Management of *Brucella* exposure among employees at an urban hospital

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Abstract

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Objectives:

This study was a longitudinal, descriptive study that used data collected by Harborview Medical Center (HMC) in June 2019 to evaluate adherence to the Centers for Disease Control and Prevention (CDC) recommended protocol for post-exposure prophylaxis (PEP), symptom reporting, and serology testing following a *Brucella* exposure among hospital employees. Our aim was to describe the factors associated with early PEP cessation among persons following an exposure event, to explore the proportion of exposed persons who took part in serial serologic testing and symptom reporting, and to better inform antimicrobial stewardship, employee health, and infection prevention efforts in the future.

Methods:

Descriptive data concerning the course of treatment for each exposed person were abstracted from electronic medical records and summarized in a customized REDCap tool. In response to a Brucella exposure event, the CDC recommends that high-risk exposures receive a combination of 100 mg doxycycline twice daily, and 600 mg rifampin once daily, for three weeks. Weekly symptom screening and sequential serological monitoring every six weeks is recommended for high- and low-risk exposures through 24 weeks post exposure. Minimal risk exposures are not recommended to take PEP but

symptom screening and serological monitoring may be considered. Therefore, weekly electronic symptom reports and the results from five *Brucella* serology tests were collected for each exposed person. Characteristics of the entire exposed population (N=236) were summarized as well as those classified as having high-risk exposures (N=150), low-risk exposures (N=8), and minimal-risk exposures (N=78) per CDC criteria. A summary of adherence to the CDC recommended guidelines and an analysis of the required follow-up efforts along with commonly reported symptoms was completed on the high-risk population. Lastly, a regression analysis was completed to explore the independent variables associated with PEP cessation.

Results:

Of the 236 persons involved in this event, 150 (57.3%) were determined to have had high-risk exposure for *Brucella.* Most persons with high-risk exposures were prescribed the CDC recommended antibiotic combination of doxycycline and rifampin (112, 75.2%). However, only 82 (54.7%) completed the full course of PEP.

Taking ≤2 additional medications for conditions unrelated to the exposure, i.e., in addition to the PEP regimen, was the only statistically significant variable associated with PEP cessation in the unadjusted model, with such persons being less likely to cease taking PEP in comparison with persons taking >2 additional medications (OR=0.4, 95% CI=0.2-0.9, p-value= 0.028). Mostly non-statistically significant findings indicate that symptom complaints may not be associated with early cessation of PEP.

Conclusions:

The proportion of exposed persons who were able to complete and partially complete CDC recommended symptom and serologic monitoring was lower than recommended. Follow-up with

exposed persons reporting adverse symptoms during PEP was laborious for employee health. Although the majority of results were not statistically significant, this study offers valuable information on what variables may be predictive of PEP cessation.

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Introduction

Brucellosis is the most common zoonotic infection globally with approximately 500,000 new cases reported worldwide each year. [1,2,7] The disease presents signs and symptoms similar to numerous other infections including fever, sweats, malaise, headaches, fatigue, muscle pain and arthralgia. Complications from brucellosis may involve osteoarticular infections, including the spine.[3] Transmission of brucellosis occurs primarily through the ingestion of infected food products or contact with infected animals but can also be spread via inhalation of infectious aerosolized particles which makes it a high-risk occupational hazard for laboratory workers.[1,4] In addition, there are case reports of transmission events during surgery, and labor and delivery. [4] In high-income countries antibiotics for post-exposure prophylaxis (PEP) is recommended in these settings.[2]

Brucella has numerous species which are best described by their preferred domestic host, with the most common strains consisting of *Brucella abortus,* primarily found in cattle, *Brucella melitensis* in goats, *Brucella suis* in feral swine, *Brucella canis* in dogs, and *Brucella ovis* in sheep.[3] Current epidemiology indicates that cases in the United States are primarily due to *B. melitensis* most likely secondary to international travel from countries with higher rates of infection. [1]

In 2017, the Centers for Disease Control and Prevention (CDC) released revised recommendations for the management of exposure to *Brucella* in hospital settings. The document outlines exposure scenarios, PEP antibiotic recommendations, and follow-up guidelines for three separate levels of exposure risk: minimal-, low-, and high-risk, each of which includes combinations of serological testing, symptom survey checks, and PEP recommendations depending on exposure risk level and which species of the bacteria was present. According to the guidelines, all high-risk exposed persons should take part in daily self-fever checks, weekly symptom screenings, serologic testing every six weeks for a total of 24 weeks and should be prescribed a combination of antibiotics consisting of oral doxycycline (100mg)

twice daily and rifampin (600mg) once daily to be taken for 21 days.[5] Tetracyclines are contraindicated for pregnant patients, so pregnant women should be prescribed a modified course of PEP in consultation with their doctor to avoid doxycycline.

While the CDC guidelines are thorough in their recommendations for treatment and exposure response, adherence to the suggested approaches may be difficult because of the tremendous effort required from employee health to follow the exposed employees and the high burden placed on exposed persons to complete the suggested screening procedures. In addition, the antibiotic combinations recommended as PEP may lead to side effects such as gastrointestinal complaints impacting the likelihood of completion of the prescribed regimen.[6] Lastly, judicious prescribing of antibiotics is one of the pillars of antimicrobial stewardship to mitigate the emergence of antibiotic resistance, suggesting the need to better understand adherence and potentially modifiable factors associated with adherence to prescribed regimens.

Exposure Event

In June 2019, a patient was admitted to Harborview Medical Center (HMC) in Seattle, WA, with a three-month history of back pain, fevers, and chills. The patient worked as a farmer in Mexico and in Washington State and reported contact with cows. On imaging, the patient was found to have extensive lumbar spinal osteomyelitis with concern for an unstable spine and paraspinal abscesses and subsequently underwent surgical debridement and fixation of the spine. *Brucella* was not considered at initial presentation, but operative cultures ultimately grew *Brucella suis.* Because *Brucella* was not initially considered in the differential, this patient's care was performed in standard precautions resulting in exposure of operating room (OR) staff during drilling of the spine or in the airspace of the OR thereafter. In addition, the patient had a surgical drain left in the infected spinal region that required

manual emptying with a squeezing maneuver performed at the bedside. There was concern that this maneuver could cause infectious particles to aerosolize, thus exposing any employee who emptied the surgical drain and employees in the nearby airspace. The microbiologists who opened the specimen plates growing the bacteria experienced an exposure to the bacteria as this is a known high-risk event. Finally, there was an inadvertent spill of an operative specimen growing in supportive media during shift change in the microbiology area a large, open laboratory, exposing numerous laboratory workers in the microbiology areas as well as throughout the airspace of the room. In total, 236 hospital employees were involved in this exposure event.

In response, HMC in conjunction with Public Health – Seattle & King County and the Washington State Department of Health implemented CDC guidelines for testing and prevention of brucellosis after an exposure. HMC created a pop-up clinic so exposed staff could meet with an Occupational Medicine, Infectious Diseases, or Family Medicine physician to discuss their individual risk, evaluate their medical history, and be offered PEP when indicated. Exposed persons, based on their exposure risk level, were advised to take part in serial serologic testing every 6 weeks for 6 months and weekly symptom monitoring for 6 months. Employees were followed closely through Employee Health and an additional registered nurse was hired to orchestrate follow-up for the 6 months after the exposure event. In the end, there was no seroconversion among those that were exposed, and no one developed any clinical syndrome consistent with brucellosis.

Our study describes the factors associated with early PEP cessation among persons exposed to *Brucella* and explores the proportion of exposed persons who took part in CDC recommended serial serologic testing and symptom reporting to better inform antimicrobial stewardship, employee health, and infection prevention efforts in the future.

Methods

Study Design, setting, and participants

We conducted a longitudinal, descriptive analysis of employees exposed to *Brucella* in June 2019 at Harborview Medical Center (HMC), a 413-bed acute care hospital that serves as a public safety-net hospital for King County, Washington, as well as the level 1 trauma and burn center for Washington, Wyoming, Alaska, Montana, and Idaho. HMC is owned by King County and managed under contract by the University of Washington (UW).

The study was approved by The University of Washington Human Subjects Division who determined that the need for informed consent was waived. Study participants included 236 healthcare workers and hospital staff who were involved in the *Brucella* exposure event and the analysis used data collected during post-exposure visits.

Exposure Assessment

The CDC guidance outlines PEP recommendations and follow-up/monitoring considerations for three exposure risk levels: high-risk, low-risk, and minimal (but not zero) risk.[5] In high- and low-risk exposures, serological monitoring is recommended every six weeks for 24 weeks after the exposure and symptom surveys are recommended weekly through 24 weeks post exposure. Minimal-risk exposures may consider symptom watch on the same schedule in consult with their physician and were offered to all as an option during this exposure. A summary of the decision criteria for the assignment of risk as well as in accordance with the CDC recommended guidance for PEP, symptom surveillance and serological monitoring can be found in Figure 1.

In order to prescribe PEP to this number of employees, a pop-up clinic was established and staffed by Infectious Diseases, Occupational Medicine, and Family Medicine Physicians, and supported by pharmacists with infectious diseases expertise. Each employee considered at high-risk or possibly high-

risk had an individual appointment with a physician to evaluate their medical history and discuss risks and benefits of PEP.

Follow-up

Weekly symptom surveys and serology testing results were reviewed and reported symptoms or inconclusive serology results were followed-up on via telephone by Employee Health nurses. Exposed persons reporting concerning symptoms met with physicians through Employee Health on an as needed basis.

Data Collection

Study data were collected and managed using REDCap electronic data capture tools hosted at UW. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.[8] Data for this study were recorded in a customized REDCap (version 11.2.1) data collection instrument established for this specific project to ensure consistency of the data collected and minimize the time spent in medical record databases. Data from employees in all exposure risk levels were abstracted from post-exposure visit documentation and employee health records. This included demographic information, occupation, medical comorbidities, location of exposure, exposure risk level, the number of additional medications the employee was on at the time, and if they were prescribed PEP and completed the course. In addition, data were collected by Harborview Employee Health staff on weekly electronic symptom reports using Catalyst and Survey Monkey as well as the results from five *Brucella* serology tests, performed by the CDC as a modified serum agglutination test to detect IgG

antibody levels at 0, 6-, 12-, 18-, and 24-week time points.[5] Lastly, data were collected on the number of follow-up calls completed by hospital staff and number of follow-up visits to manage health complaints observed while taking PEP.

Statistical Analysis

Analyses were conducted with the use of R version 4.0.5.[7] First, characteristics for all exposed persons (N=236) involved in the exposure event were stratified by exposure status (full cohort, high-risk, low-risk, and minimal-risk). A count and percentage of the number of employees exposed at each location within HMC was calculated, as well as their determined risk level, and a count of people that completed varying levels of serology testing (no testing was defined as 0 weeks complete, partial completion was defined as between 1- and 4- weeks complete, and full completion was defined as all 5 weeks). Completion of electronic symptom survey results was also calculated (0% completion = 0 weeks, 25% completion = between 1- and 6-weeks completion, 50% completion = between 7- and 12- weeks, 75% completion = between 13- and 18- weeks, and full completion= between 19- and 24- weeks).

A secondary analysis focused on the high-risk exposed employees. A descriptive summary was calculated using the median and interquartile range (IQR) to summarize the age and number of additional medications among this cohort. The count and frequency was taken to summarize gender, pregnancy status, immunocompromised status, and medical comorbidities. In addition, an analysis of the summary of treatment as well as adherance to the CDC guidelines was performed. Count and frequency was used to outline if the exposed persons were prescribed PEP, particular antibiotics prescribed, potential for drug-drug interactions between existing medications and PEP, and completion of therapy.

After the descriptive summaries were complete, a summary of the follow-up efforts and symptoms reported was calculated. The analysis stratified the high-risk persons by acceptance or declination of PEP PEP. The count and frequency were used to summarize the proportion of exposed persons in each cohort that had a follow-up call or visit with an RN or MD at any point during the exposure response. The symptoms reported during a visit or phone call were combined with symptoms reported in the electronic symptom surveys and a count and frequency of the number of persons who reported various symptoms was calculated. The summary reflects a count of if the symptom was reported at least once, although exposed persons may have reported the same symptom multiple times.

Finally, univariate and multivariate logistic regression analyses were completed to investigate the relationships between various independent variables and the dependent variable of PEP cessation, with the proportion of persons who ceased PEP, odds ratios, confidence intervals and p-values calculated. All included variables were treated as binary and included gender, age, location of exposure, any symptom complaint, and the number of additional medications persons were taking at their initial intake visit. Gender and age were added as descriptive variables that would be predictive of PEP cessation. Gender was split into men and women, using men as the reference group. Age was included as a binary variable of persons ≥40 years of age and persons <40 years of age. Since the laboratory exposure event occurred in the microbiology laboratory area of the main lab, we hypothesized that this group would be more likely to complete PEP. This subset of employees is also highly educated regarding the occupational hazards of a *Brucella* exposure and may be more likely to take preventive measures such as PEP more seriously. Therefore, this variable was included as a binary option for if they were exposed in the microbiology laboratory or elsewhere (including the OR, general laboratory, or by the surgical drain), with those exposed elsewhere being used as the reference group. We also hypothesized that persons taking additional medications apart from the prescribed PEP would be more likely to cease taking PEP. Therefore, we separated this subset into two groups: those taking ≤ 2 additional medications and those

taking >2 additional medications. Those taking >2 additional medications were used as the reference group. Lastly, we hypothesized that symptom complaints would be predictive of PEP cessation, so all symptoms reported during the follow-up period by exposed persons were aggregated into a binary variable detailing if they complained one or more times, or never complained at all. The no complaint group was used as the reference group.

Results

Descriptive Statistics

In total, 262 persons were evaluated for exposure, with 150 (63.5%) considered in the high-risk cohort, 8 (3.4%) in the low-risk cohort, and 78 (33.1%) in the minimal-risk cohort. 26 employees, all of whom had an initial visit with a physician, were determined to not have been exposed and were removed from all analyses. Eighty-eight persons (37.3%) were exposed to the surgical drain changes, 63 (26.7%) were exposed in the OR, and 63 (26.7%) in the general laboratory. Exposure in the microbiology laboratory involved 22 (9.3%) persons. In the high-risk cohort, 61 (40.7%) persons were exposed in the OR. In the low-risk cohort, four (50%) were exposed in the general laboratory, and among the minimal-risk group 75 (96.1%) were exposed during the surgical drain event.

Within the high-risk exposures, the median (IQR) age was 44 years (32.3 – 54.2) and the median (IQR) number of medications each person was on for other conditions was one (0.0-3.0). 86 (57.3%) persons were men; three (2.0%) women were pregnant at the time of exposure. A total of three (2.0%) persons were determined to be immunocompromised at the time of the exposure. In analysis of notable medical comorbidities at the time of exposure, there were 33 (22.0%) persons with cardiovascular disease, two (1.3%) with liver disease, and 42 (28.0%) with another comorbidity, such as diabetes mellitus, asthma, anxiety/depression, hyperlipidemia, hyperthyroidism, and allergic rhinitis. In total, 73 (48.7%) persons

reported no comorbidities at the time of the exposure. Table 1 summarizes the descriptive characteristics of high-risk exposures.

Among high-risk exposures, 79 (52.7%) persons completed all five weeks of serology testing. Among low-risk exposures, six persons (75%) partially completed serology testing. In analysis of symptom survey completion levels across the full cohort, most persons (112 [47.5%]), did not participate, 37 (15.7%) completed between 1 and 6 weeks of symptom surveys, 23 (9.7%) completed between 7 and 12 weeks, 20 (8.5%) completed between 13 and 18 weeks, and 44 (18.6%) completed all 24 weeks of symptom surveys recommended by CDC. Among the high-risk group, 42 (28.0%) completed all symptom surveys, 77 (51.3%) completed some and 31 (20.7%) completed none. Among low-risk exposures, two (25%) completed all symptom surveys, three (37.5%) completed some, and three (37.5%) completed none. No minimal-risk exposures took part in serology testing or symptom surveys, as it is not recommended by the CDC. However, all were given the option to participate during the initial exposure assessment with their doctor. Table 2 summarizes the characteristics of all employees who experienced the *Brucella* exposure.

Treatment and adherence to CDC guidelines

Among the high-risk exposed persons, 121 (80.7%) were prescribed PEP, 28 (18.7%) declined PEP even though it was recommended, and one person did not attend the screening appointment. A majority of 112 (75.2%) persons were prescribed the CDC recommended first-line regimen of doxycycline plus rifampin for three weeks as PEP, while eight (5.3%) were prescribed another combination of PEP in consultation with their doctor. This included persons prescribed rifampin alone for a longer duration due to pregnancy at the time of exposure, persons prescribed a combination of rifampin and trimethoprim/sulfamethoxazole (TMP-SMX), and persons prescribed doxycycline and rifampin, who were thought to experience side effects due to doxycycline and were switched to rifampin and TMP-

SMX. Among the high-risk exposed group, 27 (18.0%) had a potential drug-drug interactions between rifampin and their other medications but no absolute contraindications to rifampin were identified. Of persons who started PEP in the high-risk group, PEP was completed by 82 (54.7%) persons, while 33 (22.0%) did not; 35 (23.3%) left the institution or were lost to follow up. Among this subset of persons whose PEP completion status was unknown, the majority were men who were exposed in the OR. Table 1 summarizes the treatment combinations that were prescribed to the high-risk exposures as well as the rate of adherence to the CDC guidelines.

Follow-up Efforts

Follow-up efforts included over 200 visits with physicians and nurses, required a dedicated registered nurse for the 6 months following the event, and months of work performed by laboratory workers at HMC as well as at Public Health – Seattle & King County and the Washington State Department of Health. Among persons who accepted PEP, 83 (68.6%) had a follow-up call or visit with a nurse or doctor while 38 (31.4%) did not. Among persons who declined PEP, 14 (48.3%) had a follow-up call or visit with a nurse or doctor while 15 (51.7%) did not. Of the persons prescribed PEP, the median (IQR) number of calls from an RN was 1.0 (0.0 – 2.0). Within the group that accepted PEP, fatigue was reported at least once by 49 (32.7%) employees, gastrointestinal issues were reported by 44 (29.3%), other musculoskeletal pain was reported by 19 (12.7%), joint pain was reported by 10 (6.7%), back pain was reported by nine (6.0%), and 63 (42.0%) reported other symptoms. Within the group that declined PEP, three (2.0%) reported gastrointestinal issues, two (1.3%) reported other musculoskeletal pain, two (1.3%) reported fatigue, one (0.7%) reported back pain and eight (5.3%) reported other symptoms. Joint pain was not reported by any exposed persons who declined PEP. Common additional symptoms

reported in both groups included headache, sweats/chills, fever, loss of appetite, dizziness, and cold symptoms. A summary of follow-up efforts and symptoms reported is summarized in Table 3.

Factors Associated with PEP Cessation

In the unadjusted regression model, persons taking 2 or fewer additional medications were less likely to stop PEP compared to persons taking more than 2 additional medications (OR=0.4, 95% CI=0.2-0.9, p-value=0.028). However, when adjusting for the other factors, this association became borderline statistically significant (OR=0.4, 95% CI=0.1-1.0, p-value=0.056). Although no other univariate or multivariate analyses were statistically significant, a trend toward higher odds of PEP cessation was observed in women both in the univariate (OR=2.4, 95% CI=1.0 – 6.4, p-value=0.053) and multivariate (OR=2.3, 95% CI=0.9-6.5, p-value=0.093) analysis, and in persons < 40 years of age in the adjusted model (OR=1.5, 95% CI=0.6 – 3.7, p-value=0.38). Table 4 summarizes the findings from the logistic regression analysis.

Discussion

Our descriptive analysis revealed that while many high- and low-risk exposed persons took part in CDC recommended serology screening and weekly symptom surveys for 6 months, a large portion of them did not complete the full amount. Among the high-risk exposed persons, just over half completed their prescribed course of PEP with many ceasing PEP early. Among employees that took PEP, a large number of adverse symptoms were reported, most commonly gastrointestinal issues and fatigue. The odds of PEP cessation were also increased in women, in persons <40 years of age, those who were taking more

than two other medications, and in those who reported complaints, although none were statistically significant in an adjusted model.

In addition, our analysis also found that a large number of high-risk exposed employees required additional follow-up calls or visits with HMC Employee Health. The Infection Prevention & Control and Employee Health teams at HMC spent a substantial amount of time following up with a exposed persons in response to abnormal serology results and symptoms reported during weekly electronic symptom surveys. HMC even hired additional staff to focus on this event and relied heavily on volunteer work to respond appropriately.

The currently available literature focuses primarily on responding to a *Brucella* outbreak rather than an exposure event, with little information available outlining the challenges encountered when following-up after such a large-scale exposure. Given the incubation period of up to six months for *Brucella*[4], prolonged monitoring is recommended with intensive symptom reporting and serologic testing. Our findings provide information regarding the feasibility of adherence to such currently recommended CDC guidelines in a real-world exposure. In practice, our findings indicate that the guidelines are not easy to adhere to and require a large level of effort. In addition, the proportion of people reporting symptoms after the exposure, either due to the PEP medications or other factors was high. Anticipating and accounting for the amount of time required to respond to the initial event and 6-month follow up period is critical to understand before undertaking a large-scale effort. If there is an early understanding of the effort needed, medical professionals can improve counseling, monitoring, and provide support after a *Brucella* exposure event.

This study had several limitations. Data collected in response to the exposure were more detailed for high-risk exposures as they had initial physician visits and less detailed for the low- and minimal-risk exposures, which limited the descriptive analysis of all persons involved. Due to the nature of how the

symptom survey data was collected, it is highly likely that persons experiencing symptoms were more likely to participate in the weekly symptom assessment than those who were not experiencing symptoms, leading to some level of sampling bias. In addition, since these data were self-reported and optional, participants may be more likely to report symptoms deemed socially desirable and leave out symptoms they are embarrassed to discuss. This study was conducted with observational data and power to detect association was limited. We used PEP completion as the outcome measure for our model but had a substantial number of persons with unknown PEP completion status.

This project was a hypothesis generating, descriptive study based on a real-world *Brucella* exposure event. Our attempt to follow CDC guidelines in response to the exposure generated a large amount of work for hospital staff and volunteers in an exposure where no employees ended up seroconverting or developing symptoms consistent with brucellosis. Further research should include a cost analysis of the staff time and hospital expenditures required to implement CDC guidelines. Outcomes from this analysis can be used to inform future studies seeking to understand the predictors of antibiotic cessation following occupational *Brucella* exposure and better inform antimicrobial stewardship efforts.

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Appendices

***Figure 1**: Criteria for assignment of exposure risk and CDC guidance for treatment of exposures to Brucella*

Exposure Risk	Determination of risk	Post-Exposure Prophylaxis (PEP)	Symptom Surveillance	Serological Monitoring
High-Risk	Operating Room: • Present during drilling procedure or up to 2 hours after. Laboratory: • Microbiology lab within 5 feet of the open specimen plate Present anywhere in the laboratory during/up to 2 hours after the spilled specimen. Surgical Drain: • Performed emptying of drain or within 5 feet of emptying.	Recommended	Weekly symptom reporting and daily self-fever checks for 24 weeks after exposure	Sequential serological monitoring at baseline and every 6 weeks for 24 weeks after exposure
Low-Risk	Laboratory: • Microbiology lab greater than 5 feet of the open specimen plate Surgical Drain: • Opened the drain but not involved in emptying it	Considered in consult with physician (particularly if immunocompromised or pregnant)	Weekly symptom reporting and daily self-fever checks for 24 weeks after exposure	Sequential serological monitoring at baseline and every 6 weeks for 24-weeks after exposure
Minimal (but not zero) risk	Surgical Drain: • Employees in the airspace of the open drain	Not recommended	Considered in consult with physician but offered to all	Considered in consult with physician

Source: CDC, 2017

Table 1: Characteristics of all exposed persons (N=236)

Variable	Full cohort (N=236)	High-Risk (N=150)	Low-Risk (N=8)	Minimal-Risk (N=78)
Location of Exposure				
Non-Microbiology (%) Operating Room (%) General Laboratory (%) Surgical Drain (%)	214 (90.7) 63 (26.7) 63 (26.7) 88 (37.3)	128 (85.3) 61 (40.7) 56 (37.3) 11 (7.3)	8 (100.0) 2 (25) 4 (50) 2 (25)	78 (100.0) 0 (0.0) 3 (3.9) 75 (96.1)
Microbiology Laboratory (%)	22 (9.3)	22 (14.7)	0 (0.0)	0 (0.0)
Exposure Risk Level (%)	236 (100)	150 (63.5)	8 (3.4)	78 (33.1)
Serology Completion				
No Completion (0 weeks) (%)	82 (34.7)	4 (2.6)	0 (0.0)	
Partial Completion (1-4 weeks) (%)	73 (31.0)	67 (44.7)	6 (75.0)	
Full Completion (5 weeks) (%)	81 (34.3)	79 (52.7)	2 (25.0)	
Symptom Survey Completion				
0% Completion, 0 weeks (%)	112 (47.5)	31 (20.7)	3 (37.5)	
25% Completion, 1-6 weeks (%)	37 (15.7)	35 (23.3)	2 (25.0)	
50% Completion, 7-12 weeks (%)	23 (9.7)	23 (15.3)	0 (0.0)	
75% Completion, 13-18 weeks (%)	20 (8.5)	19 (12.7)	1 (12.5)	
Full Completion, 19-24 weeks (%)	44 (18.2)	42 (28.0)	2 (25.0)	

Table 2: Descriptive characteristics, summary of treatment, and adherence to CDC guidelines in high-risk exposures (N=150)

Age, Median (IQR)		44.0 (32.3 – 54.2)
Number of additional medications, Median (IQR)		1.0 (0.0 - 3.0)
Gender, Men (%)		86 (57.3)
Pregnancy Status, Pregnant (%)		3 (2.0)
Immunocompromised Status, Immunocompromised (%)		3 (2.0)
Medical Comorbidities *		
	Cardiovascular Disease (%)	33 (22.0)
	Liver Disease (%)	2 (1.3)
	Other (%)*	42 (28.0)
	None (%)	73 (48.7)
Prescribed PEP		
	Yes (%)	121 (80.7)
	No (%)	1 (0.6)
	Patient Declined (%)	28 (18.7)
Combinations of PEP Prescribed		
	Doxycycline + Rifampin (%)	112 (75.2)
	Other combination of PEP (%)**	8 (5.3)
	PEP Not Initiated (%)	29 (19.5)
Completion of PEP		
	Yes (%)	82 (54.7)
	No (%)	33 (22.0)
	Unknown (%)	35 (23.3)

**Common 'other' medical comorbidities include diabetes mellitus, asthma, anxiety/depression, hyperlipidemia, hyperthyroidism, and allergic rhinitis.*

***Rifampin + trimethoprim/sulfamethoxazole or longer duration rifampin*

Table 3: Summary of follow-up efforts and symptoms associated with post-exposure prophylaxis in high-risk exposures, stratified by PEP prescription (N=150)

	Accepted PEP N=121	Declined PEP N=29
Persons that had a follow-up call or visit		
Yes (%)	83 (68.6)	14 (48.3)
No (%)	38 (31.4)	15 (51.7)
Follow-Up Efforts, median (IQR)		
Calls from RN	1.0 (0.0 – 2.0)	0.0 (0.0 – 1.0)
Calls from MD	0.0 (0.0 – 0.0)	0.0 (0.0 – 0.0)
Visits with RN	0.0 (0.0 – 0.0)	0.0 (0.0 – 0.0)
Visits with MD	0.0 (0.0 – 0.0)	0.0 (0.0 – 0.0)
Symptoms Reported*		
Joint Pain (%)	10 (6.7)	0 (0.0)
Back Pain (%)	9 (6.0)	1 (0.7)
Gastrointestinal Issues: nausea, vomiting, diarrhea, or abdominal pain (%)	44 (29.3)	3 (2.0)
Other Musculoskeletal Pain (%)	19 (12.7)	2 (1.3)
Fatigue (%)	49 (32.7)	2 (1.3)
Other Symptoms** (%)	63 (42.0)	8 (5.3)

**Symptoms reported is a count of if the symptom was reported at least once, percentages are reported as a count out of all 150 high-risk exposures.*

***Common 'other' symptoms included headache, sweats/chills, fever, loss of appetite, dizziness, and cold symptoms*

Table 4: Logistic Regression Summary

	Cessation of PEP (%)	Unadjusted Odds Ratio (CI)	p-value	Adjusted Odds Ratio* (CI)	p-value
Gender					
Men (n=44)	8/44 (18.1)	Reference		Reference	
Women (n=71)	25/71 (35.2)	2.4 (1.0 – 6.4)	0.053	2.3 (0.9 – 6.5)	0.093
Age					
≥ 40 years of age (n=60)	17/60 (28.3)	Reference		Reference	
< 40 years of age (n=55)	16/55 (29.1)	1.0 (0.5 – 2.3)	0.932	1.5 (0.6 – 3.7)	0.387
Location of Exposure					
Non-Microbiology Laboratory (n=93)	29/93 (31.2)	Reference		Reference	
Microbiology Laboratory (n=22)	4/22 (18.2)	0.5 (0.1 – 1.5)	0.232	0.4 (0.1 – 1.3)	0.165
Number of Additional Medications					
> 2 Additional Medications (n=35)	15/35 (42.8)	Reference		Reference	
≤ 2 Additional Medications (n=80)	18/80 (22.5)	0.4 (0.2 – 0.9)	0.028	0.4 (0.1 – 1.0)	0.056
Any Symptom Complaint					
No complaints (n=54)	15/54 (27.8)	Reference		Reference	
1 or more complaints (n=61)	18/61 (29.5)	1.1 (0.5 – 2.5)	0.843	0.9 (0.4 – 2.2)	0.876

Calculation included the following factors in the analysis of the adjusted odds ratio: any symptom complaints, gender, age, number of additional medications, and the location of exposure.