Pulmonary Tuberculosis in Department of Navy Beneficiaries

2013 Annual Report

Table of Contents

Executive Summary

This annual report describes cases of active pulmonary tuberculosis (TB) among United States Department of Navy (DON) beneficiaries from calendar years 2005 to 2013. Overall, there were 97 confirmed cases of active pulmonary TB during this timeframe, including 8 cases among DON recruits and 18 cases among DON active duty personnel.

In 2013, there were eight cases of active pulmonary TB, four of which were among active duty personnel (three Sailors, one Marine) and one of which was a Navy recruit. Two active duty cases (50%) and the recruit case were foreign-born. One active duty case was assigned to a ship at the time of diagnosis; the remaining active duty cases were assigned to locations within the continental United States (CONUS).

Active pulmonary TB in the DON beneficiary population is rare, particularly among active duty service members, but the disease presents unique challenges due to the nature of military settings and populations. Data in this report contribute to the overall understanding of TB in the DON population and inform program and policy decisions related to force health protection.

Introduction

Tuberculosis (TB) is a disease caused by the bacterium *Mycobacterium tuberculosis* and most commonly manifests as a respiratory illness. While TB disease can develop in nonrespiratory sites, only the respiratory illness is contagious. There are two conditions of TB: latent TB infection (LTBI) and active TB disease. Persons with LTBI are infected, but their immune systems prevent bacterial growth. LTBI is not infectious, has no symptoms, and cannot be spread to others. Active TB disease occurs when the immune system no longer suppresses bacterial growth. Active TB disease can develop weeks or years after infection and can be spread to others through the air when an infected person coughs or speaks. Symptoms include a cough lasting three weeks or longer, chest pain, coughing up blood or sputum, weakness or fatigue, weight loss, loss of appetite, chills, fever, and night sweats. The risk of developing active disease is higher for persons with human immunodeficiency virus (HIV), with recent TB infection (in the last two years), with other comorbidities such as diabetes that make it harder for the body to fight infection, who abuse alcohol or other illegal drugs, or who were not treated correctly for LTBI.[1]

TB is one of the world's deadliest diseases. One-third of the world's population is infected with TB, and in 2012, nearly 9 million developed active TB disease. There were approximately 1.3 million TB-related deaths worldwide in 2012, and it is a leading cause of mortality among HIV-positive persons.[2] In the United States (US), TB burden is relatively low. In 2012, 9,945 TB cases were reported in the US, a rate of 3.2 per 100,000 persons. This is a 6.1% decrease in the case rate compared to 2011.[3] In 2012, 63% of reported TB cases in the US were among foreign-born persons; the case rate among foreign-born persons (15.9 per 100,000) was nearly 11 times higher than the rate among US-born persons (1.4 per 100,000).[4]

TB infection is identified using the tuberculin skin test (TST) or interferon-gamma release assays (IGRAs) which test blood. A positive TST or IGRA only indicates infection; it does not distinguish between LTBI and active disease.[5] In addition, those who have received the Bacille Calmette-Guérin (BCG) vaccine against TB will likely have a positive reaction to a TST. The BCG vaccine is not generally used in the US, but is often given to children in countries where TB is common. IGRA results are not affected by prior BCG vaccination.[6]

Chest x-rays and sputum tests are used to confirm active TB. The presence of acid-fast bacilli (AFB) on a sputum smear is a quick method for indicating potential TB disease. A culture is needed regardless of smear results to confirm diagnosis, as it possible for a person to be smear-negative and culture-positive.[5]

Treatment of LTBI is necessary to prevent the development of active TB. The standard treatment regimen is six or nine months of daily or twice-weekly isoniazid (INH).[7] For active TB, the first-line drugs include INH, rifampin (RIF), ethambutol (EMB), and pyrazinamide (PZA). The standard regimen is all four drugs daily for eight weeks, followed by a continuation phase of INH and RIF daily or twice-weekly for 18 weeks.[8] To ensure compliance with LTBI and active TB treatments, these medications are often provided as directly observed therapy (DOT), where a health care worker directly observes the patient taking the medication.

Tuberculosis in the US Military

Unique environmental conditions, such as close living quarters and closed ventilation systems aboard Navy ships, place Navy and Marine Corps service members at increased risk for the spread of TB, with the potential for major impacts on mission readiness. Several TB outbreaks aboard ships have previously been documented.[9,10] Routine overseas travel to countries where TB is endemic also places service members at increased risk for TB. TB is highly endemic in southwest and south-central Asia, particularly in Afghanistan, which had the 12th highest per capita rate of TB cases in the world in 2004.[11] Service members are at risk for becoming infected when in close contact with local civilian workers while deployed to countries where TB is more prevalent.[12]

Navy Bureau of Medicine and Surgery (BUMED) Instruction 6224.8B, *Tuberculosis Control Program* (21 Feb 2013) provides policy and guidance for TB control among Department of the Navy (DON) military personnel. Under this instruction, all Navy and Marine Corps accessions are tested for LTBI through TST or IGRA. Those with a history of TB, a positive TST or other test, or previous treatment for LTBI must provide medical documentation of clinical evaluations, hospitalizations, diagnoses, and treatments. LTBI screening is also performed for personnel embarking on a commissioned vessel, during the Periodic Health Assessment (PHA), as directed by combatant commanders, as part of a contact or outbreak investigation, if clinically indicated based on history or physical, or as recommended by the cognizant Navy Environmental Preventive Medicine Unit (NEPMU).

This report summarizes active pulmonary TB cases from 2005 to 2013 among DON beneficiaries, including active duty service members, recruits, retirees, and their family members.

Technical Notes

The EpiData Center Department (EDC) at the Navy and Marine Corps Public Health Center (NMCPHC) receives electronic health data from military treatment facilities (MTFs) worldwide. Data used to identify pulmonary TB cases included chemistry and microbiology laboratory tests and medical event reports (MERs). Supplemental data such as personnel databases and case reviews of electronic medical records were used to obtain more information about confirmed cases.

Laboratory Tests

Positive TB cases in microbiology and chemistry data were those where *M. tuberculosis* was identified from an acid-fast culture or nucleic acid amplification test (NAAT) from a sputum or bronchoalveolar lavage sample. Smears positive for acid-fast bacilli (AFB) that did not specifically identify *M. tuberculosis*, tests positive for nontuberculous *Mycobacterium*, and positive tests for *M. tuberculosis* from extrapulmonary sources were not considered positive cases. AFB smear results were summarized in the case series of active duty service members only.

Medical Event Reports

BUMED Instruction 6220.12B, *Medical Surveillance and Notifiable Event Reporting* (12 Feb 2009), requires that a MER be submitted to Disease Reporting System-internet (DRSi) when a reportable medical event is suspected or confirmed at a Navy MTF. Pulmonary TB is a reportable event, per Armed Forces Reportable Medical Events Guidelines (March 2012). All MERs for tuberculosis from 2005 to 2013 were reviewed. Patients with a MER with a case status of "confirmed," or with a MER and an associated positive test from microbiology or chemistry data (regardless of MER case status), were considered positive cases.

Case Verification

There were 136 positive TB cases identified from laboratory data and MERs. These cases were verified and confirmed using the Armed Forces Health Longitudinal Technology Application (AHLTA). AHLTA is the electronic medical record system used by Department of Defense MTFs worldwide. It includes provider notes and diagnoses for outpatient encounters, laboratory results, and other clinical notes. Verification of cases using provider notes was necessary to ensure true TB case capture, as this additional clinical information would not be available in a laboratory record and may not be included in a MER. Thirty-nine cases were excluded upon AHLTA review; reasons for exclusion included those with extrapulmonary TB or those who were screened for active TB but actually had LTBI. Five cases did not have AHLTA encounter information available; these cases were included in the analysis as positive cases.

Data Analysis

Trends are reported for all DON beneficiaries with additional analyses for active duty service members and recruits separately. Cases were attributed to the month and year of the specimen collection date of the positive TB test or the MER reported date, whichever was earlier. The same method was used to attribute cases to a parent MTF if more than one MTF was involved in the case's care. Demographic variables were found in both data sources. Personnel databases were used to obtain country of birth and rank information for active duty service members and recruits. Denominators for TB rates in the active duty population were from the Defense Medical Epidemiology Database (DMED) maintained by the Armed Forces Health Surveillance Center (AFHSC). Case presentation details, including presence of symptoms and chest x-ray results, for active duty service members and recruits were summarized using MER notes and AHLTA encounter notes.

Contact Investigations

Contact investigation reports archived by the Preventive Medicine Department at NMCPHC were summarized for informational purposes. These reports document contact investigations performed by NEPMUs in response to active tuberculosis cases associated with DON facilities. Cases may not necessarily be active duty service members or other DON beneficiaries; therefore, not all contact investigation reports will be associated with a MER or with a confirmed case in this report.

Data Limitations

Microbiology and chemistry data maintained at the EDC are routinely generated within the

Composite Health Care System (CHCS) at fixed MTFs. These data do not included records from shipboard facilities, battalion aid stations, purchased care visits, or in-theater facilities. Microbiology testing results show the organism that was identified, not what the test was intended for; i.e., if a physician suspected an organism different from the one that was identified, the record will not show the organism that the physician suspected. Microbiology data are useful for identifying laboratory confirmed cases of illness; however, cases where a physician chooses to treat presumptively without laboratory confirmation will not be captured. Clinical practice with regards to culturing varies between providers and facilities. Chemistry data contain groups of tests, called panels, which are ordered when patients present with non-specific symptoms. If the test name or test results within a panel are not disease-specific, these results may not be captured in search terms used to query the data. Classifying chemistry and microbiology results involves extensive searching of free-text test result fields. It is possible that some results were misclassified; however, validation steps included in this analysis will help mitigate such errors.

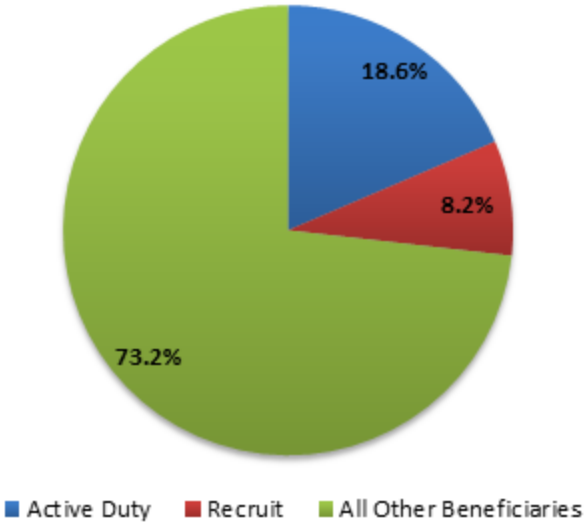
DRSi is a passive medical event reporting system that allows users to document reportable events on a case-by-case basis. MER completeness and validity is reliant upon accurate data entry by DRSi recorders. Shipboard or forward deployed cases may be reported to DRSi, but internet access is required, which may result in extended delays in data availability. Reportable medical events identified outside of the Military Health System (MHS), such as purchased care visits, cannot be reported in DRSi unless the case is reported to a local MTF. These cases may be captured during follow-up care at the MTF.

The use of laboratory data and medical event reports together to identify cases, with additional case verification using AHLTA encounter records, minimizes the effects of these limitations.

Trends in Tuberculosis: All DON Beneficiaries

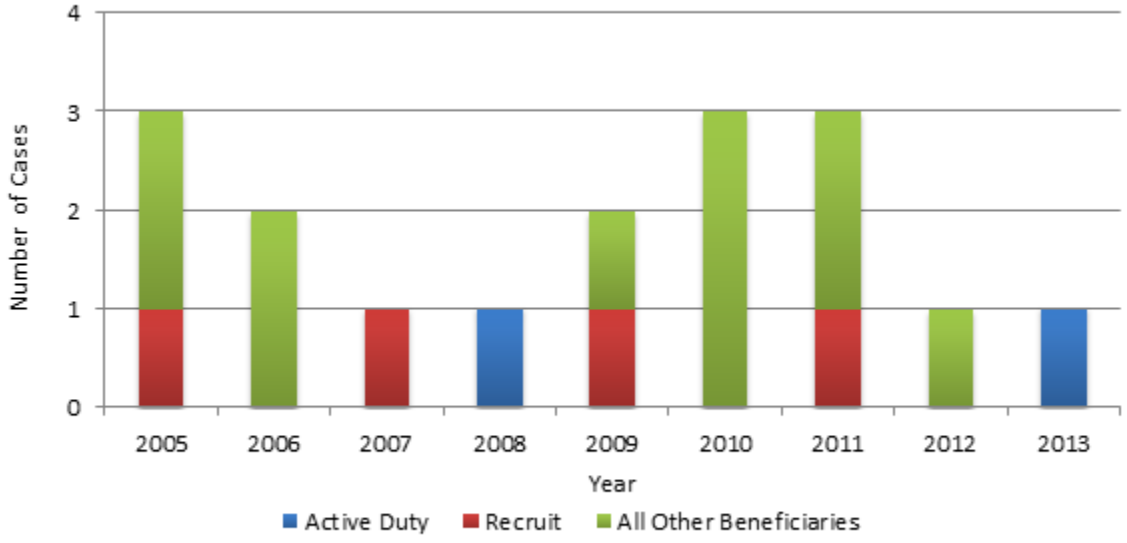
From 2005 to 2013, 97 confirmed cases of pulmonary TB were identified among DON beneficiaries, which included active duty service members, recruits, retired service members, and their families. Most cases were spouses of service members/retirees (44.3%), followed by retirees (19.6%) and active duty service members (18.6%). Overall, the MTF with the highest percentage of overall cases was Naval Medical Center (NMC) San Diego (43.3%), followed by NMC Portsmouth and Tripler Army Medical Center (AMC)-Ft. Shafter (9.3% each).

Figure 1. Pulmonary Tuberculosis Cases by Beneficiary Status, DON Beneficiaries, 2005-2013



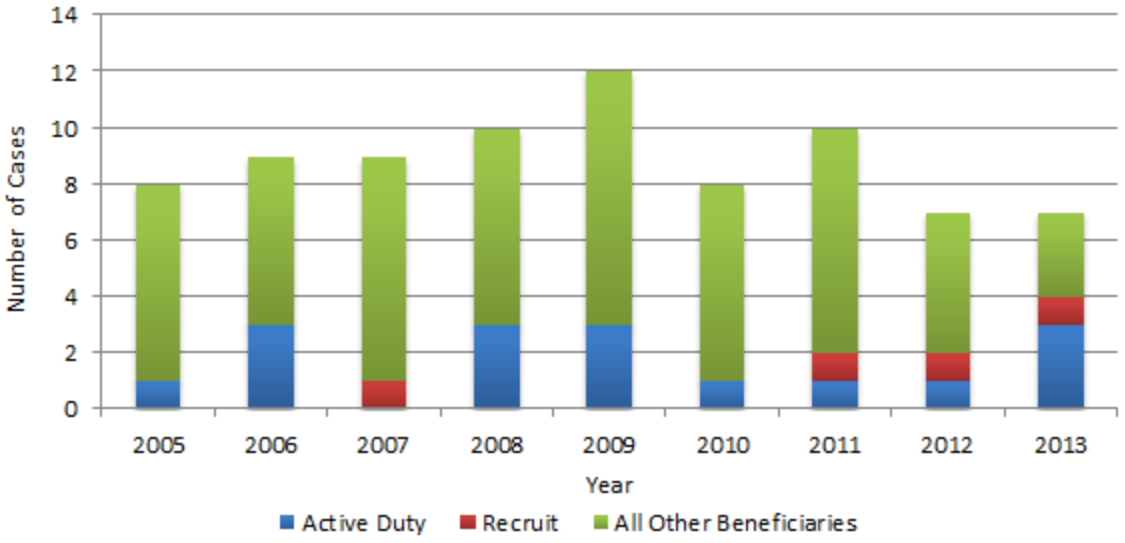
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Figure 2. Pulmonary Tuberculosis Cases by Year and Beneficiary Status, Marine Corps Beneficiaries, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Figure 3. Pulmonary Tuberculosis Cases by Year and Beneficiary Status, Navy Beneficiaries, 2005-2013



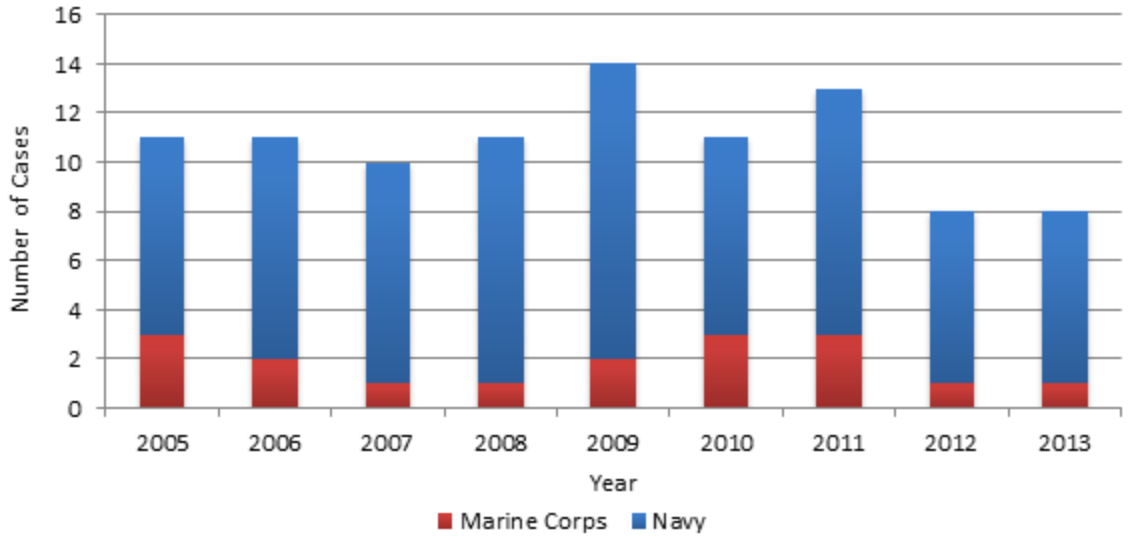
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Table 1. Pulmonary Tuberculosis Cases by Service and Beneficiary Status, DON Beneficiaries, 2005-2013

	Marine Corps				Navy			
Year	Active Duty	Recruit	All Other Beneficiaries	**Total**	Active Duty	Recruit	All Other Beneficiaries	**Total**
2005	0	1	2	3	1	0	7	8
2006	0	0	2	2	3	0	6	9
2007	0	1	0	1	0	1	8	9
2008	1	0	0	1	3	0	7	10
2009	0	1	1	2	3	0	9	12
2010	0	0	3	3	1	0	7	8
2011	0	1	2	3	1	1	8	10
2012	0	0	1	1	1	1	5	7
2013	1	0	0	1	3	1	3	7
Total	2	4	11	**17**	16	4	60	**80**

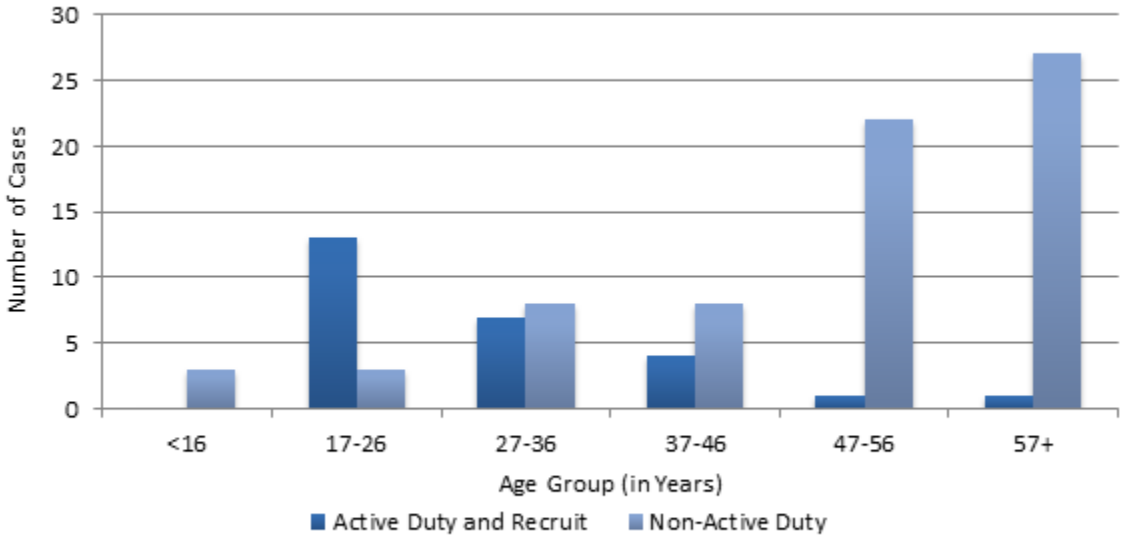
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Figure 4. Pulmonary Tuberculosis Cases by Year and Service, DON Beneficiaries, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 03 April 2014

Figure 5. Pulmonary Tuberculosis Cases by Age Group and Beneficiary Status, DON Beneficiaries, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 04 April 2014

Table 2. Pulmonary Tuberculosis Cases by Beneficiary Status and Age Group, DON Beneficiaries, 2005-2013

	Age Group (in Years)					
	<16	17-26	27-36	37-46	47-56	57+
Beneficiary Category						
Active Duty	NA *	7	5	4	1	1
Recruit	NA	6	2	NA	NA	NA
All Other Beneficiaries	3	3	8	8	22	27

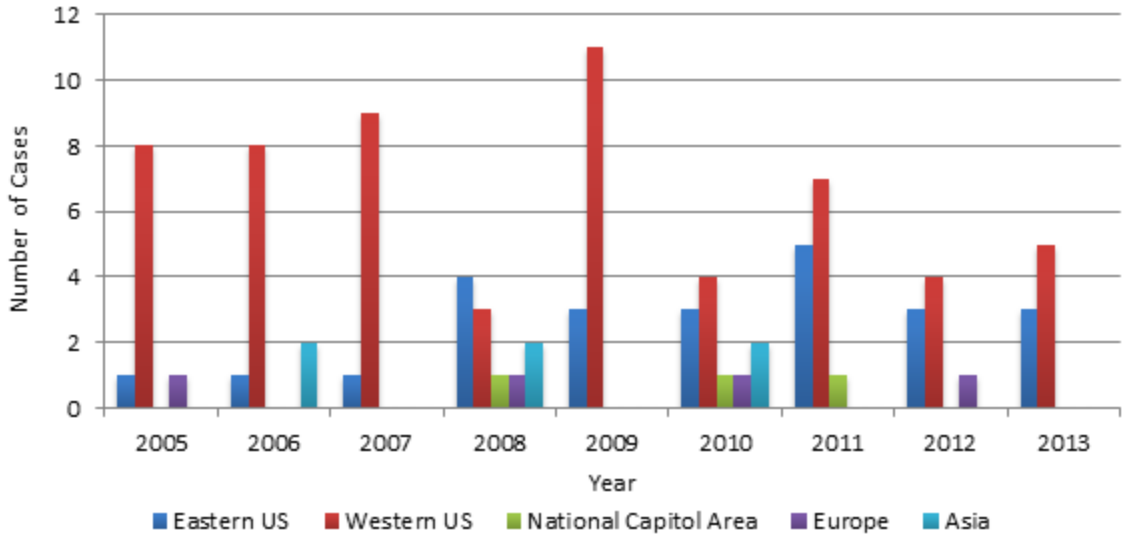
* NA=not applicable age group for the beneficiary category
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Table 3. Pulmonary Tuberculosis Cases by Geographic Location and Parent MTF*, DON Beneficiaries, 2005-2013

Geographic Location	Parent MTF	Count	Percent (N=97)
Eastern US	NMC Portsmouth	9	9.3%
	James A Lovell FHCC [+]	5	5.2%
	NH Jacksonville	3	3.1%
	NH Pensacola	3	3.1%
	NH Beaufort	2	2.1%
	L. Wood ACH-Ft. Leonard Wood	1	1.0%
	William Beaumont AMC-Ft. Bliss	1	1.0%
Western US	NMC San Diego	42	43.3%
	Tripler AMC-Ft. Shafter	9	9.3%
	NH Bremerton	2	2.1%
	60th Med Grp-Travis AFB	1	1.0%
	62nd Med Grp-McChord AFB	1	1.0%
	NH Camp Pendleton	1	1.0%
	NH Lemoore	1	1.0%
	NH Oak Harbor	1	1.0%
	USS Peleliu (LHA5)	1	1.0%
National Capitol Area	Walter Reed National Military Medical Center [^]	3	3.1%
Europe	Landstuhl Regional Medical Center	2	2.1%
	NH Naples	2	2.1%
Asia	NH Okinawa	3	3.1%
	NH Guam-Agana	2	2.1%
	NH Yokosuka	1	1.0%

* 1 case with unknown MTF
[+] Formerly NH Great Lakes
[^] Formerly National Naval Medical Center Bethesda and Walter Reed Army Medical Center
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 04 April 2014

Figure 6. Pulmonary Tuberculosis Cases by Year and Geographic Location, DON Beneficiaries, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 04 April 2014

Trends in Tuberculosis: DON Recruits

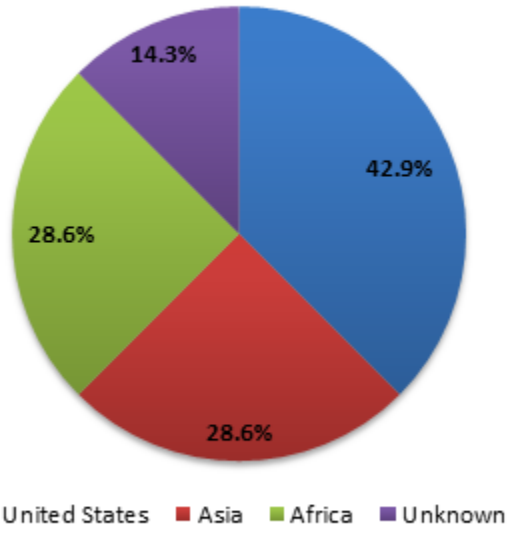
Eight confirmed cases of pulmonary TB were identified from 2005 to 2013 among DON recruits. Four of these were accessions to the Marine Corps and four were accessions to the Navy. Country of birth was known for seven cases; four were foreign-born (one each from Cameroon, China, Nigeria, and Vietnam) and three were born in the US. Case presentation details were available for seven cases; all of which were initially identified as potential TB cases based on a positive TST at accession. Two were also symptomatic, with symptoms including cough, night sweats, and weight loss.

Table 4. Pulmonary Tuberculosis Cases by Year, Service, and Training Facility, DON Recruits, 2005-2013

	Marine Corps		Navy	
	MCRD Parris Island	MCRD San Diego	NTC Great Lakes	
Year				*Total*
2005	1	0	0	1
2006	0	0	0	0
2007	0	1	1	2
2008	0	0	0	0
2009	1	0	0	1
2010	0	0	0	0
2011	0	1	1	2
2012	0	0	1	1
2013	0	0	1	1
Total	2	2	4	8

Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Figure 7. Pulmonary Tuberculosis Cases by Birth Location, DON Recruits, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi; DMDC
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Trends in Tuberculosis: DON Active Duty Service Members

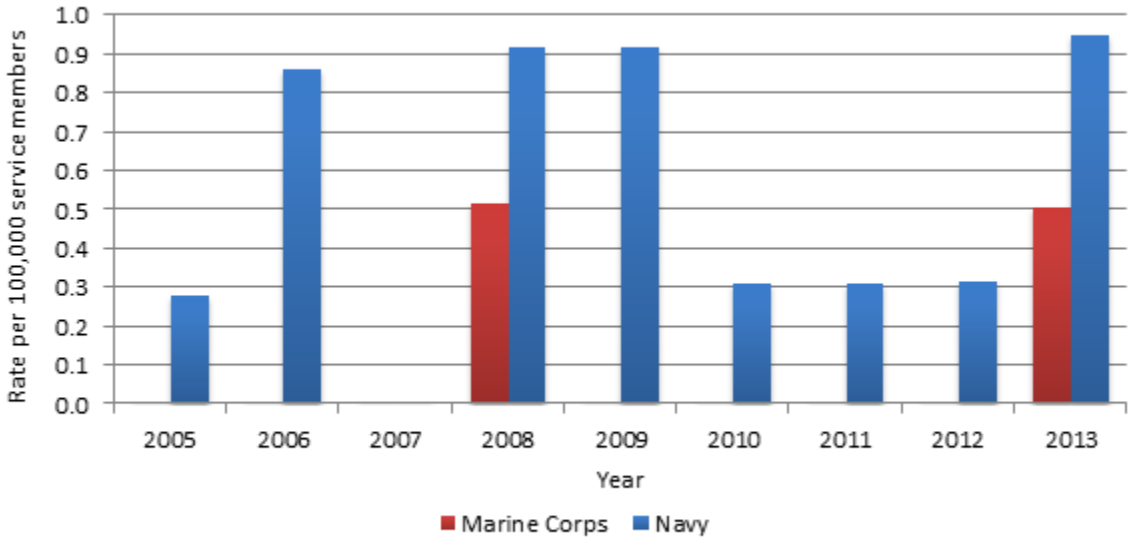
There were 18 confirmed cases of pulmonary TB among DON active duty service members from 2005 to 2013; 16 were Sailors and 2 were Marines. Rates in both services were below 1 per 100,000 service members in all years. The majority of cases were enlisted service members (72.2%) and most cases were in the 17-26 year age group (see Table 2 above). Country of birth was available for 17 cases; of these, 12 were foreign-born and 5 were born in the US. Most of

the foreign-born cases were born in the Philippines (58.3%). The remaining foreign-born cases were born in Korea, Mexico, Nepal, Peru, and Trinidad and Tobago (one each). Overall, 12 cases (66.7%) were known to be have previous positive TST results (indicative of LTBI) and 8 of these completed treatment at the time of the previous positive TST.

Most cases (n=12; 66.7%) were symptomatic, presenting with one or more of the following: cough, fever, chills, night sweats, weight loss, hemoptysis, and headache. Seven cases had positive AFB smears; the remaining 11 cases had negative smears or unknown smear results. All 18 cases were culture-confirmed. One case had evidence of drug resistant TB (resistant to INH). Additional active duty case information is further summarized in the case series in Appendix A.

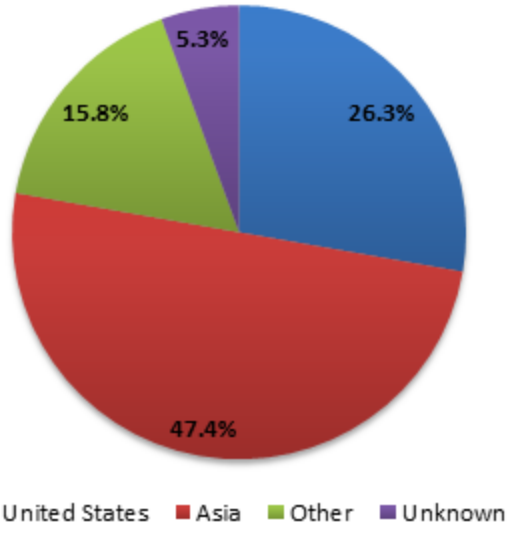
Most active duty cases (n=10; 55.6%) were assigned to a CONUS shore duty station at the time of diagnosis. Six cases (33.3%) were assigned to a ship, and the remaining two cases were assigned to shore duty stations outside of the continental US (OCONUS). The most frequent diagnosing and/or treating MTF was NMC San Diego (33.3%), followed by NMC Portsmouth and Tripler AMC-Ft. Shafter (11.1% each).

Figure 8. Pulmonary Tuberculosis Rates by Year and Service, DON Active Duty Service Members, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi; DMED
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Figure 9. Pulmonary Tuberculosis Cases by Birth Location, DON Active Duty Service Members, 2005-2013



Datasources: CHCS microbiology and chemistry; DRSi; DMDC
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Table 5. Pulmonary Tuberculosis Cases by Geographic Location and Parent MTF, DON Active Duty Service Members, 2005-2013

Geographic Location	Parent MTF	Count	Percent (N=18)
Eastern US	NMC Portsmouth	2	11.1%
	James A Lovell FHCC [+]	1	5.6%
	NH Jacksonville	1	5.6%
Western US	NMC San Diego	6	33.3%
	Tripler AMC-Ft. Shafter	2	11.1%
	NH Bremerton	1	5.6%
	USS Peleliu (LHA5)	1	5.6%
National Capitol Area	Walter Reed National Military Medical Center [^]	1	5.6%
Europe	Landstuhl Regional Medical Center	1	5.6%
	NH Naples	1	5.6%
Asia	NH Guam-Agana	1	5.6%

[+] Formerly NH Great Lakes
[^] Formerly National Naval Medical Center Bethesda and Walter Reed Army Medical Center
Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Table 6. Pulmonary Tuberculosis Cases by Year and Permanent Duty Station Location, DON Active Duty Service Members, 2005-2013

	CONUS Shore	OCONUS Shore	Ship	
Year				*Total*
2005	0	1	0	1
2006	2	1	0	3
2007	0	0	0	0
2008	3	0	1	4
2009	1	0	2	3
2010	0	0	1	1
2011	0	0	1	1
2012	1	0	0	1
2013	3	0	1	4
Total	10	2	6	18

Datasources: CHCS microbiology and chemistry; DRSi
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, 10 April 2014

Contact Investigations

Information archived in TB contact investigation reports is variable. While other investigations may have occurred during this time period, the following represents information archived at NMCPHC for TB contact investigations between 2005 and 2013.

USS 2006

In 2006, an active duty Sailor assigned to a ship presented to medical with cough, fever, chills, headache, and nausea. A chest radiograph taken at that time revealed a right upper lobe infiltrate and the Sailor was given a diagnosis of community-acquired pneumonia. Symptoms continued for several months and the Sailor was eventually confined to berthing and referred to a pulmonary clinic for further evaluation, where a diagnosis of pulmonary TB was made. This case was a native of the Philippines with 12 years of active duty service. The case had a history of LTBI since accession, including completion of six months of INH therapy.

During the contact investigation, initial testing of 320 close contacts revealed 12 (3%) new positive TST results. Based on results of initial testing, and due to concerns specific to the shipboard setting, testing was expanded to all Sailors and civilians aboard the ship for at least 48 hours at any time during the case's infectious period. This investigation was further complicated by a high number of potential civilian contacts (n=1,225) during a Tiger Cruise that overlapped with the case's infectious period. Therefore, the investigation was conducted in conjunction with the Centers for Disease Control and Prevention (CDC). Testing in all 5,000 Sailors resulted in 139 (3%) new positive TST results. A case-control study was then used to prioritize civilian testing. This prioritization scheme identified 38 civilians who shared berthing with the case; all were subsequently tested. One of these 38 civilians had a new TST positive result. There were no secondary cases of active TB disease in the military or civilian populations resulting from exposure to the active case.

NH 2006

An active duty Sailor who was a healthcare worker at a Naval hospital presented to medical in 2006 with a history of approximately four weeks of cough, night sweats, and fatigue. Sputum collected at that time was AFB positive and the Sailor was immediately given presumptive treatment for TB with four-drug therapy. A positive NAAT for TB confirmed the diagnosis. The case was a Korean-born officer with a history of exposure to active pulmonary TB disease as a child.

An initial investigation resulted in INH treatment of two contacts, one of which was a previous TST converter. A follow-up investigation included testing of 63 additional contacts; none of which had a new positive TST result. Individuals tested included household and close work contacts, as well as patients of the case. The case completed therapy in 2006 and was asymptomatic upon deployment in 2007.

USS 2008

Active pulmonary TB was identified in an asymptomatic active duty Sailor assigned to a ship in the course of routine deployment screening. When the Sailor had a positive TST, a chest x-ray was performed, which revealed scarring without lesions. The Sailor was referred to the regional medical center where a diagnosis of LTBI was made and treatment was initiated. Sputum AFB and polymerase chain reaction (PCR) test results taken at that time were negative, but a culture from the same specimen was later positive for TB. The case was referred to a pulmonology clinic for evaluation and treatment.

The case was a native of the Philippines who arrived in the US in 2003 and lived in California, with travel to Manila in 2006 prior to joining the Navy in 2007. Medical history included BCG vaccination, a pneumonia diagnosis in 2004, and a chest x-ray at accession with small residual left lung effusion. The case also recalled a slight TST reaction at accession, but it was recorded at 0 mm.

The subsequent contact investigation identified 73 close contacts. Sixty-eight of these contacts had a previous TST reaction or had been previously given a chest x-ray as a previous reactor. No new latent infection or reactivation was found. The remaining five contacts were not available for testing due to alternate duty stations or separation from service.

Joint Base 2010

In 2010, a family member of an active duty Sailor presented to civilian medical with symptoms including cough, sore throat, fever, nausea, fatigue, and malaise. The patient was initially treated for a viral infection. A subsequent evaluation at a Naval clinic included a chest x-ray showing a cavitary lesion. The patient was then referred to seek inpatient care. The case was diagnosed with TB based on a TST result of 10 mm and a 4+ positive sputum AFB smear.

The case was born in Liberia and immigrated to the US in 1997. The case had a history of BCG vaccination and a negative TST result recorded in 2003. Travel history included travel with the active duty sponsor to multiple duty stations, including Puerto Rico and Italy.

The contact investigation was conducted by the cognizant NEPMU. The case was considered to be highly contagious with an infectious period of more than four months. The on-base portion of the investigation identified 23 close contacts, including family, close friends, and healthcare contacts. Among the family, two new latent infections and one active case were identified. Among the close friends and healthcare contacts, there were no new positive TST results or new disease. The county public health department completed the off-base portion of the contact investigation.

NSA 2011

A civilian employee of a child development center at an OCONUS command was diagnosed with active pulmonary TB in 2011. The case experienced symptoms including a productive cough, pleuritic chest pain, and night sweats over a period of 18 months and had multiple medical encounters. The case was initially treated for upper respiratory infection, followed by diagnosis and treatment for pneumonia, and then diagnosis and treatment for coccidioidomycosis after previous treatments failed. Subsequent positive AFB sputum smears and cultures positive for TB confirmed a diagnosis of pulmonary TB.

The case was a native of the Philippines and immigrated to the US in the late 1980's with an active duty spouse. At that point, the case was diagnosed with LTBI and completed six months of INH therapy. The case began employment at the child development center in 2010 and had completed annual occupational screening twice since that time, with no abnormal findings.

The cognizant NEPMU began a contact investigation at the request of the Commanding Officer of the Naval hospital and the Public Health Services Directorate. The infectious period was determined to be more than 21 months. The case also worked in the infant care room at the child development center, so there was concern for exposure to children less than one year of age. The investigation identified 119 high priority contacts, including infants under the care of the case, other staff members at the center, healthcare workers, and family members. Of these, 118 were tested and two positive TST results were identified, both in infants. The investigation was then expanded to include an additional 322 low priority contacts. Of these, 239 were tested, and there were no new positive TST results. Case finding and risk communication during this investigation was complicated by holiday leave and a highly mobile population. The international setting provided additional challenges, such as risk communication, case support in the small command community, and distance from public health support.

USS 2012

In 2012, a contact investigation was conducted related to exposure onboard three ships and two military installations to active pulmonary TB in two civilian contractors. Exposures began in May 2012 and continued into November of that year. The contact investigation was conducted by the cognizant NEPMU in conjunction with local civilian public health personnel. The NEPMU investigation identified over 300 shipboard and military installation contacts selected for testing; four of those tested had new positive TST results.

NH 2013

A family member of an active duty service member was suspected to have pulmonary TB at an OCONUS command in 2013. The case was primarily experiencing pleuritic chest pain and reported being "hot at night." A chest radiograph revealed an opacity in the left lower lobe consistent with atypical pneumonia and atelectasis (collapse of the lung). Following a positive IGRA test, it was recommended that the patient initiate four-drug treatment for presumptive primary active TB. When the case presented for follow-up, there was concern whether the infection was truly active disease or LTBI. Consultation with Infectious Disease led to the patient providing sputum samples for AFB staining and bronchoalveolar lavage was conducted for AFB culture and sensitivities. All sputum samples were ultimately negative for *M. tuberculosis* and the case was treated with INH for nine months for LTBI.

The case was a native of Ethiopia and arrived at the OCONUS command in 2011 to live with an active duty family member stationed there. The patient had received BCG vaccination while in Ethiopia.

A contact investigation was conducted at the request of the Commanding Officer at the Naval hospital. The infectious period was determined to be four months in length based on the case's symptoms. Eighteen people were identified as high-priority contacts, three of which were family members. All 18 were in close proximity to the case for eight or more hours on any given day, or for at least fifteen hours in any seven day period. There were seven low priority contacts, who were teachers that were in close proximity to the case for at least three hours or more in any seven day period. Seventeen of the 18 high priority contacts were tested, all had negative TST results. Three of the seven low priority contacts were tested and were negative; the remaining four declined screening and testing. In addition, 72 non-contacts (concerned students and teachers) were tested; eight of these had a positive TST result and received LTBI treatment.

This was a unique situation as the case and subsequent investigation were treated as if active TB was diagnosed, when the case actually had LTBI and did not have active disease. There was also difficulty in communicating with contacts as several had returned to the US.

Appendix A: Active Duty Case Series

Year	Service	Country of Birth	Duty Station	AFB Smear Results	Presentation	Reported in DRSi	Notes
2005	Navy	US	OCONUS	Positive; 3+	Symptomatic: cough, fever, dyspnea. Chest x-ray with infectious process.	Yes	INH resistant TB. Prior converter in 2004; completed 9 months INH.
2006	Navy	Unknown	CONUS	Positive	Symptomatic: cough x5 weeks, weight loss, headache.	No	Unknown TB history.
2006	Navy	Philippines	CONUS	Positive; 4+	Symptomatic: cough x1 month. Suspicious chest x-ray.	Yes	Originally diagnosed with pneumonia. Prior converter in 1995; completed 6 months INH.
2006	Navy	Korea	OCONUS	Positive	Symptomatic: cough, fever, chills, night sweats. Granulomas noted on chest x-ray.	Yes	Prior converter as teenager; no notes on treatment. History of BCG vaccination. Household contact with active TB as a child.
2008	Navy	Philippines	CONUS	None	Symptomatic: cough. Abnormal chest x-ray.	No	Originally diagnosed with and treated for pneumonia. Prior converter at accession in 1987; completed 12 months INH. History of BCG vaccination.
2008	Navy	Philippines	CONUS	Negative	Asymptomatic. CT given for other medical issue was concerning for TB.	Yes	Prior converter at accession in 1990; completed 6 months INH.

Year	Service	Country of Birth	Duty Station	AFB Smear Results	Presentation	Reported in DRSi	Notes
2008	Marine Corps	US	CONUS	Negative	Asymptomatic. Positive TST at screening. Suspicious chest x-ray.	No	Prior converter in 2005; no notes on treatment.
2008	Navy	Philippines	Ship	Negative	Asymptomatic. Positive TST and suspicious chest x-ray during deployment screening.	No	Prior converter at accession; no notes on treatment. History of BCG vaccination.
2009	Navy	US	CONUS	Negative	Symptomatic: cough x5 months. Persistent infiltrate on chest x-ray x3 months.	Yes	No prior TB history.
2009	Navy	Philippines	Ship	Negative	Symptomatic: symptoms consistent with pneumonia.	Yes	Originally admitted for H1N1 pneumonia. Unknown TB history.
2009	Navy	Philippines	Ship	Negative	Asymptomatic. Suspicious chest x-ray at follow-up for previous abnormal chest x-ray.	Yes	Diagnosed with LTBI at accession in 2007; completed 6 months INH. History of BCG vaccination.
2010	Navy	Peru	Ship	Positive	Symptomatic: fever, chills, headache, cough, sinus congestion. Suspicious chest x-ray.	Yes	Prior converter in 2001; completed 6 months INH.
2011	Navy	Nepal	Ship	Negative	Symptomatic: cough, hemoptysis, fever, chills.	No	Prior converter in 2005; completed 9 months INH.
2012	Navy	Philippines	CONUS	Negative	Asymptomatic. Positive TST and suspicious chest x-ray during TB screening.	Yes	Prior converter in 2009; no notes on treatment.

Year	Service	Country of Birth	Duty Station	AFB Smear Results	Presentation	Reported in DRSi	Notes
2013	Navy	Mexico	CONUS	Positive; 4+	Symptomatic: cough x5 months, hemoptysis. Concerning chest x-ray and CT.	Yes	Originally diagnosed with and treated for pneumonia. Prior converter at age 16; treated for 6 months (treatment not specified).
2013	Navy	US	CONUS	Negative	Symptomatic: fevers, night sweats. Positive IGRA. Lesion on CT.	Yes	Originally diagnosed with and treated for pneumonia. Unknown TB history.
2013	Navy	Trinidad & Tobago	Ship	Positive	Symptomatic: cough, chest pain, chills, weight loss, night sweats.	Yes	No prior TB history. Last TST within 2 years was negative.
2013	Marine Corps	US	CONUS	Negative	Asymptomatic. Positive TST and concerning CT and chest x-ray at physical.	Yes	No prior TB history. Exposure to foreign nationals with active TB during deployment.

Appendix B: Armed Forces Tuberculosis Case Definition for Public Health Surveillance

5.61 Tuberculosis, Pulmonary
EXCLUDES: Latent tuberculosis infection which includes personnel that are screening test positive (TST/PPD+ or FDA-approved blood assay+) without evidence of active disease.

Clinical Description: A chronic bacterial infection caused by *Mycobacterium tuberculosis*, characterized pathologically by the formation of granulomas. The most common site of infection is the lung, but other organs may be involved. Specific symptoms of pulmonary tuberculosis include cough, chest pain, and hemoptysis. Systemic symptoms also include fever, chills, night sweats, fatigue, and weight loss.

Clinical Case Definition:
All of the following:

- A positive tuberculin skin test or an FDA-approved blood assay for *M. tuberculosis* (unless immunocompromised);
- Other signs and symptoms compatible with tuberculosis (e.g., an abnormal and unstable [worsening or improving] chest radiograph, or clinical evidence of clinical disease); and
- Completed diagnostic evaluation, including: history, physical exam, smear and culture, Mantoux skin test, and chest x-ray.

Laboratory Criteria for Diagnosis:
Any of the following:

- Isolation of *M. tuberculosis* from a clinical specimen, or
- Demonstration of *M. tuberculosis* from a clinical specimen by nucleic acid amplification test.

Case Classification:
Probable: Clinical signs and symptoms of pulmonary tuberculosis with demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained.
Confirmed: A clinically compatible case that is laboratory confirmed.

Required Comments: Indicate whether case is probable or confirmed.

Additional Considerations: Document the patient's history of exposure to a known or suspected case, travel to or origin from highly endemic countries, potential occupational exposure (e.g., health care worker), evidence of multi-drug resistance, and history of tuberculosis vaccine (i.e. BCG). A case should not be counted twice within any consecutive 12-month period. However, a case occurring in a patient who had previously had verified TB disease should be reported and counted again if more than 12 months have elapsed since the patient completed therapy. A case should also be reported and counted again if the patient was lost to supervision for greater than 12 months and TB disease can be verified again.

Appendix C: DRSi Reporting Form Elements

Case Identification (ID) Number
Sponsor Social Security Number (SSN)
Family Member Prefix (FMP)
First Name
Last Name
Middle Initial
Sex
Date of Birth
Race/Ethnicity
Branch of Service
Duty Status
Rank/Grade
Permanent Duty Station
Diagnosis: Tuberculosis, pulmonary
Date of Onset
Reporting Unit
Method of Confirmation
Case Status (suspect, probable, confirmed)
MER Status
Date of Report
First Reported Date
Original Reporting Unit
Laboratory Tests
Sputum AFB Smear (positive, pending, negative)
Culture (positive, pending, negative)
Nucleic Acid Amplification Test (positive, pending, negative)
Other Labs Not Listed
Is this case a case contact of a known/suspect active TB patient? (yes, no)
Is there evidence of multi-drug resistance (resistance to 3 or more drugs)? (yes, no)
Was this exposure duty related? (yes, non-deployment related; yes, deployment related; no)
Pertinent travel? (yes, no)
If there was pertinent travel, select countries of travel. (select all that apply)
Comments (2,000 characters maximum)

Appendix D: Points of Contact

Navy Environmental and Preventive Medicine Unit Number 2
(Atlantic and European regions)
1887 Powhatan Street
Norfolk, VA 23511-3394
DSN: 377-6600 Comm: (757) 953-6600
Fax DSN: 377-7212 Comm: (757) 953-7212/7213
PLAD: NAVENPVNTMEDU TWO NORFOLK VA
Web site: http://navymedicine.med.navy.mil/nepmu2/
E-mail: nepmu2norfolkthreatassessment@med.navy.mil

Navy Environmental and Preventive Medicine Unit Number 5
(Pacific region)
Naval Station Box 368143
3235 Albacore Alley
San Diego, CA 92136-5199
DSN: 526-7070 Comm: (619) 556-7070
Fax DSN: 526-7071 Comm: (619) 556-7071
PLAD: NAVENPVNTMEDU FIVE SAN DIEGO CA
Web site: http://www.nepmu5.med.navy.mil
E-mail: nepmu5@nepmu5.med.navy.mil

Navy Environmental and Preventive Medicine Unit Number 6
(Pacific theater)
1215 North Road
Pearl Harbor, HI 96860
DSN: (315) 473-0555 Comm: (808) 225-7820
Fax: (808) 473-2754
PLAD: NAVENPVTMEDU SIX PEARL HARBOR HI
Web site: http://nepmu6.med.navy.mil/
E-mail: nepmu6admin@med.navy.mil

Navy Environmental and Preventive Medicine Unit Number 7
(European and African theaters)
PSC 819
Box 1
FPO, AE 09645-0018
DSN: (314) 727-2230 Comm: 011-34-956-82-2230
PLAD: NAVENPVNTMEDU SEVEN ROTA SP
Web site: http://www.med.navy.mil/sites/nmcphc/nepmu-7/Pages/default.aspx
E-mail: nepmu7@eu.navy.mil

Navy and Marine Corps Public Health Center
620 John Paul Jones Circle Suite 1100
Portsmouth, VA 23708-2103
DSN: 377-0700 Comm: (757) 953-0700 After hours: (757) 621-1967
FAX DSN: 377-0685 Comm: (757) 953-0685
PLAD: NMCPHC PORTSMOUTH VA
Web site: http://www.med.navy.mil/sites/nmcphc/Pages/Home.aspx
E-mail: epi@nehc.mar.med.navy.mil

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