

BACKGROUND

The risk of a laboratory acquired infection is real across all institutions. Recently the rise of *Brucella* exposures in clinical laboratories showcases a pressing need for best biosafety practices, yet many laboratories are faced with the hurdles of not having support towards a robust biosafety program. It is also difficult to measure an effective biosafety program when it is functioning properly, which in turn can affect leadership buy-in. Laboratory leadership may not fully comprehend all of the work ensuring safer practices. APHL through the Biosafety and Biosecurity Committee (BBC) is developing a tool to calculate the cost of staff time lost when a potential laboratory exposure occurs. This tool can assist biosafety professionals by calculating the monetary value in terms of both dollars spent, time invested and lives affected to prevent, control, and treat potential laboratory exposures or lab acquired infections.

METHODS

Laboratorians can use the two versions (Costs Breakdown for Lab Acquired Infections and Exposures and Costs Breakdown of Lab Acquired Infection and Exposure to *Brucella*) that can calculate the cost of time lost towards laboratory exposures. In the development of this tool, we utilized four different categories for calculating the cost of time for the exposure to be considered in the analysis.

- **Employee Time**
- **Laboratory Time**
- **Physician/Employee Health Clinic Time**
- **Public Health Response Time**

Using data from multiple references, we were able to determine the average salary of laboratory staff, physicians and epidemiologists to assist us in the calculation of time lost in a potential exposure. Figure 1 represents the potential cost breakdown of a laboratory *Brucella spp* exposure.

Figure 1: Costs Breakdown of Lab Acquired Infection and Exposure to *Brucella spp*

Costs Breakdown of Lab Acquired Infection and Exposure to <i>Brucella</i>					
Post Exposure Steps	Mitigation/Evaluation Steps	Time Range (minutes)		Direct Costs (\$USD)	
		MIN	MAX	MIN	MAX
Laboratory Staff Time and Costs					
Decontamination	Decontaminate area following exposure incident*	30	120	\$36.86	\$99.46
Documentation	Review: First report of Injury by safety committee (director, biosafety officer, supervisor)	120	240	\$280.78	\$561.56
Risk Assessment	Laboratory risk assessment (Laboratory Manager)	60	60	\$41.73	\$41.73
Reallocated Work Time	Time lab workers spent away from regular position to cover for absent lab workers	0	4800	\$0.00	\$3,212.80
Total Laboratory Staff Time and Costs		210	5220	\$359.37	\$3,915.55
Exposed Worker Time and Costs					
Notification	Notify occupational health, HR, supervisor, biosafety officer, laboratory director	15	60	\$10.04	\$40.16
Documentation	Initiate & complete first report of injury, including witnesses (25 min, 5 min)	60	60	\$40.16	\$40.16
Travel	Travel to occupational health site	10	60	\$6.69	\$40.16
Patient Appointment	Emergency room or healthcare facility wait time	15	60	\$10.04	\$40.16
Patient Appointment	Physician review of exposure, review history, identify treatment	30	90	\$20.08	\$60.24
Travel	Travel to pharmacy/Rx pick-up	10	60	\$6.69	\$40.16
Documentation	Costs of Rx (Doxycycline 100mg 2x daily + Rifampin 600mg 1x daily for 3-6 weeks)*			\$25.09	\$50.18
Patient Time	Treatment (5-10 min @ 7 days)-Rx	35	70	\$23.43	\$46.85
Travel	Travel to Occupational Health follow-up appointment	10	60	\$6.69	\$40.16
Follow-up Appointment	Review: Follow-up Occupational Health	30	90	\$20.08	\$60.24
Symptom Monitoring	Completion of symptom monitoring logs (5-10 minutes, 7 days/week for 4 weeks)	140	280	\$93.71	\$187.41
Missed Work Time	Days absent from work due to exposure (Max time based on acute infection, with 2 weeks missed work)	0	4800	\$0.00	\$3,212.80
Total Exposed Worker Time and Costs		355	5690	\$262.70	\$3,858.69
Healthcare Provider or Occupational Health Time and Costs					
Treat Patient	Physician review of exposure, review history, identify treatment	30	90	\$58.50	\$175.50
Documentation	Complete patient paperwork/documentation, Treatment: Rx written/called in	30	60	\$58.50	\$117.00
Patient Review	Review: Occupational Health follow-up	30	90	\$58.50	\$175.50
Total Healthcare Provider Time and Costs		90	240	\$175.50	\$468.00
Public Health Response Time and Costs					
Patient Interview	Conduct interview with exposed worker	30	90	\$16.75	\$50.24
Laboratory Walkthrough	Document lab layout and workflow, location of incident, proximity of employees to incident	120	240	\$66.98	\$133.96
investigation	Assess if contact investigations are necessary	30	120	\$16.75	\$66.98
Post Exposure Monitoring	Post exposure monitoring and incident follow-up	60	120	\$33.49	\$66.98
Total Public Health Response Time and Costs		240	570	\$133.96	\$318.16
Total Number of Exposed Lab Workers 1					
Subtotal (minutes)		895	11720	Total Min and Max Costs	
Subtotal (hours)		14.9	195.3	\$931.53	\$8,560.39
Total (All exposed, minutes)		895.0	11720.0	Total Min and Max Costs for all Exposed	
Total (All exposed, hours)		14.9	195.3	\$931.53	\$8,560.39
Additional Time and Costs to Consider					
		Average Laboratory Worker Salary (\$USD/hr)		Average Salaries (\$USD/hr)*	
Risk of symptom relapse in infected individuals		Laboratory Scientist	\$32.99	Internal Medicine Physician	\$117.00
Review of protocols (individual, supervisory/management, Safety Comm)		Laboratory Manager	\$41.73	Laboratory Professional	\$40.16
Retraining (individual, group, division)		Laboratory Director	\$56.93	Epidemiologist	\$33.49
*The cost of a bloodborne pathogen cleanup kit is incorporated into this equation \$15.99 is the cost of a small bloodborne pathogen cleanup kit obtained from amazon.com .					
*Costs of Doxycycline 100mg and Rifampin 600mg obtained from goodrx.com based on research obtained from 70,000+ pharmacies. Minimum value attributed to 3 weeks of treatment with maximum treatment duration lasting 6 weeks. Dosage and choice of drug information obtained from CDC Brucellosis Reference Guide: Exposures, Testing, and Prevention at https://www.cdc.gov/brucellosis/pdf/brucellosis-reference-guide.pdf .					
*Average determination of each of these salaries was found by using the sources below:					
National Average Laboratory Professional Compensation: https://www.mlo-online.com/management/article/21076556/mlos-2019-annual-salary-survey-of-laboratory-professionals					
National Average Internal Medicine Physician Compensation: https://www.statista.com/statistics/250160/median-compensation-earned-by-us-physicians-by-specialty/					
National Average Epidemiologist Compensation: https://www.bls.gov/ooh/life-physical-and-social-science/epidemiologists.htm					

Components of the Tool to Consider When Calculating Cost of Lab Exposures

Employee Time

- Time to notify and document incident
 - Notify supervisor and Biosafety Officer of exposure
 - Complete report of injury
- Travel time
 - Travel to occupational health, medical clinic/ER, pharmacy and follow-up appointments
- Wait time
 - Doctor's appointment, Pharmacy pick up and Follow-up appointments
- Symptom monitoring
 - Completion of symptom monitoring logs
 - Reporting symptoms

Laboratory Time

- Time to document incident
 - First report of injury by safety committee (Director, biosafety officer, lab supervisor)
- Decontaminate lab area
- Perform laboratory risk assessment
- Select agent exposure form
- Time spent covering employee absences

Physician/Employee Health Clinic Time

- Initial appointment
 - Exposure review
 - Identify treatment
- Complete paperwork
- Follow up and patient monitoring

Public Health Response Time

- Patient interview
- Laboratory walkthrough
 - Document lab layout, workflow, and location of incident
- Exposure and contact investigation
- Post exposure monitoring

CONCLUSION

This tool emphasizes the importance of an effective biosafety program that can in turn reduce the likelihood of laboratory acquired infections or exposures. The tool will also support communicating the value of biosafety towards laboratory leadership. Laboratories should always conduct their own site specific biological risk assessments after potential exposure events have occurred to help determine any root causes and if any mitigations can be implemented to reduce the likelihood of recurrence. Currently APHL is finalizing the tool and will be housed on the APHL biosafety website www.aphl.org/biosafety. If you have any questions regarding this tool, please contact APHL at biosafety@aphl.org.

For More Information

Please visit www.APHL.org/biosafety or contact us at biosafety@aphl.org.



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