Pertussis, or whooping cough, is a vaccine-preventable disease that has slowly increased in incidence over the years despite high nationwide pediatric vaccination rates. Since the introduction of the whole-cell pertussis vaccine in the 1940s, pertussis has been reasonably well controlled among the US population, but incidence has been steadily rising since the mid-1980s. Pertussis surveillance data eventually pointed to adolescents and adults as the culprits; those aged 19-64 were found to be the biggest reservoirs of the disease and largest source of transmission to non-immune contacts. In Massachusetts alone, adults and adolescents comprised 90% of reported pertussis cases in recent years¹. Currently, there are few recommendations for, and little public knowledge of, acquiring a pertussis booster during this age range despite recommendation of such by the Advisory Committee on Immunization Practices (ACIP) in 2012². Increasingly reported cases of pertussis in this age range bring to the forefront the need to broadly recommend boosters for adults and adolescents.

Pertussis spreads easily in the population through person-to-person droplet transmission. It is challenging to diagnose due to its varied clinical presentations; most infected adults and infants younger than 6 mos present atypically, with the characteristic “whoop” sometimes absent¹¹. *B. pertussis* has a more complex pathogenesis than other bacterial infections⁶, and this makes diagnosis and treatment difficult. Pertussis is very commonly misdiagnosed- since it often masquerades as just a chronic cough (mainly in adults), pertussis is not always considered as an initial diagnosis³. Because many other pathogens cause symptoms similar to pertussis, specific diagnostic laboratory testing is
needed to confirm infection- the most accurate of these being use of Polymerase Chain Reaction testing (PCR). Nasopharyngeal swab specimens are the most common sampling method, but as this is unpleasant to the patient, it is often refused. Reported cases are only those that are confirmed via laboratory testing, so many true cases of pertussis are significantly underreported. The infection range of pertussis is generally 4-21 days, with an incubation period of 7-10 days post-exposure\(^3\). For non-immune contacts such as infants younger than 6 mos., pertussis can be extremely severe and, at times, deadly. The leading cause of pertussis-related infant death is often pneumonia caused by secondary infection\(^3\).

In 2014, a total of 28,660 pertussis cases were reported to the CDC\(^4\). To the casual glance, this number seems rather low and not particularly worrisome. However, this number is low because of the number of pertussis cases that go unreported due to the reasons mentioned in the previous paragraph. This number is subsequently higher than in recent years, raising questions as to the increased number of cases. Aside from waning immunity in adolescents and adults, more accurate diagnostic tests, better reporting methods and a growing number of unvaccinated individuals also contribute to the growing number of cases.

Aside from those who are unable to receive vaccinations for medical reasons (myself included) or those who opt out for religious reasons, there are others who, for whatever reason, feel it unnecessary to vaccinate. The “anti-vaxxer” movement is a small, yet deeply destructive collective of individuals who choose not to vaccinate themselves or their children for various philosophical reasons. Staunchly opposed to scientific fact and credible data, these individuals feed on hearsay and speculation to
drive their beliefs. Many of these individuals have an almost opiate-like reliance on herd immunity, assuming that since most others are vaccinated, they and their children will be protected. However, the more people who follow this philosophy, the more herd immunity dwindles—92-94% coverage rate is needed for pertussis herd immunity to be effective. It is currently not legal in Massachusetts to refuse vaccination for reasons other than medical or religious opposition\(^5\), but other states allow it. While it was not focused on or discussed in this particular project, the fact that no legal repercussion exists for spreading of preventable, communicable disease and the question of future necessary legislation against not vaccinating for philosophical reasons were raised. Would this be a positive step for the future, or a veritable Pandora’s box of legal and constitutional hoops?

In addition to the philosophical unvaccinated, the ease of travel and immigration also presents another challenge to disease prevention. As Framingham Board of Health nurse Kitty Mahoney stated, “Nothing is ever more than a plane ride away”. This is what causes most global public health issues; those visiting from countries with different vaccination schedules or requirements often bring these diseases into the country with them, where they are spread to unvaccinated individuals and beyond.

Pertussis CAN be prevented through vaccination and awareness, and yet pertussis is the least well controlled of all the bacterial vaccine-preventable diseases\(^6\). Not only is pertussis a health burden, it is a considerable financial and societal burden as well. Adults infected with pertussis miss an average of 9.8 days of work\(^7\) (or if medically excluded, 21 days from onset of cough or 5 days after start of prophylactic antibiotic) and this number can increase if care of a sick child is needed. The average cost of a hospital stay due to
pertussis is the most expensive for infants ($9,580), followed by adolescents and adults ($5,310) and children aged 1-11 yrs ($4,729). Physician visits due to lingering cough increase in misdiagnosed patients. Overall, it is cheaper to vaccinate than it is to treat.

Common misconceptions are that pertussis is a childhood disease and that the current vaccines provide lifelong immunity. A Google search will yield thousands of images of infants, toddlers and pregnant women receiving the vaccine, and just as many advertisements to vaccinate this same group, but very few advertisements focus on adults and adolescents. Immunity from the acellular pertussis vaccine has been known to wane over the decade following the last pertussis dose, which is usually administered prior to age 7. Due to global safety concerns related to the whole-cell pertussis vaccine, migration to acellular pertussis vaccines occurred in the 1990s and has remained since. Rates of vaccination with combination Tdap for adults and adolescents have increased over the years, from 8.2% in 2010 to 17.9% in 2013, but these rates need to be higher in order for incidence to decline. Pertussis vaccination by no means prevents the disease, but it is the best way to reduce serious disease, hospitalization and spread. These are just some of the many challenges facing the control and the spread of pertussis, but the most rectifiable is lack of awareness, and this project strove to increase the awareness of pertussis infection in a relatively high-risk population as well as encourage those at risk to take preventative measures to protect themselves, their colleagues, and loved ones. The implementation of this project is a small, yet positive contribution to the pertussis awareness movement.

The site for my practicum project was a mid-size, gene therapy-focused biotechnology company with several sites around the Boston Hub and Metrowest areas. It
was acquired by a large French-based pharmaceutical company in 2011, which brought it innumerable resources—among them being access to certain vaccines at no cost to employees. While the exact demographic data of the site was not legally obtainable, it is known that this company’s Framingham site has a broadly heterogeneous population of about 3,000 employees, nearly all of who fall into the at-risk age range for pertussis infection. The geographic layout of the site results in significant movement of employees between different buildings during business hours, and shuttle services within and between the sites are used daily. Constant interaction and gatherings in smaller spaces (elevators, meeting/break rooms, and the shuttle) creates a very high-risk environment for pertussis infection, which employees can then transmit to non-immune contacts at home or elsewhere. Because pertussis is spread in droplet form and also through contact of contaminated surfaces, a risk assessment of the site environment considers it a high-risk setting. Those contracting an illness at work will most definitely share it with loved ones at home— and the attack rate for secondary infection with pertussis is 80%¹. Conversely, the high-traffic buildings set the scene for a successful awareness campaign. It is in the best public health interest for the Occupational Health division to encourage vaccine-preventable disease protection, and a recent outbreak of measles at a neighboring company in March 2014 as well as a mild pertussis outbreak at the company’s headquarters in Cambridge solidified the desire to increase awareness and encourage employees to take advantage of the resources at their fingertips. With the support and resources of the Occupational Health department and the Town of Framingham Board of Health, a Pertussis Awareness Campaign was launched at this company’s site in late March 2015.
The goals of this project, as decided upon by myself and my supervisor, were to present a site-wide awareness campaign and also host a seminar for interested individuals in order to increase pertussis and the need for a booster in the years following childhood. As I am employed at this company, it was a familiar and effective site for me to conduct my awareness strategies.

To begin my campaign, I first met with my supervisor and mentor, Anne Fitzgerald. Anne is an occupational health manager at the practicum site and also the regional lead in the Boston hub for the company’s occupational health department. She is also an alum of the UMass MPH program, which I found to be a positive because I now had someone who understood what I was trying to accomplish. Anne and I discussed several topics after I gave her some ideas as to what my public health interests were, and eventually our conversation turned to infectious disease epidemiology— a particular interest of mine. She then mentioned that the health center had wanted to do some sort of pertussis campaign but it kept getting “back burned”. I saw this as a great opportunity and something that I could really dig into and expand upon, so I asked if I could take this on as a project. After the blessing from the occupational health director, the wheels were in motion and I began my research. The on-site seminar date was set for Apr 2, with two scheduled Tdap clinics on the following week.

Anne had given me several valuable contacts during our initial meeting, and one of them was Kitty Mahoney, the chief public health nurse at the nearby Framingham Board of Health. I concluded that Kitty would be a valuable resource to the campaign, and would probably be able to provide me with data that I would be unable to acquire easily on my own. I reached out to Kitty asking for her help and response was an
enthusiastic “yes”. I launched into my own research, looking up multiple pertussis facts from the CDC and NIH and also performing my own incidence/prevalence calculations based on population data for the surrounding area and Massachusetts. I wanted to choose and present facts that hit “close to home” in order to really enunciate the importance of pertussis prevention. I later chose not to present this data, instead focusing on more general facts to present to my target audience. I also performed a site-specific risk assessment, and gap analysis of national pertussis data to help explain rising incidence. Even though most of the employee population at this company possesses the knowledge to understand the data, I chose to keep it simple and interesting to all. I reserved a space for the on-site seminar, and reserved Kitty for that day as well to come and speak in conjunction with me in order to give a more detailed clinical perspective on pertussis and to describe how a board of health operates in terms of disease control. Most of January was spent researching and organizing all of my facts and starting to assemble my seminar presentation. It was difficult to decide what to include and what to leave out, and I had to keep my audience in mind at all times. Often I would sit and consider “what would I find interesting in a seminar like this?” and used that to guide me in my efforts.

In early February, I met with Kitty at the Framingham Board of Health office. At our meeting, she provided me with several pieces of literature from the Massachusetts Department of Health on pertussis as well as some charts and her own insight from years of public health nursing. She is a wildly interesting individual and I was excited to have her present with me. We agreed to keep in touch as the project progressed, and when I had finished my research and put my slides together, I sent them to her for her review. I chose to focus on topics my audience could really relate to: threats to children, missed
work days, etc. We decided to each present half of the slides and discuss our respective topics during the seminar. Her praise for my collaboration of the slides and the facts included was a very big positive and encouraged me further.

With March came the on-site advertisements and the campaign. With Anne’s guidance, I determined that a time period of two weeks prior to the seminar was the ideal duration for an on-site campaign. I acquired a box of informational material on Adacel (the adult Tdap vaccine) from the marketing division, which I planned to have available at the seminar and at the occupational health center for anyone interested. I worked with the site’s media services department to design posters that would be displayed in all of the major buildings around the site, and also the site communications department to make digital media signs for the buildings as well. I utilized the “curiosity factor” - the media presented crucial, yet intriguing facts about pertussis in order to spark interest in the seminar, with an invitation to “find out more” on Apr 2\textsuperscript{nd}. An email blast also went out to all of the groups on site, inviting them to attend the seminar. What surprised me was the amount of receptivity all those involved displayed toward helping me. Each of the people I contacted was eager to help me without hesitation and did an absolutely exceptional job, and I am thankful for the support I received.

On Apr 2\textsuperscript{nd} at 12 pm, the on-site Pertussis Awareness Seminar was held. 22 people were in attendance, and several more tuned in via phone and Adobe Connect. All gave their permission to appear in potential photo/video during the presentation via signature at the door. The presentation in its entirety is included with this report. At the end of the presentation, I was happy to see that questions were asked and the audience was engaged. Anne, Kitty and I were able to field the questions and I was interested to
hear that several in attendance had had personal experiences with whooping cough and were eager to discuss their experiences. Overall, the seminar turned out better than I could have expected and I think all who attended walked away with a heightened awareness.

After the seminar, I conducted an online survey for the attendees, and from those that responded, I found the results interesting. Most people initially did not know that the Tdap vaccine (among others) was available at the company sites at no cost to them. All of those who attended responded that they now had a better understanding of the challenges facing pertussis control and what they can do to help. Most of those who responded were not, prior to attending the seminar, aware that adults and adolescents needed to receive a pertussis booster. All felt that the seminar provided adequate information on pertussis dangers, and of those who responded to a question regarding the Tdap clinics, 2 responded that they would attend and the majority responded that they would receive a booster from their doctor or other healthcare provider. Overall, I believe the seminar conveyed a lot of crucial information (especially the “By the Numbers” section) and enlightened those who attended to the very real threat of pertussis, especially related to their work environment. Seven people attended the Tdap clinics held the week after the seminar, according to the records of the occupational health center. 

One of the difficulties I faced was a lack of financial resources. Since it was performed separately from my role at the company, I was limited in what I could create and present. Had it been a seminar associated with a specific product or sponsored event, I probably would have been able to acquire promotional items and have more informational events. I paid for the refreshments at the seminar out of pocket. I did not
look at my limited budget as a true hurdle, as it did not stop me from accomplishing anything, but it taught me to be savvy and how to make the most out of what I had. Another difficulty I found was finding just the right ways to engage a wide audience, especially a busy, working one. In the future, I would have more direct communication with the site when promoting events, such as sending an invitation as a meeting planner with a reminder instead of just an email, as most people may have simply forgotten about the seminar whereas a block on their calendar would have reminded them. Designing the campaign materials was a challenge as well sometimes it was difficult to find the balance between having an annoying amount of information versus too little information.

Overall, I feel as though this project really conveyed an important message to a high-risk population. I was happy to be able to incorporate all of my classroom knowledge into this project and to see it applied to a realistic task. One of the best things that happened was the moment that I felt everything had fallen into place- all of my planning had allowed my actions to go off without a hitch, and all that I had left to do was host the seminar. Another rewarding thing was the amount of interest colleagues showed in attending and in my topic, especially from those who reached out to express their interest in attendance because they had young children at home and wanted to know how to keep them safe. I was pleased with how everything turned out and from my research and efforts I have a deeper understanding of how diseases affect a population and how important awareness and prevention activities are. The pieces of the public health puzzle have come together; I consider my project and its goals and objectives to have been met, as well as a great success.


