CAROLINAS MEDICAL CENTER

Atrium Health

# Extrapulmonary Tuberculosis in a Large Healthcare System

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## Background

- Tuberculosis (TB) is the leading infectious cause of death globally with 10 million new infections annually [1].
- The yearly incidence of extrapulmonary TB has increased despite decreases in total new cases each year in the United States (US) [2,3]. There were 2,820 new cases of extrapulmonary TB in 2017 representing 31.0% of disease burden [2].
- Historically, the sites most commonly involved were lymphatic, pleural, and bone/joint [2].
- Mecklenburg County in North Carolina has a low incidence of tuberculosis, however it remains an active public health threat with an increasing case rate seen from 2015-2017 [4].
- Atrium Health is a large, not-for-profit healthcare system in the Southeastern US with its flagship hospital Carolinas Medical Center located in Mecklenburg County, NC. The purpose of this study was (1) to analyze the incidence of extrapulmonary TB within the health system and (2) to examine associated patient characteristics.

## Methods

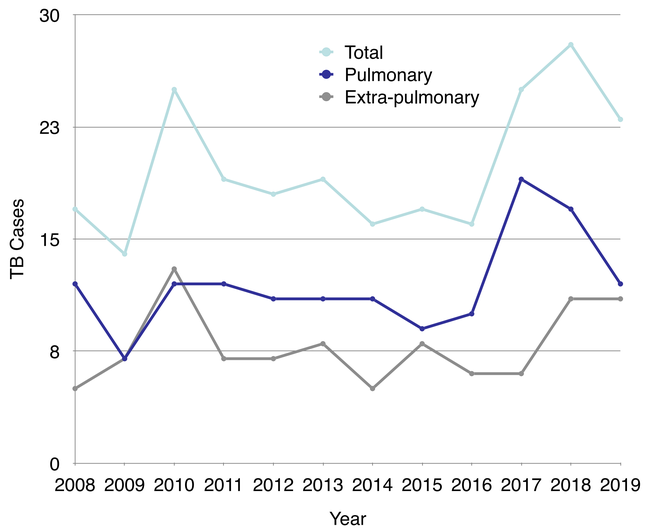
- We performed a retrospective review of 241 patients with a tuberculosis diagnosis within Atrium Health from 2008-2019 to analyze and understand trends within the regional patient population as it pertains to extrapulmonary tuberculosis infections.
- Diagnosis was confirmed by culture data, histopathology, and radiographically depending on patient case. Following initial chart review, four patients were removed after determining the results were false positives or incorrectly reported. The remaining 237 patients were included in this analysis.
- The primary objective of the study was to examine the incidence of extrapulmonary tuberculosis and compare this with the incidence trends reported within the literature.
- The data was also analyzed to determine additional associations with patient characteristics including HIV status, race, ethnicity, and birthplace. For the purposes of this review, all patients with extrapulmonary disease were analyzed together.

## Results

- 237 patients were identified as having confirmed TB infection from 2008-2019 within Atrium Health. Of those, 143 (60%) had pulmonary disease, 52 (22%) had extrapulmonary disease, and 42 (18%) had pulmonary and extrapulmonary disease. Those with concomitant disease were considered to have extrapulmonary disease in this review.
- Patient demographic data can be found listed in Table 1. Patients were 55% male with a median age of 44. Forty percent were African American, 29% Caucasian, 21% Hispanic or Latino, and 51% US-born. Thirty-seven percent of patients were HIV positive while another 18% of patient's had unknown HIV status. Information regarding patient's race, ethnicity, and birthplace were unknown for 2 patients.
- Sites of extrapulmonary disease are listed in Table 2. Lymphatic was most common (35%) followed by pleural (24%), GI/Peritoneal (12%), CNS (10%), and Bone/Joint (10%). In some patient cases, more than one extrapulmonary system was involved.
- Table 3 provides a breakdown of lymphatic system involvement. 66% of skeletal disease was noted to be vertebral. Other sites included GU, pericardial, skin, and disseminated disease (5%).
- Cases by year can be found listed in Graph 1. With the exception of years 2009-2010, pulmonary disease outnumbered extrapulmonary disease. The percentage of extrapulmonary cases were 29% in 2008, 39% in 2012, 38% in 2016, and 48% in 2019.

## Yearly Trends

Graph 1 - TB Cases Per Year




## Patient Demographics

Table 1

| Characteristic | Pulmonary | | Extra-pulmonary | |
|---|---|---|---|---|
| **Total (n, %)** | 143 | 60% | 94 | 40% |
| **Median Age (n, range)** | 38.5 | 18-86 | 44 | 20-62 |
| **Male (n, %)** | 96 | 67% | 52 | 55% |
| **Race (n, %)** | | | | |
| Caucasian | 68 | 48% | 27 | 29% |
| African American | 48 | 34% | 38 | 40% |
| Asian | 23 | 16% | 25 | 27% |
| Other | 2 | 1% | 2 | 2% |
| Unknown | 2 | 1% | 2 | 2% |
| **Ethnicity (n, %)** | | | | |
| Not Hispanic or Latino | 96 | 67% | 72 | 77% |
| Hispanic or Latino | 45 | 31% | 20 | 21% |
| Unknown | 2 | 1% | 2 | 2% |
| **Birthplace (n, %)** | | | | |
| United States | 74 | 52% | 48 | 51% |
| Foreign Born | 67 | 47% | 44 | 47% |
| Unknown | 2 | 1% | 2 | 2% |
| **HIV Status (n, %)** | | | | |
| Positive | 6 | 4% | 35 | 37% |
| Negative | 118 | 83% | 42 | 45% |
| Unknown | 19 | 13% | 17 | 18% |

## Extrapulmonary Sites

Table 2

| Body System[1] | (n, %) | |
|---|---|---|
| | n=124 | |
| **Lymphatic** | 43 | 35% |
| **Pleural** | 30 | 24% |
| **CNS** | 12 | 10% |
| **Bone and Joint** | 12 | 10% |
| **GI/Peritoneal** | 15 | 12% |
| **GU** | 3 | 2% |
| **Pericardial** | 1 | 1% |
| **Skin** | 2 | 2% |
| **Disseminated[2]** | 6 | 5% |

[1]More than one system may be involved for each case of extra-pulmonary disease

[2]Defined as blood, bone marrow, or splenic involvement

## Lymphatic Breakdown

Table 3

| Lymphatic System | (n, %) | |
|---|---|---|
| | n=43 | |
| **Cervical** | 17 | 40% |
| **Intrathoracic** | 8 | 19% |
| **Axillary** | 7 | 16% |
| **Other** | 11 | 26% |

## Conclusions and Future Directions

- Lymphatic and pleural involvement were the most common extrapulmonary sites seen which is consistent with US statistics [2].
- Thirty-seven percent of patients were HIV positive, however, 18% of patients were never tested. It is unknown whether or not this testing was performed at the health department following enrollment in therapy but it does show the need for more consistent HIV testing within our healthcare system.
- Forty percent of patients were noted to have extrapulmonary TB which is higher than the 31% reported in the US in 2017 [2].
- In the last several years, there has been a rise in the proportion of extrapulmonary TB within our healthcare system which deserves further investigation and analysis. In future studies and analyses of the TB data within Atrium Health, further attention should be paid to TB related mortality as well as a deeper investigation into associated comorbidities that may affect presentation and outcome.
- The data trend shows that TB remains an active health threat in our health system and requires ongoing support of public health initiatives.

## Resources

1. Global tuberculosis report 2019. Geneva: World Health Organization; 2019. License: CCBY-NC-SA3.0IGO.
2. Centers for Disease Control and Prevention (CDC). *Reported Tuberculosis in the United States, 2017*. Atlanta, GA: US Department of Health and Human Services, CDC; 2018.
3. Kourbatova EV, Leonard MK, Romero J, Kraft C, Rio CD, Blumberg HM. Risk factors for mortality among patients with extrapulmonary tuberculosis at an academic inner-city hospital in the US. *European Journal of Epidemiology*. 2006;21(9):715-721. doi:10.1007/s10654-006-9060-7
4. Mecklenburg County Public Health, Tuberculosis Control Program. *Mecklenburg County Tuberculosis Reports, 2015–2017 Demographic and Clinical Data.* Charlotte, NC: Mecklenburg County Public Health, Epidemiology Program; 2018.