CUMULATIVE REFLECTION OF DIDACTIC AND EXPERIENTIAL LEARNING ACQUIRED IN THE BIOMEDICAL SCIENCE PROGRAM

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Introduction

The MMSc. in Biomedical Science (BMS) program has offered its students many opportunities to observe in different areas of the healthcare field that they may not have previously had access to or been exposed to. This has helped me to better understand myself and where I would like to go in the future. Before becoming a student in the BMS program, I had never even considered emergency medicine, but after being able to shadow in a pediatric emergency department, I found that I really enjoyed the quicker pace and the interactions, both with other staff members and with patients. My classes have also been very informative and allowed me to pursue research of the topics that I find interesting. I believe they have provided a strong foundation of knowledge for my next steps in life. In this report, I will reflect on the four aspects of the program that had the greatest impact on my view of the healthcare field: classroom application of material, querying the literature and creating a clinical question, communication in healthcare, and the psychosocial determinants of health.

From the Classroom to the Clinic

One of the most applicable classes to my shadowing experience has been Infectious Disease. In this class, we covered various diseases caused by microorganisms ranging from viruses to protozoa, their symptoms, available diagnostics tests, and finally what treatments are available. While observing in the pediatric emergency department, I was able to see a number of the diseases that we had learned about. The most stand-out of these cases were a girl with Lyme disease and a girl with infectious mononucleosis.

The patient with Lyme disease presented with the chief complaint of sudden onset knee swelling and pain with no history of antecedent trauma. She came from a rural area, and her family had dogs. However, because she arrived at the emergency department with her aunt, it was unknown if those dogs were on tick medications. Because of my background in veterinary medicine, my first thought for spontaneous joint swelling is usually Lyme disease. Dr. Paulin, whom I was shadowing, had similar suspicions. She decided to ultrasound the knee to look for any possible soft tissue damage or signs of Lyme disease. On the ultrasound, Dr. Paulin found that there was inflammation in the synovial sac, causing it to protrude from the joint space creating a Baker's cyst. Joint effusion is one of the most common symptoms of Lyme disease.[1] Though this presentation does not have a specific sign name on ultrasound, Dr. Paulin has been compiling cases of Lyme arthritis to create a sign that can assist in diagnosing Lyme disease using ultrasound compared to other forms of arthritis.

After the ultrasound of the patient's knee, Dr. Paulin conducted a Lyme titer. To diagnose Lyme disease, a serologic test, either a Western blot test or an enzyme-linked immunosorbent assay (ELISA), must be done.[1] After a positive titer, the girl was put on a 21-day course of doxycycline.

The patient with infectious mononucleosis presented with a history of fever and fatigue over the prior two weeks. She had previously been diagnosed with influenza at a different emergency room, but her mother was concerned that the symptoms were more severe and lasting longer than the previous cases of influenza the patient had had previously. Dr. Paulin ordered a monospot test and had her fellow perform an ultrasound while it was running. They found that the patient had a swollen spleen and liver, which are symptoms of mononucleosis that can be very dangerous if the patient is participating in activities such as contact sports or high intensity exercise. The spleen is at risk of rupturing from these events. After talking to the patient and her mother, it was reported that their family had a history of thyroid diseases, with both the mother and grandmother having theirs removed at an early age. Dr. Paulin also decided to ultrasound the patient's thyroid and found that there were irregularities in the tissue. This presentation can also be a sign of mononucleosis, but with the patient's family history, Dr. Paulin ordered a thyroid blood panel to check for abnormalities. After talking to the patient and her mother about the findings, a nurse reported that the monospot test was positive. As there is no treatment for mono, she was sent home with supportive care instructions.

In both of these cases, testing was required to confirm a diagnosis. We learned in class that Lyme disease is most commonly confirmed with an ELISA test, which takes 1-2 weeks to confirm, while infectious mononucleosis can be confirmed with a monospot test or an Epstein-Barr virus (EBV) antibody test, which can be completed in under 5 minutes and 3 days respectively.[2] This raises the question whether there is a rapid test that is sensitive and specific enough to accurately lead to a diagnosis of Lyme disease in patients suspected of contracting the condition.

There is a rapid test that can be used as a preliminary indicator to identify Lyme disease. As described in a study of Lyme arthritis, the Sofia Lyme Fluorescent Immunoassay is a rapid test that can be used to identify the presence of IgG or IgM antibodies against *Borreliella burgdorferi* in 10 minutes.[3] Donovan et al. tested the Sofia IgG to see if it could be used to accurately differentiate children with Lyme arthritis from those with other forms of arthritis to aid in acute care decision making. The Sofia IgG identified all 51 positive samples, but also came back with two false positives out of the 55 negative samples. This yielded a sensitivity of 100% to the Sofia IgG and a specificity of 96.4%.[3] It was concluded that the Sofia IgG rapid test has potential in aiding physicians in their decision making when faced with patients presenting with Lyme disease symptoms, however an ELISA should still be used for confirmation of a true diagnosis.

Framing a Clinical Question and Interrogating the Literature

Much of my medical background comes from working in a veterinary hospital in Northeastern Ohio. Over the last five years of my employment there, I have witnessed Lyme disease diagnoses rise from a handful of cases a year to a few every month. This increase is also being seen in human medicine, with the average number of reported cases growing from 3.2 per 100,000 people in 1993 to 18.8 per 100,000 people in 2022.[4] The range of *B. burgdorferi* infections has also been expanding west, giving rise to greater risks in previously unaffected areas.[5]

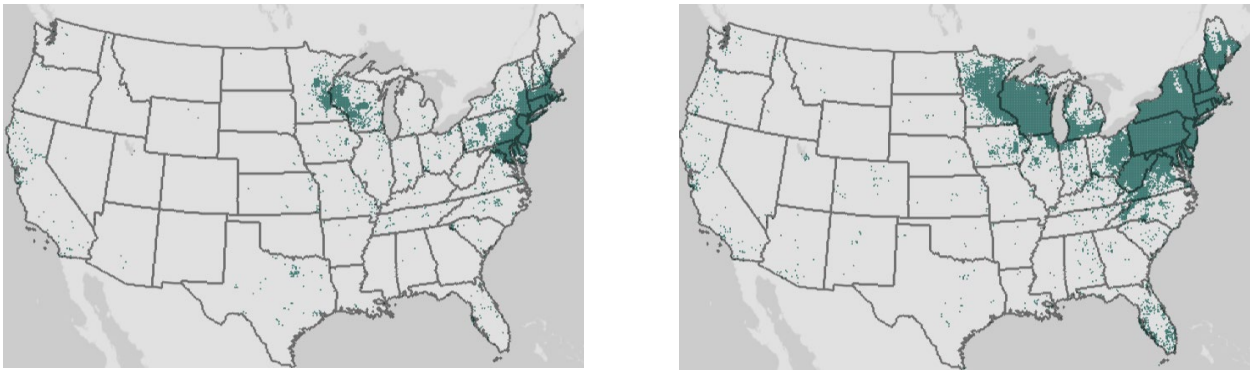


Figure 1: The two maps show the increase of reported Lyme disease cases from 2000 (left) to 2022 (right).[5]

With this rise in cases also comes the rise in antibiotic use to treat them. The gold standard treatment for Lyme disease is doxycycline, from the tetracycline class. One study surveyed eight pediatric emergency departments in endemic areas from 2015-2023 and found that doxycycline use increased from 6.9% to 67.9% in children under 8-years-old and from 42.1% to 84.7% for children over 8-years-old.[6] It is a broad-spectrum antibiotic, meaning that it targets a wide variety of bacteria when used, including good bacteria in the gut microbiome.[7] Because of this, doxycycline has numerous negative side effects, including nausea and vomiting,

abdominal pain, and diarrhea. Using broad spectrum antibiotics can also lead to resistance in bacteria that are not the targets of treatment, creating more dangerous strains as a result.

With all of this in mind, I questioned whether there is a more effective way to treat Lyme disease. My initial exploration of this topic led me to hygromycin A, an aminoglycoside antibiotic effective against spirochetes such as *B. burgdorferi* with much milder effects on eukaryotic cells. I then created a PICO question to focus my research around and then further investigated the literature.

PICO refers to a format used to effectively create clinical questions. The P stands for the patient or problem being queried, I for the intervention or exposure, C for the comparison or control, and O for outcome.[8] My PICO question became: In patients with Lyme disease, does the use of hygromycin A as compared to doxycycline reduce adverse side effects? To answer this question, I searched the Miami University Libraries Web of Science database using the terms "hygromycin A" and "Lyme." Using these terms, I was able to find a relevant article.

In this study, researchers selectively screened antibiotics derived from species of soil actinomycetes, a common source of many broad-spectrum antibiotics, with the reasoning that narrow-spectrum antibiotics had been previously overlooked.[9] To do this, concentrated culture supernatants were screened against *B. burgdorferi* and *S. aureus*. This screen revealed that hygromycin A, an antibiotic known to have poor activity against gram-positive and -negative bacteria, is highly specific and bactericidal to spirochetes.[9] This is because hygromycin A is taken up by a nucleoside transporter that is specific to spirochetes. Once inside the cells, it binds to the 23S rRNA subunit in the peptidyl transferase center and inhibits protein synthesis.

When hygromycin A was tested in various human cell lines, it showed no cytotoxicity.[9] Researchers then moved to animal trials. Three weeks after mice were infected with *B. burgdorferi*, they were injected with hygromycin A for five days. After the treatment period, the mice were determined to be free from infection.[9] Because the injections were able to clear the pathogen, they then tried oral administration of hygromycin A and found similar results. When the gut microbiomes of these mice were compared to cultures before treatment and cultures from mice treated with broad spectrum antibiotics, the changes were much milder.[9] Two of the other antibiotics tested resulted in an increase in pathogenic *Enterococcus*, and the mice treated with amoxicillin specifically saw an increase in *Bacteroides* due to resistance.

Based on the results of this study, hygromycin A showed specificity to *B. burgdorferi* and reduced adverse effects. However, one of the pitfalls of this study topic is that Phase I of human trials for hygromycin A as a treatment for Lyme disease only recently started in May of 2024. The results have not yet been published. Hopefully, as the trials continue more information will be made available. Because the mice studies found that hygromycin A is selective and effective against *B. burgdorferi* while showing no cytotoxicity through oral administration, researchers are also theorizing that bait traps laced with the antibiotic could potentially be used to eliminate infections in reservoir species. White-footed mice are a common host for the tick species that carry Lyme disease, leading to populations being easily infected by ticks and then infecting future ticks. By reducing Lyme infections in these mice, we could reduce the spread of the disease in critically affected areas. Though this study does not completely answer my research question, it does provide valuable insights on next steps in the treatment of Lyme disease.

Reflection on Effective Communication in Healthcare

Provider–patient interactions are a crucial part of the art of medicine. A provider needs to be able to effectively communicate with a patient so that they can not only make a more informed decision about their health but also feel safe to tell their provider about the problems and barriers they may face. Because of this, positive interactions lead to better care, greater health literacy, and a deeper level of understanding between provider and patient.[10]

The best provider–patient interactions I have observed have been at the Hospice of Cincinnati. Because of the nature of care that is being provided, the nurses have a chance to talk extensively with the patients or their patients' healthcare power of attorney. In palliative medicine, many things change about the kind of care that someone is receiving. No longer are they being constantly monitored on beeping machines nor woken up at all hours of the day or night for blood draws, imaging, or any number of other procedures. Instead, patient comfort is the top priority. This shift often comes along with many questions from caregivers, family members, or the patients themselves if they are still cognitively able.

On one occasion, a woman had been transferred to the hospice facility with advanced multiple sclerosis. To my knowledge, she was not fully conscious before nor while I was there. Her husband came in while I was observing, so the nurse I was shadowing and I went in to talk to him about her plan of care. The nurse began the conversation by asking about how the patient’s care had been handled up to this point, and we learned that he had been her primary caregiver for many years. The nurse remarked that, though it must have been difficult, he had done a wonderful job, evidenced by her lack of bedsores and body condition despite the severity of her disease. She reassured him that it was very clear how much he loved his wife. Then, the

nurse asked about any care plans they already had in place. He said that the one thing his wife didn't want was to be "hooked up to a bunch of machines" and instead wanted to pass naturally. The nurse acknowledged this, and then began to describe the care his wife would be receiving at their center, such as pain medications and occasional repositioning, and answering any questions he had. After, the nurse moved back into a more personal line of questioning, asking about how they met, their lives together, and their children. When we found out that the patient had been a nurse, she asked if they could put an indicator on her door to signify to the other staff members that she had worked in the medical field as a way to honor her service. He was very appreciative of the gesture.

The entire interaction was very calm. The nurse began by establishing a relationship with the patient's husband through her initial questions, which then led her to be able to identify why the patient was there and what about her care needed to take priority. With this, they were able to discuss a plan of action centered on the patient's wishes for her end-of-life care. All of these together culminated in a very positive provider-patient interaction.

In contrast, one poorly handled provider-patient interaction that I observed also happened while shadowing in the hospice center. A younger woman had entered the facility because she needed round-the-clock nursing care for her leukemia. In one interaction, the communication between her and the nurse that I was shadowing seemed to break down in a way that made it difficult for them to get back onto the same page. The patient had been given a stronger dose of a medication to see if it would help to reduce her pain for a longer interval compared to the other pain medication that she was having to receive every four hours. This stronger dose, however, made her very groggy and difficult to wake. As a result, she missed the normal dosing time for her other medications, one being her anti-nausea pills, ondansetron. Around an hour later, one of

the nursing aides told the nurse that the patient was much more awake and requested her ondansetron as her nausea was setting in. When we arrived back in the room with her medications, the patient asked if she could have a one-time dose of the intravenous (IV) ondansetron instead of the pills. She stated that the pills have an odd taste and because she missed her original dosing time, she would like something more fast acting. Her nurse informed her that, because her goal is to hopefully move back home, she should take the pill form over the injection. To this, the patient reiterated that she only wants the IV dose this one time because she was off her normal schedule. They continued this exchange a few more times, ending with the patient refusing the medication unless it was the IV form and the nurse saying that she would ask the doctor for a one-time dose, though she did not believe he would prescribe one. By the end, both the patient and the nurse seemed agitated.

I believe that the communication between the two broke down because the nurse didn't fully explain to the patient why the pills would be more beneficial than a single IV dose, did not make the patient feel like she was an active participant in her own care, and then kept pushing back on the patient's request to at least ask the doctor about switching for this single dose. I believe that a better approach to this situation would have been to actively listen to the patient's concerns and explain why taking the pills might be a better option over the IV dose. Not only would the pills be what she has access to at home, but by the time she called the doctor, obtained the prescription, and administered the dose, the pills might have already taken effect. If the patient still wanted the IV form after this conversation, I would have simply made the request instead of continuing to push. Ultimately, the outcome was one of symptom relief rather than of a more critical nature, so deferring to patient preferences might be the better approach.

In conclusion, positive provider–patient interactions are essential to maintain open lines of communication between health care workers and their patients, leading to better care and greater understanding.

Effects of Poor Communication

Communication between providers is extremely important in medicine. It is through properly conveying important information that a patient's situation can be assessed and the best care can be provided. If a patient is being transferred between departments or even hospitals, then a clear and concise system of communication is necessary.

One such communication tool is SBAR. SBAR stands for situation, background, assessment, and recommendation, and it has become an increasingly common system of communication between providers.[11] It provides a quick framework for passing on the necessary information about a patient's care. First, "situation" is a brief explanation of identifiers and the patient's problem. Next, "background" is any information of the patient's history that is relevant to the situation at hand, such as a previous diagnosis, vital signs, medications, or allergies as well as anything that has already been done, such as the administration of fluids or the collection of laboratory data. A comprehensive history is not necessary at this time. "Assessment" is what you think is happening. Stating the body system that you believe to be of concern or the severity of the issue is useful in this stage as efficient reference points for other providers. Finally, "recommendation" is how you think the problem can be solved. Altogether, SBAR creates an efficient system of conveying information pertinent to the problem at hand.

When this communication flow breaks down, issues leading to tension between providers and inappropriate handling of patients may arise. One such situation occurred while I was shadowing at Akron Children's Emergency Department. The person working on admissions that night received a phone call from emergency services that they were en route with a cold drowning victim being transported from another hospital. No communication from the other hospital was received about transferring the patient, nor had a transfer been accepted by any staff at Akron Children's Hospital. Because of this, the information that was available about the patient was limited only to what the emergency service providers knew. This resulted in 45 minutes of trying to resuscitate the patient with chest compressions, heated blankets, and 3 milliliters (mLs) of epinephrine. Finally, the patient was pronounced dead. It was not until we made it back to the office area to input notes that we finally learned about the patient's status at the previous hospital.

The patient had fallen through the ice on a pond and had been submerged for 30-45 minutes before the original emergency services team had been able to pull him out. He was sent to a local hospital, where they were able to warm him back up to 35°C. They performed chest compressions on him for an hour and administered 22 mLs of epinephrine. After all of this, they connected him to a LUCAS® chest compression system to perform the chest compressions while he was transported for more than 30 minutes to Akron Children's. Nowhere in any of the information that was received did it say that he had regained a pulse or cardiac rhythm. Given the patient's status, pronouncing him dead at that point rather than deciding to transfer him to another hospital might have been the more humane choice. Not only were his parents forced to travel a long distance to be with their son, this transfer likely provided false hope for a more positive outcome. Additionally, his family will also have to shoulder the added expenses of that

transportation and bills from two hospitals. The costs are compounded given the fact that the family is Amish and likely does not have medical insurance nor easy access to a car.

The hospital's actions were also very unprofessional towards the providers at Akron Children's Emergency Department. Because of the lack of proper communication, the responding team did not know the full situation or the relevant medical history and only had the assessment of emergency services to create a plan from. This led to unnecessary medical procedures being performed on the boy and valuable resources being taken away from other patients in need.

Though I do not know the full extent of the aftermath of this incident, I do know that there were discussions about reporting the original hospital for violating the Emergency Medical Treatment and Labor Act. In this Act, it is clearly stated that transferring a patient to another medical facility is only appropriate when the recipient facility certifies that they have available space, the appropriate personnel, and agreed to accept the transfer.[12]

If I were in a key role at Akron Children's Hospital overseeing the review of this case, my first act would be to contact the person in charge of transferring patients at the other hospital to get a clearer picture of where the communication broke down. If through this communication we were able to collectively pinpoint areas for improvement that might prevent a situation like this from happening again, the effort would be well worth it. If the other hospital were to remain uncooperative with my efforts, I would likely move to filing a formal complaint with the appropriate governing body in accordance with the Emergency Medical Treatment and Labor Act.

In conclusion, proper communication between providers is necessary to ensure that the best care can be provided to patients. With this knowledge, systems such as SBAR have been put into practice and have resulted in increased ability to present information between providers and improve outcomes. When these systems break down, it is important to find the disconnects and collaborate on solutions to ensure quality care is always given to patients.

Reflection on Psychosocial Determinants of Health

There are two main categories that are commonly used to determine a person's health outcomes: biological determinants and social determinants. Biological determinants include factors such as a person's genetic predisposition, behavior, or exposure to harmful chemicals or organisms. On the other hand, social determinants of health are external factors, including socioeconomic status, education, environment, or access to care.[13] Together, these two models can help to shape a physician's understanding of, as well as plans and goals for a patient's current and future health.

Most often, these biological and social factors interact with one another; if a person is of low economic status, they are more likely to be less educated, have a poorer living environment, greater exposure risk to harmful compounds, and limited access to health care.[14] I saw one such case while I was shadowing an ambulatory pharmacist. A woman was coming into the office later that day for an appointment to talk about her diabetes control. The pharmacist informed me that the patient was of a lower economic status and had been having difficulties making it to her appointments due to transportation issues. The pharmacist then pulled up a chart of the patient's blood glucose sugars over time, reported by her FreeStyle Libre, and explained that the woman also has a very erratic work schedule, making it hard for her to have a consistent meal schedule. As insulin is a drug that generally needs to be taken within a certain time period of eating, her varied schedule meant that she could not give herself the insulin on a regular schedule and often could not give it during the optimal time intervals, resulting in large swings between her high and low serum glucose levels. The pharmacist did tell me that when the patient is able to consistently take her insulin, she has shown to be very well controlled. It is when outside factors interfere that she is unable to remain constant. Chronically uncontrolled diabetes often leads to

major adverse health outcomes, including cardiovascular disease, amputation, blindness, organ dysfunction, or even death. As such, this patient's long-term well-being might be jeopardized by these variables.

Because of her socioeconomic status, this patient had unstable transportation that limited her access to medical care. Her socioeconomic status also meant that she needed to work long hours to support herself and her family, leading her to pick up extra shifts whenever she could. This often resulted in her skipping meals or forgetting her insulin when she was finally able to eat. Along with that, much of her diet consisted of unhealthy or fast food because it was cheaper and easier to acquire. All of these factors stemming from her socioeconomic status contribute to her overall poor diabetic control.

Many studies have been conducted with the idea of exploring the links between socioeconomic status and diabetes. One such study compiled and analyzed data related to diabetes from the National Health and Nutrition Examination Survey (NHANES) sent out by the Centers for Disease Control and Prevention from the years 2007–2020.[15] The study consisted of survey results from over 30,000 individuals from the ages of 20-79 years. Of these, 9,883 people were reported to be of low socioeconomic status, defined by comparing family income to national poverty guidelines. Individuals in this category were found to have 37% higher prevalence of diabetes compared to their counterparts categorized as high socioeconomic status.[15]

The NHANES also reported a variety of other factors, such as gender, race, education, and physical activity and found that along with low socioeconomic status, minorities, those with education of high school level or less, and those who do not meet basic physical activity

standards have a higher prevalence of diabetes. As mentioned earlier, these factors are compounding, so someone of a low socioeconomic status is more likely to have fewer educational accreditations and lower health literacy, resulting in worse health outcomes.[15] Surprisingly, there is debate about the relationship between physical activity and socioeconomic status because of proposed bias in research.[16] A majority of the studies conducted have focused on leisure-time physical activity and have not explored occupational, transport, or domestic physical activity, all of which have a higher association with low socioeconomic status. Only leisure-time physical activity was found to have a higher association with high socioeconomic status.[16] More inclusive research is needed to gain a better understanding between physical activity and socioeconomic status.

Finally, prevention programs targeting people of ethnic minorities and people of low socioeconomic status to tackle the disproportionate number of cases of diabetes among them have been recommended.[15] Such programs would help to decrease the rise in prevalence of diabetes while increasing the health literacy of these groups, ultimately leading to better outcomes. In the case of the patient I saw while shadowing, these programs could come in the form of local food banks partnering with grocery stores or produce sellers to offer healthier options for low-income families residing in food deserts or food swamps. For this patient specifically, it may be beneficial to try other medications aside from just insulin that allow for a more flexible dosing schedule to help her gain better control.

Diabetes is just one example of conditions affected by socioeconomic status. A low socioeconomic status is linked to a shorter life expectancy and greater health risk–taking behaviors, such as smoking or alcohol consumption.[17] These are then associated with higher risks of specific outcomes, including but not limited to lung cancer or liver cirrhosis. In response,

many efforts have been taken to try and reduce systemic barriers to care and promote healthy habits, but results have not been as effective as implementers hoped.[17] Research has now shifted to try to understand the psychological struggle associated with low socioeconomic status. It has been learned that, when facing problems that seem to have no solutions, people fall into avoidance-based coping. This can ultimately lead to continued stress and mental strain, both of which are associated with poorer decision making.[17] To combat this, policies that might reduce the mental burden of those in a low socioeconomic status, such as changes to working conditions or neighborhood safety measures, have been advocated for.[17]

Impact of the Program on my View of a Career in Healthcare

The science of medicine has always been interesting to me, but it's the human connections that have fueled my pursuit of making it my career. Through my shadowing experiences, I have observed a wide variety of interactions between doctors and their patients, but the one through line is always compassion. This compassion takes a different form for every patient—one may need a strong guiding hand, while another may need a softer approach—but each variant puts the patient's best interest first. One interaction that truly resonated with me was between a resident and a patient he was meeting for the first time. It started off very normally, with introductions and a general overview of how the patient has been doing, before jumping into a review of the patient's history. The doctor went over all of the patient's major health concerns and their possible paths to resolutions rather quickly. When he finished, the patient was having trouble composing herself. She told him of how scared and frustrated she was, as she had made numerous lifestyle changes to no great effect on her health. It was then that the resident realized he had overwhelmed her. Immediately, his tone and body language shifted. He told her that the adjustments she had made were great steps in the right direction, and then he reassured her that everything was manageable and they would work out a plan together. With these words, he had reminded her that she was not doing this alone, and the patient seemed immensely comforted by that. Watching them reminded me that it is for those moments, for the connections, that I want to go into medicine.

Nothing has specifically made me question my choice of career path, but there have been moments that solidified my desire to enter pediatrics. One evening while shadowing at the pediatrics emergency department, a couple came in with their daughter whose jejunostomy tube (J-tube) had come out. A J-tube is a feeding tube used to bypass the esophagus and stomach and

deliver nutrients and medicine straight into the small intestine, or jejunum. As such, having the tube pulled out leaves one vulnerable to severe infections and malnutrition. Her parents had tried to get an appointment with their regular doctor, but when there were no available time slots, they were told to go to the emergency room instead to hopefully be seen by a specialist more quickly. The patient was a young girl with a developmental disability, making communication with her difficult. She did not understand what we were trying to do and resisted while the doctor was trying to insert a sterile tube into the opening in her abdomen. At first, her parents were trying to distract her, but soon had to restrain her instead, leaving me with the task of trying to divert her attention. The patient's mother handed me her phone with a song and music video playing. I kept the video in view and sang along to the song with her. In the end, we were able to insert a new tube and wrap the patient's stomach to help prevent infection while keeping her relatively calm. When we finished, her mother thanked us profusely for being so patient with her daughter.

Pediatrics has always been a path I was considering. My background is in veterinary medicine, which I discovered is strikingly similar to working with young pediatric patients. However, I had not previously considered emergency medicine as a career. I had never needed to go to the emergency department before, and all of the media I had consumed made it feel like a constant whirlwind, something that I did not find appealing in a place of work. I was pleasantly surprised to find that my time shadowing with an emergency medicine doctor was very different from what I had seen through television shows and movies. I liked the quicker pace and the wider variety of patients that I was able to see. The doctor I was shadowing, Dr. Paulin, specialized in both pediatric emergency medicine and ultrasound, which was also something I had very little experience with before. The number of maladies that could be seen and more easily diagnosed with it was mind boggling. Dr. Paulin also shared with me some of her ongoing

research into creating a new sign to identify Lyme Disease with an ultrasound. Pediatric emergency medicine and ultrasound have become career paths I am now seriously considering because of this program.

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