

**Slide 1**

Lee Reichman: Good afternoon. And welcome to our Web-based seminar, "Management of Tuberculosis in Emergency Department Settings." I'm Lee Reichman, and I'm the executive director of the New Jersey Medical School Global Tuberculosis Institute, and I will be moderating today's program. The risk of TB transmission is high in settings such as emergency departments, where care may be provided to patients before they're diagnosed with TB disease.

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This web-based seminar will discuss the typical presentation of TB patients in the emergency department, and outline the steps necessary to reduce missed opportunities for appropriate diagnosis and treatment. The seminar will also cover administrative, environmental and respiratory protection control measures, with the goal of improving infection control practices in emergency department settings.

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Our faculty members today are Dr. Elissa Schechter-Perkins, from Boston University School of Medicine, and Juanette Reece, from the Baltimore City Health Department Tuberculosis Control Program.

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After this introduction, Dr. Schechter-Perkins will provide an overview of TB in the emergency department, and then discuss infection control in the emergency department, including triage, airborne infection, isolation and personal respiratory control for patients and providers. Juanette Reece will present a case study about a program and emergency department collaboration in Baltimore city, and we will then have time for questions and discussion.

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So we'll now begin with Dr. Elissa Schechter-Perkins. Dr. Schechter-Perkins is an Assistant Professor of Emergency Medicine in the section of Public and Global Health at the Boston University School of Medicine. She's also a full member of the Medical Advisory Committee for the Elimination of Tuberculosis for the State of Massachusetts. And I'll now turn the program over to her, Dr. Schechter-Perkins.

Elissa Schechter-Perkins:

Hi. Thank you for the introduction. I'm Elissa Schechter-Perkins. I'm an emergency medicine physician at Boston Medical Center. And for the next 45 minutes, we'll be talking about tuberculosis in the emergency department.

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The main topics that we'll be covering are when, in the course of an emergency department shift, your TB antenna should go up, and you should have concern that the patient in front of you might have tuberculosis; what the initial emergency department management ought to be in an emergency department patient suspected of having tuberculosis; and what infection control measures your emergency department should have in place.

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So, the question comes up, who walking in to your emergency department, might conceivably have tuberculosis? Just to make our jobs a little bit more difficult, the answer, unfortunately, is everybody.

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Worldwide, along with AIDS, tuberculosis is a major leading infectious cause of death. And it affects over one-third of the world's population. Every year, 1,700,000 people die from tuberculosis worldwide. In the United States, tuberculosis is also a major problem. It's increased from 1980s to 1993, as you know, primarily due to increase in AIDS. Since 1993, the incidence of tuberculosis has been steadily decreasing, and actually, in 2008, is at the lowest rate recorded since national recording began in 1953. However, there were still 12,898 new diagnoses of tuberculosis. In Massachusetts, which is where I work, tuberculosis continues to be a major problem. And the rates that we see are fairly similar to the national rates, at 4.1 cases per 100,000 people, which is – which makes for approximately 260 new diagnoses of tuberculosis in 2008.

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So the answer is, honestly, that everybody might have tuberculosis. It's out there. Your job is to suspect it. For physicians in the audience, you might remember that in medical school they taught us that tuberculosis is the great mimic, and may not be an obvious diagnosis based on the patient's clinical

presentation. Well, that means that you're not going to find tuberculosis if you're not considering it, and if you're not looking for it.

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So you need to be thinking about tuberculosis, because it still exists. And you especially need to be thinking about it if, like I do, you work in an emergency department. This is where I work, in the emergency department at Boston Medical Center. And this lecture is going to focus on tuberculosis in the emergency department for a number of reasons.

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Those main reasons are that we see tuberculosis in the emergency department, we miss tuberculosis in the emergency department, and we spread tuberculosis from the emergency department.

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Remember how I said that everybody might have tuberculosis? Well, that's certainly true.

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That said, there are certainly some people who are lower risk for tuberculosis. And then the majority of patients who test positive for active tuberculosis do tend to have certain high-risk criteria, which we'll be analyzing in somewhat more detail in the next few slides. Before we do that, though, I'd like to take a closer look at the group of patients we commonly see in the emergency department. A Venn diagram will actually show us that these patients that tend to be high risk for tuberculosis actually overlap very much with the patients that we frequently see in the emergency department, combining to give us high-risk emergency department patients.

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Here's why. Let's take a look at some of the CDC data for 2008. We can see that fully eighty percent of the tuberculosis – of the newly-diagnosed tuberculosis cases in 2008 were in ethnic minorities, broken down as you see on the slide on front of you. Given the percentage of the population that make up these minority groups, this means that tuberculosis rates were twenty three times higher among Asians than they were among whites; were eight times

higher among blacks than they were among whites, and were seven and a half times higher among Hispanics than they were among whites. Looking further at the cases diagnosed in 2008, sixty percent of cases were diagnosed in those born in a foreign country. We should note here that foreign-born does not necessarily mean new immigrants, as sixty percent of the patients diagnosed have been in the United States for more than five years by the time of their diagnosis. Finally, fifteen percent of the patients diagnosed in 2008 with tuberculosis had comorbid HIV infection.

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I have a little bit more information specifically about Massachusetts, where I work. You can see that nine percent of the cases diagnosed in 2008 were among substance abusers, three percent were among homeless patients, and two percent were among those who reside in correctional facilities, with an additional two percent among those who reside in nursing homes. So looking, for example, at the homeless patients, you can see that that was a case rate of 24.9 per 100,000 cases of tuberculosis, which is significantly higher than the Massachusetts case rate of 4.1 per 100,000. Correctional facilities, 20 per 100,000; again, significantly higher than the Massachusetts case rate.

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Remembering that our emergency departments throughout the United States typically serve as our health care system's safety net, we realize that the groups in this bullet, those ethnic minorities, foreign-born, those with HIV, drug users, nursing home patients, homeless patients, prisoners, all are more likely than others to be underserved regarding their health care. That means that all of these patients are more likely to be using emergency departments, because they don't have a usual (force) of care. So for any little incident that comes up, they're more likely to show up to an emergency department. Also, a lot of these groups are more likely than your average bear to suffer from other illnesses, not related to tuberculosis, that necessitate emergency department visits. As you can well imagine, nursing home patients frequently visit emergency departments, even for complaints not related to tuberculosis.

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So what does that tell us? Again, everybody who walks into the emergency department could potentially have tuberculosis. However, the highest risk groups to keep in mind are the patients that we commonly see in the emergency department. Specifically the patients that we see in the emergency department that are ethnic minorities, foreign-born, suffer from HIV, drug users, nursing home patients, homeless patients or prisoners.

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The next reason to focus on tuberculosis, besides for the fact that we see it in the emergency department, is that we miss it in the emergency department. The next two slides reference studies confirming that yes, we see tuberculosis, and we don't do a very good job of diagnosing it.

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This is a study by Socolove in the reference section, and it was a retrospective study from an urban teaching hospital. It found that in a 30-month time period, 44 contagious tuberculosis patients made 66 visits to the emergency department prior to their diagnosis. That's an awful lot of people who were potentially exposed to tuberculosis in the emergency department.

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The study by Long in the reference section, showed that half of the newly-diagnosed tuberculosis cases had an antecedent emergency department visit in the previous six months. They had an average of 2.2 visits per patient and they were more likely to have a visit to the emergency department as they approached their diagnosis. Finally, those seen in the emergency department tended to be the most sick out of all of the tuberculosis patients.

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The study in the references done by Rau showed that in hospitalized patients, the median interval from admission to initiation of medications was a full six days. And fully three-quarters of the patients had a delay of at least 24 hours. So yes, we're missing it in the emergency department. Otherwise, there wouldn't be such a big delay.

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This is my why-oh-why slide. Why is this the case? Why are we doing such a poor job at recognizing tuberculosis?

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Going back to the study by Socolove, which was a series of emergency department patients later found to have contagious pulmonary tuberculosis, they found that the clinical presentation of tuberculosis can be very variable and non-specific. Cough, which we were taught is the major complaint of patients suffering from tuberculosis, was only present in sixty four percent of those who visited the emergency department, and was the chief complaint in only twenty percent. In fact, only thirty six percent of the patients seen in the emergency department, later found to have active pulmonary tuberculosis had a respiratory complaint at triage. Other chief complaints that they found included fever, chest pain, weakness and abdominal pain, none of which are going to scream tuberculosis in my clinician's mind.

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They also found, in the same study, that the clinical presentation of a contagious tuberculosis patient may not even be related to tuberculosis in the first place. In fact, we found that alcohol was a major confounder. There was one patient in their study, a 45-year-old male, with frequent alcohol-related visits, who presented to the emergency department 30 times during the study period. And tuberculosis was not considered in this patient until he had made more than six potentially contagious emergency department visits. So we can see that patients are not presenting by the book during the course of their emergency department visit, and specifically in their triage visit, they're not mentioning the typical features of tuberculosis that we think to look for. And they are maybe not even mentioning any symptoms related to their active tuberculosis, even though they have it on their arrival to the emergency department.

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There's a further problem, too, though. Even when we do suspect tuberculosis in the emergency department, definitive diagnosis is just not possible. As you know, the gold standard of culturing the organism can take days to weeks.

Although most emergency departments can rapidly get back the Ziehl-Neelsen stain, which identifies acid-fast bacilli, it's only fifty to eighty percent sensitive. So we're working with an innate disadvantage, in that we have a very hard time making the diagnosis of tuberculosis, even if we are suspicious of tuberculosis.

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Finally, in the emergency department, we spread tuberculosis. This is a picture from the Rothman article, illustrating that emergency departments are high-risk sites for propagation of infection, and can serve as a potential bridge for aerosolized infections.

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We spread tuberculosis between patients, from patients to health care workers, and from patients to family members. In fact, we spread it more than other areas of the hospital, and more, even, than the community.

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We spread it between patients, and that's partially due to the emergency department infrastructure.

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As you all know, overcrowding has become a major problem in emergency departments.

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It's a major problem in both the waiting room as well as in the emergency department itself, where we see boarding in an emergency department hallway, and we see patients in room without sufficient ventilation precautions. These patients are walking tuberculin machines that are sitting, closely packed, next to each other in waiting rooms for long periods of time, or closely packed in emergency department hallways, breathing, speaking, coughing and generally just spreading tuberculosis.

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They also spread it more often to staff, and for a number of reasons. The patients in the emergency department tend to be sicker, requiring more

rapidity in their care, as well as more invasive clinical procedures that produce large amounts of aerosol. For example, emergency department patients frequently get intubated, they frequently get suctioned, they occasionally provide sputum for culture, even if people are not thinking tuberculosis, if they're just thinking pneumonia – bacterial pneumonia. So the acuity actually contributes to the more invasive procedures that are more likely to spread to tuberculosis in the emergency department. They are also, as we discussed earlier, atypical presentations, in which staff members don't even suspect that the patient in front of them has tuberculosis. Yet they're are intubating the patient and suctioning the patient who happens to have TB.

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So, emergency department staff has been shown repeatedly to be at greater risk of tuberculosis. Depending on which study you look at, you'll find variable rates of tuberculin skin test conversion among ED staff workers. What does seem to be consistent is that they're at significantly higher risk than other hospital employees. As much as six times more likely than other hospital staff to convert their TST during the course of their employment.

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And finally, patients spread it to their family members, or to other people's family members. Infectious patients that are not properly recognized in the emergency department, are not properly isolated when they upstairs, or they may, as the study by Socolove showed earlier, actually even go home.

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So we're now going to shift gears a little bit and talk about specific patients who present to the emergency department and how to handle them.

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So, we're going to get clinical.

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Case number one refers to a young, healthy, 35-year-old male who's had a cough and fever for the last four days. His cough is productive of yellow sputum, but he otherwise has no past medical history, no medications, and he's

generally well appearing on exam. He does, of note, have – found to be coughing, and have rales at his right lung base.

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So maybe we decide to get a chest x-ray on him. And this is what his chest x-ray looks like. Now, let's say, hypothetically, because you've seen my lecture, your tuberculosis antenna is super high, you're going to consider tuberculosis in this patient.

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However, this theoretical patient doesn't meet any of the patient-centered high-risk criteria for tuberculosis. And given his short duration of symptoms, you're actually probably not too concerned about tuberculosis in this patient. Well, you still have to treat him, right? We think he probably has pneumonia, based on his clinical presentation and his x-ray. So what agent are we going to choose? Well, let's think about the organism. The most common organisms in community-acquired pneumonia are Strep pneumo, H flu and atypicals.

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Thinking about the agent, we used to use penicillin for patients like this. However, they're no longer such a good option because of high-level drug-resistant Strep pneumo.

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So, what next? We move maybe to the current IDSA and ATS guidelines. And what they suggest is that we use a macrolide. A macrolide like azithromycin. Strong recommendation, level-one evidence. It's first line in patients like this today. Great. Send him home on a dose of azithromycin, and we're done.

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But let's say, all of the sudden, our theoretical patient becomes case number two, and reminds us that he actually has a history of an underlying lung disease, such as asthma. Perhaps rather than an underlying lung disease, he was actually recently treated for another infection, maybe prostatitis, in the last three months.

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All of the sudden, he's jumping to a different category, under the IDSA guidelines. He is now becoming a patient who has either a comorbidity, in which they're recommending a respiratory fluoroquinolone, or a patient who has recently used an antibiotic, and therefore has a high rate of resistant Strep pneumo. Again, they're recommending a respiratory fluoroquinolone.

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Wait a second. Don't we use respiratory fluoroquinolones to treat resistant tuberculosis? Can this be a problem?

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All of the sudden, we're treating a large number of patients with an agent that is somewhat effective in treating tuberculosis. That's what the development of this new class of highly-effectively once-daily fluoroquinolones has meant. But what if we were mistaken in our initial diagnosis, and what initially looked to us like community-acquired pneumonia was actually a case of missed pulmonary tuberculosis? Now, all the sudden we're looking at a patient who has a partially treated tuberculosis. This can cause significant problems, such as a delay in the diagnosis of tuberculosis, or even the development of resistant tuberculosis.

#### **Slide 45**

Fortunately, this seems to be a more theoretical problem than an actual problem encountered.

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The article that we're – that's in the reference section by (Long) looked at registries in Canada, which is not so different from the United States, as far as tuberculosis numbers are concerned. As you can see, they found that a fairly significant number of patients with newly diagnosed tuberculosis had been treated fairly recently with a fluoroquinolone. In fact, seventeen percent of the patients had been treated with a fluoroquinolone in the previous six months. And most of them were within 90 days of diagnosis. However, only three out of 74 of those patients, four percent, were resistant to fluoroquinolones. And each of these patients had in common the fact that they had received more than one course for fluoroquinolones, some receiving

two, three, even four courses of a fluoroquinolone prior to their tuberculosis diagnosis. Still, four percent is not completely negligible. And that's a concern, if four percent of the patients that we're treating with a fluoroquinolone end up with resistant tuberculosis.

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However, the Huang study that is cited in the references found that the majority of cases that are resistant to fluoroquinolones were also resistant to multiple other drugs, suggesting that the resistance was not secondary to the fluoroquinolone use, but rather the patient was actually infected with a multi-drug-resistant tuberculosis.

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At this point, though, it's still a fairly new issue. Because fluoroquinolone risk is continuing to increase in the United States. This issue of fluoroquinolone-resistant tuberculosis might become a bigger problem if the prevalence of tuberculosis increases, or the use of fluoroquinolones increases. So, in spite of the IDSA and ATS guidelines, a number of well-respected infectious disease physicians are recommending that we try alternative regimens rather than fluoroquinolones in patients with community-acquired pneumonia that's complicated by underlying lung disease or recent antibiotic use.

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The most important take-home message from this discussion, however, is that if a patient returns to the emergency department, after either completely failing, or somewhat improving, and then failing again, after a course of a fluoroquinolone, you should consider the possibility that you might have been wrong the first time. You might have missed active pulmonary tuberculosis. It might be time to admit this patient, do a further workup, and perhaps get your own tuberculin skin test checked one more time.

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Let's move on to case number three. Case number three refers to a 46-year-old homeless male, born in Peru, complaining of cough, fever, night sweats and weakness for one month.

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Now, in school, we all learned that the major signs that cause us to be clinically suspicious for tuberculosis were cough greater than two weeks duration, dyspnea, fevers, chills, night sweats, weight loss, hemoptysis. We learned in this lecture that we can see a variable clinical presentation.

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So we need to keep up a high level of suspicion in a patient that has the correct epidemiologic profile. This case meets the high-risk criteria that we were given earlier, because the patient was both foreign-born and homeless. So he has two strikes against him, epidemiologically. Additionally, clinically, he's got a number of strikes against him complaining of cough for a month, fever for a month, and night sweats for a month. He basically fits the bill. We are fairly suspicious of tuberculosis in this patient. But how high should our suspicion be? Should we actually go ahead and start an anti-tuberculosis regimen right now? Clearly a lot of consideration goes into the decision-making process. All the epidemiologic information. Check. Clinical information. Check. Microscopic findings of AFB and culture for microbacteria tend to a little bit unrealistic in the emergency department. However, in an any department setting, these other diagnostic resources are readily available.

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And so a culture – I'm sorry, a chest x-ray must be obtained in any emergency department in whom you're considering tuberculosis. It's an easily available test that we get back rapidly. It's something that we need to do. What we're looking for with our chest x-ray is primarily pulmonary active tuberculosis. Rather than old tuberculosis, we're looking for the real deal.

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This is the x-ray of a patient that I saw in Peru, who had active pulmonary tuberculosis. And his x-ray is fairly classic. He has a right upper lobe cavitory infiltrate. Commonly, we see, on chest x-rays in patients with tuberculosis, lesions in the upper lobe or superior segment of the lower lobe. We also see cavitation, which is associated with increased infectivity.

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The other finding that we look for, and I apologize for the poor resolution of this x-ray on your screen, is miliary tuberculosis, which is when there's small, one- to three-millimeter nodules throughout the lung field. Both of these findings, or either of these findings, would be suspicious of – would be concerning for tuberculosis in your patient.

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Now, the next step in diagnosing tuberculosis, if your chest x-ray is concerning, is obtaining a sputum sample. As you know, the first thing that we're looking for in our sputum sample is an AFB on the smear. And this is not a bad test. It's rapid. It has a sensitivity of sixty percent in culture-positive patients. Sixty percent could be even lower, depending on the skill of the lab tech, and depending on the bacillary load. It's been determined that the number of bacilli that need to be present in a sample for positive AFB smear is between 10-to-the-third to 10-to-the-fourth bacteria per milliliter. And so depending on the level of infectivity of your patient, you may or may not be able to see it. Whether or not this step gets done in your emergency department, depends on a number of hospital-related issues, including the number of isolation beds in the hospital. If there is a very limited number of isolation beds in the hospital, if the patient has a significant boarding time in the emergency department, it makes sense to start the workup in the emergency department. And you can obtain an induced sputum to send for the sputum sample – to send the sputum sample for an AFB. How rapidly you get this test back, however, depends on your hospital. It's usually a few hours. If it's negative, this may be sufficient, though, for you to avoid sending the patient to an isolation bed. So it may be worth keeping the patient in the emergency department until you get results, to save a precious hospital resource.

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The next thing that we look for when we send a sputum sample, is the culture. As you know, this is the gold standard for diagnosing tuberculosis, but it takes a long time to get back – days to weeks. And obviously these results don't come back until long after the patient has left the emergency department.

However, if we're going to bother sending the sputum sample, waiting for an AFB that might actually influence our emergency department management and disposition, we might as well send the culture. Because we can get them from the same sputum sample that we're already obtaining.

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Other diagnostic modalities that are frequently used for diagnosing tuberculosis, such as the PPD or the QuantiFERON Gold, have absolutely no real role in the diagnosis of tuberculosis in the emergency department, for multiple reasons. First of all, it's not necessary to have this information prior to starting a treatment regimen. And also, the results are not gotten quickly enough to influence any sort of emergency department management or disposition of the patient. And finally, they don't distinguish between active tuberculosis and latent tuberculosis infection.

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So how about the disposition of these patients? As you know, many patients with active tuberculosis start their regimen as outpatients. However, from an emergency medicine perspective, this just may not be easy. In order for us to safely discharge a patient, any patient, from the emergency department, they need to be well appearing. Which they may not be, considering that they presented with their symptoms to an emergency department in the first place. As we saw earlier, the patients that tend to have active pulmonary tuberculosis that present to an emergency department tend to be sicker than your typical pulmonary tuberculosis patients, meaning that the patient may not pass this first test. Additionally, the patient needs to be in an appropriate social situation. Meaning that they can easily be contacted for follow up. An ED, which as we mentioned, sees a large numbers of safety-net patients who tend to be more – tend to have less stable social situations, they tend to be more homeless, for example, it may not be possible to arrange follow-up sufficiently with these patients for us to feel comfortable. So we may not be able to discharge them from a purely social perspective. And, in order for us to be able to discharge them, we need to be able to contact our local health department. We need to know the state laws on who to contact and how to go about contacting them. Unfortunately, this is not common knowledge for most emergency physicians, and it may actually be fairly difficult information to

come by. So the default, the admission of the patient to the hospital, is frequently what happens, just because they're unsure of the laws, and they're unsure of how to go about following up the patient. Unfortunately, or possibly fortunately, depending on your point of view, what it means is that most of these patients are going to be admitted to the hospital.

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Let's move on to case number four. Case number four is a 46-year-old female who's non-compliant with her HIV medications, who's complaining of cough for one month.

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This is her chest x-ray. Now, this is not at all what we have learned to be a typical chest x-ray for tuberculosis, but that turns out to be exactly what this patient had.

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There's a number of things, then, that you need to keep in mind regarding tuberculosis and HIV. You need to remember that tuberculosis can occur at any CD4 count, because as we have said earlier, only between eleven and fifteen percent of tuberculosis patients may actually have HIV. The next point that you have to remember is that the degree of immunosuppression influences the clinical, the radiographic and the histopathologic presentation of tuberculosis. Above a CD4 count of 350, this patient will look like any other tuberculosis patient you've learned about, regarding both symptomatology, physical findings and chest x-ray. However, as the CD4 count drops below 200, all bets are off. And the patient is more likely to have an extrapulmonary manifestation of tuberculosis, have less severe symptoms, and have a completely abnormal-looking chest x-ray, or normal-looking chest x-ray, but there is absolutely no relation to what we learned is typical in a tuberculosis patient.

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The next point to keep in mind is that a larger percentage of AIDS patients actually have primary tuberculosis, meaning that they were recently infected. It's important to know this, because they're more likely to have atypical chest x-ray findings. However, the majority will still have reactivation tuberculosis.

In fact, the presence of HIV is the single biggest predictor for progression from latent to reactivation tuberculosis. In an HIV-uninfected patient, there's only a five to ten percent lifetime risk of eventually suffering from active tuberculosis. However, in an HIV-positive patient, that has a positive tuberculin skin test, there's a seven to ten percent annual risk of active pulmonary TB. That's annual risk. The last point, as you know, is that tuberculosis and HIV interact to make each illness more severe.

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So, if you're suspicious of tuberculosis in an AIDS patient in the emergency department, this is going to change your diagnostic workup for a number of reasons. First of all, your suspicion of tuberculosis is significantly higher than just a community-acquired pneumonia. Secondly, there's decreased sensitivity of the AFB smear when a patient is immuno-compromised. It seems to be due to a smaller number of bacilli in the sputum. What that means is that, whereas with non-HIV patients, we might be reassured with just one negative AFB smear. In an HIV-positive patient, we're going to wait for all three AFB smears to come back before we're convinced that the patient is not actually suffering from active pulmonary tuberculosis. Since most protocols require that the smears be done on different days, this means that the patient is going to be admitted to a hospital isolation bed and cannot get away with going to a floor bed, if they suffer from HIV and you're concerned about tuberculosis.

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Moving on to case number five. The chief complaint is back pain. It's a 19-year-old healthy male from Vietnam with worsening back pain and tenderness over his back.

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This is his CT. Even for those of you who are not radiologists, it's fairly clear that there's a problem with this vertebral body. It's not normal. What this is, is Pott's disease with destruction of the spine, due to tuberculosis.

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This is an MRI of a different patient who also is showing destruction of vertebral body due to tuberculosis.

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So what's important to remember about tuberculosis is it can be anywhere. From an emergency department perspective, though, the most important point is that it does not require isolation unless it's pulmonary or laryngeal. Those are the only public health threats.

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So this is a patient that I took care of that had tuberculin pericarditis.

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And this is a person, who I took care of, who had tuberculin iritis. Neither which require isolation and are not quite the public health threat of pulmonary or laryngeal TB, but are still just as dangerous to the patient himself, and require us to remember that tuberculosis can exist outside of the lungs.

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Now, for the final portion of the lecture, we're going to shift gears to the bigger picture of infection control. Specifically in that high-risk area that I call home, the emergency department.

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Why do we bother? Why is it that we put all this effort into infection control procedures? Well, the answer is, it works. There have been a number of studies have shown that infection control procedures work in decreasing the amount tuberculosis spread.

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The Behrman article, which is referenced in the reference section, described a multi-pronged tuberculosis infection control program that had an administrative piece, engineering controls and a respiratory protection piece. What they found in their study was a six-fold decrease in latent tuberculosis infection in emergency department health care workers, from the time that they started the program to the time that they finished the program.

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So to review, tuberculosis is spread by droplet nuclei, airborne particles from patients who have pulmonary or laryngeal TB when they do activities such as coughing, sneezing, shouting, singing, speaking. The droplets are small, only

one to five micrometers. And normal air currents keep the particles airborne for prolonged period of time. This means, as you all know, that small bits of contagious tuberculin glory get into the air, and they stay there.

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Now, what makes an area particularly high-risk for the spread of tuberculosis? Environmental factors, such as small spaces, enclosed spaces, poor air flow or poor ventilation, infrequent cleaning or inadequate disinfection of material, as well as a person problems with improper procedures for handling specimens.

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Does this sound familiar? Yes. This could actually be a poorly managed emergency department. We're just one little tuberculosis incubator. Fortunately, implementing infection control programs in the emergency department actually does work, as I said.

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As described by the CDC in a 2005 summary guidelines for preventing the transmission of mycobacterium tuberculosis in a health care setting, an infection control program in a health care setting has three pieces. And administrative piece, an environmental piece, and a respiratory piece.

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So the administrative piece is that the reduction of the risk of exposure via the implementation of an effective program. The second level, the environmental controls, aims to reduce the spread and reduce the concentration of droplet nuclei in the air. And the final piece, the respiratory protection controls, further reduces the risk of exposure in special areas and high-risk circumstances.

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So the administrative controls. They're the first level. And they're dependent on the higher-ups in the department. It essentially involves the setting up of the program, the training aspect of the program, and the iron-fist enforcement of the infection control program.

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One of the major problems is the importance of the training. A lot of emergency department staff are not particularly attuned to tuberculosis, and easily forget about it during the course of their other clinical duties. Constant reminders via posters is one example of a measure to increase awareness. This participate poster was developed by the Massachusetts Medical Advisory Council for the Elimination of TB, to be placed throughout emergency departments to constantly remind staff members to think about tuberculosis.

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The same group developed these magnets, which can be placed throughout the emergency department, as a subtle reminder to staff that tuberculosis is out there, hiding among their patients, just waiting for a chance to come out and affect others. Steps such as these, which increase emergency department health care workers' awareness of tuberculosis, fall under the category of administrative controls and are an important part of any infection control program.

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Moving on to the third piece, the respiratory protection piece, this is dependent on the individuals. It ought to be enforced by the higher-ups, but really is the individual health care worker's responsibility. It needs to have a training piece, in which health care workers are trained on respiratory protection, and it needs to have a mask fitting piece, where either annually in high-risk places, or maybe less than annually in lower-risk places, health care workers are fitted with masks to make sure that they're getting the adequate protection from tuberculosis. N-95 disposables are available in most emergency departments. It's the last line of defense against tuberculosis, however, and they're only effective when the suspicion of tuberculosis has already been generated, such that the health care workers are actually using these precautions.

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The second level is the physical space. And the aim of the environmental controls are to control the source of the infection, dilute and remove the contaminated air, and control air flow.

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Environmental controls include a high air flow, at least six air changes per hour, and air cleaning methods, such as HEPA filters that filter droplets from the air, and UVGI, which kills or inactivates tuberculosis. Finally, cleaning the air, by making it a negative pressure room.

**Slide 85**

So what we end up with are the need for these airborne infection isolation rooms, or the TB rooms. We know the science behind preventing the transmission of tuberculosis. The problem is that this is just one of the multitude of engineering issues that arise when constructing an emergency department.

**Slide 86**

A study done in 1995 by Moran showed that most emergency departments did not have these adequate environmental controls. In fact, under twenty percent of emergency departments had tuberculosis rooms, and under two percent of emergency departments had the appropriate environmental controls in the triage and waiting areas. Things were starting to improve, because this is about the time that the new CDC guidelines started coming out, but it's unclear if things have changed since then. I'm actually not aware of any recent comprehensive studies of emergency departments regarding environmental controls.

**Slide 87**

Additionally, the problem becomes resource utilization. The trick is getting the appropriate patients into the appropriate rooms. Even if the rooms are available. And what that requires is protocols for identifying, evaluating and managing infectious tuberculosis patients.

**Slide 88**

One important consideration is to get the infection control started at triage, even before the patient enters the physical emergency department. An effective strategy here will minimize nosocomial, or hospital-acquired infections, throughout the emergency department, which we know is a high-risk space, as well as throughout the entire hospital.

## **Slide 89**

We should consider initiating tuberculosis airborne precautions for any patient who has signs or symptoms of tuberculosis disease on arrival. However, that's becoming fairly difficult in these H1N1 days, where two-thirds of the patients that I can see on any given shift have a cough. And they generally don't require such stringent isolation procedures.

## **Slide 90**

There have been a lot of triage protocols developed to predict who needs strict isolation measures associated with tuberculosis. However, they've all met with limited success, both in their sensitivity, i.e., picking up patients who have tuberculosis, and in their specificity, not placing too many patients in isolation. The problem is that talking to a patient is just not sufficient. You can't guess tuberculosis status after a five-minute triage interview.

## **Slide 91**

So, what do we do? We might consider a protocol where anybody with a cough is masked. A large number of these patients are going to have bacteria or viruses, and a mask is actually sufficient for them, because they're large droplets that don't remain suspended in the air. And then, for patients that have a cough and higher risk factors, we might consider using TB rooms for those patients. Additionally, we can consider a high-risk procedure, such as those that generate aerosolized droplets, such as intubation, suction and induced sputum, be done only in rooms with non-recirculated air. That could mean having a trauma room that has non-recirculated air, and doing all high-risk procedures in that trauma room, or that resuscitation room. However, even this is going to miss certain patients, because as we saw earlier, a large number of patients coming to the emergency department with active tuberculosis don't present with the typical symptoms of tuberculosis.

## **Slide 92**

How about admission to the hospital? Well, if your emergency department doesn't have an isolation room, you need to have a rapid identification of possible cases, and then get them out of the ER. You have to kick them out of the emergency department as quickly as you can, in order to get them to an airborne isolation infection bed.

**Slide 93**

If your emergency department does have an isolation room, you have a little bit more time. Any patient who's considered to be high-risk, you can put in your isolation bed in the emergency department, and then screen them to determine who's going to need an isolation bed in the hospital.

**Slide 94**

This spring, actually the Annals of Emergency Medicine had an article by Moran, that's in the reference section, that discussed the development of a decision instrument to determine which emergency department patients require an in-hospital airborne infection isolation bed. And it found that any one of these factors, a history of tuberculosis, an immigrant, homelessness, history of incarceration, recent weight loss, chest radiograph with apical infiltrate, or chest radiograph with cavitary lesion. Any patient who had any one of those symptoms was triaged to or was placed in a hospital isolation bed.

**Slide 95**

And they found that this decision rule actually had fairly good sensitivity, at 96.4 percent. What that means is that you won't miss patients with tuberculosis – 96.4 percent of the patients had one of these findings, and was therefore appropriately sent to an isolation bed. The specificity of 48.7 percent is actually not bad. Of the 2,423 patients that didn't have tuberculosis, 1,180 of them exhibited none of the high-risk criteria. They therefore would have been triaged to a low-risk category and would not have wasted a hospital isolation bed. So that's actually pretty good.

**Slide 96**

So, we're going to move on a little bit and try to summarize what we've learned today.

**Slide 97**

The first thing, I think, is that emergency departments are dangerous places. You may not want to work there.

**Slide 98**

The next thing that we learned is that we can minimize danger when providers are aware of tuberculosis, recognize the risk factors promptly, and are in an environment with protection measures in place.

**Slide 99**

So I apologize for any sloth that went into the development of the lecture that might have prevented it from being as effective as it could be.

**Slide 100**

And finally, these are the references for all of the studies that were cited during the presentation, and you can find them for further reading in the online handout. Thank you.

**Slide 101**

Lee Reichman: Thank you, Dr. Schechter-Perkins, for sharing your knowledge and experience with us. It was an outstanding lecture.

**Slide 102**

And next, we're going to switch to Juanette Reece. Ms. Reece is a health educator with the Baltimore City Health Department Tuberculosis Control Program. She has a Master's of Health Science degree, and has been with the Baltimore City Health Department TB Control Program since 2007. And I'll now turn the program over to Ms. Reece, who will present a case related to today's topic. Ms. Reece ...

Juanette Reece: Hello, good afternoon. I'd like to first thank the Global TB Institute for giving me the opportunity to share what we've done here in Baltimore city regarding TB education and training in emergency departments. My name is Juanette Reece. I'm a health educator with the Baltimore City Health Department, and today I'm going to discuss Baltimore city's response to the TB outbreak in the homeless population.

**Slide 103**

In 2004, pulmonary TB was diagnosed in a homeless man. He was smear positive, highly infectious, and while contagious, and of course before he was diagnosed and started on treatment, he stayed a number of nights at several homeless shelters and had over 12 clinical encounters, which included local

hospitals and clinics. From 2004 to 2008, Baltimore city had a total of 39 outbreak-linked cases. Several visited local EDs, and in some cases, TB was not diagnosed. So these individuals, including the initial case, were showing to EDs for various reasons, including unintentional injuries or injuries from assault, non-emergency-related problems, like being intoxicated, or even with a cough and fever. So even though they may have been symptomatic for TB, it was missed, either due to a more apparent health problem, or another diagnosis. TB was just not on their radar.

#### **Slide 104**

Prior to the outbreak, we generally saw about one to four cases in the homeless population. But as you can see, we saw a substantial decrease in 2004, with nine outbreak-linked cases. In 2005, there were 10 linked. And in 2007, 14 of 47 cases for the year were homeless. So thirty percent of our total cases in 2007 were homeless, which is pretty significant. Since 2007, we've seen only two outbreak-linked cases. One in 2008, and one so far this year in 2009.

#### **Slide 105**

A number of recommendations were made by the CDC at the conclusion of their investigation of the outbreak. We implemented these program activities based on those recommendations. In light of our topic today, I'm going to focus on activities relating to our education and training of health care providers.

#### **Slide 106**

The steps that we took, was to first identify facilities to target, then put those facilities on our high-priority list to notify them of the outbreak. We developed 30-minute presentations for TB in-service trainings and coordinated with them to schedule and conduct it.

#### **Slide 107**

Our activities initially focused on high-priority locations, which is basically any place that a person with TB spent time. This included homeless shelters, soup kitchens, clinics and EDs. We found that homeless persons were frequently admitted and seen in the EDs of local hospitals.

Many homeless people will use the EDs as their only source of health care. Studies have shown that homeless persons have high rates of emergency department use. Compared with the general population, the homeless are three times more likely to use an emergency department at least once in a year. Emergency department-based studies have also shown that homelessness is associated with repeated emergency department use. Program activities were targeted to emergency department and infection control staff of the high-priority locations, and then expanded over time to include additional facilities that were not as frequented by the homeless.

**Slide 108**

Notification of the outbreak was initiated using bulletins, e-mailed alerts, newsletters and phone calls. We followed up with "Think TB" reminders to infection control and ED staff.

**Slide 109**

This is an example of a TB alert that was sent out, which essentially brings attention to the correlation between homelessness and the use of EDs. It also states some symptoms and reminders of what to do.

**Slide 110**

This is an example of a reminder message, which we also use to update the EDs with any new information regarding the outbreak.

**Slide 111**

When coordinating education and training with the health care providers, we established a point of contact, which was usually the ICN, then we worked around their schedule to conduct the in-service. The in-service was delivered on an annual basis.

**Slide 112**

Our objectives for education and training were to increase knowledge of TB, increase awareness of the outbreak, reduce delays in diagnosis, ensure appropriate referrals to the TB control program.

**Slide 113**

Key messages included, think TB, consider TB in any homeless person with a cough greater than two weeks, night sweats, fever and weight loss, and other

symptoms. Prompt respiratory isolation and the use of masks and prompt diagnosis evaluation including the collection of one or more sputum samples.

**Slide 114**

Trainings were delivered by either a medical director, nurse practitioner, nurse case manager, community health educator or a combination. Trainings included a TB refresher, information on homelessness in Baltimore City, and updates on the outbreak. And the following is an overview of the topics that we discussed.

**Slide 115**

We also distributed a wealth of educational materials and resources. We all should know this poster, it's pretty popular.

**Slide 116**

OK, so we learned that yes, there were gaps in TB case detection in EDs. And that homeless individuals with TB were usually in the hospital at the time of diagnosis. We also learned by program activities resulted in increased communication between the health department and health care providers, and that ED staff were very receptive to the training and the recommendations.

**Slide 117**

OK. Thank you.

**Slide 118**

Lee Reichman: Thank you very much, Ms. Reece, for sharing your case with us. There should be lively discussion of these two excellent talks so let's open the floor for questions and discussions.

(Mildred Perez): Good afternoon. My name is (Mildred Perez) in New Jersey. My question is, did they follow up or went to the homeless shelter to see if there were – problems were there? Or if there was any person – a contact there that needed to be screened?

Lee Reichman: Juanette, I guess this is for you.

Juanette Reece: Yes, we had a range of activities, outreach activities, targeted in the homeless population following the outbreak. We had contacts at several shelters in the city. We also did mass screenings at several shelters in the city.

(Mildred Perez): After that, did – anything else was done in terms of any type of prevention measure?

Juanette Reece: Yes, we implemented cough-alert policies in the shelters, where we had an individual that stayed at the shelters, go around at night and observe anyone who had symptoms. Then they would track in a cough log. And someone from the health department would go there periodically. And if, of course someone was consistently coughing or had symptoms, we'd bring them in for a TST and we'd also get a sputum sample. We also do education and training with the staff of the homeless shelters within the city, and also education with clients.

Lee Reichman: OK, thank you very much. Do we have some more questions?

Nisha: Hi, this is Nisha Ahamed from the Global TB Institute. I have a question for Dr. Schechter-Perkins. I wonder if you could talk a little bit about – a bit about your experience at Boston General, in terms of how ED physicians sort of feel about all this push about paying attention to TB. Obviously it's a challenging environment to work in. Have you seen any of that in terms of, I don't know, reticence or being overwhelmed with other issues and not having time to deal with the possibilities of TB?

Elissa Schechter-Perkins:

I think that's an excellent question, because it's a major issue that we have to deal with. There are so many things on the plate of an emergency medicine physician, or an emergency medicine nurse, that tuberculosis is very easily dropped to sort of the background. Today – in today's environment, with H1N1 and sort of all of the hysteria that's surrounding it, we're actually finding it a little bit easier to talk about respiratory protection. And it's become a lot more standard for us to expect our nurses, especially out at triage, to, when they hear of a patient having a cough, immediately place them in a mask. Now, obviously this is not excellent protection against tuberculosis, but it is at least a start, suggesting that people are starting to be

aware of how infectious – how respiratory infections are spread, and how an emergency department is very dangerous. Now, the last hospital that I worked in, which was in Los Angeles, actually saw a significantly higher proportion of tuberculosis patients, and they did a much better job there at screening for tuberculosis and immediately placing high-risk patients into appropriate isolation rooms. I think it's only natural that your awareness of tuberculosis is going to reflect how common tuberculosis is diagnosed in your emergency department. But you know, some of the problems that we've encountered are that high-risk patients that are likely to have tuberculosis can walk into any emergency department, even ones that don't see frequent tuberculosis cases. And so, making all emergency department staff aware is important. But, as you say, it's difficult. There's going to be pushback from the clinicians. Because there's so many other things on their plate.

Lee Reichman: OK, thank you. Other questions?

Rey McDonald: I have a question here. Rey McDonald, the Global TB Institute. I was wondering, I noticed that the slide from Boston showed that they were using Ziehl-Neelsen stains. And I was wondering if using maybe a fluorochrome stain, along with PCR, might increase the sensitivity a bit in identifying these patients, along with the chest x-rays you're doing there in Boston.

Elissa Schechter-Perkins:

You know, I think you're probably right. Unfortunately, that's one of the decisions that's out of our hands as emergency physicians. That tend – the specific tests that are done tend to be a decision made by the infectious disease physicians and the laboratory physicians. And the emergency department, unfortunately, tends to get left out of that discussion. So while you're probably right, we tend to not have a role in that discussion.

Lee Reichman: This is Reichman in Newark. I was going to ask you – you made a very compelling case for the fact that emergency department physicians are really in the front lines. We have, over the years, done the same with pulmonologists and with infectious disease docs, and their societies, first pulmonary and then infectious disease really got interested in support of TB control, TB training, TB education. Do you know if anything's happening in the emergency

department? They have societies also, I assume, that do continuing education and things like that. And you know, you all have the right index of suspicion in Boston, but how about other emergency departments throughout the country? Are they also attuned, or do you think it's worthwhile to try and get them attuned?

Elissa Schechter-Perkins:

I absolutely agree. The issue, as was brought up earlier, is again this is just one more thing on the plate of emergency physicians. And depend on sort of local infectious disease physicians, local public health commissions and thing to increase our awareness. I would say that the majority of emergency physicians, tuberculosis is just not high on their radar screen, unfortunately. And myself and others are working to increase that. But it tends to be something that is a little bit lower on the radar screen of emergency physicians.

Sally Cook: Hi, this is Sally Cook with the Vermont Department of Health.

Lee Reichman: Hi, Sally.

Sally Cook: I just had one comment and question for Juanette.

Juanette Reece: Yes.

Sally Cook: Thanks a lot for your presentation. I really love your piece about development of a 30-minute presentation for TB in-service trainings, because nobody has time for anything anymore, much less TB. And the 30-minute presentation, I'm really interested in whether you have, maybe just an outline of that, or something you know something that we might be able to look at, to adapt, for Vermont? For providers?

Juanette Reece: Oh, yes, definitely, I can I guess submit it to New Jersey and they can disseminate it to anyone who needs it.

Lee Reichman: We'll be glad to do that.

Juanette Reece: OK, great.

Sally Cook: That'd be great. Thanks.

Lee Reichman: OK. Some more questions.

According to our data, there's 53 very quiet people sitting out there.

Patrick Ndibe: This is Patrick Ndibe from the New Jersey Department of Health.

Lee Reichman: Hi, Patrick.

Patrick Ndibe: Hey, Dr. Reichman. Juanette, thank you for a good presentation. I recently, over the summer, went to Jackson, Mississippi, to help them. They were having some TB outbreaks in their homeless populations. And they kind of faced the same problems as you did. And one thing I was able to accomplish while I was there was to get the shelter operators to agree to develop a protocol whereby they screen the people before they admitted them into their shelters. And it's just like a protocol, where they have to be screened by the health, local health department. In fact, actually they screen them, they give them a picture ID to show that they have been screened. I was wondering if you guys thought about anything like that during your experience

Juanette Reece: Yes, of course that would be ideal. And we would love for shelters to implement that policy. It has been discussed. However, there doesn't seem to be, I guess a consensus as to implementing it. Not everyone is gung ho for that policy, because there are so many other things that they do upon intake that it's just not – they're not trying to incorporate it, I guess, right at this time.

Patrick Ndibe: OK, thank you. Because I asked this question, because I know that we can do all the screenings we want to, but if we are not preventing people who have not been screened from getting in there and infecting others, our efforts would be... You know, so that's something I wanted to throw out there.

Juanette Reece: Thank you.

Patrick Ndibe: All right. You're welcome

Lee Reichman: Thank you, Patrick. Are there some more questions, folks?

Anita Khilall: This is Anita. Elissa, there's a question asking whether your ED contacts the infection control department in your facility, when you have a suspected TB patient.

Elissa Schechter-Perkins:

By protocol, we do. Our protocol is absolutely that we contact infection control in our facility. However, unfortunately the dissemination of protocols such as this is not excellent. And I don't think this is particularly my facility, in – just my facility. It's actually been a problem at every hospital that I've worked at. Our policy and procedures manual is multiple hundreds of pages. So, by protocol we're supposed to, obviously, contact infection control. However, whether or not this actually happens tends to be very physician-dependent. And there have been multiple efforts by emergency department administrators and infection control administrators to try to publicize these protocols. And unfortunately, it happens if somebody thinks to do it, and otherwise it tends to not happen.

Lee Reichman: OK, thank you, Elissa. More questions.

Anita Khilall Can you talk a little bit about how one would go about determining which triage level to use in the ED?

Elissa Schechter-Perkins:

So, the first assessment generally tends to be on how ill a patient is on their emergency department presentation. And if somebody has unstable vital signs, the whole screening aspect of any triage protocol is essentially ignored, and the patient is brought back to an area where they can immediately receive resuscitation. If the patient doesn't fit into that criteria, then they get moved, they get bumped to a lower triage level. And at that point, there's – you know, they're supposed to do some basic screenings for a variety of different things. You know, domestic violence, things like that. And again, how often that happens is very situationally dependent. It depends on how many patients are presenting to the triage nurse at once. And it's also very nursing-dependent. It depends on sort of how in turn the nurse is with the different – the different screening procedures that are in place.

So it becomes, unfortunately, yet again a problem of tuberculosis sometimes being given the less importance than you would hope it would be given, because there are so many other things weighing on the minds of the triage nurse and so many other – so many other concerns that have to be dealt with at once.

Anita Khilall      Thanks.

Lee Reichman:    Elissa, do you have any data on the tuberculin conversion rate of your emergency room personnel?

Elissa Schechter-Perkins:

In our particular hospital, I actually don't, no. It would be interesting, but I don't know it.

Lee Reichman:    OK. Any more questions?

Lisa Outerbridge: This is Lisa Outerbridge. I'm calling from Bermuda and I'm from the department of health. And I'm actually with practitioners from our local hospital, from the emergency department and infection control. And I just have a question. In the first presentation, you mentioned – you made note of the risk population, where you spoke of homeless people and foreign-born people, etc. And on a handout, I have note of international travel. And in Bermuda, we have a – most of our population, whether it's foreign-born or local, have a great preponderance for travel. And I didn't hear that mentioned in any of the presentations.

Lee Reichman:    Elissa?

Elissa Schechter-Perkins:

Yes, foreign travel certainly does predispose you to tuberculosis. However, it does seem that most of the patients who've been diagnosed with active tuberculosis seem to have more risk factors than just foreign travel. And what we are trying to focus on is the really high-risk factors, because virtually all of the patients – or a very high proportion of the patients that are seen in the emergency department have high-risk travel. I know, for example, the study

by Moran looked at international travel and found that it wasn't particularly predictive of active pulmonary tuberculosis. My thought is that, mostly likely, if you were to test a large enough number of people, that yes, international travel, particularly extended international travel, not just a week on vacation to a given location, but you know a Peace Corps stay for two years, or a you know a mission that was over a month or two months, might predispose people for tuberculosis. But in the general population that we see, it tends to not be quite as – quite as risky of an epidemiologic factor, compared to some of the other factors that I mentioned.

Lisa Outerbridge: Thank you.

Lee Reichman: Thank you. Nisha Ahamed just pointed out to me that traveling to Paris probably doesn't qualify. Probably more likely traveling to a developing country and spending more time in a developing country, which has a high TB rate. Many western European countries have very low TB rates.

Lee Reichman: Any more questions.

Anita Khilall We have another question asking, how do you feel the implementation of universal health care will impact the use of EDs being used by uninsured people with TB?

Elissa Schechter-Perkins:

Well, that's a kind of loaded question. You know, I think any situation in which underserved patients are less likely to use the emergency department will decrease their risk of spreading tuberculosis in the emergency department. Whether universal health care will manage to effectively decrease the use of emergency departments by underserved patients, I think that still remains to be seen.

Lee Reichman: A couple of years ago, Amy Davidow who works at our center, wrote a paper about the socioeconomic status of TB patients, and speculating that foreign-born people with TB might be of a higher socioeconomic level and go to private doctors rather than clinics. And for clinics, I guess you could also say, rather than emergency departments. So you may have a, really, a sampling

error when you're looking at these groups. Alfred Lardizabal here in New Jersey.

Alfred Lardizabal: Yes, I have a question. I'm still intrigued by how we could properly approach missed diagnosis of TB in the emergency room. I guess in the heightened awareness of influenza, we automatically set aside people who we suspect have influenza. So I think if we lump TB as a potentially airborne illness, then maybe we could hitch a ride in terms of awareness. Secondly, what do you think is the value of the radiology department in sort of adding another layer to the net of avoiding misdiagnosis?

Elissa Schechter-Perkins:

So, I absolutely agree with you. As far as hitching a ride, along with the H1N1, and that's something that I'm very proactive and in my department, is yes, let's try to mask patients who are coming in coughing. Not just because of tuberculosis, but because we have this very sexy new disease, H1N1, that we're all on the lookout for. And so I think that you know public health departments, I think that emergency departments, I think that people are sort of trying to bring awareness about the importance of respiratory control, as H1N1 is becoming a bigger and bigger problem. As far as the radiology issue, I think it's a very important point. I think that improving diagnosis of tuberculosis is absolutely dependent on astute radiologists appropriately looking at x-rays and being willing to write on their results, that it is possibly consistent with tuberculosis. The problem that we've encountered is that a lot of radiologists are hesitant to write that finding as their diagnosis, as potentially consistent with tuberculosis, because all of the sudden, it's going to unleash a huge sort of backlash of infection control necessities. But having radiologists who are trained in recognizing tuberculosis and then communicating that information back to the requesting physician, that this might be consistent with tuberculosis, is an important point. Additionally, if the emergency physician is concerned for tuberculosis, having them note that in the x-ray requisition, I think, is also important step in making the radiologist aware that they should be looking particularly for findings related to tuberculosis.

Alfred Lardizabal: Thank you.

Lee Reichman: I guess another thing that could be done is sort of, and I don't know if emergency departments do this. I know that pulmonary departments, infectious disease departments, our institute, have weekly conferences where we discuss cases, case conference, management of cases, etc. Perhaps emergency departments should have consecutive case conferences, where they look at what went into the missing of that diagnosis. Because sooner or later, I guess you find out that that case that was here for 16 visits and never was diagnosed, had TB. Then perhaps a post-mortem, and I say that in a non-specific way, finding out what were the problems – they do that, they call it a root cause analysis, is what they call it at this institution. But it might be useful.

Elissa Schechter-Perkins:

Absolutely. No, I'm in complete agreement. I think that provides a teachable moment. That's when emergency department personnel, and any personnel who was involved in the care, if there was a missed case of tuberculosis, all of the sudden you have a teachable moment for providers. And that's an important facet of education in the emergency department.

Lee Reichman: Great. OK, that's all the time we have allotted for the seminar today. I'd like to thank, really profusely, our faculty, for two outstanding talks, and for sharing your knowledge and experience with all of us.

### **Slide 119**

I'd like to point out that the New Jersey Medical School Global Tuberculosis Institute provides medical consultation to providers in the northeastern region. Please feel free to call us at 1-800-4TB-DOCS.

### **Slide 120**

And that concludes the conference, and thanks so much for your participation.