REFLECTION AND SYNTHESIS OF CLINICAL AND ACADEMIC EXPERIENCES IN THE BIOMEDICAL SCIENCE PROGRAM

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INTRODUCTION

The MMSc in Biomedical Science program at Miami University provided an excellent environment for me to reflect on my decision to pursue a new career in medicine. Through my shadowing, I observed a variety of clinicians and the extraordinary work they do. Rounding with internal medicine teaching teams showed me both the excitement and immense stress of inpatient medicine. Whether it's the attending physician under a constant barrage of questions, or the residents working endless hours to meet graduate medical education training requirements, it became clear I am not pivoting into an easy career. Observing in outpatient and primary care settings exposed me to intimate clinical encounters where clinician's interpersonal skills were key in guiding patients through important health decisions. Lastly, spending time with these providers allowed me to learn about their varied career paths and receive advice on specialties I should consider. Alongside the clinical experience, classroom studies have given me a chance to develop a better understanding of what I observed in the clinic. I am grateful for the opportunity to learn more about medicine and be an observer of deep, personal conversations with people of all backgrounds.

In this reflective paper, I will discuss how knowledge from my coursework provided insight into a patient diagnosed with febrile neutropenia. I will describe my review of the literature to explore a clinical question that arose from my coursework. I will also reflect on several clinical scenarios that cultivated my passion for medicine and challenged me to consider how I might strive to maintain professionalism in stressful situations. Finally, I will discuss an enlightening clinical encounter that taught me about a socioeconomic determinant of health. Together, these experiences have shaped my understanding of patient care and increased my excitement for a transition to a career in medicine.

FROM CLASSROOM TO CLINIC

As a quality engineer for a Raman spectroscopic equipment manufacturer with a background in biomedical engineering, my classwork did not often apply to my job. I sometimes wondered, "Did I miss the day in class when they talked about GD&T?". However, I quickly learned that a strong worker is someone who can use their background and resourcefulness to learn new, challenging concepts and apply their newfound knowledge to their work. On the other hand, when concepts you know from class do arise, it is fun and rewarding.

Shadowing with an internal medicine teaching team on a hospital's oncology floor led to several instances that piqued my interest when I heard some familiar biomedical science concepts. For example, in my "Biology of Cancer" coursework we read about the immune system's defenses against cancer. We learned about the cell types that mount attacks against cancerous cells as well as some of the cell signaling pathways that chemotherapeutic drugs target. One patient that the team rounded on was undergoing docetaxel treatment for prostate cancer. Docetaxel targets intracellular microtubules and thus blocks the cell's ability to replicate via the cell cycle.[1] Cell cycle deregulation is a common theme in cancers.[2] As this drug is non-specific for cancer cells, it can also impact normal cells of the body including those making up the immune system. This patient had been admitted to the hospital with a condition called febrile neutropenia (FN), an adverse event of chemotherapeutic treatment of solid tumors where risk is related to intensity of treatment.[3] The attending physician and resident discussed starting the patient on "GCSF," which I noted in my shadowing journal to look up later. What is a "GCSF?" Why would a "GCSF" help FN?

Through my coursework, I gained foundational knowledge about the role of white blood cells (WBCs) in the defense against disease. WBCs come from different lineages that determine if it is a granulated cell (granulocyte) or a non-granulated cell (agranulocyte).[4] Agranulocytes, such as T cells, play a central role in the attack against cancer, while granulocytes provide defense against pathogens. Neutrophils, the most abundant sub-type of granulocytes in the blood, defend against bacteria and fungi and are used as biomarkers for assessing immune system function. A patient is defined as neutropenic when they have an abnormally low neutrophil count (<1500 cells/μL).[5] The immune system can also respond to pathogens by raising internal body temperature, producing a fever. Accordingly, the patient with FN was experiencing a fever because their low neutrophil count left them vulnerable to infection. G-CSF is a glycoprotein that works to increase neutrophil count in the blood by promoting their release from the bone marrow.[6] It also prevents death of neutrophils via apoptosis, another concept discussed in the class as cancer cells are able to avoid apoptosis to become immortal. Thus, it became clear why the physicians wanted to administer a G-CSF: to increase neutrophil count so the patient's immune system could fight off the infection. The inclusion of administration of antibiotics during the discussion of FN treatment prompted me to wonder about the broader range of treatment options available and their effectiveness compared to G-CSF.

Several studies reinforce the decision by the physicians to use G-CSF in patients with febrile neutropenia. A 2021 study compared prophylactic antibiotics and G-CSF for preventing febrile neutropenia in cancer patients being treated with chemotherapy.[7] In this multi-site study, 458 patients with early-stage breast cancer (EBC) that had received docetaxel-cyclophosphamide chemotherapy were split into two approximately even groups—one group receiving prophylactic antibiotics and the other receiving prophylactic G-CSF. This study found that prophylactic G-CSF administration reduced febrile neutropenia (FN) occurrence by a statistically significant level compared to prophylactic antibiotics (5.7% vs. 15.8%, $p < 0.001$). Hospitalization rates for any reason were numerically lower, 12.2% compared with 17.5%, for G-CSFs and antibiotics, respectively, though this difference was not statistically significant. Additionally, a retrospective cohort study evaluated the effectiveness of a combination of G-CSFs and antibiotics to prevent FN.[8] This was a single site study that focused on Japanese men with metastatic castration resistant prostate cancer (mCRPC). Fifty-six patients were evaluated at each cycle of their chemotherapy regimen. For every cycle of chemotherapy, all patients were administered G-CSF. Antibiotics were given in 74% of the chemotherapy cycles. FN occurred 5 times in 4 different individuals across the combined 443 cycles of chemotherapy. In one of these instances the patient had been administered a combination of prophylactic antibiotics and G-CSFs. This indicated that the combination intervention was more successful at reducing FN occurrence than G-CSFs alone. Exploring beyond antibiotics, I encountered a novel therapeutic agent called plinabulin. A 2022 double blind randomized controlled trial compared plinabulin, an agent that supports neutrophil recovery via a distinct mechanism, to G-CSF.[9] Eligible patients were adults who would benefit from docetaxel treatment for their solid tumor cancer, including breast cancer, prostate cancer, or non-small cell lung cancer. In all, 105 adults were administered the same dosage of docetaxel and were administered plinabulin or G-CSF, at a split of 52 patients and 53 patients, respectively. FN occurred in just one cycle, in the G-CSF group, while no FN events occurred in the plinabulin group, indicating that plinabulin is non-inferior to G-CSF after the first week of the first cycle of docetaxel treatment. Other occurrences of clinical consequences, including severe bone pain and changes in docetaxel use, were generally comparable for plinabulin and G-CSF. Researching G-CSFs shed light on why they are widely used as a standard treatment for chemotherapy induced neutropenia. However, research seems to be showing that combination treatments including G-CSFs and antibiotics or pro-hematopoietic agents, like

plinabulin, might better address the medical need of reducing occurrences of FN in cancer patients undergoing chemotherapy. A meta-analysis may be needed to provide a more comprehensive recommendation on these combination therapies, as the several studies I reviewed are limited by their power.

In my "Biology of Cancer" course, I learned how cancer develops and how chemotherapies target the deregulated pathways of cancerous cells but that the mechanisms attacked by chemotherapy can impair critical components of the immune system. Furthermore, we discussed the importance of the adaptive immune response in attacking cancerous cells. Seeing this classroom knowledge reflected in clinical research and ultimately in the clinical setting gave me a much clearer picture of how theoretical immunology translates into real-world decision-making in oncology.

FRAMING A CLINICAL QUESTION AND INTERROGATING THE LITERATURE

The PICO method – standing for patient/problem, intervention/exposure, comparison/control and outcome – is a structured framework for forming thoughtful clinical questions. Physicians are expected to be lifelong learners and to continually investigate the best solutions for their patients. The PICO framework supports this process by helping physicians efficiently search the literature and find the best evidence-based practices. My experience in the Biomedical Science program has encouraged me to ask questions about what I've seen in the clinic and classroom. One topic from my "Biology of Cancer" course that caught my interest was a form of cancer therapy called immune checkpoint inhibitors (ICIs).

Over the past two decades, ICIs have been developed to counteract the ability of many tumors to evade the immune system, a challenge long recognized by oncologists. Cancerous cells evade destruction by natural killer (NK) cells and cytotoxic T lymphocytes (T-cells) by presenting immune checkpoint proteins, such as programmed cell death ligand 1 (PD-L1), on the cell membrane.[10] PD-L1 interacts with the programmed cell death (PD-1) receptor protein expressed by T-cells, shutting down T-cell activity (Figure 1). This feature is used by normal cells in the body to prevent autoimmune destruction. Several anti-PD-1 antibodies have since been developed, including pembrolizumab (Keytruda) and nivolumab (Opdivo). Additionally,

antibodies that bind the cytotoxic T lymphocyte associated antigen 4 (CTLA-4) checkpoint protein have also been approved for use. These antibodies target a separate immune checkpoint, further upstream in the immune response process (Figure 1). The oldest and most commonly prescribed checkpoint inhibitor is the anti-CTLA-4 antibody ipilimumab (Yervoy). As I reviewed the literature and learned more about these exciting new therapies, I became aware of their unique class of toxicities known as immune-related adverse events (irAEs). Additionally, I found that these therapies are approved for use in overlapping cancer types. This led me to develop the clinical question: In patients with advanced (stage 3 or later) melanoma treated with immune checkpoint inhibitors, does anti-PD-1 antibody therapy as compared to anti-CTLA-4 antibody therapy result in fewer or less severe immune-related adverse events? To learn more about my question I used the PubMed Clinical Queries and MEDLINE databases with the keywords, "anti-PD-1," "anti-CTLA-4," "melanoma," "immune-related adverse events," and "safety". Searches on UpToDate provided information on where I could find articles that answer my clinical question as well.

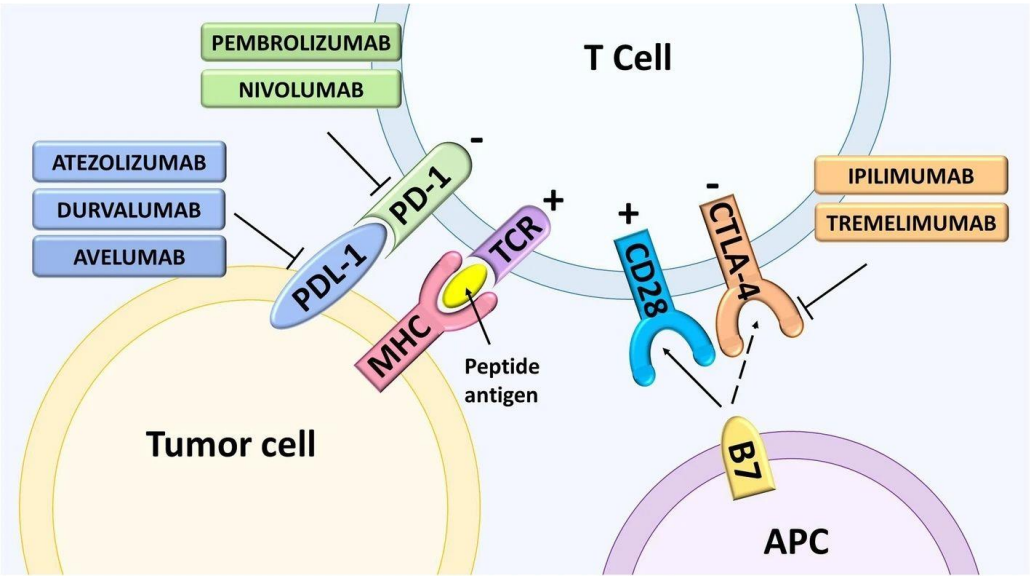


Figure 1: Mechanisms of action of immune checkpoint inhibitors. Adapted from Seebacher et al. Journal of Experimental & Clinical Cancer Research (2019) 38:156[11]

To better understand the comparative safety of immune checkpoint inhibitors, I reviewed a 2018 network meta-analysis titled "Comparative safety of immune checkpoint inhibitors in cancer."[12] This meta-analysis combined data from 32 randomized controlled studies totaling 14,252 patients. The anti-PD1 agents nivolumab and pembrolizumab were reviewed, as well as

the anti-CTLA-4 agents ipilimumab and tremelimumab. Several different cancer types were reviewed, including 10 studies on melanomas. The authors of this study reported that across several cancers nivolumab was safer than ipilimumab and tremelimumab with respect to grade 3 or grade 4 adverse events (see Table 1 for description of grading). Additionally, 86.8% of patients receiving ipilimumab experienced any adverse event (grade 1 through grade 5) as compared to 71.8% and 75.1% of the patients receiving nivolumab and pembrolizumab, respectively. For patients with melanoma, the study indicates that anti-PD-1 antibodies were associated with numerically lower rates of grade 3 or 4 and grade 1-5 adverse events compared to anti-CTLA-4 antibodies, although not to a statistically significant level. The only statistically significant results for patients with melanoma indicated that anti-PD-1 therapy alone was safer than combination regimens of any ICI plus conventional therapy. This study has several limitations including potential unreported irAEs because of their late onset nature, lack of standardization for reporting irAES, and the heterogeneity across the reviewed trials, an inherent weakness of meta-analyses.

Grade	Description
Grade 1	Mild; asymptomatic or mild symptoms; clinical or diagnostic observations only; intervention not indicated.
Grade 2	Moderate; minimal, local or noninvasive intervention indicated; limiting instrumental activities of daily living (ADL), where instrumental ADL refers to preparing meals, shopping for groceries or clothes, using the telephone, managing money, etc.
Grade 3	Severe or medically significant but not immediately life-threatening; hospitalization or prolongation of hospitalization indicated; disabling; limiting self-care ADL, where self-care ADL refers to bathing, dressing and undressing, feeding self, using the toilet, taking medications, and not bedridden.
Grade 4	Life-threatening consequences; urgent intervention indicated.
Grade 5	Death related to AE.

Table 1: Description of grading of adverse events adapted from Common Terminology Criteria for Adverse Events (CTCAE) version 4.03[13]

This meta-analysis revealed the higher safety profile of anti-PD-1 antibody therapy as compared to conventional therapy for patients with melanoma. However, it was unable to show a statistically significant difference in a head-to-head comparison of the ICIs for the patient

population I was interested in. Nonetheless, understanding the results of this study would be a great help in discussions with a patient who is trying to decide what type of treatment regimen they should pursue for their melanoma.

REFLECTION ON EFFECTIVE COMMUNICATION IN HEALTHCARE

Good communication is key in any industry for building relationships with colleagues, problem solving, and ensuring successful project completion. In medicine, good communication paired with interpersonal skills is paramount. When clinicians communicate effectively, patient outcomes such as treatment adherence improve.[14] Empathy and humility are characteristics of clinicians that are known to improve quality of communication with patients.[15][16] Conversely, ineffective communication between a provider and patient can result in noncompliance with a patient's preferences, or lack of self-motivation in the patient to persistently manage their health.[17][18] Further, when communication between providers breaks down or is mired by unprofessionalism, patient safety is put at risk.[19]

Shadowing provided me with the opportunity to observe numerous interactions between healthcare providers and their patients, as well as interactions among healthcare providers themselves. Initially, I took for granted how often I saw positive, effective encounters. However, once I became attentive to the foundations and techniques behind effective interactions, I was able to distinguish excellent clinical encounters, as well as identify those that fell short of benefiting the patient. The positive interactions provided examples for me to strive to achieve as a future physician, while the negative interactions gave me a chance to reflect on how I might handle the situations differently when they inevitably arise.

EFFECTIVE COMMUNICATION

An interaction I observed with an otolaryngologist stood out as having many elements of a good encounter. It was the first patient of my shadowing session that day, just after lunch break, so the provider and I had an extra few minutes to discuss the upcoming patient. The patient's chief complaint was dizziness. They had been experiencing this dizziness for months and had previously been to the clinic to address it. We looked at the patient's magnetic resonance imaging (MRI) results. There was only one finding to note: a cyst in the frontal sinus cavity. However, there were no findings that might be the cause of the dizziness. Thus, it seemed to me that

discerning the underlying etiology of the patient's symptoms would be difficult. I was not sure what to expect from the visit. What followed was a great example of effective clinician-patient communication.

The provider began by asking an open-ended question about the patient's dizziness, allowing the conversation to flow wherever it needed. The patient revealed some frustration with a previously prescribed medication that was "not working". He went on to further explain that he was suspicious that one of his many medications might be the source of his dizziness. The provider attempted to elicit some more information about the patient's expectations for normalcy and how his dizziness was impacting his life. The patient gave a very defeated-sounding answer, saying that he "doesn't even know what is normal anymore." The conversation then took an unexpected, but important, turn when the provider asked, "How are you doing with your mental health?"

The patient discussed his grief and his recent negative social interactions. The patient had lost his wife within the last couple of years and had been encouraged by his friends to try to start dating. However, he had been unable to connect with anyone and admitted to being rude to others due to a perceived lack of emotional understanding. The provider handled the long discussion skillfully. She encouraged the conversation, accepted the patient's complaints, and affirmed the patient's connections between his social issues and illness. These strategies mirror core motivational interviewing techniques such as affirming, active listening, and helping patients explore discrepancies between their health status and goals.[20] The provider ultimately suggested a cognitive-behavioral therapy (CBT) workbook to help with the grief. The patient shifted in the chair and expressed his concerns with therapy, describing how previous talk therapy did not provide much benefit for him. The provider went on to explain why a workbook is used for CBT and how it differs from talk therapy. The patient was much more accepting of this idea but still had a sense of uncertainty. The provider reassured the patient the workbook would be prescribed but with no obligation to complete it. By the end of the visit, the resolution was to discontinue the medicine which the patient was dissatisfied with and thus was an unnecessary burden. The patient agreed to try the CBT to aid with his grief and to see a specialist for the cyst found in his sinus.

I found this to be a successful visit because the provider took a broad approach at the start of the conversation to understand the barriers preventing resolution of this patient's complaints. When the patient began expressing dissatisfaction in his life, the provider shifted focus to his emotional well-being. Thus, the conversation revealed the poor status of this patient's mental health and the additional burden the patient was feeling by having to take several medications. This prompted a change of treatment plan to align better with the patient's preferences. The provider set a strong example of the importance of open-mindedness and humility in a clinical encounter.

INEFFECTIVE COMMUNICATION – PROVIDER AND PATIENT

Few of the clinician-patient interactions I witnessed during shadowing stood out as particularly poor. At worst, some interactions felt awkward or strained. One such moment occurred during a shadowing experience in a cardiac intensive care unit. That day, I accompanied a large teaching team composed of several residents, a physician assistant (PA) student, a pharmacist, pharmacy student, and a medical student. Many of the patient interactions during that session felt somewhat uncomfortable, which may have been partly due to the large team size. Compared to smaller or more cohesive teams I shadowed—such as internal medicine or pediatric intensive care unit—this group felt more rigid and less engaged. From a patient's perspective, I imagine the experience could have felt overwhelming or impersonal.

One patient seemed to be particularly affected by the ensemble. He was back in the hospital after having a coronary artery bypass graft and at risk of further blockage. The attending physician did well to describe the situation at hand; however, the interaction took a negative turn after the physician listed numerous lifestyle changes the patient would need to make. The patient did not know how to respond. I imagine the many eyes peering at him were overwhelming. The patient feebly offered up that he might stop smoking. The provider immediately steered the conversation to how he could help the patient stop smoking, but even then, it was not convincing that this patient was going to stop. Additionally, the tone of the conversation was gruff. The attending physician came across as dominating the conversation. By the end of the visit, it seemed little progress was made towards guiding the patient to a successful recovery. The interaction resembled a parent scolding a child rather than a collaborative conversation.

The provider had an opportunity to apply motivational interviewing with this patient interaction. Instead of a paternalistic tone, the provider could have asked open-ended questions to understand the barriers preventing the patient from changing his smoking habits. Then the provider could have worked to strengthen the patient's internal motivation to quit smoking, a typical outcome of the motivational interviewing technique.[20] However, the provider tried to "shock" the patient into change. This commonly used strategy in describing risk associated with cardiovascular disease is under scrutiny for whether it produces sustainable behavior change.[18] Lastly, with a large team, it is more difficult to identify team members and describe the necessity of the team, which might be important to the patient's preferences.[21] As discussed in the classroom, the patient and provider relationship is sacred. Thus, putting the patient in an uncomfortable situation likely led to him saying things he felt he "should" say, but without genuine intent. The principal provider from the team might have had better success returning for a one-on-one conversation rooted in shared decision-making.

Although not an overtly bad interaction—there was no disruptive behavior or conduct clearly detrimental to the patient—this instance showcased the subtlety of a poor clinical encounter. The provider was unable to effectively communicate with this patient because of the setting and the communication strategies used. The physician's inability to connect with the patient led to the patient's uneasiness, making this interaction feel awkward. With greater humility and use of evidence-based communication techniques, the provider may have been able to persuade the patient to be more conscientious about their health management.

INEFFECTIVE COMMUNICATION – PROVIDER TO PROVIDER

I first witnessed ineffective provider to provider communication during my observation of a physician assistant (PA) in the emergency department (ED). The ED's attending physician instructed the PA to seek a consultation with the infectious disease (ID) team for a seemingly straightforward hand injury. Although the PA maintained professionalism during interactions with both the attending physician and the ID team, they privately expressed frustration to me about the attending's decision. The PA felt confident that the consultation was unnecessary, as they anticipated the ID team would confirm their initial assessment, thus delaying patient discharge. There was some additional eye-rolling and grumbling to me after the consultation when the plan from ID was the exact same plan that the PA had presented to the attending. While

the expression of frustration itself is normal, it was noteworthy to me because of the potential for the frustration to seep into professional interactions. On the day of my shadowing, the ED was not terribly busy; however, on a very busy day with increased stress, or on a day with stress carried in from outside of work, I could see the frustration spilling over into the conversations with the attending and ID team. Thus, I felt it presented a risk of becoming unprofessional if voiced more openly in front of patients or colleagues. Furthermore, modeling this "insidious" passive-aggressive behavior to younger professionals in the field, or hopefuls such as myself, can lead to adoption of these actions, which perpetuates the cycle of "insidious" behavior, continuing to put the safety of patients at risk.[22] If I were able to address this with the PA, I would gently suggest approaching the attending with evidence-based references to reinforce their treatment plan. In such a case, the attending's increased confidence in the proposed care strategy may avert the need for an ID consultation.

The second instance occurred while shadowing an internal medicine teaching team. The team was managing a patient presenting with a serious condition—an esophageal fistula. The internal medicine team had requested consultations from the gastrointestinal team and another surgical specialty, yet by midday, no concrete recommendations had been provided. Here, I detected some subtle unprofessionalism from multiple perspectives. The surgical teams appeared unresponsive, possibly perceiving the internal medicine team's request as unclear or inadequately structured. Conversely, the internal medicine team perceived the lack of timely engagement by surgical consultants as a cause for frustration. This situation parallels a scenario described in "Communication Between Clinicians"[23] and highlights a breakdown in effective inter-team communication and coordination, ultimately impairing timely patient care.[24]

To improve this scenario, using a tool such as SBAR (situation-background-assessment-recommendation)[25] might have allowed the internal medicine team to clearly define their concerns, the patient's clinical context, and explicitly request actionable recommendations, thus improving the response time from the surgical teams. According to "Raising the SBAR", concise communication protocols enhance patient safety and interprofessional interactions significantly by clearly delineating expectations and clinical urgency.[26]

The third scenario involved interactions between an attending physician and a cardiology fellow. During patient presentations, the attending interrupted the fellow a few times, insisting on

precise and specific descriptions due to the severity of the patients' conditions. Though well-intentioned—emphasizing clarity and precision—the attending's manner of interrupting frustrated the fellow, culminating in an abrupt response: "I know!" from the fellow. Here, the fellow allowed the rush of emotion to slip out, as I feared might have happened with the PA in the ED. When delivered inappropriately, interactions, even those stemming from good intentions, risk compromising the educational environment. The unprofessional behavior introduced unnecessary stress and tension into the clinical setting. The fellow's reaction, while understandable, also risked escalating the conflict and negatively impacting professional dynamics.

Subtle unprofessionalism can escalate quickly, negatively impacting not only professional relationships but patient care as well. If confronted with a similar scenario, and if my role permitted, I would consider privately addressing the attending physician afterward. I would respectfully acknowledge their intent to uphold standards while gently suggesting less confrontational methods of providing feedback. Additionally, I would support the fellow by validating their feelings, encouraging resilience, and discussing strategies to respond professionally in stressful situations. Healthcare professionals have a moral obligation to intervene or mediate in such uncomfortable scenarios proactively.[27]

Each observed situation shares a common theme: power dynamics and communication challenges leading to subtle yet impactful unprofessionalism. Certain relationships, such as attending-to-fellow or attending-to-PA, can inadvertently foster environments prone to unprofessional exchanges unless explicitly addressed.[26][27] Approaches such as structured communication tools (SBAR) can help mitigate these issues. As an observer, I may not have much standing to intervene in these more subtle scenarios of unprofessionalism, however my shadowing experiences, and learning in the classroom, have highlighted the moral obligation to stand up to unprofessionalism when I do have the authority.

While the instances of unprofessional behavior observed were not extreme, they highlight the need for continuous improvement and display the subtlety and fine line that physicians must walk to prevent excessive emotion spilling into their work. Recognizing potential tensions early and addressing them respectfully can prevent unprofessional behaviors from escalating, thereby safeguarding both patient care and professional relationships. My experiences highlight the

importance of clear communication, situational awareness, and professional emotional regulation.

SOCIAL DETERMINANTS OF HEALTH

Through my shadowing experiences, I gained valuable perspective on the breadth of patient backgrounds. I learned how an individual's unique circumstances play a role in their health. Accordingly, I saw how factors such as housing stability and socioeconomic status influence each patient's health. These are among the many elements that make up an individual's social determinants of health. As a young man who grew up in a stable household with strong family support, I was particularly struck by patient interactions where housing instability and socioeconomic hardship severely impacted health outcomes. These interactions pushed me to review the literature to understand what I was observing in the clinic. I became more aware of how many individuals are negatively affected by housing instability, and the compassionate work that physicians do to ensure the health of their patients.

One notable patient interaction clearly demonstrated how social determinants can significantly impact an individual's health management and outcomes. The patient presented to the clinic to establish care with a primary care physician. Before meeting with the patient, the resident physician I was shadowing reviewed the patient's recent visit to the ED which revealed uncontrolled diabetes. The patient's blood glucose level had exceeded 600 mg/dL during their ED visit. I knew from my endocrinology class that this was almost six times higher than the typical blood glucose level. The resident physician taught me that the patient's glycosylated hemoglobin (HbA1C), measuring 11.3 mmol/mol, indicated the patient's blood sugar levels were chronically averaging around 250 mg/dL.

The resident physician skillfully inquired about the patient's life to reveal what contributed to the patient's uncontrolled diabetes. We initially learned of behavioral factors that contributed to the patient's poor glycemic control, including regular drinking habits. As the conversation carried on, the resident physician uncovered significant underlying social factors affecting this patient's health. The patient's educational attainment halted at high school, and they acknowledged their low health literacy as related to diabetes. The patient had experienced job instability in recent years as they had moved between several states and shifted from construction to security work. Additionally, the patient had an uncertain health insurance

situation. Although the patient was employed by a large corporation, Kroger, they mentioned they had recently lost Medicaid coverage, and that they used cash to pay for the visit's co-payment. Making matters worse, the patient had unreliable transportation due to a recent car crash. However, the most significant factor affecting the patient's care was their struggle with housing insecurity.

As recently as a month prior to the visit, the patient had been living in a homeless shelter. During this unstable time, the patient had been prescribed dulaglutide (Trulicity), but had not been taking it, explicitly stating they were not adhering to the medication because of their stay in a homeless shelter. This culminated in the ED visit due to symptoms from their uncontrolled blood sugar levels. Thankfully, the patient had a supportive family network who assisted them in finding housing. With this change in housing situation, the patient expressed optimism about getting their health back under control.

Recognizing the intertwined social factors, the healthcare team did a great job of stepping into action with this patient. They promptly started several medications to manage the patient's diabetes. They arranged an information session with the clinical pharmacist during the visit. This ensured the patient would not have to return to the clinic, preventing absences from work and accommodating the patient's unreliable transportation situation. The pharmacist explained the new medications, proper dosing, timing, and administration, addressing the gaps in the patient's health literacy.

Research consistently shows housing insecurity exacerbates negative diabetes-related health outcomes. A 2023 study evaluated over one million patients from Toronto diagnosed with diabetes who accessed hospital services.[28] There were approximately 7,000 patients with a documented history of housing insecurity. The study found an almost three-fold increase in hospitalizations for hyperglycemia for individuals with a history of homelessness. Other complications such as myocardial infarction, stroke, heart failure, and peripheral artery disease were also experienced at higher rates by patients with a history of housing insecurity. A separate cohort study of American military veterans conducted in 2016 found a similar association between homelessness and diabetes.[29] This study looked at approximately one million veterans, with about 8,000 veterans having evidence of homelessness. About one third of veterans with evidence of homelessness had an annual mean HbA1c greater or equal to 8 mmol/mol, the

researchers' cutoff value for poor glycemic control. There was also an association with race, as non-Hispanic black veterans made up 39.1% of the homeless cohort as opposed to about 10% of the non-homeless cohort. Lastly, a 2020 study provided valuable insights into how housing instability specifically impacts clinical management of diabetes.[30] Eighteen primary care providers practicing in Connecticut described the challenges in adapting treatment regimens. Providers needed to be creative to ensure a patient was adhering to their treatment, and many even worked to improve their patients' housing situation. They would involve social workers, connect patients with various resources, or even directly advocate with housing authorities and utility companies.

This patient interaction demonstrated how housing instability can severely affect a patient's health and how a provider must manage a chronic disease. The patient's difficulty adhering to critical diabetes medication while experiencing housing insecurity underscores the direct impact housing stability has on maintaining health. The patient is one example of thousands of patients across North America whose housing insecurity contributes to poor glycemic control. Reflecting on this interaction and examining literature has deepened my understanding of the complexity of patient care.

CONCLUSION

I knew that I did not want to apply to medical school directly from my job as a quality engineer. In the quality department, the goal is to make informed decisions with the best information—even when it is not readily available. It is up to the engineer to explore potential solutions, gather data, document, and present a clear path of action. No supplier will accept a material return request if the only argument is "the parts don't work." Similarly, I knew that I couldn't make a life-altering career change simply "because I want to." I needed to learn a lot more about being a physician before making the major decision to change careers into medicine. This program has been a great opportunity to gain understanding of clinical decision making and explore the complexities of patient care—proving to myself why it is a path worth pursuing.

Nearly everything I've seen has made me excited for a future in medicine. I am driven by the chance to grow into an amazing, compassionate clinician like those I have shadowed. I enjoy building one-on-one relationships with people and understanding them deeply. I am looking

forward to becoming a subject matter expert in a topic that I am deeply fascinated by: the human body. Although many days of hard work lie ahead, I am eager to meet these future challenges because I believe in where it's leading me.

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