62 (3.2)	NR	2/219 (0.1)	NR	**9/722 (1.2)**
Visitors	NR	3/152 (2.0)	NR	3/23 (13)	NR	NR	3/72 (4.2)	NR	7/269 (2.6)	NR	**16/516 (3.1)**
Mothers	NR	NR	19/216 (8.8)	NR	NR	NR	1/108 (4.4)	NR	n/a	NR	**20/324 (6.2)**
Country	US	Australia	US	Australia	US	US	Japan	US	Canada	South Africa	

**Active tuberculosis cases; ^second round TST testing likely occurred after age 3 months for infants, but age of tested infants not specified; ~no TSTs conducted for LTBI identification, only symptom screening +/- CXR during follow-up*

NR= not reported

One infant who developed TB disease had shared a postpartum room with the TB-infected mother of another newborn. Four mother/baby pairs were sharing a room and reported one mom as coughing who was then tested and found to have smear+ TB. One infant exposed in shared room over 3 days was treated clinically for TB based on an abnormal CXR; the infant had negative TST and cultures; the infant's mother had a TB test conversion following the exposure [15]. Of note, the TB-infected mother's own infant was also treated clinically for tuberculosis. In another study, premature twins were similarly diagnosed with active TB after exposure to the smear-positive mother of another infant who shared a post-partum room for 17 days [21]. One of the twins was readmitted for respiratory distress and TB was identified before there was knowledge that the mother of the infants' roommate had been ill with TB; the link was found during a source case evaluation. The ill mother's pre-mature infant died of respiratory distress and was presumed to have had tuberculosis. Twenty-one other infants were evaluated and not found to have active TB, though there was no evaluation reported for LTBI.

The other three infants that developed active TB disease were presumably exposed in the neonatal intensive care unit; all cases had been born during a 2-week period in the same hospital. These infant cases were identified because of an investigation initiated after several multi-drug resistant (MDR) TB cases had appeared within the hospital over a short period of time. Multiple healthcare workers and non-infant patients in the hospital developed active TB with the same DNA fingerprint over a short time period [17].

Six infants had TST conversions and were considered to have LTBI, including 2 infants who had previous BCG vaccination [12, 16].

Of nine healthcare workers found to have LTBI, 4 had no documented baseline TST results [18, 20], and one with TST conversion was born in a high incidence country and/or had BCG vaccination [14]. One study reported 4 healthcare workers with TB test conversions; however they note that this conversion rate of about 3% is similar to the hospital's conversion rates during routine TB testing [16].

Of the 16 visitors found to have LTBI, three had no documented baseline TST results and five were noted to have been born in a high-incidence country and/ or had past BCG vaccination [14, 15, 18, 20].

4.2.3 Systematic Literature Review

One publication identified reviewed nosocomial tuberculosis exposures among infants <24 months (not limited to the neonatal and newborn nurseries and including infant-to-infant exposures) in the literature and the national UK database, the Tuberculosis Incident and Outbreak Surveillance System. This review looked at data prior to October 2008. They identified 7 instances of TB transmission to infants among 4867 infants screened across the literature plus their database (0.14%) [22].

4.2.4 Literature Review Summary

Overall, these literature review findings suggest that identification of TB among hospitalized infants is rare; the majority of infants evaluated for tuberculosis following exposure in hospitals

have no evidence of LTBI or TB disease. Active TB cases were identified among 8 infants in the above publications; 4 (50%) of these infants were the index case (one was the twin of the index and treated as a case for failure to thrive), which prompted an investigation within their birth hospitals that ultimately found an adult source case and led to testing of additionally exposed infants; 3 (37.5%) were identified because of an MDR-TB outbreak detection system that identified an outbreak within a hospital that included the nursery; and 1 (12.5%) infant was identified because another mother in a shared room was found to have symptomatic tuberculosis while in the post-partum unit. These cases suggest that active TB in infants was more likely to prompt an investigation than result from an investigation. Additionally, the 8 infants with active TB were either exposed from a healthcare worker (n=5, 62.5%) or by a symptomatic mother who shared a post-partum room (n=3, 37.5). One health-care worker who was the source case for 2 of these infants had a history of an abnormal CXR and had never been treated for LTBI. The 3 infants exposed in post-partum rooms (one set of twins) were exposed to 2 mothers who were symptomatic with TB during their post-partum stay. This suggests that prevention of TB among infants in hospitals could include encouraging LTBI treatment among healthcare providers and screening mothers for symptoms of TB, and providing isolation and testing of mothers symptomatic during their post-partum hospital stay. Furthermore, 5 of these infant TB cases were identified from exposures within the United States in 2 publications from the 1990s, when TB rates in the US were elevated.

Overall, LTBI was found more frequently among exposed heath care workers or mothers of hospitalized infants, although in the latter group, foreign birth was more highly associated with TB test conversion that degree of TB exposure.

4.3 California Data and Literature Review Findings

Overall, transmission to newborn infants in hospital settings is rare. In the 17 published studies presented above, of 3,728 exposed infants evaluated after TB exposure (10 with smear-positive index cases), only 18 (0.5%) had either TB disease or infection. During the eight contact investigations discussed previously (7 with smear-positive index cases) in California, of 1,327 exposed infants evaluated, none (0%) were found to have TB disease or infection. It is important to note that exposed infants in these investigations were generally treated prophylactically for LTBI until 3 months of age when a negative TST was reliable.

The rates of transmission suggested by TB infection and disease among infants from TB exposures in neonatal settings in California are lower than those in the literature. There are a few possible explanations for this discordance. First, the exposures in California occurred more recently on average than those in the literature. It is possible that thorough contact investigation procedures, treatment of LTBI among health-care workers, symptom screening of mothers with previously positive TB testing upon arrival at the hospital for delivery, and environmental controls in neonatal care settings in California helped prevent exposure to TB. In the literature, many healthcare workers, visitors, and mothers who tested positive for LTBI did not have baseline test results, making it difficult to know when and by whom they had become infected. Additionally, several of the index cases in the literature were identified through a source case investigation in a hospital setting after an infant was diagnosed with TB. Finally, it is

important to note that the California experience recorded in this document is only those responses the state health department was involved in and had final outcomes recorded; it does not represent all hospital contact investigations that include infants. Large or extensive hospital outbreaks resulting in infant TB exposure often come to the attention of the state public health department, but our internal review could be missing some cases in which we were not notified and exposures in these settings did result in infant TB disease or LTBI.

4.4 General Conclusions

The information shared to this point including the literature review, our state contact investigation data, and specific considerations to infants and in hospitalized settings allow for some cohesive strategies. In the vast majority of these scenarios, the individuals with the highest risk for exposure are not the infants, but the health-care workers or caregivers of the infants. Although caregivers can be good proxies for exposure to infants, especially in the well-baby nursery, interpretation of TB testing results can be challenging, as many have no record of baseline TB testing results. Infant and mother stays in the well-baby nursery are brief, which reduces time for TB transmission. Additionally, caregivers are often not patients in the hospital by the time the exposure is identified and tracking down individuals for testing in the community is often challenging and time-consuming.

5 APPROACH TO CONTACT TRACING IN NEONATAL HOSPITAL UNITS

Below are a series of steps that can be used to approach TB exposures involving pediatric inpatients and the ensuing contact investigation.

Step 1: Gather case information and gather partners

Case information gathering is routine, but for neonatal hospital investigations, gathering all the necessary partners is key. These hospital partners should include (at minimum): infection control practitioners, occupational health, building/HVAC engineers, risk management, someone who understands the workflow and layout of the neonatal hospital unit (for example, Chief or Medical Director of the NICU), and often public relations.

Step 2: Evaluate health-care workers and other close contacts

As in routine contact investigations, other immediate testing should be performed in the case's household and other close social contacts (i.e., carpools, close friends).

Additionally, as we have found, the best information that can be quickly and initially gathered to inform information on infectiousness in the hospital is testing of exposed healthcare workers. Most health-care workers should have at least a baseline TB test upon hire at each institution. If the exposure was recent, many health-care workers are still employees of the health-care center and easy to identify and track down for testing. These factors make the **exposed health-care workers the easiest population on which to focus immediate testing**. TB testing should be performed by employee health or other hospital entity during work hours to increase ease of testing for the health-care workers. Initial results with comparison to baseline data can help determine if hospital transmission is likely to have occurred.

Step 3: Consider hospital environment and risk to infants

While testing of close contacts and exposed health-care workers is underway, information should continue to be gathered about the ventilation, physical set-up, and the directness and extent of contact between potentially exposed infants and the infected individual, as was discussed previously. Using this strategy, by the time you have identified the infants at highest risk of exposure, you can step back and review the health care and close contact testing data to help you determine ongoing need and/or extent of neonatal testing.

Evaluation for TB should occur only among potentially exposed infants, helping to avoid unnecessary and prolonged LTBI treatment among non-exposed infants.

Step 4: Expand investigation as needed

If transmission is found in the hospital among workers and infants, testing of the next groups with most exposure is important. This is the same strategy as is used in the CDC guidelines, as linked above.

Some investigations might include testing of exposed infants' parents, particularly mothers who might have shared a room with the infant. If mothers of babies are exposed to tuberculosis and the mother has a baseline negative TB test performed during pregnancy, this can help to inform

the contact tracing. If mothers known to be TB test negative during pregnancy without other known TB exposures during pregnancy have new positive results, this might suggest spread from the hospital index case. However, mothers, parents, or other visitors often do not have baseline TB testing results documented to guide investigation strategies; a positive TB test in a non-US—born mother with no baseline TB test, for example, doesn't explain if the mother might have been infected from the hospital index case or if the mom has long-standing LTBI. Therefore, a strategy of evaluating and testing other adults is often a lower priority, as it does not help to understand the extent of infectiousness of the index case, but can be important for case finding particularly if a lot of transmission has been found in the hospital.

PART 2: TOOLS AND RESOURCES

1 TOOLS FOR NEONATAL HOSPITAL-BASED CONTACT INVESTIGATIONS

1.1 LOCAL HEALTH DEPARTMENT CHECKLIST FOR RESPONDING TO TB EXPOSURES IN NEONATAL HOSPITAL SETTINGS

Step 1: Gather case information and gather partners

WHAT	WHO	DUE	DONE	TOOLS
Identify a local TB case manager/ point person for this investigation				
Review index patient's medical information to confirm TB diagnosis: • TST/IGRA • CXR • Smear • Culture • HIV status • Symptom history • Other pertinent information				
Interview (or re-interview) index patient to determine: • Symptoms and onset dates • Close hospital contacts • Hospital work schedule and activities • Other pertinent information				
Establish period of infectiousness				
Review information and make a decision about the need for a hospital CI				Considerations for TB exposure in neonatal hospital settings
Determine how many counties may be affected (hospital location, residence of index case, residencies of contacts)				
Designate data management, epi, and data entry staff				
Provide your Supervisor/TB Controller with a summary of the situation				
Contact State TB Control Branch if assistance is needed				

WHAT	WHO	DUE	DONE	TOOLS
Call infection control contact at hospital and explain the situation; set up a time to meet with hospital officials (often infection control and occupational health), program liaison and local health departments of other counties affected				
Prepare and distribute meeting agenda				
Conduct a meeting and develop an action plan: • Discuss confidentiality and obtain signed confidentiality forms, provide a brief TB and CI overview • Agree on process for obtaining patient info (try to get electronic data) • Discuss key considerations (risk/ protective factors, environmental factors within hospital) • Decide on TB screening dates and locations (whether to offer screening at LOCAL HEALTH DEPARTMENT or through private providers) • Agree on process for informing staff, parents and media • Identify CI team members • Agree on communications between LOCAL HEALTH DEPARTMENT and hospital				Contact investigation overview
Set a time for follow-up meeting or telephone conference, if needed				

Step 2: Evaluate health-care workers and other close contacts

WHAT	WHO	DUE	DONE	TOOLS
Identify community contacts (household or otherwise)				
Obtain employee work schedules and locations of work				
Identify and evaluate the spaces in which the index patient spent time; determine how conducive the spaces are to TB transmission based on index patient infectiousness				Contact tracing in hospitals
Try to get electronic contact data from hospital				
Assign a high, medium or low priority to each contact				
Provide list of high and medium priority contacts to data entry staff to start populating the contact database				Contact investigation record template
Decide which test will be used to screen the contacts (IGRA, TST, CXR), who will need follow-up testing and how it will be completed. IGRA is preferred for non—US-born adults.				Evaluating healthcare workers
Notify exposed staff of need for testing, perform testing, record results.				Script for calling exposed staff; Alert letter to staff FYI letter to staff General tuberculosis information
Offer treatment for staff with new LTBI or previous positives without documented treatment.				LTBI treatment for adults

Step 3: Consider hospital environment and risk to infants

WHAT	WHO	DUE	DONE	TOOLS
Collect patient admission/ discharge data, visitor data if applicable				Contact investigation record template
Visit the infant exposure areas to review layout, set-up, and ventilation.				Neonatal ICU layout
Decide which groups of infants require evaluation based on risk of exposure. Consider the ventilation, physical set-up, and the directness and extent of contact between potentially exposed infants and the infected individual.				Considerations for infants
Evaluate all exposed infants for signs and symptoms of TB disease and perform a CXR.				Evaluating infants for TB disease
For infants without TB disease, start window prophylaxis for exposed infants <3 months corrected gestational age and for any infant exposed within the previous 10 weeks.				Evaluating infants
Designate telephone line and/ or email address within the TB Program to address calls or questions from parents/public				
Customize the media release template and hold press conference (as needed)				Sample press release
Decide who (hospital or local health department) will be responsible for contacting				
Call all parents of contacts, pediatricians of contacts and contact staff using the respective call scripts				Call scripts
Send out customized alert letter to parents of contacts and pediatricians				Letter templates

of contacts, informing them of the TB exposure (include TB fact sheet)				Letter inserts Infant tuberculosis information for pediatricians General tuberculosis information
Identify contacts who have been missed and follow up				Straggler flow diagram

Step 4: Expand investigation as needed

WHAT	WHO	DUE	DONE	TOOLS
Keep track of evaluation/ screening results in CI spreadsheet for patients, staff and community contacts				Contact investigation record template Testing results fax form
Generate a list of missing information from the CI spreadsheet				
Identify contacts who have been missed and follow up				Straggler flow diagram
Generate summary reports for the CI (decide how often and who will review)				
Decide if investigation needs to be expanded or can be closed				
Share results with hospital administrators, staff, and parents				
If necessary, issue a final press release				

1.2 Contact Investigation Evaluation Strategies (Steps 2 and 3)

1.2.1 Evaluating infants

Exposed: All infants born between *[dates of infectious period]* who stayed in rooms in the *[defined section of hospital – NICU, postpartum, newborn nursery]* after their deliveries during the periods when the index case was present. All infants who were in the *[defined section of hospital – NICU, postpartum, newborn nursery]* after delivery only on days when the index case **was not present** were **not exposed** and **need no evaluation**. Consultation with an expert in pediatric infectious diseases or pediatric TB physician is highly recommended.

TB testing of infants: Tuberculin skin tests (TST) are not considered to be reliable in young infants, especially prior to 3 months after a 40-week gestation pregnancy (corrected gestational age). Although Interferon Gamma Release Assays (IGRAs) are not routinely used in children <2 years of age per American Academy of Pediatric guidance, using 2 tests for infection is recommended to increase test sensitivity particularly among symptomatic or high-risk young infants. Consider if the TST or IGRA status of the infant's mother or closest inpatient healthcare providers might be a surrogate for risk to the infant, if they have had comparable potential exposure to the index case and baseline testing results. **Any infant with a positive TB test** (5mm or greater induration TST or positive IGRA), **regardless of the time of exposure or infant's age**, must be evaluated immediately for active TB with physical exam and 2-view CXR. If there is no evidence of active TB, the infant should receive treatment for LTBI.

All exposed infants should receive a 2-view CXR and physical examination as part of their TB evaluation; additionally, infants at least 3 months (corrected gestational age) or older should receive a TST and IGRA. TB symptoms are often subtle or absent; when present, the most common include weight loss or poor weight gain, fever, cough, and chills. The physical exam should be thorough and include the following:

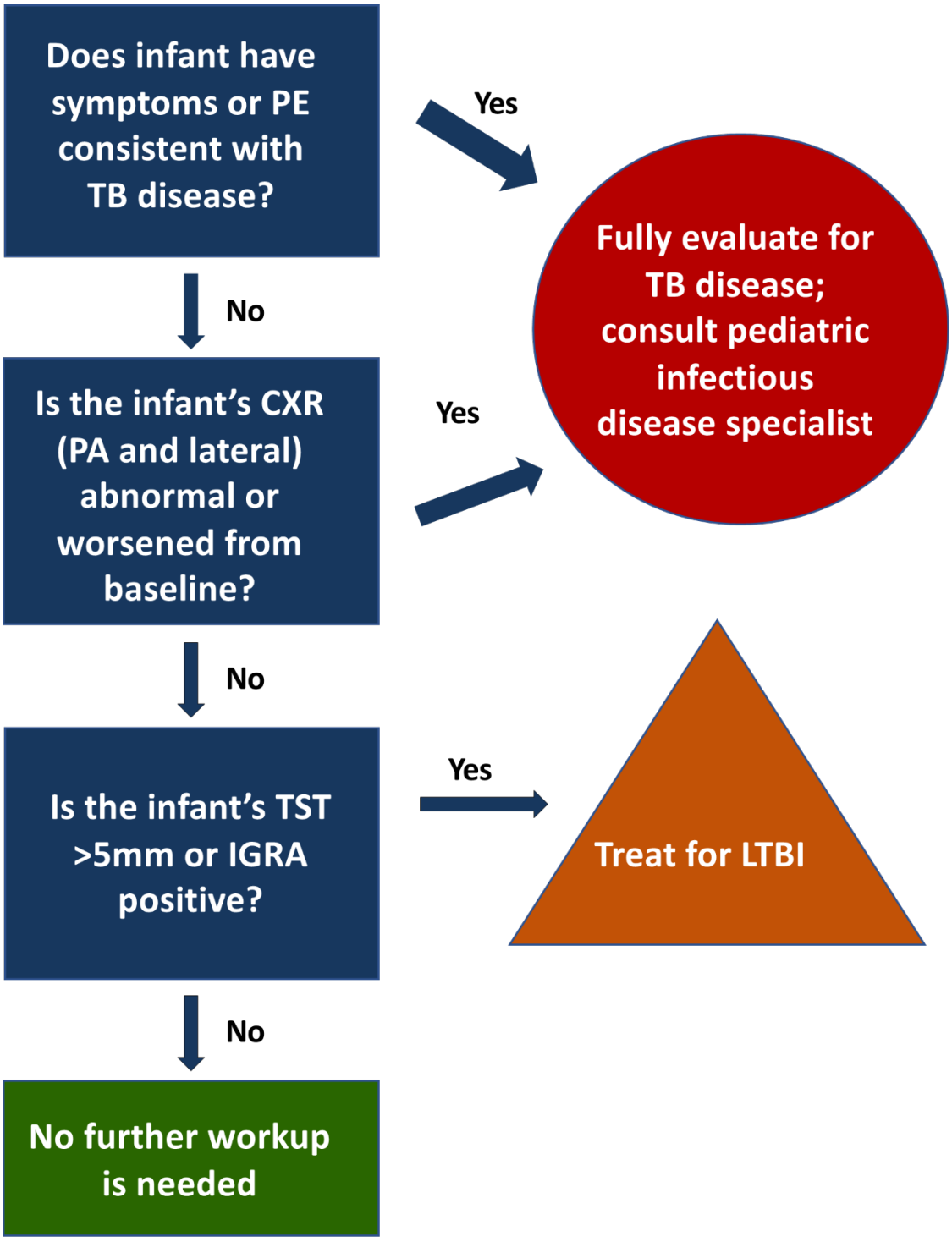
- Temperature and growth parameters, alertness and meningeal signs, and the results of palpation of back and extremities. Special attention should be placed on the examination of the lungs and cervical lymph nodes.
- Lung findings are relatively modest; even if the child has an abnormal CXR. Infants and adolescents are most likely to have rales, decreased breath sounds, and increased work of breathing.
- Enlargement of the liver or spleen can be determined by careful palpation of the abdomen for any masses or organ enlargement.

Infants who were potentially exposed can be divided into two cohorts: those in whom more than 10 weeks have elapsed since exposure, and those in whom less than 10 weeks have elapsed since exposure. These two cohorts will be evaluated differently because the reliability of the TB test results in the infant become more reliable with increasing time from exposure (see algorithms below).

Infants who were exposed ≥ 10 weeks prior to *[last day of infectious period]* **and are at least 3 months corrected gestational age** should have a TST and IGRA, a physical examination, a symptom check by a primary provider, and a 2-view CXR. If all of these are negative, the infant should be considered uninfected and no further action is required. If the TB test is positive, with

normal exam and CXR, the infant should complete a course of treatment for LTBI. If the CXR is abnormal or there is concern for active TB on exam, the baby should undergo work-up for TB disease prior to starting treatment.

1.2.1.1 Infant evaluation and treatment algorithm #1: last exposure to TB ≥ 10 weeks ago AND infant is ≥ 3 months corrected gestational age



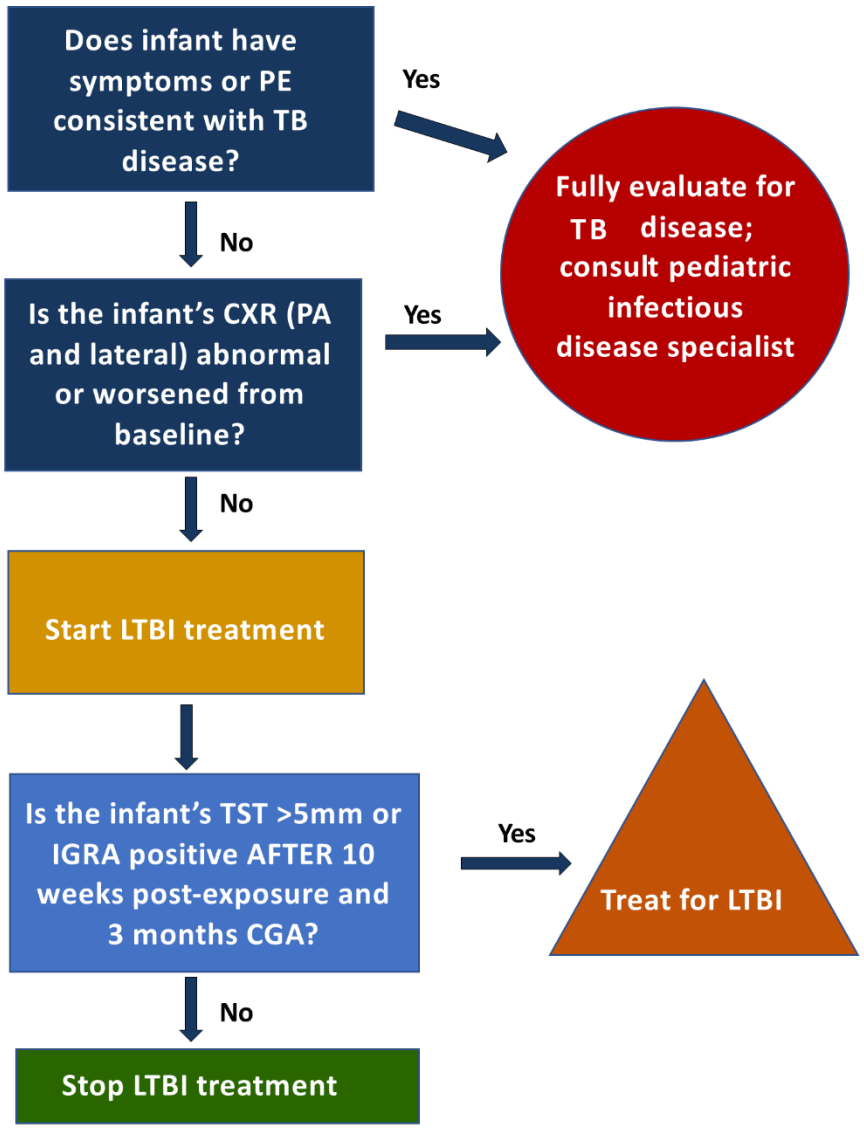
Adapted from outbreak response materials developed by Dr. Tara Greenhow

Note: For any positive results and for LTBI/ TB treatment, coordinate with the health department

LTBI: latent TB infection, CGA: Corrected Gestational Age; PE: physical exam; CXR: chest x-ray (PA and lateral)

Infants who were exposed < 10 weeks prior to *[last day of infectious period]* **or are younger than 3 months corrected gestational age** should have a physical exam, symptom review, and 2-view CXR. If all are negative, the infant should be started on LTBI treatment and continue until treatment completion or until TST and IGRA are both negative (after at least 10 weeks have elapsed from the time of exposure and the infant is at least 3 months corrected gestational age). If either TB test is positive, the child should complete LTBI treatment. If the physical exam or CXR are concerning for active TB disease, the infant should undergo work-up for TB disease prior to starting any treatment.

1.2.1.2 Infant treatment and evaluation algorithm #2: last TB exposure <10 weeks prior OR infant younger than 3 months corrected gestational age

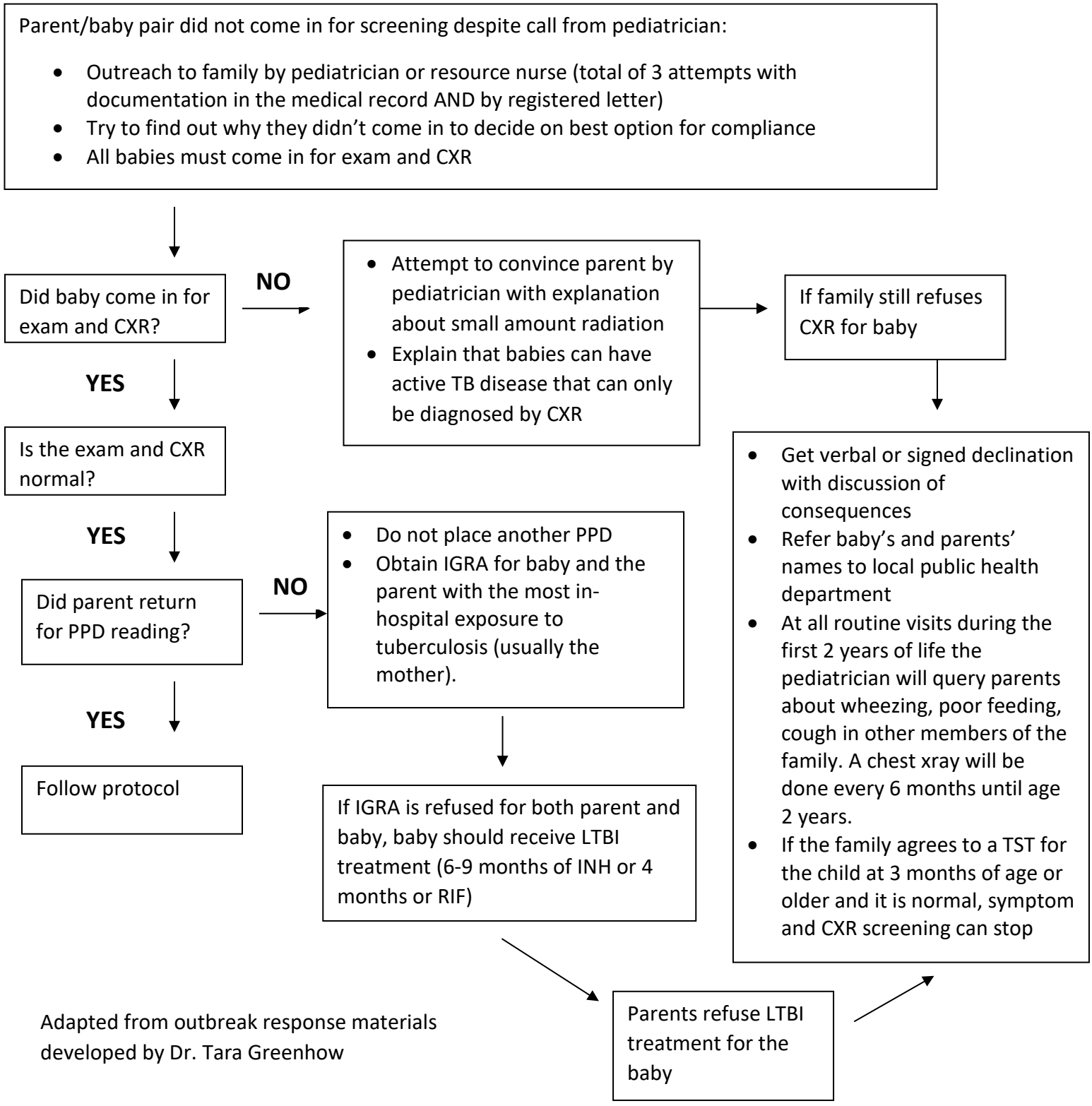


Note: For any positive results and for LTBI/ TB treatment, coordinate with the health department

LTBI: latent TB infection, CGA: Corrected Gestational Age; PE: physical exam; CXR: chest x-ray (PA and lateral)

If parents refuse to have their infant evaluated, refuse CXR, and/or refuse INH if offered, see the Infant Contacts Straggler Flow Diagram for next steps.

1.2.1.3 Infant contacts straggler flow diagram



Adapted from outbreak response materials developed by Dr. Tara Greenhow

1.2.1.4 Evaluation for TB disease

For infants identified with symptoms of TB disease or abnormalities on CXR should undergo further workup and evaluation for TB disease.

- Diagnostic tests should be performed; gastric aspirates have the highest specimen yield for infants, though overall, yield is low (see here for details on how to collect a specimen: Curry TB Center Pediatric Tuberculosis: A Guide to the Gastric Aspirate (GA) Procedure) [23]. Lumbar punctures are often performed in infants suspected of tuberculosis disease, as tuberculosis can penetrate the immature blood-brain barrier and lead to TB meningitis at much higher rates than for older children and adults. Most infants under 1 year of age who are being evaluated for TB disease should undergo lumbar puncture according to the American Academy of Pediatrics [4].
- It is difficult to confirm TB microbiologically as children cannot easily produce sputa and sputa that are collected are usually smear negative. For concerns on specimen collection and lab submission, consult with the local health department or the <state or local lab>.
- It is acceptable to over treat in uncertain situations. If a patient is not stable, specimens should be collected for cultures and treatment for TB disease should be started; sometimes diagnosis becomes clear over time. If the diagnosis doesn't become certain, treatment for TB disease should be completed. Weigh all likely diagnoses, consider risks and benefits, and make the best judgment after discussion with family and a pediatric TB physician-expert.
- Any diagnosis of TB disease should be reported to the local health department.

1.2.1.5 LTBI treatment for infants

INH: 10-15 mg/kg daily for 6-9 months

- Liquid formula (common side effect is diarrhea, but young infants typically tolerate)
- Crushed pills mixed into milk
- IV form available, sometimes requires ordering from a specialty pharmacy
- ***Infants exclusively breastfed and receiving INH should also receive B6 supplementation (6.25mg, ¼ of 25mg tab) crushed and mixed in milk.***

Rifampin: 20-30 mg/kg daily for 4 months

- Opened capsule (have to round to the nearest 75mg, or ½ capsule split over 2 days to ensure accurate dosage)
- Compound pharmacy can make liquid formulation
- Use if there is known INH resistance, or concern for resistance in source case or for a shorter treatment option

1.2.2 Evaluating healthcare workers

Exposed: All healthcare workers (HCWs) who work in the *[defined section of hospital – NICU, postpartum, newborn nursery]* should be considered potentially exposed to TB by the index case, regardless of their shift. This includes nurses, care partners and unit assistants.

All HCWs should have their TB test completed by *[date]*.

- **All HCWs whose work schedules included the period from *[dates of infectious period]*** will have TST or IGRA repeated 8-10 weeks after the first test. The purpose of the second test is to capture the possibility of heavier exposure that might have occurred during the last weeks that the index case worked when they may have been more infectious.
    - If both of the tests are negative, no further evaluation is necessary and the HCW should be considered uninfected
    - If the TB test is positive and there is no history of a prior positive test, further evaluation is required. A CXR should be done and the HCW referred to Employee Health for further evaluation. All TST or QFT conversions should be reported to Infection Control immediately at *[phone number]*.
- **If a HCW started working in the *[defined section of hospital – NICU, postpartum, newborn nursery]* after *[first date of infectious period]***, then the TST/IGRA should be delayed until 8 weeks have elapsed since the first day of work on the affected unit. The TB test should be repeated 8-10 weeks after the last exposure to capture the possibility of heavier exposure that might have occurred during the last weeks that the index case worked when they may have been more infectious.
- **If a HCW has a known positive TST or QFT**, that HCW must have a symptom review and consider a CXR. If the HCW has not been previously treated for LTBI, the worker should be encouraged to take treatment, and referred to a primary provider.

1.2.2.1 LTBI treatment for adults

3HP: Once a week dose of Isoniazid and Rifapentine for 12 weeks (CDPH 3HP Fact Sheet)

- **Isoniazid** 15mg/kg, max dose 900mg
- **Rifapentine:** 900mg (for individuals >50kg) **(see 3HP Fact Sheet for dosing < 50 kg)**

Rifampin: 600mg daily for 4 months

Isoniazid AND Rifampin daily for 3 months: 300mg Isoniazid and 600mg Rifampin

INH: 300 mg daily for 6 months

1.2.3 Evaluating mothers

Exposed: All mothers in *[defined section of hospital – NICU, postpartum, newborn nursery]* on a shift when the index case worked between *[dates of infectious period]*

Testing:
All potentially exposed individuals without a prior history of a positive TB test should have repeat testing.

- **If at least 8 weeks have elapsed since the exposure and the TB test is negative**, the individual should be considered uninfected, and no further action is needed.
- **If less than 8 weeks have elapsed since the exposure, and the TB test is negative**, it should be repeated when 8-10 weeks have elapsed.
    - If the second TB test is negative, the individual should be considered uninfected, and no further action is needed.
- **If the TB test is positive, regardless of the time elapsed from the exposure**, a CXR should be done, and the individual referred to a primary provider for further evaluation and treatment.
- **If the potentially exposed individual has a known prior positive TB test**, a repeat TB test is not needed, but a CXR should be obtained.
    - If the CXR is normal, and the individual has no symptoms, LTBI treatment should be completed if not previously documented.
    - If the CXR is abnormal, individuals should be referred to their primary provider for evaluation for active TB. If there is no evidence of active TB, and no history of prior treatment or prophylaxis, LTBI treatment should be offered.

1.2.3.1 LTBI treatment for adults

3HP: Once a week dose of Isoniazid and Rifapentine for 12 weeks (CDPH 3HP Fact Sheet)

- **Isoniazid** 15mg/kg, max dose 900mg
- **Rifapentine:** 900mg (for individuals >50kg)

Rifampin: 600mg daily for 4 months

Isoniazid AND Rifampin daily for 3 months: 300mg Isoniazid and 600mg Rifampin

INH: 300 mg daily for 6 months

1.3 CONTACT INVESTIGATION RECORD TEMPLATE

Use Excel spreadsheet 'Contact investigation record template'

Contact's Last Name

Contact's First Name

Infants Mother's Name (or initial name in medical record after delivery)

Contact's Date of Birth

Medical Record # (might be 2 different MRNs for infants initially with birth mother's name)

Country of Birth

Gender

Contact Type (Infant, Family, Visitor, Employee)

If Employee, Specify Title

Admit Date

Discharge Date

Last Exposure Date

Place of Exposure (NICU, Maternity Ward, L&D, ED, Radiology, Outpatient, Other)

If NICU, specify room number

In isolette or on ventilator during all potential exposure periods (Yes, No, Unk)

If other place of exposure, specify

Cumulative Hours of Exposure

TB Symptoms (Yes, No, Unk)

Immunocompromising condition/treatment? (Yes, No, Unk)

Pregnant (Yes, No)

Priority (High, Medium, Low)

Previous PPD/IGRA Date

Previous PPD/IGRA Result (Pos, Neg, Indeterminate, Not Done, Unk)

Previous PPD Induration Size (mm)

1st Date PPD Read

1st PPD Result (mm)

2nd Date PPD Read

2nd PPD Result (mm)

IGRA Date

IGRA Result (Pos, Neg, Indeterminate, Not Done, Unk)

Converter? (Yes, No)

Date of CXR

CXR Result (Normal, Abnormal consistent w/ TB, Abnormal not consistent w/TB)

Physical Exam Date

Exam Result (No evidence of TB, Suggestion of TB, Not Done)

Window Prophy Rx Started? (Yes, No, Unk)

Window Prophy Rx Start Date

LTBI Rx Started? (Yes, No, Unk)

LTBI Rx Start Date

Parent's Name (if contact is an infant)

Address

City

County of Residence

ZIP

Home Phone

Phone (Work/Cell)

Preferred Language

Name of Primary Care Provider

Primary Care Provider Phone Number

Comments/Notes

2 SAMPLE COMMUNICATIONS (STEPS 2 AND 3)

2.1 SAMPLE PRESS RELEASE

[Replace this text with your organization's identifier]

[NAME OF COUNTY] **HEALTH OFFICIALS WORK WITH LOCAL HOSPITAL ON TB CASE**

Contact: *[Names and phone numbers of Chief Medical Officer and Media Officer of corresponding county]*

[Date]

FOR IMMEDIATE RELEASE

The *[county name]* County Public Health Department is working with *[name of hospital]* to investigate potential exposures to an individual with active tuberculosis (TB) who spent time in the facilities. The individual is currently isolated and receiving treatment to prevent the spread of TB.

Health officials are working together with the medical center, *in consultation with California Department of Public Health*, to assess patients, visitors, and staff to determine who might have been exposed to TB. There were periods of exposure in the *[defined section of hospital – NICU, postpartum, newborn nursery]* from *[dates of potential exposure].* Parents of exposed babies will be contacted within 24 hours, while others potentially exposed will be contacted within the next few days.

There is a difference between latent TB infection (LTBI) and TB disease. People with TB disease are sick from the germs that are active in their body and they may cough a lot, feel weak, have a fever, lose weight, cough up blood, or sweat a lot at night. People with TB disease are capable of giving the infection to others. People with TB infection (without disease) have the TB germ in their body, but they are not sick because the germ is inactive. They cannot spread the germ to others. About one out of ten people with TB infection become sick with TB disease. TB disease and infection can be treated and cured.

Although it might be a new experience for the infants, parents, patients, and staff exposed, these types of investigations are regular activities for the *[county name]* County Public Health Department. Any patients, visitors or staff determined to have LTBI will receive further testing and medication to ensure that they do not develop the active form of TB disease.

For general TB information, visit www.cdc.gov/tb/. During business hours, *[name of county]* residents with questions can call *[name of county]* Public Health at *[phone number]*.

2.2 CALL SCRIPTS

2.2.1 Script for calling guardians of exposed infants

You are being contacted because your baby was exposed to active tuberculosis (TB) upon a recent stay at *[hospital name]* Hospital. As soon as the contagious person was found to have contagious TB, he/ she was placed in isolation. To ensure everyone's safety, the *[name of county]* Health Department TB Control Program is working closely with *[name of hospital*] to contact all exposed patients and their families immediately.

We need your baby to be evaluated for TB.

[Briefly ask about other TB risk – any other known TB cases to whom the baby was exposed, whether the infant or his/ her mother is immunocompromised]

The evaluation, required by the [county name] County Department of Public Health TB Control Officer, will include two TB tests (a skin test and a blood test), chest x-ray, and physical examination now, and another TB skin test in a few months. The results of this evaluation and any treatment are confidential. However, California law requires this information to be reported to the Department of Public Health.

If testing will take place with private providers:
Please call your healthcare provider to schedule an appointment for your baby to be seen. Your baby will need two TB tests (a skin test and a blood test) and a chest x-ray now, and he/she may need to have another TB skin test in a few months. It is extremely important that your healthcare provider shares the results with us to make sure that your baby gets the proper care. Please have your provider send, email, or fax the results to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*
Email Address: [address}

If testing will take place at LOCAL HEALTH DEPARTMENT:
Please call the *[county name]* County Department of Public Health TB Control Program to schedule an appointment for your baby to be seen. If for some reason you cannot bring your child to the *[county name]* County Department of Public Health, you could bring him/ her to a health department clinic closer to your home. Please call *[health dept. phone number]* to get the location of the health department clinic nearest your home.

Do you have any questions? Thank you for your time. If you have questions at any point, please don't hesitate to call *[phone number]*.

2.2.2 Script for calling pediatricians of exposed infants

You are being contacted because it has come to our attention that during your patient _____'s stay at *[hospital name]* Hospital, he/she was exposed to a person who has been recently diagnosed with tuberculosis (TB). To ensure everyone's safety, the *[name of county]* Health Department TB Control Program is working closely with *[name of hospital*] to contact the pediatricians of all exposed infants immediately. We will also be contacting the infant's family directly.

Newborns are especially susceptible to tuberculosis infections and the disease can progress very quickly, so it is important that this infant be evaluated right away as outlined below. **Please contact the family and have the infant brought into your office for evaluation as soon as possible.**

As you know, tuberculin skin tests (TST and IGRAs) may be unreliable in infants less than 3 months corrected gestational age (falsely negative due to immature immune system). Therefore, we are recommending the following:

- A tuberculin skin test (TST) and IGRA (Quantiferon or TSPOT), clinical evaluation, and 2-view chest x-ray (CXR) to be done now
- Repeat TB tests to be done at ____ months of age (3 months corrected gestation age at a minimum) if the initial testing is negative

[We do not feel that treatment is indicated unless the skin test is positive OR we recommend window prophylaxis treatment with isoniazid or rifampin until the repeat TST is found to be negative.]

It is important that you not wait for the parents to contact you, but that you make every effort to reach the parents to have them bring the infant into your office.

If testing will take place with private providers:

Clinical Evaluation:
The infant needs a thorough examination looking for evidence of active tuberculosis with a special focus on the following areas

- Fever
- Respiratory status, increased work of breathing
- Cough
- Growth delay, lack of weight gain
- Feeding problems
- Look for evidence of pulmonary and extra-pulmonary tuberculosis

- Enlarged liver or spleen

Chest X-Ray
Order both PA and lateral views
If there is a question of interpretation of the CXR, *[name]* can be called for consultation.

Treatment
If there is any evidence of possible active tuberculosis in the infant from your physical exam or the chest x-ray do not start preventive therapy. Call the TB Control Program at the number below so further evaluations can be made to determine the proper course of treatment. Consultation with a pediatric infectious diseases expert is recommended.

- *After ruling out any evidence of active TB on either exam or CXR, infants with any positive TB test should be treated for LTBI with either 6-9 months of INH or 4 months of Rifampin.*
  - *INH: 15 mg/kg daily x 6-9 months. Liquid formulation is available*
  - *RIF: 20-30mg/kg daily x 4 months (liquid requires compounding, otherwise round to the nearest 75mg to use opened capsules mixed in milk or food).*
- *Infant should be seen monthly while on treatment and the medication dose will need to be adjusted as the baby gains weight.*
- *If the infant is exclusively breastfed and receiving INH: add pyridoxine (Vitamin B_6) 6.25mg daily (¼ of a 25mg tablet).*
- *Be sure to check for possible interactions with other medications that the infant is taking such as with Dilantin, or use of other hepatotoxic drugs (such as Tegretol). Dosages of other medication may need to be adjusted due to interactions.]*

Follow up with monthly office visits:

- Continue to check for symptoms of active tuberculosis as onset may be delayed.
- Check for symptoms of toxicity, particularly symptoms of anorexia, malaise, and rash.
- Adjust medication dose for weight gain.
- At ____ months of age the infant should get a TB skin and blood test. It is not recommended that this be done now due to the patient's age. A positive test in a contact is an induration of **5 mm or greater for the skin test or a positive result on the blood test**.

For contact investigation and monitoring purposes, <u>it is extremely important that all results are shared with us</u>. We will email, mail, or fax you a form to fill out with your patient's results. What is the best way to send it to so that you will get it?

After filling out the form, please fax it to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*
Email Address: *[email]*

If testing will take place at LOCAL HEALTH DEPARTMENT:
We have instructed your patient's parent(s) to bring the child to the *[county name]* County Department of Public Health TB Control Program for the skin test and CXR. You may call to request your patient's results.

Do you have any questions? Thank you for your time. If you have questions at any point, please don't hesitate to call *[county name]* Department of Public Health TB Control Program *[phone number]*.

2.2.3 Script for calling exposed staff

You are being contacted because you were exposed to active tuberculosis (TB) during your time working at *[hospital name]* Hospital. As soon as the contagious person was found to have contagious TB, they were placed in isolation. To ensure everyone's safety, the *[name of county]* Health Department TB Control Program is working closely with *[name of hospital*] to contact all exposed staff immediately.

We need you to be evaluated for TB.

Briefly ask about other TB risk – any other known TB contacts, previous known TB exposure, whether immunocompromised, etc.

All staff working in the *[defined section of hospital – NICU, postpartum, newborn nursery]* whose work schedules included the period from *[dates of infectious period]* should have initial testing completed by *[date]*, and will have a follow-up test repeated 8 weeks after the first test. If a staff member has a known positive PPD, that person must have a symptom review and get a chest x-ray, and symptom review should be repeated after 8 weeks.

You have the option of being tested at the Employee Health Services of *[hospital name]* Hospital, or by your private healthcare provider. If you decide to be tested by your healthcare provider, it is extremely important that they share the results with us to make sure that you get the proper care. We will send you a form for your private provider to fill out with your results. Please have them fax it to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*

Do you have any questions? Thank you for your time. If you have questions at any point, please don't hesitate to call *[phone number]*.

2.3 LETTER TEMPLATES

2.3.1 ALERT letter to guardian

(ALERT – In the case that evaluation is recommended as part of a CI)

[Replace this text with hospital and/ or health department identifiers]

[Date]

Dear Parent or Guardian of _____

Your baby was exposed to active tuberculosis (TB) upon a recent stay at *[hospital name]* Hospital. You are strongly encouraged to have your baby evaluated for TB.

[Note: If the exposure occurred in a section of the hospital with both mother and baby inpatients (i.e., maternity or postpartum wards), testing can be recommended to both mother and baby in this letter, if appropriate]

TB has different symptoms in children than adults and can be very difficult to diagnose without a full medical evaluation. If your child does not have this evaluation, they may be at risk for active TB which could include: pneumonia, meningitis, seizures, coma, death.

If your child does have this evaluation, you might be reassured that your child is not infected with TB or if they are infected, they could take medication to prevent the development of active disease.

The evaluation, required by the *[county name]* County Department of Public Health TB Control Officer, will include a TB skin test and blood test, chest x-ray, and physical examination now, *and repeat TB tests in a few months (depending on timing of letter being sent)*. The results of this evaluation and any treatment are confidential. However, California law requires this information to be reported to the Department of Public Health.

If testing will take place with private providers:
Please call your healthcare provider to schedule an appointment for your baby to be seen. Your baby will need a TB skin test and blood test, a chest x-ray now, and repeat TB skin and blood tests in a few months. It is extremely important that your healthcare provider shares the results with us to make sure that your baby gets the proper care. Please have your provider fax the results to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*

If testing will take place at LOCAL HEALTH DEPARTMENT:
Please call the *[county name]* County Department of Public Health TB Control Program to schedule an appointment for your baby to be seen. If for some reason you cannot bring your child to the *[county name]* County Department of Public Health, you could bring him/ her to a health department clinic closer to your home. Please call *[health dept. phone number]* to get the location of the health department clinic nearest your home.

The enclosed materials provide additional information about TB and the TB tests. If you have further questions, please contact us at *[phone number]* or you can talk to your doctor. Your baby's pediatrician has received a letter explaining our recommendations.

Sincerely,

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.3.2 ALERT letter to pediatrician

(ALERT– In the case that evaluation is recommended as part of a CI)

[Replace this text with hospital and/ or health department identifiers]

[Date]

To: Dr. _____

From: *[Name and credentials]*, Health Officer

Regarding: Infant name _____ DOB _____

Urgent Medical Follow–Up Needed

It has come to our attention that during the above-named patient's stay at *[hospital name]* Hospital during the period of *[timeframe of patient stay]*, they were exposed to a person who has been recently diagnosed with tuberculosis (TB). As you are the doctor on record for the above-named infant, you are being sent this information regarding the recommended evaluation and treatment of the infant for this tuberculosis exposure. If you are not the physician for the above infant, please call our office right away at *[phone number]* so we can identify the correct doctor.

Newborns are especially susceptible to tuberculosis infections and the disease can progress very quickly, so it is important that this infant be evaluated right away as outlined below. **Please contact the family and have the infant brought into your office for evaluation as soon as possible.**

As you know, tuberculin skin tests (TST) may be unreliable in infants less than 3 months of corrected gestational age (falsely negative due to immature immune system). Therefore, we are recommending the following:

- A tuberculin skin test along with a blood test – interferon gamma release assay (QFT or TSPOT), clinical evaluation, and 2-view chest x-ray (CXR) to be done now
- Repeat skin and blood test to be done at ____ months of age if the initial tests are negative

[We do not feel that treatment with isoniazid is indicated unless the one of the TB tests is positive OR we recommend window prophylaxis treatment with isoniazid until the repeat tests are both found to be negative]

If testing will take place with private providers:

Clinical Evaluation:

The infant needs a thorough examination looking for evidence of active tuberculosis with a special focus on the following areas

- Fever
- Respiratory status, increased work of breathing
- Cough
- Growth delay, lack of weight gain
- Feeding problems
- Alertness, meningeal signs
- Special attention to lungs, palpation of lymph nodes, and evaluation for spleen or liver enlargement
- Look for evidence of pulmonary and extra-pulmonary tuberculosis

Chest X-Ray

Order both PA and lateral views

If there is a question of interpretation of the CXR, I can be called for consultation.

Treatment

If there is any evidence of possible active tuberculosis in the infant from your physical exam or the chest x-ray do not start preventive therapy. Call the TB Control Program at the number below so further evaluations can be made to determine the proper course of treatment.

- *After ruling out any evidence of active TB on either exam or CXR, infants with positive TSTs should be treated for LTBI with either 6-9 months of INH or 4 months of Rifampin.*
  - *INH: 15 mg/kg daily x 9 months. Liquid formulation is available*
  - *RIF: 20-30mg/kg daily x 4 months (liquid requires compounding pharmacy, otherwise round to the nearest 75mg to use opened capsules mixed in milk or food).*
- *Infant should be seen monthly while on treatment and the medication dose adjusted monthly as the baby gains weight.*
- *If the infant is being breastfed and receiving INH: add pyridoxine (Vitamin B_6) 6.25mg daily (¼ of a 25mg tablet).*
- *Be sure to check for possible interactions with other medications that the infant is taking such as with Dilantin, or use of other hepatotoxic drugs (such as Tegretol). Dosages of other medication may need to be adjusted due to interactions.]*

Follow up with monthly office visits:

- Continue to check for symptoms of active tuberculosis as onset may be delayed.
- Check for symptoms of toxicity, particularly symptoms of anorexia, malaise, and rash.
- Adjust dose of INH or RIF for weight gain.

- At ____ months of age the infant should get a repeat skin and blood test for TB. It is not recommended that this be done now due to the patient's age. A positive skin test in a contact is an induration of **5 mm or greater**.

For contact investigation and monitoring purposes, <u>it is extremely important that all results are shared with us</u>. Please fill out the enclosed form with your patient's results and fax it to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*

If testing will take place at LOCAL HEALTH DEPARTMENT:
We have instructed your patient's parent(s) to bring the child to the *[county name]* County Department of Public Health TB Control Program for the TB tests and CXR. You may call to request your patient's results.

It is important that you not wait for the parents to contact you, but that you make every effort to reach the parents to have them bring the infant into your office. Thank you for your attention to this matter, and please call *[county name]* Department of Public Health TB Control Program if you have any further questions *[phone number]*.

Sincerely,

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.3.3 ALERT letter to staff

(ALERT – In the case that evaluation is recommended as part of a CI)

[Replace this text with hospital and/ or health department identifiers]

[Date]

Dear Staff Member,

You were exposed to active tuberculosis (TB) during your time working at *[hospital name]* Hospital. You are strongly encouraged to be evaluated for TB.

All staff working in the *[defined section of hospital – NICU, postpartum, newborn nursery]* whose work schedules included the period from [dates of infectious period] should have initial testing completed by *[date]*, and will have a follow-up test repeated 8 weeks after the first test. If a staff member has a known positive PPD, that person must have a symptom review and get a chest x-ray, and symptom review should be repeated after 8 weeks.

You have the option of being tested at the Employee Health Services of *[hospital name]* Hospital, or by your private healthcare provider. If you decide to be tested by your healthcare provider, it is extremely important that they share the results with us to make sure that you get the proper care. **Please have your private provider fill out the enclosed form with your results and fax it to the *[county name]* County Department of Public Health.**

Fax Number: *[number]*
Phone Number: *[number]*

If you have further questions, please contact us at *[phone number]*.

Sincerely,

_____ _____

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.3.4 FYI letter to guardian

(FYI – In the case that evaluation is a precaution, not part of a CI)

[Replace this text with hospital and/ or health department identifiers]

[Date]

Dear Parent or Guardian of _____

It has come to our attention that a person at *[hospital name]* Hospital has recently been identified as having active tuberculosis (TB). A person with active TB disease can spread TB germs through the air to those who frequently share the same air. To ensure everyone's safety, the *[name of county]* Health Department TB Control Program has been working closely with *[name of hospital*] to do TB tests on those who had the most contact with this person. To date, we have not found anybody infected with TB from this exposure. This means the risk to you and your baby is extremely low. However, in an effort to take every precaution possible, we are recommending that your baby be tested for TB.

[Note: If the exposure occurred in a section of the hospital with both mother and baby inpatients (i.e., maternity or postpartum wards), testing can be recommended to both mother and baby in this letter, if appropriate - *You may want to consider getting tested for TB as well, although your exposure was likely to be less than your baby's exposure, and adults are not as likely as children to become sick with TB if infected. However, if you have a weakened immune system because of chemotherapy for cancer, HIV infection or AIDS, diabetes, renal dialysis, or other serious medical problems, you should see your doctor for testing.]*

The enclosed materials provide additional information about TB and the TB skin test. If you have further questions, please contact us at *[phone number]* or you can talk to your doctor.

Sincerely,

_____ _____

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.3.5 FYI letter to pediatrician

(FYI – In the case that evaluation is a precaution, not part of a CI)

[Replace this text with hospital and/ or health department identifiers]

[Date]

To: Dr. _____

From: [Name and credentials], Health Officer

Regarding: Infant name _____ DOB _____

It has come to our attention that during the above-named patient's stay at *[hospital name]* Hospital during the period of *[timeframe of patient stay]*, they may have been exposed to a person who has been recently diagnosed with tuberculosis (TB). We have identified those people who had the closest contact in the hospital setting, and to date no evidence of TB transmission has been found among those tested, so we believe the risk to your patient is very low. However, since infants are more likely to become sick with TB if infected, that your patient may be screened for TB as a precautionary measure. As you know, tuberculin skin tests (TST) may be unreliable in infants less than 3 months of age (falsely negative due to immature immune system), therefore, we are recommending the following:

- A tuberculin skin test along with a blood test – interferon gamma release assay (QFT or TSPOT), clinical evaluation, and 2-view chest x-ray (CXR) to be done now
- Repeat skin and blood test to be done at ____ months of age if the initial tests are negative

[We do not feel that treatment with isoniazid is indicated unless one of the TB tests is positive OR we recommend window prophylaxis treatment with isoniazid until the repeat tests are both negative]

If you do test your patient for TB, please fill out the enclosed form with your patient's results and fax it to the *[county name]* County Department of Public Health.

Fax Number: *[number]*
Phone Number: *[number]*

While it is highly unlikely that your patient will develop active tuberculosis, you should be watchful for the symptoms of active TB. Symptoms in children can include fever, weight loss or poor weight gain, enlarged lymph nodes, and/or prolonged cough or other respiratory symptoms such as wheezing. Thank you for your attention to this matter, and please call [county name] Department of Public Health TB Control Program if you have any further questions [phone number].

Sincerely,

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.3.6 FYI letter to staff

FYI – In the case that evaluation is recommended for precaution, not as part of a CI)

[Replace this text with your hospital and/ or health department identifiers]

[Date]

Dear Staff Member,

It has come to our attention that a person associated with *[hospital name]* Hospital has recently been identified as having active tuberculosis (TB). A person with active TB disease can spread TB germs through the air to those who frequently share the same air. We are currently investigating the situation to determine which staff may have been significantly exposed to the active TB case. All staff must be mindful of not discussing information about the patient's case in order to protect their confidentiality.

The most common way to become infected with TB is by spending a lot of time with a person who has active TB. TB is rarely spread to persons who spend a small amount of time with an active case of TB. Please read the enclosed TB Fact Sheet to learn more about TB and how it is spread.

We will notify you immediately if we determine that you need to be tested for exposure to the TB germ.

If you have further questions, please contact us at *[phone number]*.

Sincerely,

TB Controller, *[County name]* *AND/ OR* *[Personnel title]*, *[Hospital name]*

2.4 GENERAL TUBERCULOSIS INFORMATION

2.4.1 Tuberculosis fact sheet

What is tuberculosis (TB)?
Tuberculosis (TB) is a treatable bacterial disease that is spread from person to person through the air. TB usually affects the lungs, but can affect other parts of the body as well, including the brain, kidneys, or spine. TB germs are put into the air when a person with TB disease of the lungs coughs, sneezes, talks, or sings.

What are the symptoms of TB?
TB of the lungs may include cough, chest pain and/or coughing up blood. The general symptoms of TB disease include feeling sick or weak, weight loss, fever, chills, and night sweats.

How can you tell if someone has TB?
Either a tuberculin skin test (TST) or an Interferon-Gamma Release Assay (IGRA) TB blood test is used to determine whether a person is infected with TB germs. For the TST, a small amount of tuberculin solution is injected under the skin on the forearm and 2-3 days later, a health-care worker checks for a reaction on the arm. For the IGRA blood test, a single blood draw is needed, and the results are generally available within a week. If either test is positive, other tests such as a chest x-ray will be done to see if the person has TB infection or TB disease.

What is the difference between TB infection and TB disease?
TB can take two forms: **active TB <u>disease</u>** and **latent TB infection (LTBI)**. A person with LTBI (but not active TB disease) is not sick and does not experience any TB symptoms. Persons with LTBI cannot spread the germs to others because the bacteria are not active. Persons with LTBI can be prescribed medicine to prevent them from developing active TB disease.

Persons with **active TB disease**:

- May have symptoms that include: prolonged coughing, chills/fever, unexplained weight loss, chest pain, weakness, night sweats
- May spread TB to others
- Usually have a positive IGRA or TST
- Often have an abnormal chest x-ray

Persons with **TB infection (LTBI)**:

- Have no symptoms and do not feel sick
- Cannot spread TB to others
- Usually have a positive IGRA or TST and a normal chest x-ray

What does it mean to have a "positive" IGRA TB blood test or "positive" TB skin test?

A positive IGRA blood test or a positive reaction to a TB skin test does not necessarily mean that a person has active TB disease. A positive IGRA or TB skin test only shows that the TB germ has infected the person's body. Only about 10% of people with LTBI will go on to develop active TB disease over the course of their lifetime.

Additional information on TB can be found at http://www.cdc.gov/tb/topic/basics/default.htm
For more information, please contact: *[organization's main telephone line]*

2.4.2 Testing results fax form

This form should be filled out and faxed to *[county name]* County Department of Public Health at *[fax number]*

Patient Name	
Date of Birth	
Medical Record #	
Date of Testing/ Exam	
TB Test results:	TST (circle one): Positive / Negative TST: _____mm induration IGRA (circle one): Positive / Negative IGRA: Ag1-nil value _____ IGRA: Ag2-nil value_____
Chest X-Ray Result (if applicable)	
Physical Exam	

2.4.3 Infant tuberculosis and working with public health for pediatricians

Tuberculosis in infants

How is TB in infants different than in adults?
If infected, infants are more likely than adults to develop active TB disease, possibly progressing to active TB in a matter of weeks or months. In addition, the presentation of TB in infants is often distinctly different than that in adults. Infants suffer more extrapulmonary and disseminated TB than adults. Very young children are at particular risk of acute hematogenous dissemination (miliary disease) and meningitis. Infants frequently have more subtle and modest symptoms when diagnosed with TB.

How is TB diagnosed in infants?
As in adults, TB is diagnosed on the basis of history, physical examination, and chest radiograph. However, diagnosis in infants is challenging, as many may have no symptoms. Approximately 30–60% of children diagnosed with active TB in the United States have no symptoms reported by the parent at the time of diagnosis. Sometimes, poor weight gain may be the only finding of active TB.

Frontal and lateral chest radiographs are recommended by experts for the evaluation of children suspected of having intrathoracic TB. Adenopathy is seen frequently in infants and young children with TB and is reported to be present in 85% of children less than 3 years of age. Because radiologic findings for TB in children can be different from those commonly seen in adults, it is important that radiographs be interpreted by someone experienced in the interpretation of pediatric radiographs.

Bacteriologic confirmation of TB disease in infants is often challenging because of the difficulty in obtaining a specimen for mycobacterial culture. Unless a child is able to produce sputum, gastric aspiration provides the best clinical specimen.

What signs and symptoms of TB disease should I look for in infants?
In infants, common clinical manifestations of TB are nonspecific and include respiratory symptoms (cough and increased work of breathing), fever, hepatic and/or splenic enlargement, poor feeding, irritability, lethargy, lymphadenopathy, skin lesions (papulopustular, necrotic, atrophic), and ear discharge.

Symptoms in young children include cough, fever, and weight loss or failure to thrive. Miliary or acute disseminated TB may cause additional nonspecific symptoms such as fatigue, anorexia, vomiting, and diarrhea.

Testing and decision to treat infants exposed in newborn nursery or neonatal ICU

Can I manage the testing and treatment of my patient independent of the health department?

Collaboration with *<health department name>* is requested for four reasons:

1) TB testing and treatment in infants requires expertise and knowledge to ensure the best results. *<health department name>* is consulting with pediatric TB experts to ensure the most appropriate care is provided to infants exposed to TB in the NICU. This advice includes testing recommendations, clinical guidelines for LTBI, clinical guidelines for treatment of TB disease, and recommendations for how to monitor treatment.

2) For best results, treatment should be given under direct observation to ensure adherence and close monitoring. Providing this level of care is generally beyond the capacity of non-public health practitioners.

3) *<health department name>* needs to track outcomes of contacts to determine the scope of transmission resulting from this exposure and make decisions about future investigation activities.

4) Because this is a Public Health matter in addition to being a personal health matter, the *<health department name>* has an ability to assist the family with the cost of testing and treatment. All LTBI and disease medications are provided free of charge to all patients.

Are there any tests I should do before I refer my patient to the health department that will help expedite diagnosis and treatment decisions?

1) Initial testing is scheduled for <date> and will be provided free of charge. This will include a <type of test> .

2) Your patient will also need a chest radiograph and a physical examination which we are requesting you schedule as quickly as possible after the testing. It would be helpful if you made the appointment now in anticipation of the results coming to you late next week.

Should treatment be given as a precaution during the diagnostic process regardless of the initial testing results?

1) The experts at the *<consultation entity, RTMCC>* have advised at this time prophylactic treatment should be considered only on a case-by-case situation after full review of the testing results, chest radiograph and physical examination. It is most important that TB disease be fully ruled out before any consideration for treatment is pursued to assure additional resistance is not developed.

2) *<health department name>* will assist you with direct consultation with the experts on your individual patient if you have questions or concerns beyond what the *<health department name>* TB staff are able to assist you with.

How will children diagnosed with latent LTBI be treated?

If the child in your care is diagnosed with LTBI, the *<health department name>* will work with you through the guidance of expert TB consultation network to develop the appropriate treatment plan. To promote adherence and maximize the benefits of therapy, children should be treated under direct observation.

Pediatrician's role

What is my role in evaluating patients for whom *<health department name>* **is recommending testing as part of this TB contact investigation?**
<health department name> is asking providers to perform physical examinations on their patients to help diagnose or rule out active TB disease. *<health department name>* will provide an examination form for you to complete. Upon completion of the examination form you are asked to return a copy to *<health department name>* for the review of the consultants and for use in tracking the contact investigation outcomes to determine if transmission is likely and the investigation should be expanded. Please send a copy of all chest x-ray films to JCDHE for expert consultant review along with the examination form.

Moving forward, please remain alert for signs and symptoms of TB in your patient. Feel free to refer parents to JCDHE if they would like more information.

Whom can I call if I have more questions regarding an infant under my care?
<health department name> TB Clinic – dedicated number?

2.4.4 Related tools for pediatricians from the Heartland National TB Center [24]

- TB Screening Tests in Children provides info on TB tests and interpretation: (TB Screening Tests in Children)

- TB Treatment for Children, one page document: Tips for Treating Latent TB Infection in Children

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