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

Shannen Kate McIntyre-Quinn

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Dr. Chris Makaroff, Graduate Director
Dr. David DeLaet, Medical Director
Dr. Christopher Howell, Graduate Director

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Shannen Kate McIntyre-Quinn

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INTRODUCTION

There was a point in high school when I realized I wanted to work in healthcare. Admittedly, the decision to be a physician associate (PA) came more recently. When shadowing before this program, I was confronted with decisions about what path to take in school. I began shadowing PAs and saw a new perspective that interested me more than any other career had before. Parts of the job caught my attention and made me want to learn more. I observed a PA spend over an hour with one patient because the subsequent patient had cancelled. The patient really enjoyed chatting with this PA, and I watched as they talked about traveling, books they both read, as well as the reason for his visit. Even when her appointments were on schedule, this PA was able to spend thirty minutes with each patient, and many of them took the whole time to discuss their medical concerns and personal lives. It was when the conversation veered so naturally into something non-medical that I realized how important that connection was. She was able to use their established relationship to guide her patients on pertinent health issues. Being able to connect with people on a human level is critical and is something I value about this career.

An additional observation I made while shadowing was the amount of collaboration required in the medical field. I really enjoyed watching the various interactions between providers of all kinds. All the PAs whom I have shadowed have had a very close relationship with the physician, nurses, assistants, and other health care providers on their teams. It has been nice to see how you get to work together with other providers as well as patients in deciding upon a specific treatment. For example, a PA was trying to figure out what to do for a patient who came in with abdominal pain. This patient ended up having multiple additional problems,

and the PA wanted to confirm the best way to proceed. All interactions were very respectful and considerate of both patient and family.

While this particular experience was very positive, there are certain parts of the job that have made me think about what a working day may look like. While a PA may get more time to spend with patients than physicians, a large chunk of the day is still spent on the computer. This is not the only feature that gave me pause. I additionally found hesitancy regarding those aspects of medicine that are more focused on it being a business, components that many people don't see. Many times, PAs explained to me that they often felt pressure from the company to spend the least amount of money possible. In one instance, a PA explained that a patient with severe asthma could potentially be admitted due to the condition in which they presented. However, the patient had previously documented issues with leaving against medical advice. The PA explained that keeping her could cost the hospital more money than administrators might want to spend. The PA stated that he tried to convince the patient to stay, but she expressed wanting to leave. Though concerned, he resigned himself to her decision, but not before making sure that she had the medication she needed before leaving. This pressure to be efficient in terms of patient turnover and minimizing costs often clashed with the PA's opinions. A large portion of my concern stems from the fact that medicine has been turned into a business heavily influenced by insurance companies, as many PAs with whom I have worked have expressed. I am concerned with what the future holds when providers are pressured to optimize care yet may not be able to do so for concerns regarding cost containment.

Despite these systemic issues, at the end of the day, providers service people. Volunteering while in this program has allowed me to practice with the human element of the job: forming connections. Spending time with older adults at the Knolls provided me with the

opportunity to engage with people on a human level. I don't want to be a provider to treat diseases. I want instead to treat people with diseases. One day while volunteering, I was asked to spend one on one time with a few of the nonverbal residents to provide them with some human contact for the day. One resident had a book about San Francisco on his table. I showed him the beautiful photographs of the city and talked about where they were. After a couple minutes of looking at the photos, we made eye contact and in that brief moment, connected. There is an amazing feeling after getting through to people when talking about something that interests them, especially with people with limited communication. They are still able to hear and understand and need to be treated with respect and compassion. It is very important to me to remember that people are human and while the science of medicine is incredible, healthcare is more than the physiology of disease.

FROM THE CLASSROOM TO THE CLINIC

During my shadowing experiences I have seen a variety of medical diagnoses. Some of these were familiar to me as topics discussed in classes. In Molecular Biology, we discussed the central dogma, describing the transfer of genetic information from DNA to RNA to protein. We also talked about what happens when the process of cell division goes wrong due to an issue at the gene level. Cancer is not always genetically based, but we discussed when it can be and how certain genes can increase the risk of developing cancer. I am excited to learn how this information can be used to treat people with cancer as well as preventing it from occurring.

While shadowing, I observed multiple patients with cancer. In urology, I saw many patients with prostate and bladder cancers. When shadowing in hospice, I saw a patient with a type of rectal cancer and another with a type of brain cancer, glioblastoma. After witnessing the

effects of these cancers on patients' lives, I wanted to learn more about how they worked on a cellular level and how that related to my class, Molecular Biology.

A 2024 article investigated the role of genetics in the treatment of glioblastoma. This specific tumor, though a common form of cancer in the central nervous system, is particularly difficult to treat.[1] When the tumor forms, it has a high level of heterogeneity meaning it has a complex microenvironment, and this has acted as a challenging barrier to treatment.[1] The glioblastoma begins forming near a blood vessel in the brain, eventually enveloping it and using it as fuel for its own growth.[1] Multiple common genetic variations found in this cancer were highlighted in the article. The TP53 gene is a tumor suppressor gene that is an important regulator of the cell cycle and functions in arresting cellular development.[1] TP53 mutations are fairly common and present in about 30% of cases of glioblastoma.[1] When this gene is mutated, control of the cell cycle is disturbed, leading to tumor development.[1]

Due to the nature of the cancer and how difficult it is to treat, there have been a number of attempts to combat it. One treatment, immunotherapy, turns the body's immune system against the cancer.[1] By teaching the immune system to recognize and destroy cancer cells, this therapy shows promise as an effective method of fighting this cancer.[1] More research needs to be done, but the initial construct for an effective treatment is in place. One challenge that arises with treatment is the proximity of the cancer to the blood-brain barrier. An important structure to keep harmful substances from the brain, this barrier can be a challenging one to cross. While protecting the brain from harm, it also serves as a physical blockade from treatment as well.[1] Targeted therapies evaluating how a treatment can be delivered and act in a localized manner are being researched.[1] Because these properties make it a form of cancer that is difficult to treat, the authors suggest a multidisciplinary approach to treatment will be necessary.[1]

The authors perform an effective analysis, reference a number of trials, and discuss multiple hypothetical treatment options.[1] I would be interested to further understand the specific therapies and the studies performed that allowed them to be presented as options. It is also interesting to me how many different issues can arise in the genes for one type of cancer. There were multiple mutations and biomarkers just for this specific malignancy.[1] While this paper is extremely interesting, it is important not to forget the real-life effects this cancer has on people, some I witnessed while shadowing.

FRAMING A CLINICAL QUESTION AND INTERROGATING THE LITERATURE

When formulating a clinical inquiry, it is important to be as specific as possible. As evidence-based medicine contributes to medical decision making, it is important to collect as much information as possible in order to best inform patient care.[2] Each aspect must be accounted for in a clear, concise manner. This can be done through a template format known as PICO which stands for patient or population, intervention, comparison, and outcome.[3] Identifying these variables can contribute to better information searches by having a more specific objective. This leads to a more successful application of evidence-based practice.[2]

Right before attending this program, I worked as a nursing aide in a rehabilitation facility. This experience prompted my interest in spending time with residents at the Knolls of Oxford. Something I noticed in several residents at both care centers was their desire to leave. It wasn't necessarily that they disliked the facility itself, rather expressing that they preferred to be at home. I was curious if they truly needed to be there after seeing how upset they were. I am sure that some did, I saw that when I worked as a nursing aide. Several patients needed more help with activities of daily living than others. However, it has been found that stress can negatively

impact the healing process, increase complications, contribute to longer hospital stays, and elevate rehospitalization rates.[4] The stress these patients are experiencing can impact their recovery process. Older adults are often in need of short-term rehabilitation due to the level of support required through different stages of recovery.[5] I wanted to know what other options there were for therapy, especially in older adults. I developed a question in the PICO format to better identify literature that was relevant to my inquiry.

In adults 55 years and older with mobility impairment due to injury (P), does a standard outpatient physical therapy regimen (I) compared to home-based therapy (C) contribute to better outcomes with healing time and regaining mobility (O)?

One article investigated the effects of home-based therapy compared to traditional therapy in recovery after a total knee replacement.[6] Traditional therapeutic measures are under the supervision of a professional, but the authors identified growing interest in rehabilitation at home.[6] Inpatient and outpatient groups were both given the same exercises and time frame for recovery.[6] They found no significant difference in the outcomes between groups as patients regained their range of motion.[6] The authors found that while an option, home therapy did not offer any large benefit over traditional outpatient therapy on the recovery post-operation.[6] However, this does not mean there is no benefit. Home therapy was found to be a more practical option for patients wanting to return to a routine.[6] The researchers found that both options for rehabilitation have benefits, but there wasn't enough of a difference to rule either one out as ineffective.[6] This leaves the possibility open for future investigations of different therapies.

Another article looked at a common injury among older adults, hip fractures.[7] These researchers utilized PROs (Patient Reported Outcomes) as a measurement for progress in rehabilitation. The use of PROs had not been widely used before this for a comparison in

physical recovery.[7] This study found that between home-based therapy and hospital-based therapy, there was not a significant difference, excluding pain, between the outcomes in readmission rates and mortality rates.[7] The PROs between groups were also similar, and neither therapy location was reported as better than the other.[7] Consistent with the results of the previous study, neither home-based nor inpatient therapy was significantly better than the other for recovery and rehabilitation.[7] It showed the potential for home-based care as an option for recovery.

Throughout this literature investigation, I found that drafting the question in the PICO format made it easier to narrow down the search to find what I actually needed. Literature searches can help inform medical decision making, leading to educated treatment plans.[2] As medical information is so often updated, it will be important to stay updated on the literature. Because it is so vast, using a specific format will be a good way to create strong questions to narrow down searches. Using the information found will be imperative to creating relevant treatment plans for patients.[8]

REFLECTION ON EFFECTIVE COMMUNICATION IN HEALTHCARE

When I think about my time shadowing, I recall mostly pleasant encounters. The majority of interactions between providers, as well as between providers and patients, were effective. However, there were a few examples where I felt uncomfortable or thought that there was a lack of professionalism. In these cases, there may have been an alternate way the situation could have been handled.

When shadowing a cardiothoracic surgeon, I was incredibly nervous to be in the operating room for the first time. I couldn't stop thinking about how I might react when I saw

this person being operated on. Initially, we arrived while the patient was being prepared with anesthesia and all the monitors were placed. The patient was asleep and there were some comments thrown around about his weight. The surgeon I was shadowing repeatedly made comments about the patient's size, and they were not in relation to medication or for any clinical reason but rather delivered as a joke. Nobody said anything as everyone was moving and busy dealing with trays and tools and setting up the speaker for music. The procedure was a carotid endarterectomy so only a portion of the man's neck was visible when the team was finished preparing the surgical field. I watched as the surgeon went in and was amazed as the plaque was removed. While the artery was being repaired, Dr. A handed me the plaque to see and told everyone, "This is why you don't smoke". While that is certainly motivation to not smoke, he didn't seem to be very empathetic or respectful of the person in front of him. I didn't know the patient's situation, only that they were an avid smoker. I was uncomfortable with the way he talked about the patient and thought that Dr. A should have been respectful. Talking about someone is not good behavior to practice unless done with professionalism and empathy.

Another example of unprofessional conduct that I observed was between providers in the Emergency Department. I was shadowing a physician associate (PA) who was caring for a patient with a broken humerus. The head of the bone was fractured in three different places and would likely need surgery. The PA suggested to the patient that surgery was possible, but he would have someone from orthopedic surgery come look at it. He made sure the patient was comfortable and went to go contact the orthopedic service. After an unsuccessful attempt at reaching them, he saw a few more patients. He tried calling again after that and someone finally answered. All I could hear was someone say "What?" loudly and in a very impolite tone. The PA and I looked at each other as he took a breath and explained the situation. The person on the

other line stated that they were very busy and in the middle of something. The PA called again a little while later to ask for an update on the status of the doctor. The attending physician answered a second time and was rude again. When I left two hours later, nobody had yet come to see the patient.

This interaction was interesting because it was not a small office setting where everyone knows one another. The pace in the hospital tends to be very busy, and this orthopedic surgeon was obviously frustrated. However, I did not think that it was an appropriate response to be brusque on the phone when another provider was trying to get help for their patient. Everyone has bad days, and I don't expect every day to be perfect. Apologizing when this happens is good, as it shows accountability and repairs relationships as long as lashing out is a rare occurrence. In the future, if someone is being short with me, I would approach and check in with the person. I would hope people would do the same for me. Experiencing a difficult time is universal and checking in with people can show that you are there for them. As future health care workers, we need to remember that we are part of a team and need to support each other as much as we support our patients.

While shadowing, I also experienced multiple effective interactions. An example from one of these experiences was when I shadowed a PA in urology. A patient was concerned about irregularities with urination as well as erectile dysfunction. While I stood in the back of the exam room, I noticed how uncomfortable the patient seemed while talking about these problems. He explained his urinary symptoms while apologizing and generally appearing uncomfortable. He repeatedly looked at me and I remained as neutral as possible while listening. The PA that I was shadowing also remained objective, asking follow-up questions in an effort to better understand the issue, while trying to make the patient as comfortable as possible. These were sensitive issues

he disclosed, and I don't think my presence helped his unease. The PA supported him by maintaining professionalism and kindness.

After finding out more about his concerns, the PA asked about his current medications. He was not satisfied with the results of a particular prescription he was taking to treat erectile dysfunction. He asked about other options which the PA explained to him. After presenting the options and potential side effects, she asked about his pharmacy preference. She explained that the particular drug he was interested in was quite expensive at certain pharmacies, and she looked at four different ones near him to try and find the cheapest option. Upon finding one they both agreed on, she put the order in for him and also suggested some testing that could be done to help diagnose his urinary symptoms.

She then turned to a discussion of behavioral interventions that might improve his concerning symptoms. This is where I found that the interaction was especially successful because part of her suggestion was to lower the amount of caffeine he drank. The patient stated that he did not like water and drank coffee throughout the day. The PA was surprised but took care to avoid saying something that might make the patient feel bad. She explained that caffeine can cause excessive urination, his chief complaint. The PA then asked if decreasing the amount of coffee he drank was a possibility. He initially reacted like she had told him he could never have coffee again, but after further discussion, he agreed that he could drink less coffee if it meant decreasing discomfort and trips to the bathroom. She told him he could come back in a few weeks to see if there was any improvement.

This interaction was really successful because both parties were involved in the decision-making process and were able to come to a reasonable plan of care that the patient felt comfortable implementing. While the patient was initially very uncomfortable, the PA's calm

and professional approach seemed to ease some of that concern by the end of the appointment. I admired that she looked for different pharmacies to find the most financially accessible option for the patient, as well as educating him that coffee is a substance that promotes urination, called a diuretic. Presented with this knowledge, the patient seemed more inclined to comply with the recommendation to drink less coffee. It was nice to see a sensitive topic being handled without making the patient feel more awkward. This interaction showed me how working in healthcare is a privilege as people confide in you, often sensitive topics, that need to be handled with compassion and professionalism.

While most interactions are very positive, many of these conversations are often cut short due to time constraints. Some discussions do not go as in-depth as either party may like, because of this. When people feel rushed, I notice they tend to minimize concerns, when there is usually more to the story. Appointments are often given a short time frame which can negatively impact patient satisfaction.[9] When people wait a long time for an appointment, they may not feel satisfied with their care if seen for only ten minutes.[9] Due to these time constraints, good communication between patients and providers is vital. Without effective communication, patients are more susceptible to adverse outcomes.[10] In order to decrease the prevalence of these outcomes, it is important to prioritize how information is presented and how a patient receives it.[10] I observed an instance of provider-patient communication that adversely impacted the quality of the clinical visit.

A primary care physician (Dr. X) whom I was shadowing would scan through his patient's chart to prepare for each visit. He often had notes written to himself to prompt asking specific questions about their lives. With this particular person, he told me that the patient had chronic anxiety and frustrated him. He explained that in the past, the patient had come to the

office with a problem but was often reluctant to try any of his proposed solutions. From his perspective, the patient was not trying to help themselves and he was doing all he could in terms of suggestions. However, I wondered what the patient felt regarding Dr. X and whether they felt he was meeting them where they were. I was interested to see if Dr. X was addressing hesitancy about a particular suggestion he had. I did not want to assume anything about either party, so I went in with an open mind.

When we entered the room, the patient was friendly but seemed very nervous. Doctor's offices can be intimidating to some patients, so I could relate. Dr. X wanted to hear why she was in the office, and she explained that her anxiety was making it difficult for her to achieve daily tasks and goals. He asked if she was taking her medication, and she explained that she had not been. He appeared frustrated and tried to find out why, yet she didn't have a very clear answer. She had been taking the medication for years and it was working, at least she said it was, and he was confused. Rather than trying to further understand and identify barriers, he simply told her to go back to taking it and asked if there was anything else she needed. This appointment was near the end of the day, and Dr. X seemed tired when we were back in his office. This encounter is difficult to evaluate because everyone has bad days, but I think this interaction could have been handled better. It might have been more productive to try to find out why the patient had stopped her medication, what was going on with her current life, or if she wanted to try an alternative therapy. An article found that shared decision making is an important part of patient centric healthcare.[11] Listening to patient preferences is an important part of formulating a health plan, something I thought was missing in this interaction.[11] I felt that while Dr. X may have been frustrated or fatigued, he needed to try to keep personal emotions out of the exam room. Perhaps the patient did not feel comfortable explaining her situation or may not have access to another

doctor with whom she might feel more at ease. Regardless, the patient likely left the visit feeling as though little was accomplished, underscoring the critical role of effective patient-provider communication in achieving positive health outcomes for patients.

REFLECTION ON THE PSYCHOSOCIAL DETERMINANTS OF HEALTH

There are lots of factors that make up a person's health, for example, their age, race, sex, and genetics.[12] These biological factors, however, do not exclusively determine the health status of an individual. Social determinants are an additional set of variables that influence the status of a person's health. These non-medical factors include the conditions a person faces as they age.[13] A person's choices can affect these qualities, but are often limited by access, such as people experiencing poverty.[13]

I have observed this issue in multiple patients while shadowing. In an office in downtown Cincinnati, the physician associate (PA) I was observing explained that a large portion of her patients are experiencing poverty, housing insecurity, food insecurity, and/or a lack of transportation. Each of these determinants has shown effects on the health of her patient population. This PA explained some of the issues her patients deal with and that often, appointments are missed. Missing an appointment is usually not due to lack of desire. People often make their appointment months in advance with the intention of coming back but a situation arises, forcing them to miss their slot. The social factors they experience play a large role in this. The result is not getting the care they need.[14] Conversely, when shadowing in a different, more suburban area, there was not a single absence.

After observing missed appointments downtown, the PA and I discussed poverty. People may face similar determinants of health but will be affected differently due to unique life

circumstances. She seemed very concerned when discussing this as people have expressed difficulty getting to her office, or trouble affording their medication. This PA also sees a large number of cancer patients, and when the malignancy has been eradicated, close follow-up treatment and surveillance are critical. If someone cannot access the medication they need, this becomes an issue. A study investigating the effects of poverty on health status found a causal relationship between poverty and worsening health outcomes.[14] There are many potential reasons for this as a lack of basic needs can contribute to poor health if people are not able to regularly access nutritional food and water, secure housing and transportation, and medications. Some of these I witnessed when shadowing downtown Cincinnati. It was a different experience than shadowing in a suburban area and I feel fortunate I had this exposure. Being mindful of all of the potential social factors is equally important to focusing on the biological ones. Seeing patients also means being aware of all the other factors that can play in to their health and trying to work with them to come up with a plan that works for them in their unique situation.

It will be especially important to consider that certain demographics are more susceptible than others regarding the influence of adverse social factors. While poverty has been shown to lead to more negative health outcomes, a study shows how there is also a large amount of intersectionality between determinants.[14] Some populations are more susceptible such as women and people of color.[12] Children are another population vulnerable to the social determinants of health.[15] Health status in later life can be affected by a low socioeconomic status (SES) during childhood.[15] Children born into and growing up in poverty are negatively affected in terms of development, education, and other social and biological factors.[15] This is especially prevalent in urban communities where poverty is increased.[13] Children growing up in an urban neighborhood are more likely to come into contact with indoor and outdoor pollutants contributing to an

increased likelihood of developing asthma.[13] This burden is also higher among the populations that live in these neighborhoods, often racial and ethnic minorities.[13]

When working in the future, it will be important to consider the populations in the area I am serving as factors such as race, ethnicity and SES play an important role in the health of communities. Whatever the location, knowing how to connect with and treat people of all demographics is important as a healthcare provider in order to treat people as a whole, rather than merely focusing on a condition.

IMPACT OF THE PROGRAM ON MY VIEW TOWARDS A CAREER IN HEALTHCARE

This program has assisted in my desire to pursue a career as a physician associate (PA) in three ways. First, the shadowing I have been able to complete while part of this program has been an invaluable experience. I have had the opportunity to make connections in a variety of specialties within the PA pathway. I have learned a lot about the career from an overview, down to a personal level when interacting with these professionals. Second, I have received mentoring that has helped astronomically in my preparations for healthcare professional school. From mock interviews to personal statement edits, this program has provided me with individualized help to assist me on my path to PA school. Third, this program has provided a higher level of coursework. This has strengthened my desire to continue learning at the graduate level and has widened my appreciation for a variety of new topics. I am looking forward to working in healthcare and having the privilege to form relationships with patients and help them both physically and mentally using an evidence-based approach.

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