During my two months in Addis Ababa, Ethiopia I worked on a pilot project to determine baseline data regarding microbiological quality of bovine milk produced by small scale farmers in urban and peri-urban areas of central Ethiopia. Surveys were also given to individual farmers and collection center owners to determine current milking procedures and potential risk factors regarding the contamination of milk. The project was a collaborative effort between the Ohio State University (OSU), Addis Ababa University, Aklilu Lemma Institute of Pathobiology (ALIPB) and the Netherlands Development Group (SNV). I worked closely with Dr. Pamela Fry, a recent DVM from OSU and Eyasu Tigabu, a Phd student at ALIPB and frequently touched base with Dr. Wondwossen Gebreyes, my faculty advisor at OSU. I also met with my preceptors, Professor Getachew (ALIPB) and Dr. Luce (CDC), to discuss the project and was given insight in how to overcome obstacles that arise while working in a developing country.

Public Health Issue:

With more than 43 million heads, Ethiopia has the largest livestock population in Africa and holds great potential for dairy development. In the capital city of Addis Ababa alone, there are more than 5,200 dairy producers with more than 58,000 heads of cattle (Tegene et al., 2002; Ahmed et al., 2004). While the industry is growing at a rapid rate, no milk quality standards currently exist. Therefore it is important to establish milk quality standards that focus on food safety measures in order to improve public health. Baseline information on food borne pathogens is important in setting legislative standards for milk quality and in potentially implementing a quality based payment system that is currently under consideration by the Ethiopian government. For our specific project we focused on Staphylococcus aureus and Salmonella enterica, two pathogens of great public health concern. While Salmonella has shown to be present in milk and milk products throughout Central Ethiopia in past
studies (Zelalem et al, 2006), our pilot study did not detect the organism. We did however find a 31% prevalence of coagulase positive Staphylococcal species in the milk samples we analyzed.

*S. aureus* is a gram positive bacteria that is an important cause of bovine mastitis throughout the world (Almeida et al., 2004) and is responsible for a significant decrease in milk production among infected cows. A study on bovine mastitis in central Ethiopia sampling 500 lactating cows throughout the area showed 22.3% were infected with subclinical mastitis. *S. aureus* was implicated in 42.6% of these cases (Bekana et al., 2008). Once one cow in the herd is infected, the organism can easily be spread to the rest of the herd and cause an even greater economic impact. Due to the nature of the infection, subclinical mastitis is very difficult to treat and often leads to the culling of infected cows in the United States. When culling is not an option the infected cow can be segregated from the rest of the herd and treated accordingly if detected early (Radostits et al., 1999). As a developing country, small scale dairy farmers in Ethiopia often do not have the means to routinely test or treat for diseases and in most cases cannot afford to lose any of their cattle even if they are found to be infected.

Bovine mastitis is an important route of contamination in regards to *S. aureus* and milk but humans and the environment are also important sources of contamination. Humans are commonly carriers of *S. aureus* and without proper hygiene practices can easily contaminate food products such as milk. Between 30-50% of humans carry *S. aureus* and a large percent of these strains are enterotoxigenic (Le Loir et al., 2003; Asao et al., 2002). In our study, 100% of the farmers we surveyed milk their cows by hand allowing for a large potential of contamination throughout the milking process due to poor personal hygiene.

In addition to the economic impact *S. aureus* can have on the milk value chain, there is a significant public health risk associated with the pathogen. Certain strains of *S. aureus* are enterotoxigenic and cause a significant amount of food poisoning throughout the world. Staphylococcal food poisoning is characterized by a sudden onset of nausea, vomiting, diarrhea, and abdominal cramps.
In most cases the gastroenteritis is self limiting, but some individuals are more susceptible to complications than others (Le Loir et al., 2003). In the case of staphylococcal food poisoning the elderly, children, and individuals with weakened immune systems are at most risk (CDC, 2010). Certain strains of *S. aureus* can be resistant to antibiotics and these strains are given special focus in our study because of their increased public health significance.

In order to continue the increase in the milk value chain productivity and ensure the products are safe for consumer consumption it is imperative to set standards for milk quality and provide farmers with the means to meet those standards. The reality of this goal will require all sections of the milk value chain to work together, but developing baseline information on the current quality of milk and identifying issues within the system are an essential starting point.

**Responsibilities:**

In regards to the pilot project our responsibilities were vast and varied day to day. While many details of the project were arranged prior to our arrival, there were still many things that needed to be arranged and finalized once we were in the country. When first arriving in the country our main responsibilities consisted of determining the logistics of implementation of the project as a whole. This included securing a lab space, processing our lab supplies through customs, scheduling of sample collections, and arranging for transportation to the different sites. Once the logistics were determined we were able to begin sample collection and the laboratory processing of the samples. During this time we were responsible for coordinating with Milk Cooperative managers and quality officers in the intended area of study with the help of SNV. With their support we were able to collect milk samples from individual farmers and bulk tanks at collection centers and administer our questionnaire to the farmers and collection center owners. Once the samples were collected we processed the samples at the ALIPB microbiology laboratory for isolation of *S. aureus* and *Salmonella*. While processing samples we trained the ALIPB PhD student in basic microbiological laboratory techniques and molecular methods.
such as Polymerase Chain Reaction (PCR). All data from the laboratory work and questionnaires were inputted into an excel spreadsheet.

**Objectives:**

Prior to starting the practicum my expectations were to have an enlightening cultural experience and apply the theories and skills I had learned in the classroom in a pilot project on the microbiological quality of milk in Central Ethiopia. What I gained from this experience surpassed my expectations. Not only was I able to apply the skills I had learned but I also developed an entirely new skill set and made contacts that will benefit me greatly in future work within the global health field. The nature of working in a developing country requires patience and the ability to work through challenges and overcome obstacles. Some of these challenges included the bureaucracy of Ethiopia, different work ethics, and language barriers. The paperwork and processes required to do what seemed like simple tasks was often time consuming and very unclear. In these situations we learned to be flexible and creative. You do not always have immediate access to the people you need to provide you with answers and at times just have to accept that you are not going to get as much accomplished that day as you had hoped. In addition, when working with different organizations there is a certain level of language barrier even if the individuals speak English. Many things had to be translated for us and it was difficult to be sure you both had the same understanding of the activity discussed. The experience of working through these issues can be applied to global health work I do in the future whether it be in Ethiopia or another developing country.

In addition to developing the skills and patience to work in a developing country I was able to see firsthand how factors such as poverty, lack of education, and poor infrastructure can exacerbate public health issues. For example, one question on our survey asked if the farmers kept any records concerning production, diseases, or medical treatments. Over 72% of the individuals surveyed kept no
records at all and illiteracy was a common explanation. After meeting with several experts on the milk value chain in Ethiopia, it was clear the many issues

FEEDBACK:

Benefits:

- Deeper understanding of how different environmental, social and economic factors can impact public health issues in a developing country
- Experience and take part in Ethiopian culture
- We were independent and ultimately responsible for completing the project successfully
- Saw firsthand many of the topics studied throughout the global and public health curriculum
- Met with different NGO’s working towards capacity building in Ethiopia and saw some of the progress made
- Took part in something that may impact an entire country
- Made numerous contacts which may open opportunities for future jobs or collaborations

Unique Experiences:

For me the best part of the Ethiopian culture is how you are treated when invited into someone’s home. You immediately feel welcome and it is almost as if you are family. When you are so far from home in a completely foreign environment, it is very comforting to be able to enjoy a home cooked meal with people who seem to immediately view you as one of their family members.

Dance and music are also a large part of Ethiopian culture. We were able to watch traditional dancing at our hotel and at a local traditional dance house. We even learned to dance the Ethiopian way known as “iskista” although not very well. This is a traditional dance where you only move your shoulders and keep the rest of your body still.

Ethiopia is rich in history and has many historical and religious attractions. Some are within Addis Ababa and central Ethiopia, but the majority of the attractions are day or more travel from the
capital. Due to our demanding schedule with the project we did not have the time to travel to these sites. I hope to return in the future and set aside time to see more of the country.

Advice:

The skills and insight gained from an international practicum are not something accessible in a classroom and the overall benefits are enumerable. However when considering such a practicum, it is important to remember that there are many challenges and stresses associated. While it is impossible to anticipate and prevent all of the obstacles, there are things to do and know before you depart that will help.

- Start planning for travel as early as possible
- It is a developing country, but you will be able to find the essentials
- Learn a little of the language before you go – while most people in academics speak English much of the population does not and it would be helpful to know some Amharic for day to day living
- Bring cash in 50 or 100 dollar bills - you can exchange them to birr at the airport and at various hotels (beware of black markets)
- Food is very cheap overall – our meals ranged from less than 1 USD per meal to 7 USD for a nice meal
- Ethiopia is one of the safest African countries – biggest problem is pick pocketing but you should always be extra cautious when traveling to any foreign country
- Register with the U.S. embassy to receive email updates concerning the political climate
- Buy a travel book – Lonely Planet has a lot of information on the culture, religion, food, precautions to take, and other information relevant to travelers

I would recommend this practicum to a student who is ready for a challenge, can be flexible and adjust to different cultures, can work independently, and would like to broaden their perspective on the world.
View of Assela; To me this captures in part the essence of a developing country. You can see the growing infrastructure in the background showing progress but in the forefront is the horse drawn buggy symbolizing the progress that still needs to be made.

These pictures show the contrast between the rural land and the city, Addis Ababa.

There is a close interaction between humans and livestock on a daily basis even in the city.
Milk is brought to collection centers from individual farmers in the surrounding areas. The milk is then collected by Milk Co-operatives or private processing plants to be pasteurized in Addis Ababa. This process is the formal market and accounts for only a small portion of the overall milk production throughout the country.

In this picture I am working with the Sellale Co-opertive manager in administering the questionaires while the local dairy farmers observe
On the right myself and Eyasu are performing antimicrobial resistance testing. On the left we are trying out a new Polymerase Chain Reaction (PCR) machine at ALIPB.

Our research team and my preceptor Prof Getachew
We are visiting the children and elderly Dr. Wondwossen Gebreyes sponsors through the Mary Joy Organization.

Dr. Fry and I are taking part in a homemade traditional meal and enjoying the cultural coffee ceremony.
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