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International Journal of Medical Students
The International Journal of Medical Students (IJMS) is a peer-reviewed open-access journal (ISSN 2076-6327) created to share the scientific production and experiences of medical students and recently graduated physicians worldwide.

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EDITORIAL STAFF

IJMS International Journal of Medical Students

The *International Journal of Medical Students* (IJMS) is an open-access, peer-reviewed scientific journal (ISSN 2076-6327) that publishes original research in all fields of medicine. The Journal was created in 2009 to share the scientific production and experiences of medical students (*i.e.*, MBBS students, MD students, DO students, MD/MSc students, MD/PhD students, etc.) and recently graduated physicians (<3 years into practice) from all over the world. Our objective is to be the primary diffusion platform for early-career scientists, using standards that follow the process of scientific publication.

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IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Editorial

Artificial Intelligence in Medicine and Medical Education: Current Applications, Challenges, and Future Directions

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The father of modern computers Alan Turing provided us with a basis to understand intelligent machines through his infamous "Turing test" where machines were tested to determine their capability to think as human beings.[1] The term artificial intelligence (AI) was coined years later in 1956 by John McCarthy.[2] Until recently, most machines would fail the test but current advances and leaps in technology have made ChatGPT Version 4 and Eugene Goostman, a program devised by Google to pass the Turing test.[3,4] AI in medicine can be used via two interfaces- virtually through big data applications or physically through robots, artificial neural networks, and prostheses. AI working using big data applications are known as large language model (LLM). LLM are trained using large amounts of data collected so that they can generate responses to queries given by the user. On the other hand convolutional neural networks (CNN) (a type of neural network based on AI) are used to perform decision-making tasks with minimal human input through heuristics.[5] This editorial aims to discuss potential applications, current use, existing legal regulatory framework, challenges, future directives and calls to stakeholders on AI in medicine and medical education.

AI: Potential and Current Use

AI is at the precipice of completely revolutionizing healthcare as we know it. AI can improve medical education by personalizing education to individual student, increase diagnostic precision, aid healthcare professionals in decision-making, and reduce human error. Students at Duke and Stanford University are currently supporting studies on building enhanced technologies using AI to integrate into existing curricula and healthcare practices. [6] The Human Diagnosis Project aims to improve diagnosis and provide it at accessible rates by assimilating machine learning to physician diagnosis.[6] Homer Stryker School of Medicine and "Resource Medical" have collaborated to provide simulation center using AI for medical students to train.[6] Educators can be assisted by AI to better understand their student weaknesses and develop tailor-made courses, which the students can access and when the students make an error the AI can detect the student's weak point and assist students in overcoming the same. The Radiology department at the University of Florida is using AI to enhance mammography detection rates. Certain medical universities have introduced courses for their students to learn about upcoming technological healthcare innovations. To reduce human error during prescription AIs are being incorporated such as MedAware, MedEye, and MedPass.[6]

The use of AI in the field of research has exploded. AI and especially generative AI has been a useful aid in scholarly writing by improving vocabulary and grammar. Antiplagiarism programs are using AI for plagiarism checks and AI can assist in database searches and literature reviews. PubMed, a free database containing millions of articles, has updated its search algorithm using Best Match (BM25) and LambdaMART (L2R) AI algorithms. The Best Match will process the search results and L2R will then rerank the first 500 results. The function of query suggestion, query expansion, author name disambiguation, and automatic article indexing are also done by AI.[7] Despite these benefits, numerous obstacles must be overcome before AI becomes a staple in the medical field.

Obstacles in AI adoption

The four pillars of bioethics serve as a foundational framework for ethical decision-making in healthcare and are followed by all healthcare personnel.[8] The pillars are autonomy, beneficence, non-maleficence, and justice. Hence it is sought to reason that the ever-evolving, dynamic sphere of AI should also be bound to the same pillar. The examination of AI should first ask the question: is AI a moral agent, and if not, should AI be built to be such an agent?[9]

Manipulation and Bias

The base of a future clinician starts from the education they receive as an undergraduate. With the proliferation of AI and use of LLM, there can be a worry that misuse by companies can cause manipulation and impose hidden influences on their user. Through algorithmic manipulation, AI can target and exploit the decision-making capacities of its users. The Cambridge Analytica

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scandal[10] was able to instill hate among communities through targeted political advertisements and with medicine so closely intertwined with politics - it seeks to reason that psychological manipulation can be done to bypass users' autonomous will. More worryingly is the concept of "garbage in, garbage out" where AI is taught using pre-existing datasets that have an underrepresentation of minorities or contain racist, and sexist stereotypes and the usage of the AI to solve queries can lead to the reinforcement of these stereotypes.[11] CNNs were found to be less effective in diagnosing skin lesions in black patients than their white counterparts.[12] This is especially worrying as blacks have a higher mortality rate for melanoma and early diagnosis is key to improving survival outcomes. In equally sick black and white patients AI misdiagnosed the black patients as healthy and gave higher priority to whites.[12] Prediction models for heart attacks misdiagnosed women patients and on further investigation, it was found that the model was trained exclusively on male datasets.[12] In clinical trials and animal studies, male sex have been preferred historically, and datasets generated from such studies when incorporated in AI can exacerbate the gender bias in healthcare.

Autonomy and Informed Consent

With the integration of AI into healthcare, it is not in the near distant future that AI-driven treatment plans will be made by physicians. Doctors have an ethical responsibility to inform and patients have the right to be aware of the impact the AI system is having on their successful or unsuccessful treatment. Currently, most AI systems are made using black-box algorithms and there is a lack of transparency on how the AI came to the treatment plan. The question arises if a treatment has failed, who should be held responsible - the AI or the healthcare professional?[13] There are currently no clear legal regulations and due to this, it hinders a patient's autonomy as they will not have the full information to make an informed choice.

Data Privacy

Most AI organizations are private organizations, and the integration of AI in medicine needs a significant amount of data to train algorithms to accurately diagnose and formulate a treatment plan. The access to such data is where the issue of privacy comes into play as there are no universal protocols for data encryption and sharing for AI projects. Furthermore, even if data was delinked, de-identification of photos and radiographic images is impossible especially if the photos or radiographic images contain unique or identifiable features. Search histories and data from smart appliances are not covered under the Health Insurance Portability and Accountability Act (HIPAA) and can be used to triangulate an individual. The access and security of AI generated treatment plans remains unanswered.[14] This stored data containing millions of patients' healthcare information can be sold on the dark web if adequate cybersecurity measures are not taken.

Legal Concerns

The legality of AI in medicine is murky with policymakers having been unable to formulate definitive laws and the existing laws (*Table 1*) are rudimentary at best.[15]

Other Concerns

Future clinicians will be dependent on AI for the majority of their decisions and will be intellectually lazy with reduced critical thinking capacity than their current counterparts.[16] AI applications despite having improved medication management have been noted to overprescribe medications.[17] All of these can lead to a loss of doctor-patient trust.[18] AI-powered devices will exacerbate existing disparities in medical outcomes among countries as usage of an AI-powered device requires stable electricity and a stable WiFi connection with affordable data plans all of which many Low-income countries (LIC) and Low middle-income countries (LMIC) do not have. For female students, certain AI applications have been used to morph their pictures and videos. These morphed pictures and videos can be done through a multitude of ways-superimpose one face onto another, manipulate lip and face movement to sync to a different audio track and generate synthetic body movements. They are then circulated using social media.[19] Their exchange leads to psychological distress, and damage to professional and personal relationships.

Integration of AI in Medical Curricula

In Medical Education

Previous studies have noted medical students are eager for AI and believe AI will have a positive impact on medicine but they have perceived a need to transform medical curriculum to incorporate AI.[20,21] The existing educational gaps noted by the students were a lack of knowledge and trust in AI applications, inadequate training to solve AI ethical issues, and inability to inform their patients about the features and risks of AI.[20] Quinn T et al.,[22] suggest an outline for embedded 4 steps AI ethics education framework. The first step includes the formulation of new AI lessons on ethics; the second step will be the crucial step where alignment of the newly formulated AI lessons into the existing curricula will be done; the third step is the education of the teachers in prerequisite technical AI knowledge and the final step will be the dissemination of the knowledge to medical students using interactive visual aids or case-based discussion.

The feasibility of such a framework is questioned as the major barriers remain on what and how AI ethics material should be incorporated into a medical student's already intensive and packed curriculum. The second barrier is that medical colleges do not have data scientists or engineers as faculties and hence pre-existing faculty who may be ill-equipped will have to be the primary instructors. Li et. al[23] found that performance expectancy, hedonic motivation, and trust affected the use of AI by medical students. Based on this they recommended enhanced awareness towards AI and enrichment of the pre-existing curriculum. For improving performance expectancy, medical educators should teach medical students the perfect way of incorporating AI to improve their scholastic performance, for hedonic motivation medical educators should use visual aids to deliver instruction on the usage of AI, and for trust students need to recognize that their educators are well versed in AI rather than faculty who have been burdened to teach about AI to their students.

Table 1. **Legal Regulation in the United States and Europe for Artificial Intelligence (AI).**[15-19]

Regulation	Description
Regulations in United States	
Medical Devices	It is regulated by the FDA under the US Federal Food, Drug, and Cosmetic Act (FDCA). Instruments, apparatus, implants, and other articles intended for diagnosis, treatment, or affecting bodily functions are defined as medical devices
21st Century Cures Act	Certain medical and decision support software functions are exempted from FDA regulation, if they are related to administrative support, lifestyle maintenance, patient records, and clinical data handling.
Draft Guidance on Clinical Decision Support Software	FDA has outlined criteria for exemption and emphasized the importance of transparency and user understanding in software recommendations.
Software Pre-Cert Pilot Program	FDA has launched a pilot program to pre-certify digital health developers based on criteria such as patient safety and product quality, allowing streamlined or exempted review processes for low-risk software devices.
Proposed Regulatory Framework for AI/ML-based Software	FDA has proposed a regulatory framework for AI software working as medical devices. The proposed framework should prioritize optimizing performance and effectiveness while reducing risks.
2023 AI Legislations	25 states introduced legislation on AI and 18 states adopted the legislation. From Feb 1, 2024, Connecticut required the State Department of Administrative Services to assess AI systems used by state agencies to rule out unlawful discrimination by AI. Louisiana requested the Joint Committee on Technology and Cybersecurity to assess the impact of AI on policies and operations. Maryland introduced a grant program assisting small and medium-sized manufacturing industries in implementing industrial AI. North Dakota redefined a person where inanimate objects such as AI and animals were excluded from the definition. Councils were created by North Dakota, Puerto Rico, and West Virginia to monitor AI used by state agencies. Law and policymakers also debated on measures to assess the impact of AI, specific privacy, and ethical issues related to facial recognition software and autonomous cars.
White House Executive Order on AI	Key highlights of the executive order include the sharing of safety results by AI developers, establishing guidelines for safety privacy, and algorithmic fairness, and protection against AI-enabled fraud.
2024 Guidelines	By Dec 1, 2024, all agencies will have to implement AI safeguards or cease using the technology.
Regulations in Europe	
Classification Process under Medical Device Regulation (MDR)	The MDR introduces changes in the classification process of medical devices with software used for prediction or prognosis being classified as a medical device.
Classification of Software under MDR	AI software targeted towards diagnosis or treatment will be classified as class IIa, IIb, or III depending on the potential impact on health. Others are classified as class I.
Conformity Assessment under MDR	All medical devices undergo a conformity assessment before being released to the market. The assessment procedure varies based on device classification and type.
EU AI Act	It is the world's first law governing AI. The Act enshrines the definition of AI. The Act prohibits the usage of AI for unlawful practices and classifies AI systems into risk categories. National and EU officers are to be appointed for enforcement of the above act. Non-compliance to the act can lead to fines.

In Ethical Education

There is a strong demand for a curriculum on ethics and law, but the current ethical education is quite limited, with students having a self-perceived lack of knowledge.[24,25] To fill this gap, student-led organizations (Asian Medical Students Association of India, Rotaract Club of Medicrew, Rotaract Club of Caduceus, Medical Students Association of India) have founded their bioethics units. These student-led units conceptualize, design, and implement projects to educate their members on ethics. These organizations have been instrumental in fostering in medical students a hunger for knowledge, but they suffer from a lack of measurable outcomes and generalizability. The International Chair in Bioethics conducts a paid 26-week International Certificate Course in Bioethics and is the major spearhead in access to and spread of bioethics education for all healthcare professionals.[26] The courses conducted here are done by interdisciplinary experts. Regrettably, the discourse and dissemination of AI ethics to medical students remain limited within their purview.

In Research

Research is another area where medical students use AI. Currently, there is a wide discourse among journals on whether generative AI should be included as an author[27] or not with major journals being against the same. Generative AI also gives out fake citations to articles that do not exist, which is referred to as 'artificial hallucinations'.[28] Hence, anti-LLM programs such as GPTZero[29] and ZeroGPT were devised to weed out generative AI content in manuscripts with varying success.[30] These future medical students who would become authors and journal editors should be educated about the judicious use of AI.

Future Directives

AI has ushered in a revolutionary age of unprecedented opportunities in the field of medical diagnosis, treatment, and patient care but the deficits in AI training have the potential to create classes of future physicians ill-equipped to navigate the intricacies of a joint human-machine healthcare system. The urgency to attend to this gap cannot be overstated and policymakers, medical educators, and stakeholders must take decisive actions to strengthen and prioritize AI education. The current crisis in AI stems from an absence of policies for the development and deployment of AI which can be mitigated by the establishment of robust ethical frameworks. Medical institutions should overhaul their curricula and integrate AI ethics through dedicated coursework and interdisciplinary collaboration. Furthermore, we request professional development and training opportunities to be provided to early as well as practicing career physicians. A proactive approach is the need of the hour.

Role of the International Journal of Medical Students

As a journal for student and early career physicians, IJMS will serve as a global, non-judgemental platform for sharing perspectives, experience, and empirical research on AI. Authors submitting their manuscripts to IJMS are advised not to utilize AI-generated content as the Journal will be scanning and rejecting articles found to have AI-generated content. The IJMS is committed to serving as an international forum for advancing knowledge and preparedness toward AI. In conclusion, the current medical curricula lacks a dedicated focus on AI, and integration of AI education is imperative and should be done through a proactive, collaborative approach from stakeholders.

From this Issue at IJMS

The current issue of the IJMS brings forth seven original research articles, one narrative and one systematic review, two case reports and five experience articles, summing up a total of sixteen publications written by medical students and early career scientists.

Mohamed et al., assessed the occurrence of generalized anxiety disorder (GAD) and its potential risk factors in nearly 400 students enrolled in a medical school from Sudan. Their data demonstrated that over 30% of the subjects suffered from GAD, with severe anxiety detected in 12.3% of the study population, which significantly impacted their daily activities. Moreover, they revealed that GAD was more likely to occur in females, med students suffering from chronic illnesses and final-year medical students.[31] Similarly, Gul et al., investigated the occurrence of depression in med students from Pakistan, pointing out based on information collected from over 300 individuals that nearly 20% of med students suffer from depression, and over a quarter of them are borderline cases. However, their assessment failed to identify risk factors for depression in the examined cohort, stressing the need for future research in the field of mental health amongst the future healthcare workforce.[32] Moreover, Ozdemir et al., evaluated the interplay between sleep alterations and stress in med students from Turkey, pointing out that healthcare undergraduates display poor sleep quality and life satisfaction, variables which seemed to be influenced by anthropometric indices, lifestyle, nutritional habits, and hormonal changes.[33] Furthermore, Brown et al., investigated the presence of gut-brain interaction disorders (DGBI) in med students from the United Kingdom, highlighting that over three-quarters of the examined population experienced DGBI. The most affected individuals seemed to be those experiencing anxiety, depression, somatic symptoms, or those who displayed poor nutritional habits, decreased physical or mental quality of life, or who frequently used medications for various reasons. Worryingly, a small proportion of the examined individuals sought help for DGBI management.[34]

On another note, Ganguli et al., evaluated the content of residency programs and other websites used by residency applicants during the match process, revealing that data regarding the wellness of healthcare workers is often lacking despite it being extremely relevant in the process of choosing a future specialty.[35] In addition, Evensen-Martinez et al., examined the impact of Spanish education on the outcome of a one-week medical trip to a Spanish-speaking, stressing that no previous knowledge of Spanish should not be vicissitude in med students' choice to engage in an international medical trip to a Spanish-speaking region.[36]

LeBron et al., investigated the appropriateness of empiric antibiotic management of uncomplicated cystitis in the emergency department, revealing no difference in prescription between week-days and weekend days, and that almost a third of antibiotic prescriptions were inappropriate for the disease.[37]

In a narrative review, Dailey examined the impact of psychosocial factors on birth outcomes of females with substance use disorder, highlighting the relevance of socioeconomic status, maternal stress, as well as mental health.[38] Rafiq et al., conducted a systematic review to analyze the influence of sociocultural variables on the study habits of medical students, revealing a potential impact of personal factors, behavior, and the environment on medical education.[39]

Several interesting case reports have been accepted for publication in the current issue. Saldaña-Ruiz et al., present the case of a female adolescent who required liver transplantation for fulminant hepatic failure, being eventually diagnosed with Hogdkin's lymphoma with liver involvement.[40] González-Zuelgaray et al., present a case of acute renal failure-induced hyperkalemia and share valuable tips on the ECG changes that occur in this type of dyselectrolytemia.[41]

Medical students also have amazing experiences to share with the international community. One can follow discussions on public health issues encountered in Cambodia and the US, as well as work in a leprosy healthcare facility from Nigeria.[42-45] Finally, you can explore Dr. Michael McGee's invaluable insights on medical socialization, drawing on his expertise in psychiatry.[46] Read all about it in this issue's virtual pages!

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Original Article

Prevalence of Generalized Anxiety Disorder and Associated Risk Factors Among Medical Students in Sudan: A Cross-Sectional Study at Omdurman Islamic University

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Abstract

Background: Generalized Anxiety Disorder (GAD) is a mental illness that significantly affects various domains of daily functioning. Limited research has been conducted on GAD among medical students in Sudan, particularly during the socio-political and economic crises. This study aimed to assess the prevalence of GAD, identify risk factors, and evaluate its impact on academic performance and daily activities among Sudanese medical students. **Methods:** A cross-sectional study was conducted among undergraduate medical students at Omdurman Islamic University. Data were collected using a self-administered online questionnaire via Google Forms, consisting of two parts: socio-demographic information and the Generalized Anxiety Disorder Questionnaire (GAD-7), a validated tool for screening and measuring the severity of GAD. **Results:** A total of 374 medical students participated, with 64.7% being female. The GAD-7 scores were high (above 9), suggesting GAD among 33.7% of participants, with severity levels of 41.2% for mild anxiety, 21.4% for moderate anxiety, and 12.3% for severe anxiety. Comparison of means showed significant associations between GAD and female students ($p<0.001$) and students with chronic diseases ($p=0.034$). GAD significantly impacted daily activities ($p<0.001$). Multiple logistic regression analysis found that students in the final year had significantly higher GAD-7 scores (Adjusted Odds Ratio=4.25, 95% Confidence Interval=1.27-14.22). **Conclusions:** The higher scores on the GAD-7 measure among Sudanese medical students are concerning. This emphasizes the urgent need to raise awareness, normalize mental health discussions, and provide accessible counseling services tailored to the students' needs.

Introduction

Mental disorders are the leading cause of disability worldwide. Individuals with significant mental health issues tend to have a lifespan that is 10 to 20 years shorter than that of the average person.[1]

Generalized Anxiety Disorder (GAD) is a mental condition characterized by persistent and excessive anxiety and worry about various events or activities, such as school or work performance. These symptoms occur on most days for at least six months and can hinder functioning in social, occupational, or other domains.[2]

The disease is highly prevalent; in the United States, it is estimated that 6.8 million adults have GAD, with only 43.2% receiving treatment.[3] It is also estimated that 5.7% of U.S. adults experience generalized anxiety disorder at some point in their lives.[4]

Studies have consistently shown that females are more likely than males to develop GAD,[5,6] with the prevalence being twice as high for them.[7] There are other risk factors associated with GAD, such as genetic factors,[8] and chronic diseases like diabetes mellitus,[9] asthma,[10] and systemic lupus erythematosus.[11]

The demanding nature of medical school with challenging training programs, both academically and emotionally across all professions, places medical students at a higher risk for GAD compared to the general population. Studies have revealed that 29% to 38% of medical students experience GAD, in contrast to the 3% to 25% prevalence observed in the general population.[12] The academic years in medical school are filled with numerous challenges, including demanding coursework, difficult exams, and extensive study hours.

Studies have shown that the prevalence of GAD among medical students varies between countries. A study conducted in the USA reported that 65.9% of medical students exhibited symptoms of anxiety.[13] Meanwhile, in Saudi Arabia, 69% of medical students were found to have varying degrees of GAD,[14] and in Egypt, the rate was a bit higher at 77.1%.[15]

The effects of GAD on medical students are profound. A study conducted in Mexico aimed to assess the impact of GAD on university students during the COVID-19 pandemic on academic performance. The findings revealed a significant negative effect of anxiety on students' academic performance.[16] Similarly, a study

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among medical students in Syria demonstrated a negative association between anxiety and academic performance.[17]

Anxiety not only affects academic performance but also impairs the ability to achieve work goals, manage household tasks, and interact with others. Several studies have reported that GAD is associated with a poor quality of life.[18,19]

While the global prevalence rates are alarming, the situation in Sudan presents unique challenges; in 2020, a study among medical students revealed prevalence rates of depression at 75%, anxiety at 55.3%, and stress at 51.8%.[20] In recent years, Sudan has faced political and environmental instability, significantly impacting the mental health of its population. Medical students in Sudan are particularly struggling to manage the requirements of their academic programs with the unstable socio-political environment, potentially exacerbating their mental health issues.[21]

Given the significant global and local implications of GAD among medical students, particularly amidst the critical socio-political challenges in Sudan, there is a pressing need for more comprehensive studies within the country. This study aimed to determine the prevalence of GAD, explore associated risk factors, and evaluate its impact on academic performance and daily activities among medical students at Omdurman Islamic University to contribute valuable insights that can guide more effective mental health support strategies for medical students in Sudan.

Methods

Ethical Considerations

This study received ethical approval on July 21, 2022, from the Ethics Committee of the Faculty of Medicine at Omdurman Islamic University (Ethical Approval No. 3/2022). All participants provided informed consent online.

Study Setting and Design

This descriptive cross-sectional institution-based study was conducted among medical students at Omdurman Islamic University from October to December 2022. The university, located in Omdurman City, Khartoum State, Sudan, had approximately 26,000 students in 2022.

Sampling Strategy

The sample size was calculated to be 379 using the following formula: $n=Z^2p[1-p]/d^2$, where n = calculated sample size, p is the prevalence of anxiety based on a previous study = 0.553, Z is the confidence level used = 1.96, and d = the level of precision (0.05).[20]

Participants for the study were selected using a systematic random sampling technique. The student list was obtained from the faculty administration. To determine the sampling interval, we divided the total number of medical students by the calculated sample size, resulting in an interval of five. A random number generator was used to select the first study participant from the first five students on the list. Subsequently, every fifth student from this initial point was selected to participate in the study. The inclusion criteria included medical students actively enrolled at the university. There were no exclusion criteria. At the start of the questionnaire, participants were informed about the purpose of the study, and assured that their involvement was entirely voluntary and that their anonymity would be preserved. Only those who gave their consent were able to fill out the questionnaire.

Data Collection Tools

Data were collected using a self-administered online questionnaire via Google Forms. The selected participants received the questionnaire link through WhatsApp. The questionnaire consisted of two sections: The first part was socio-demographic information, specific risk factors, and academic performance data: (gender, age, marital status, academic year, residence, living situation, grade point average (GPA), and medical history). The second part assessed GAD severity using the Generalized Anxiety Disorder Questionnaire (GAD-7).

Academic Performance

The academic performance of students was evaluated using their GPA, as per the system of the faculty of Medicine at Omdurman Islamic University administration. GPAs were categorized on a scale from 0 to 4, with the following classifications: Distinction (3.5-4), Very Good (3-3.49), Good (2.50-2.99), Pass (2-2.49), and Fail (<2).

Generalized Anxiety Disorder (GAD-7)

The GAD-7 is a valid and efficient tool for screening GAD and its severities. Scores are interpreted as follows: <5 (normal), 5-9 (mild anxiety), 10-14 (moderate anxiety), and 15-21 (severe anxiety). A cut-off score of 10 identifies cases of GAD, with a sensitivity of 89% and a specificity of 82%.[22,23]

Statistical Analysis

Data were analyzed using SPSS version 28. Descriptive statistics, such as frequencies, means, standard deviations, and percentages, were employed to describe the dataset. A GAD-7 score of 10 or more was considered indicative of high anxiety levels. The relationship between risk factors and GAD was analyzed using t-tests and one-way ANOVA. Statistical significance was set at P = 0.05 or less. To measure the effect size, Cohen's d was used for t-tests, and eta-squared was used for one-way ANOVA tests. Simple and multiple logistic regression were performed to predict Generalized Anxiety Disorder from various independent variables.

Results

Sociodemographic and Risk Factor Profiles

A total of 374 medical students participated in this study. Most of them were female (64.7%). Their mean age was 21.07 ± 2.18, ranging from 16 to 29 years. Socio-demographic data are presented in *Table 1*.

Table 1. **Sociodemographic and Risk Factor of Medical Students at Omdurman Islamic University, n=374.**

Variable	n	%
Gender		
Male	132	35.3
Female	242	64.7
Academic year		
1st year	80	21.4
2nd year	85	22.7
3rd year	69	18.8
4th year	79	21.1
5th year	61	16.3
Residency city		
Khartoum	82	21.9
Bahri	42	11.2
Omdurman	247	66.0
Madani	3	0.8
Marital status		
Single	366	97.9
Married	8	2.1
Residency situation		
First degree family	219	58.6
2nd degree family	27	7.2
Dormitory	108	28.8
In apartments with other students	17	4.5
With husband	1	0.3
Alone	2	0.6
Chronic Disease Presence		
yes	37	9.9
No	337	90.1
Exercise Frequency Per Week		
No	299	79.9
1-2 times	21	5.6
3-4 times	29	7.8
5 times	17	4.5
More than 5 times	8	2.1
Smoking status		
Ex-smoker	7	1.9
Smoker	8	2.1
Not smoker	359	96.0

Out of the 374 medical students who participated in the study, 101 of them reported engaging in regular exercise. It was found that nearly 50% of these students reported engaging in regular cardio exercises, while approximately 40% stated that they regularly engage in walking exercises, as depicted in *Figure 1*.

Prevalence and Severity of Generalized Anxiety Disorder among Medical Students at Omdurman Islamic University

According to the GAD-7 scale, 33.7% of the medical students exhibited high GAD scores, indicating scores of 10 or more. The severity of these anxiety levels is detailed in *Figure 2*.

Figure 1. **Types of Exercises Performed by Participants, Sudan, 2022, n=101.**

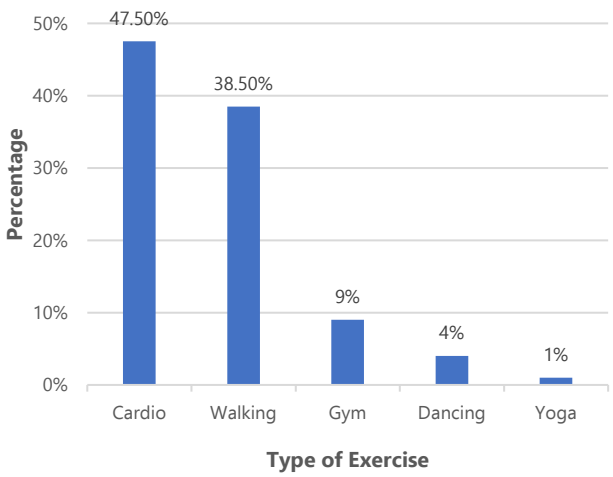
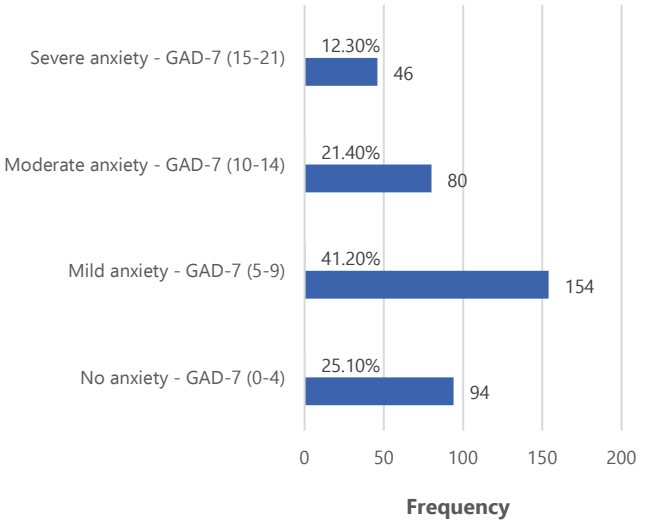


Figure 2**: Prevalence and Severity of Generalized Anxiety Disorder (GAD) among Participants at Omdurman Islamic University, n=374.**



Assessment of the Risk Factors for GAD among Medical Students at Omdurman Islamic University

A comparison of means was conducted to examine variable differences in GAD-7 scores. The results indicated that Female medical students (M = 7.80) had significantly higher GAD-7 scores than male medical students (M = 6.06) ($p < 0.001$). Additionally, no significant differences were found between age, academic year, residence city, marital status, residence situation, smoking status, and GAD-7 scores (all p-values > 0.05). However, medical students with chronic diseases had significantly higher GAD-7 scores (M = 8.64) than those without (M = 7.03) ($p = 0.034$). Furthermore, there was a significant difference in the GAD-7 scores between medical students who reported performing regular exercise (M = 7.41) and those who did not (M = 6.29, p = 0.05. *Table 2*).

Table 2. **Mean Scores, Standard Deviations, and Effect Sizes of GAD-7 Scores Across Socio-Demographic and Risk Factors.**

Variable	Mean	Standard deviation	p value	Effect size
Gender				
Male	6.07	4.40	<0.001	-0.40
Female	7.81	4.30		
Age				
Less than 18 years	7.14	5.14		
18 to 20 years	6.96	4.47	0.36	0.009
21 to 25 years	7.47	4.36		
More than 25 years	5.00	3.74		
Academic year				
1st year	6.86	4.63		
2nd year	6.62	4.50	0.35	0.01
3rd year	7.19	3.81		
4th year	7.52	4.70		
5th year	8.02	4.21		
Residency city				
Khartoum	7.40	4.54		
Bahri	7.40	3.62	0.85	0.002
Omdurman	7.07	4.51		
Madani	8.66	2.31		
Marital status				
Single	7.14	4.36	0.11	-0.56
Married	9.62	6.19		
Residency situation				
First degree family	7.18	4.49		
2nd degree family	5.30	4.40		
Dormitory	7.49	4.15	0.05	0.02
In apartments with other students	8.00	4.32		
With husband	15.00	N/A		
Chronic Disease Presence				
yes	8.65	5.57	0.03	0.37
No	7.04	4.24		
Exercise				
Yes	7.42	4.47	0.05	0.25
No	6.30	4.07		
Smoking status				
Ex-smoker	9.14	4.67	0.45	0.004
Smoker	7.87	6.08		
Not smoker	7.14	4.37		

A multiple logistic regression analysis was conducted to investigate the relationship between several predictor variables and the presence of Generalized anxiety disorder. The results show that being female ($p < 0.001$, AOR = 2.399) and being in the 5th academic year ($p = 0.019$, AOR = 4.246) were associated with higher odds of anxiety (*Table 3*).

Impact of GAD on academic performance among medical students at Omdurman Islamic University

The mean GPA of the medical students is 3.25 ± 0.525 SD. To evaluate the impact of Generalized Anxiety Disorder on students' academic performance, we compared the means of the GPA across various GAD severity levels using an ANOVA test. The findings, detailed in *Table 4*, show no significant differences in the GPAs across the different levels of anxiety among the students.

Table 3. **Multiple Logistic Regression of Predictors of Generalized Anxiety Disorder (GAD).**

Predictor Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Age	0.90	0.76, 1.06	0.21
Gender			
Male	(Reference)	-	-
Female	2.40	1.46, 3.95	<0.001
Academic year			
1st year	(Reference)	-	-
2nd year	1.30	0.65, 2.60	0.46
3rd year	2.03	0.89, 4.63	0.09
4th year	2.34	0.91, 6.01	0.08
5th year	4.25	1.27, 14.22	0.02
Marital status			
Not married	(Reference)	-	-
Married	0.66	0.12, 3.52	0.62
Chronic disease			
No	(Reference)	-	-
Yes	0.78	0.36, 1.67	0.52
Exercise			
No	(Reference)	-	-
Yes	1.20	0.68, 2.14	0.53

Table 4. **Mean Scores and Standard Deviations of grade point average (GPA) Across Generalized Anxiety Disorder (GAD) Severities.**

GAD severities	GPA Mean	Standard deviation	p-value
No Anxiety	3.23	0.623	0.160
Mild Anxiety	3.32	0.469	
Moderate Anxiety	3.16	0.512	
Severe Anxiety	3.26	0.491	

Table 5. **The Impact of Generalized Anxiety Disorder (GAD) Severity on Daily Life Activities.**

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?	Mean	Standard Deviation	p-value	Effect Size
Not difficult at all	4.11	3.67	<0.001	0.38
Somewhat difficult	6.86	3.25		
Very difficult	11.95	3.95		
Extremely difficult	11.81	3.60		

Impact of GAD on daily life activities among medical students at Omdurman Islamic University

A comparison of the means was conducted to study the impact of GAD on daily activities among students. Significantly higher mean GAD-7 scores were found among students who reported extremely difficult (11.80) and very difficult (11.95) daily activities, and lower mean GAD-7 scores were found among students who reported not difficult (4.10) and somewhat difficult (6.86) daily activities ($p < 0.001$, *Table 5*).

Discussion

Our study found that 33.7% of medical students had significantly high GAD-7 scores (scores > 9), suggesting the possibility of GAD. This rate is slightly higher than the 29% recently reported among medical students at the University of Khartoum, Sudan.[24] Another study, conducted during the COVID-19 lockdown in Sudan reported a prevalence rate of 55.3%; however, this study employed the DASS-21 scale, a different assessment tool, potentially explaining the variance in rates.[20]

Participants in our study were exposed to a complex social and political environment characterized by political unrest and economic hardship. Even following the COVID-19 pandemic, colleges often faced closures due to the unstable political situation. These factors could heighten anxiety and uncertainty about future careers among students, thereby impacting their mental well-being.

Comparatively, studies in Saudi Arabia and the USA reported prevalence rates of 31.2% and 30.6%, respectively.[13,25] In contrast, studies in Egypt reported higher anxiety rates of 77.1% and 56%; however, these studies utilized the DASS-42 tool, which might account for the higher rates. [26,27]

A high level of stress often accompanies medical school. A comparative study assessed stress levels among students from various disciplines. The findings revealed that 54.3% of medical students reported experiencing significant stress, compared to 36.6% of arts students, 32% of business students, and 15.3% of engineering students.[28]

In our study, a significant association was observed between female medical students and GAD ($p < 0.001$). This finding is consistent with studies conducted among medical students in several countries, including Saudi Arabia,[29] Turkey,[30] Egypt,[31] and the United States.[13] Some studies suggest that specific biological factors, such as abnormalities in female hormones, might contribute to increased anxiety in women, potentially leading to a higher risk of GAD compared to men.[32,33] Another study indicated that female students may be more susceptible to GAD due to their perception of patient contacts and autopsy-related duties as stressful, with exams also being a significant source of stress.[34] Moreover, multiple studies have reported that female medical students are more likely to experience of imposter syndrome, which is strongly associated with anxiety and other psychological conditions.[35,36]

The study revealed that final-year medical students were more likely to experience generalized anxiety disorder (GAD) than students in earlier academic years (AOR= 4.25) ($p=0.019$). This can be explained by the increase in academic and practical workloads, as well as the stress associated with final exams, during the last year. This aligns with previous research indicating a progressive increase in stress throughout medical education.[37] Existing studies suggest that mental health often declines upon entering medical school and remains challenging throughout the program.[38]

Regarding academic performance, our study did not find a significant difference in GPA scores across different GAD severities. This finding contradicts the results of many studies, including a meta-analysis of 238 studies, which found a significant association between increased GAD severity and poorer academic performance.[39] However, our results align with other research that found no association between academic performance and GAD.[40] Some studies have even suggested that anxiety levels might increase with higher GPA scores, as students may become more concerned about maintaining their grades.[25] These variations could be attributed to the different tools used, which can lead to varied results. It is worth noting that our study relied on self-reported GPA, rather than obtaining the data directly from faculty administration.

In our study, students who reported extreme difficulty in achieving their work, managing household tasks, or interacting with others had significantly higher mean GAD scores. This finding is similar to previous studies that have reported a positive correlation between higher levels of anxiety severity and poorer quality of life,[18,19] and lower health-related quality of life.[41]

Medical students with chronic diseases in our study exhibited higher mean GAD scores, consistent with earlier research that found significantly higher GAD scores among patients with conditions such as asthma,[10] type 2 diabetes,[9] and systemic lupus erythematosus (SLE).[11] These findings suggest that medical students with chronic diseases may be more susceptible to developing symptoms of GAD, which could have important implications for their mental health and overall well-being.

Surprisingly, our study demonstrates that medical students who engaged in regular exercise scored higher on the GAD-7 scale. This is contradictory to the existing literature, which suggests that physical activity plays an essential role in anxiety treatment[42], particularly high-intensity exercise.[43,44] However, this finding could be attributed to several factors. First, students with higher levels of anxiety might be more inclined to use regular exercise as a coping mechanism, leading to a correlation where those with higher anxiety levels are also those who exercise more. Second, medical students may engage in exercise to manage the high stress of their academic environment, which could contribute to higher anxiety levels despite regular physical activity. Additionally, it is noteworthy that the number of students who reported engaging in regular exercise was relatively small (n=101), which could influence the study's findings.

Strengths and Limitations

Our study provided significant insights into the mental health challenges faced by medical students in Sudan during a critical period. It was conducted at one of the largest and most prominent public universities in the country. However, the study

had certain limitations. While the GAD-7 tool was reliable, it's important to acknowledge that it functioned as a screening tool rather than a diagnostic instrument; a clinical assessment was necessary for a definitive diagnosis. The study was conducted at the Faculty of Medicine at Omdurman Islamic University. Although this is a large institution, this specific setting might have limited the ability to generalize our findings to medical students in other regions or countries. This suggested the need for multicenter studies. Furthermore, most of our study participants were female, which might have influenced the applicability of our findings across different genders. Moreover, the small sample size might have reduced the study's statistical power to detect significant effects.

Conclusion

This study revealed high GAD scores among Sudanese medical students, with significant associations found between GAD and female medical students as well as students with chronic diseases. GAD was found to negatively impact the ability of affected students to manage household tasks. The high prevalence of anxiety among medical students raises concerns, emphasizing the need for increased awareness, mainly focusing on recognizing and managing anxiety disorders. It is crucial to normalize discussions about mental health and provide easy access to counseling and psychotherapy services tailored to student needs. Additionally, fostering a culture of wellness within medical schools should be prioritized, with an emphasis on promoting healthy habits such as exercise, adequate sleep, and stress management. Furthermore, establishing peer support systems, including mentorship programs where senior students can guide and support juniors, can significantly contribute to a supportive environment. Additionally, training should be provided to faculty and administrative staff on how to identify and respond to students who experience anxiety, ensuring they can offer appropriate support or referrals. Future research should focus on evaluating the barriers to conducting and assessing the effectiveness of mental health services targeted at medical students and intervention programs aimed at reducing anxiety.

Summary – Accelerating Translation

Title: Understanding Anxiety among Medical Students in Sudan: A Study from Omdurman Islamic University

Main Problem: Anxiety, specifically Generalized Anxiety Disorder (GAD), was identified as a significant challenge globally, notably affecting the academic performance and overall quality of life of medical students. This problem was particularly pronounced in regions experiencing socio-political unrest, such as Sudan, where medical students were under increased stress due to the demanding nature of their studies compounded by external instability.

Aim: The study aimed to assess the prevalence of GAD among medical students at Omdurman Islamic University, identify the key factors that contributed to its development, and evaluate its impact on students' academic achievements and daily functioning. The goal was to provide insights that could aid in developing better support systems for medical students' mental health, particularly in challenging environments like Sudan.

Methodology: This study was conducted among medical students at Omdurman Islamic University, a public university in Omdurman City, Sudan. The university was established in 1912 and has 22 faculties. In 2022, there were around 26,000 students. We used a method called systematic sampling to select participants for the study.

To collect data, we used an online questionnaire with two parts. The first part asked about things like age, gender, marital status, academic year, where the students lived, their grade point average, and medical history. The second part focused on generalized anxiety disorder (GAD) and used a questionnaire called the Generalized Anxiety Disorder Questionnaire (GAD-7) to measure its severity.

The study followed ethical guidelines and received approval from the Omdurman Islamic University Ethics Committee of the Faculty of Medicine. All participants gave their consent to participate in the study electronically.

Results: In this study, we looked at a total of 374 medical students who participated. It's interesting to note that most of them were female, making up 64.7% of the participants. Out of all the medical students in the study, 35 of them mentioned having a chronic disease. What's even more interesting is that more than one-third of these students, specifically 35.7%, reported having asthma.

Out of the 364 medical students who took part, 101 of them said they regularly exercise. It's worth mentioning that nearly half of these students, about 50%, mentioned doing cardio exercises on a regular basis. Additionally, around 40% of them said they regularly engage in walking exercises.

We found that about one-third of the medical students, specifically 33.7%, had high possibility of Generalized Anxiety Disorder (GAD). When we looked at the severity of anxiety, we found that 41.2% had mild anxiety, 21.4% had moderate anxiety, and 12.3% had severe anxiety.

To understand the differences in anxiety levels, we compared the average scores. It turned out that female medical students had significantly higher anxiety scores (average score of 7.80) compared to male medical students (average score of 6.06). However, we didn't find any significant differences in anxiety scores based on factors like age, city of residence, marital status, or living situation.

We found that fifth-year medical students are significantly more likely to experience anxiety than students in other academic years

Interestingly, medical students with chronic diseases had significantly higher anxiety scores (average score of 8.64) compared to those without chronic diseases (average score of 7.03). Moreover, we found a significant difference in anxiety scores between students who reported regular exercise (average score of 7.41) and those who didn't (average score of 6.29).

We also looked at the impact of anxiety on academic performance. however, we didn't find any significant association between anxiety and academic performance.

To understand how anxiety affects daily activities, we compared the average scores again. Students who reported extremely difficult daily activities had significantly higher anxiety scores (average score of 11.80), as did those who reported very difficult daily activities (average score of

11.95). On the other hand, students who found their daily activities not difficult (average score of 4.10) or somewhat difficult (average score of 6.86) had lower anxiety scores.

Conclusion: This study showed a high level of GAD among Sudanese medical students. Key insights include that high GAD is associated with female students and those suffering from chronic diseases and the negative effect of GAD on managing daily tasks. The concerning levels of anxiety among medical students underscore the urgent need for heightened awareness and better management strategies for anxiety disorders. The study advocates for normalizing mental health discussions, ensuring accessible mental health services tailored to students, and promoting a wellness culture within medical educational institutions. Emphasizing healthy lifestyle choices, establishing supportive peer networks, and providing training for faculty and staff on recognizing and addressing student anxiety are pivotal steps. The conclusion calls for further research into the obstacles faced in implementing effective mental health services and interventions specifically designed to alleviate anxiety among medical students, aiming to enhance their overall well-being and academic success.

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Original Article

Prioritizing Mental Health: A Cross-Sectional Investigation of Depression Prevalence and Risk Factors among Medical Students in Peshawar, Pakistan

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Abstract

Background: Depression is a significant problem among medical students worldwide, affecting their well-being and potentially compromising patient care. This study aimed to determine the prevalence of depression among medical students in Peshawar, Pakistan, and to identify the associated risk factors. **Methods**: A cross-sectional study was conducted from April to June 2023, involving medical students from seven colleges in Peshawar. We employed stratified sampling to distribute surveys to students. We collected data on socio-demographic characteristics, prevalence of depression using the Hospital Anxiety and Depression Scale (HADS), and depression risk factors. We used multivariate logistic regression, clustered by university, to assess factors associated with depression. **Results**: Out of 400 distributed questionnaires, 324 were returned (response rate: 81%). The participants' mean age was 21.70 ± 1.65 years, with 53.1% being females. The prevalence of depression was 19.4% and 26.2% were borderline cases. No variables were found to be significantly linked to depression in our multivariate regression model. However, male gender, year of study, experiencing discrimination or harassment in medical school, and having negative perceptions of medical school's impact on mental health had odds ratios above 1, with confidence intervals including the null value. **Conclusion**: This study reveals a high prevalence of depression among medical students in Peshawar, Pakistan. It emphasizes the need to address risk factors and establish support systems to minimize the impact of depression on students' well-being and academic performance. Further studies are necessary to identify modifiable factors associated with depression in medical students.

Introduction

Depressive disorder, commonly referred to as depression, is a significant mental disorder. It is characterized by a long-term sad mood, loss of enjoyment, or interest in activities, with symptoms persisting for about two weeks. Symptoms include anhedonia, diminished energy, guilt or low self-worth, disturbed sleep or hunger, impaired attention, and a loss of interest and pleasure.[1]

Students in higher education, particularly those in their first year, deal with difficulties in both their personal and academic lives. These unfavorable circumstances increase individuals' susceptibility to mental health disorders such as depression.[2]

Medical educators around the world are becoming increasingly concerned about medical students' depression. According to a recent systematic review, depression was present in up to 27.2% of medical students worldwide.[3] Depression is the greatest cause of years spent with a disability and the single largest contributor to worldwide disability.[4] Inability to operate in the classroom and during clinical rotations, other problems caused by stress, and declining performance are only a few of the potential drawbacks of emotional strain on medical students.[5]

The rate of depression among medical students is quite high and when their training is complete, their levels of overall psychological discomfort are consistently higher than those of peers their own age and the general public.[6] According to a study conducted in India, medical students in their 2nd and 3rd years are more stressed out and consequently more prone to develop depression than those in their 1st year.[7] The struggle of medical students with depression may result in decreased quality of life and increased dropout rates.[8]

Depression rates among medical students vary geographically: from 6.0% to 66.5% in the UK, 13.10% to 76.21% in China, 40% in India, 66.6% of the men and 87.6% of the women in Saudi Arabia,

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10.3% in South Korea, and 70% in Karachi and 48.30% in Punjab, Pakistan.[9-15] Because depression can ultimately result in suicidal ideation, identifying the risk factors of depression in medical students should be a priority. Financial strain, exam-related stress, a lengthy study period in medical schools, and other factors have all been highlighted by Quynh Anh et al. as potential risk factors of depression.[16,17] The female gender, mental illness, lack of support during stressful times, stressful life events experienced within the previous six months, dissatisfaction with one's socioeconomic status, lack of motivation to perform well, and dissatisfaction with student's performance are independent predictors for severe and moderate depression.[18] Regular nutritional consumption, leisure and exercise time, spending time with a partner, friends, and family, and confiding in peers have all been connected to a reduction in depressive symptoms.[19]

To reduce depressive symptoms in medical students, increase self-esteem, reduce self-perceived medical errors, and eventually improve the quality of patient care, factors connected to depression in medical training should be acknowledged and effectively managed.[20] In this study, we aimed to identify prevalence of depression and its associated risk factors in medical students from several colleges in Peshawar, Pakistan.

Methods

Study Design

We carried out a cross-sectional survey-based study with medical students from all medical schools in Peshawar, Pakistan. The study was carried out from April 2023 to June 2023.

Setting

Peshawar is home to seven medical schools. We included all these medical schools in our study. Five of these schools are private, while two are public. The private schools are North West School of Medicine, Pak International Medical College, Peshawar Medical College, Jinnah Medical College, and Rehman Medical Institute. The public medical schools are Khyber Medical College (KMC) and Khyber Girls' Medical College.

Participants

We obtained informed oral consent from medical students from the 1st to the final year of the MBBS program, and questionnaires were filled out by those willing to participate.

Sample Size Calculation

To determine the sample size, we utilized the formula: $\mathbf{SS=Z^2*P(1-P)/D^2}$, where SS is the Sample Size, Z is 1.96 (reflecting the 95% confidence level), P is the Expected Prevalence or Proportion (approximately 70% from previous studies), and D is the margin of error (0.05).[14,15] By inputting these values into the formula, we calculated an approximate sample size of 323 participants.

Sampling and Data Collection

We used a stratified sampling technique, accommodating 100 students from each college, except for KMC, which had nearly 200 participants. After a thorough selection process, we chose 50 students from each of the other institutions and 100 students from KMC.

Survey

The survey contained socio-demographic characteristics, the Hospital anxiety and depression scale (HADS), the 9-item patient health questionnaire (PHQ-9), and questions related to risk factors of depression. The questionnaire was meticulously built by a special committee that included a consultant psychiatrist, a junior member, a healthcare representative, and research committee students who reviewed and discussed the survey. Following their approval, a pilot study was conducted.

Outcome Variables

The tentative diagnosis of depression was our main outcome of interest, which was evaluated using the HADS, a 14-item questionnaire, out of which 7 questions were used to diagnose depression and 7 were used to diagnose anxiety. So, we used the 7 questions for the diagnosis of depression had the following categories: 0-7 score: Normal case, 8-10 score: Borderline case, 11-21 score: Abnormal case; and severity of depression was found out using PHQ-9, a nine-item questionnaire. The severity of depression was classified as minimal depression (1-4 score), mild (5-9 score), moderate (10-14 score), moderately severe (15-19 score), and severe depression (20-27 score).

Independent Variables

The potential associations between the following factors and depression were examined: big life event (participants who had experienced the death of a close relative or friend, traffic, rape, breakups, admission to the hospital for a serious illness over the past three months, family mental illness history, academic stress among different years of medical college, and the impact of medical college on their mental health. We also identified if the students were 'day scholars' (live off-campus and commute) or 'hostelites' (live on-campus or in housing provided by the institution). In this study, we also went through to investigate the relationship between depression and discrimination (gender) and harassment in medical college using a predefined question in the survey: "Have you ever experienced any discrimination or harassment during your medical school education."

Data Analysis

Data was analyzed using SPSS Version 20. Quantitative data was expressed in terms of standard deviation and mean while qualitative was expressed in terms of frequency and percentages. Bivariate analysis included chi square test to find out the relationship between depression, survey-based risk factors of depression, and socio-demographic data.

We utilized logistic regression to identify factors associated with depression using Stata18® (StataCorp, TX). Initially, an exploratory analysis was conducted, employing simple logistic regressions clustered by medical school to identify study

variables associated with depression (HADS score > 10), using a p-value < 0.20. Independent variables deemed significant in the exploratory analysis were subsequently included in a multivariate clustered logistic regression model to identify adjusted risk factors for depression. A p-value <0.05 was considered statistically significant.

Results

Socio Demographic Characteristics of Participants

Four hundred questionnaires were distributed among medical students in Peshawar, out of which 324 were returned (response rate: 81%). The participants' ages ranged from 21 to 27, with a mean age of 21.70 ± 1.65 years. Among 324 participants, 151 (46.6%) were male, 172 (53.1%) were female, and 1 participant did not specify their gender. One hundred ninety (58.6%) participants were hostelite, 134 (41.3%) were day scholars. Numbers of participants from different colleges were KMC- 82 (25.3%), RMI- 42 (13%), PIMS- 51 (15.7%), PMC- 39 (12%), JMC- 50 (15.4%), NWMC- 24 (7.4) and KGMC- 36 (11.1%), as shown in *Table 1*.

Prevalence of Depression

According to the HADS scale, 63 (19.4%) students were depressed, and 85 (26.2%) were borderline cases. Borderline cases mean that they are at the edge of developing depression. According to PHQ9 scale 3 (0.9) participants had minimal depression, 12 (3.7%) had mild depression, 34 (10.5%) had moderate depression, 10 (3.1%) had moderately severe depression and 4 (1.2%) had severe depression as shown in *Figure 1*. Depression was high among JMC (36%) students and lowest among KGMC (13.8%) students as shown in *Figure 2*.

Figure 1. **Distribution of Depression Severity Levels Among Surveyed Medical Students in Different Colleges in Peshawar.**

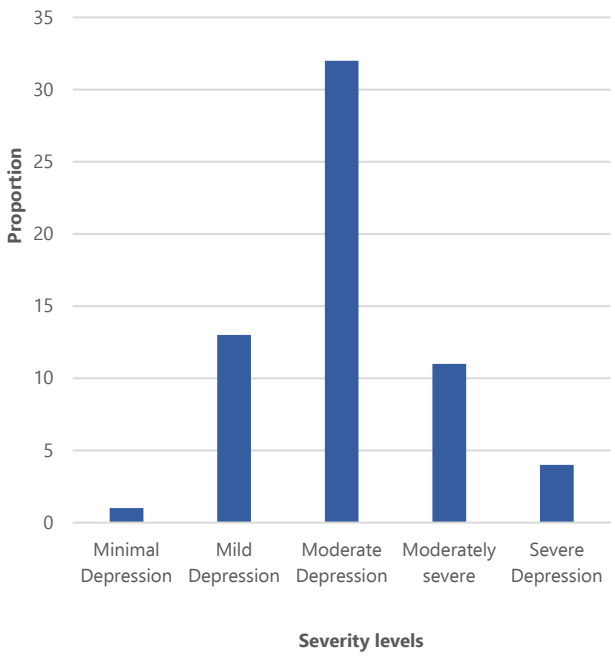
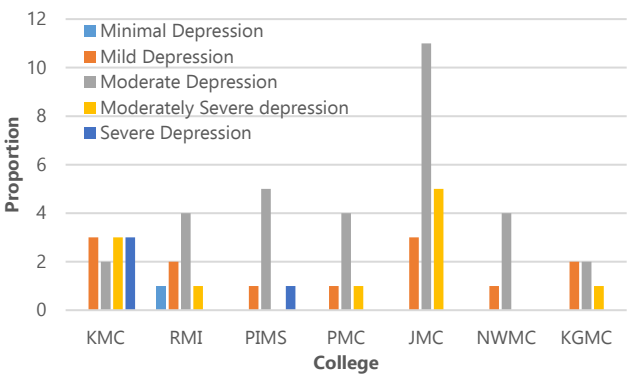


Table 1. **Participant's Socio-demographic Characteristics.**

Variables	n (324)	Males (n=151)	Females (n=172)	p-value
Age in years, mean ± SD	21.70±1.65			
Level of studies, n (%)				0.105
1st year MBBS	58 (17.9)	25 (43.1)	33 (56.9)	
2nd year MBBS	68 (21)	29 (42.7)	39 (57.3)	
3rd year MBBS	68 (21)	35 (51.4)	33 (48.6)	
4th year MBBS	82 (25.3)	38 (46.3)	44 (53.7)	
5th year MBBS	47 (14.5)	24 (51)	23 (49)	
Medical Colleges, n (%)				0.001
KMC	82 (25.3)	34 (41.4)	48 (58.6)	
KGMC	36 (11.1)		36 (100)	
RMI	42 (13.0)	24 (57.1)	18 (42.9)	
PIMS	51 (15.7)	31 (60.7)	20 (39.3)	
JMC	50 (15.4)	28 (56)	22 (44)	
PMC	39 (12)	24 (61.5)	15 (38.5)	
NWMC	24 (7.4)	10 (41.6)	14 (58.4)	
Residency, n (%)				0.491
Hostellite	190 (58.6)	85 (44.7)	105 (55.3)	
Day scholar	134 (41.3)	65 (48.5)	69 (51.5)	
Major life events, n (%)				
Have you experienced any traumatic event in life	169 (52)	71 (42)	97 (58)	0.738
Have experienced any discrimination during medical school education	81 (25)	41 (50.6)	39 (49.4)	0.011
Medical school has negatively affected your mental health	144 (44.4)	68 (47.2)	78 (52.8)	0.040
Regards family, n (%)				
Family history of mental illness	80 (24.7)	35 (43.8)	44 (56.2)	0.105
Feel stressed due to family issues, n (%)				0.521
Rarely	75 (23.1)	39 (52)	36 (48)	
Sometime	90 (27.8)	38 (42.2)	52 (47.8)	
Often	63 (19.4)	23 (36.5)	40 (63.5)	
Always	59 (18.25)	32 (54.2)	26 (45.8)	
Feel supported by family and friends, n (%)				0.002
Rarely	34 (10.5)	17 (50)	17 (50)	
Sometime	67 (20.7)	29 (43.2)	38 (56.8)	
Often	71 (21.9)	30 (42.2)	41 (57.8)	
Always	138 (42.6)	69 (50.8)	68 (49.2)	

Legend: n=total number of participants, KMC=Khyber Medical College, KGMC=Khyber Girls' Medical College, RMI=Rehman Medical Institute, PMC=Peshawar Medical College, PIMS=Pak international Medical School, JMC=Jinnah Medical College, NWMC=North West Medical College.

Figure 2. **Severity of Depression Among Medical Students Across Different Colleges in Peshawar.**



Depression-related Factors Among Medical Students

Bivariate analysis revealed significant associations between depression and the following factors: female gender (p=0.03), positive family history (p < 0.01), gender discrimination in medical school (p=0.01), negative impact of studies on mental health (p=0.04), and lack of family and friends' support (p<0.01). Conversely, year of MBBS (p=0.10), experience of any traumatic event in life (p=0.73), residency that is whether days scholars or hostelites (p=0.225) and stress due to family reasons (p=0.57) were not significantly associated with depression, as shown in *Table 2*.

Table 2. **Analysis of Depression Prevalence and Associated Factors Among Medical Student.**

Characteristics	Without Depression	Borderline	With Depression	p-valve
Sex, n (%)				0.03
Male	72 (22.2)	50 (15.5)	29 (8.9)	
Female	104 (32.2)	34 (10.5)	34 (10.5)	
Current year of MBBS, n (%)				0.1
1st year MBBS	25 (7.7)	18 (5.6)	15 (4.6)	
2nd year MBBS	37 (11.4)	14 (4.3)	17 (5.2)	
3rd year MBBS	38 (11.7)	23 (7.1)	7 (2.2)	
4th year MBBS	50 (15.4)	20 (6.2)	12 (3.7)	
5th year MBBS	26 (8.0)	9 (2.8)	12 (3.7)	
Medical Colleges, n (%)				
KMC	51 (15.7)	20 (6.2)	11 (3.4)	0.02
KGMC	26 (8.0)	5 (1.5)	5 (1.5)	
RMI	20 (6.2)	14 (4.2)	8 (2.5)	
PIMS	29 (8.9)	12 (3.7)	10 (3.1)	
JMC	23 (7.1)	9 (2.8)	18 (5.6)	
PMC	18 (5.6)	15 (4.6)	6 (1.9)	
NWMC	9 (2.8)	10 (3.1)	5 (1.5)	
Residency, n (%)				
Hostellite	97 (29.9)	57 (17.6)	36 (11.1)	0.22
Day scholar	76 (23.5)	28 (8.6)	27 (8.3)	
Major life events				
Have you ever experienced any traumatic events in your life? n (%)				0.74
Yes	90 (27.8)	44 (13.6)	35 (10.8)	
No	84 (25.9)	41 (12.7)	28 (8.6)	
Do you have a history of mental illness in your family? n (%)				<0.001
Yes	29 (8.9)	24 (7.4)	27 (8.3)	
No	147 (45.8)	61 (18.8)	36 (11.1)	
Have you ever experienced any discrimination in medical school education?				0.01
Yes	37 (11.4)	19 (5.9)	25 (7.8)	
No	139 (42.9)	66 (20.6)	38 (11.7)	
Do you feel that medical School has negatively affected your mental health? n (%)				0.04
Yes	65 (20.2)	43 (13.3)	36 (11.1)	
No	110 (33.9)	42 (12.9)	27 (8.3)	
How often do you feel stressed due to family issues? n (%)				0.570
Never	25 (7.7)	6 (1.9)	6 (1.9)	
Rarely	41 (12.8)	19 (5.9)	15 (4.7)	
Sometime	51 (15.9)	24 (7.5)	15 (4.6)	
Often	27 (8.3)	21 (6.5)	15 (4.6)	
Always	32 (9.9)	15 (4.6)	12 (3.7)	
How often do you feel supported by your family and friends? n (%)				0.002
Never	5(1.6)	3(0.9)	6(1.9)	
Rarely	8(2.5)	13(4.0)	13(4.0)	
Sometime	37(11.4)	21(6.5)	9(2.8)	
often	42(12.9)	18(5.6)	11(3.4)	
Always	84(25.9)	30(9.3)	24(7.4)	

Table 3 presents the multivariate analysis results for depression. While age exhibited a slight inverse association with depression, this association was not statistically significant, suggesting that older students may have a marginally lower risk. However, our analysis did not reveal significant impacts of gender, residence status, or additional study years on depression risk. Despite this, it is important to note that factors such as discrimination or harassment and negative perceptions regarding the impact of medical school on mental health were found to be associated with higher odds of depression, albeit not reaching statistical significance. The goodness of fit for the model was also found to be nonsignificant (p=0.21), indicating that while the model effectively summarizes the data, further exploration may be required to capture additional influential factors.

Discussion

To our knowledge, there has been no study employing a similar methodology conducted in Peshawar. Our study examined the relationships between depression and various factors, including traumatic experiences, harassment and discrimination in medical school, and the impact of medical school on mental health. We also tried to correlate depression with family problems, absence of family support, and family mental illness history. We observed a higher prevalence of depression among females, individuals affected by gender discrimination, those reporting a negative impact of medical college on mental health, and participants lacking family support. Conversely, experiences of traumatic events and stress due to family issues were not significantly associated with depression. Additionally, while our multivariate model did not identify specific associated factors, it indicated areas where potential interventions and further research could be beneficial.

Our study found a 19.4% prevalence of depression among medical students, like the 21.5% reported at Makerere University in Uganda.[21] They conducted their study in a single university and did not identify adequate risk factors associated with depression among medical students as well as the association of family related issues with depression. A meta-analysis revealed that the pooled prevalence utilizing IPD among medical students was 18.1%, which is nearly identical to the frequency in our study.[22] Our study prevalence was greater than the 10.3% prevalence of depression found among medical students in South Korea.[23] The prevalence of depression in our study was lower at 19.4% compared to the global incidence of 33.0% among university students as reported in a systemic review study.

Different methodologies, appraisal standards, measurement instruments, and cultural factors have all been cited as causes of differences of prevalence. University is a significant but fleeting era of life with unique demands in terms of academics, finances, and relationships. Going through these changes could make depression more likely. Nonetheless, the current study's high incidence rate of depression symptoms is higher than what is often observed in the general population.[24]

Table 3. **Risk Factors for Depression Among Medical Students: Analysis of Unadjusted and Adjusted Odds Ratios.**

Characteristic	Unadjusted Odds Ratio	95%CI	Adjusted Odds Ratio	95%CI	p-value
Age (continuous)	0.84	0.74-0.95	0.72	0.51-1.02	0.068
Sex: Female	(ref)				
Male	0.96	0.51-1.81	1.09	0.56-2.13	0.806
Residence: Hostellite	(ref)				
Day scholar	1.11	0.97-1.27	0.93	0.68-1.28	0.668
Year (continuous)	0.9	0.76-1.07	1.26	0.79-2.01	0.34
Family history of mental illness	2.94	1.14-7.62	0.42	0.14-1.26	0.123
Medical school effects					
Experienced discrimination/harassment	2.41	0.94-6.20	2.03	0.70-5.91	0.193
Negative effect of medical school	1.88	0.06-3.31	1.39	0.80-2.38	0.239

Legend: 95%CI: 95% confidence interval.

We conducted our study among 7 medical colleges of Peshawar, and we found that depression prevalence was highest in students at Jinnah Medical College and lowest among students at Khyber Girls Medical College. In our research, we found that gender discrimination is one of the risk factors of depression. Since Khyber Girls' Medical College is has only female students, there is no gender discrimination and therefore, the rate of depression is the lowest there. Our study also found a significant association of depression and the female gender. A similar significant association was found among females' medical students of Karolinska Institute Medical University, Sweden.[25]

Our study revealed a significant association between absence of family support and depression among medical students. These data implies that a lack of family support may be a factor in this population's higher prevalence of depression. It emphasizes how important it is to understand and deal with the effects of family dynamics on medical students' mental health. Our results are consistent with earlier studies that have repeatedly shown the importance of family support for a healthy mind. Smith et al., conducted a similar cross-sectional study and reported a strong associated between medical students' enhanced depressive symptoms and a lack of family support.[26] Another study was conducted to investigate the association between depressive symptoms and social support, which found out that greater social support was associated with decreased depressive symptoms.[27] These converging findings further emphasize the importance of family support in the context of medical education.

Surprisingly, our study did not identify a significant association between traumatic events and stress due to family issues among medical students. These results suggest that, within our study population, these specific factors may not be primary contributors to the mental health challenges faced by students at medical college. Nevertheless, a further investigation on the factors affecting medical students, using qualitative research methods or a larger sample size may be required. It highlights the need to explore other potential variables that influence mental health outcomes in this context.

Our study also did not find any association between residencies of students and depression. This finding was contrary to a study which found out that hostelites are more emotionally disturbed and are more depressed as compared to days scholars.[28]

A multifaceted approach is needed to combat medical student depression, including problems like discrimination, harassment, and the perceived detrimental impact of medical school on mental health. Accessible counseling, mental health programs, and peer support groups are essential. A safe, confidential reporting mechanism and rigorous anti-discrimination and harassment policies are essential for a secure workplace. Mental health education in the medical curriculum can raise awareness, reduces stigma, and encourages free debate. Wellness programs that teach stress management, resilience, and healthy living choices and peer mentoring can help pupils. Faculty and staff must get sensitivity training to identify and address mental discomfort and unconscious biases. Flexible academic rules can reduce academic stress, while anonymous student comments can help improve stress. Adapting tactics to change requirements needs ongoing intervention, and efficient research and evaluation. Community-building activities reduce isolation and establish support networks. These evidence-based therapies can dramatically reduce depression in medical students.

This study's limitations include the cross-sectional design, as it cannot prove causality between identified factors and depression. Due to potential bias, self-reported questionnaires may not fully reflect feelings or experiences. Since the sample was limited to Peshawar medical schools, findings may not apply to other demographics. The study could not account for all potential confounding variables, such as personal coping techniques or challenges that may affect depression risk. To better understand medical student depression, longitudinal designs, greater geographic sampling, and more complete assessments of contributory factors should be used in future studies.

In this study we provide valuable insights into the prevalence and risk factors associated with depression among medical students.

The findings shed light on the significant mental health challenges faced by this population and the associated factors.

Summary – Accelerating Translation

This study conducted in Peshawar, Pakistan aimed to determine the prevalence of depression among medical students and identify potential risk factors associated with it. The cross-sectional study involved students from seven medical colleges, and data was collected using surveys. Out of the 400 questionnaires distributed, 324 were returned, resulting in an 81% response rate. The mean age of the participants was 21.70 ± 1.65 years, with 46.6% males and 53.1% females.

Using the Hospital Anxiety and Depression Scale (HADS) for the prevalence of depression, we found that 19.4% of students were depressed. Additionally, 26.2% of the students were identified as borderline cases. Several factors were significantly associated with depression, including the female gender, having a positive family history of mental illness, experiencing gender discrimination within medical school, perceiving a negative effect of studies on mental health, and lacking support from family and friends.

The study concludes that there is a high prevalence of depression among medical students in Peshawar, Pakistan. It highlights the importance of addressing these risk factors and establishing support systems to mitigate the impact of depression on students' well-being and academic performance. The findings emphasize the need for interventions to enhance mental health support and improve the overall quality of medical education in the region.

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Original Article

Antibiotic Appropriateness on Mondays vs. Fridays: Empiric Treatment of Simple Cystitis in the Emergency Department

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Abstract

Background: The treatment of urinary tract infections (UTIs) has contributed to the rise of antibiotic resistance. Antibiotic appropriateness in the outpatient setting is lower than expected. We hypothesized that prescribing practices may vary based on the day of the week. We sought to determine the percentage of antibiotic prescriptions that met criteria for antibiotic appropriateness on Mondays vs. Fridays. **Methods:** This is a retrospective cohort study of adult females with simple cystitis presenting to the Emergency Department (ED) between 2019 and 2021. We defined antibiotic appropriateness based on the Infectious Diseases Society of America guidelines in conjunction with a regional outpatient UTI antibiogram. Each prescription was assessed for drug selection, dose, frequency, and duration. Categorical data is reported as counts (%) and compared with chi-square. Nonparametric continuous data is reported as median (range) and compared with Mann-Whitney. **Results:** 160 subjects were included: 80 came to the ED on a Monday and 80 on a Friday. Demographics were similar; except, more subjects had antibiotic allergies on Mondays. The number of appropriate antibiotic prescriptions was similar between Mondays and Fridays: 54 (68%) and 60 (75%), respectively (p=0.3). Overall, 44 subjects had an inappropriate duration of antibiotics and 14 subjects had an inappropriate antimicrobial prescribed, with no differences between Mondays and Fridays. Dose and frequency were always correct. In total, there were 46 (29%) antibiotics that failed to meet appropriateness criteria. **Conclusions:** There was no difference in antibiotic appropriateness between Mondays and Fridays; however, 29% of prescriptions did not meet criteria for appropriateness.

Introduction

Urinary tract infections (UTIs) are common and account for 2 million visits to the Emergency Department (ED) annually.[1] Women are more susceptible to UTIs due to urethral proximity to colonized vagina and rectum, moist periurethral areas that promote bacterial growth, and shortened urethral length that allows quick bladder ascent.[2,3] Due to the high volume of empiric antibiotic prescriptions for UTIs and failure to adhere to appropriate prescribing guidelines, antibiotic resistance is on the rise.[4,5] The Infectious Diseases Society of America (IDSA) published guidelines for antibiotic management of UTIs that account for local resistance.[6] These guidelines can be used alongside a local antibiogram to assess the appropriateness of antibiotics.

Studies have shown that adherence to guidelines for the empiric treatment of UTIs has been poor. Denny et al., determined that only 62.8% of antibiotics prescribed in an Australian ED met appropriateness criteria.[7] In addition to driving antibiotic resistance, there was a substantial risk that inappropriate prescribing of antibiotics could lead to increased adverse events and treatment failure. Chardavoyne et al., evaluated the appropriateness of antibiotic prescriptions in an American ED specifically for cystitis and pyelonephritis and found that antibiotic prescriptions for adults were appropriate in 68% of cases of cystitis and 46% of cases of pyelonephritis.[8]

Other studies have shown discrepancies in antibiotic prescribing practices based on the day of the week. Huibers et al., examined the frequency of antibiotic prescribing for the Danish out-of-hours primary care service and found that 17.6% of patients received antibiotics over the weekend vs. only 10.6% during weekdays.[9] Furthermore, patients seen on weekdays were more likely to get broad-spectrum penicillins, compared to beta-lactamase sensitive penicillins on weekends. Thus, the frequency of antibiotic prescription, and even the class of antibiotic prescribed, can vary. Bishara et al., compared the appropriateness of all antibiotics prescribed in an ED in Israel on weekdays and weekends and found that a higher percentage of inappropriate antibiotics were prescribed over the weekend compared to weekday. Of note, they found a significant decrease in antibiotic appropriateness from 71% on Sunday, the first day of the week in Israel, to 33% on Saturday, the last day of the week.[10]

The objective of this study was to evaluate prescribing practices at a New York City (NYC) community hospital ED and determine

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the antibiotic appropriateness of treatment for simple cystitis in females on Mondays vs. Fridays. We hypothesized that a higher proportion of antibiotic prescriptions would meet the criteria for "appropriateness" on Mondays vs. Fridays.

Methods

This was a retrospective non-concurrent cohort study of female subjects ≥18 years old presenting to the ED of a NYC community hospital between August 2019 and May 2021 and empirically treated as outpatients for simple cystitis. Ethics approval was obtained from the New York Medical College IRB (#14607). Two authors performed data extraction. 25% of charts were double screened. Conflicts were resolved by consensus. Due to the clear definitions of antibiotic appropriateness established by the IDSA guidelines, inter-rater reliability for antibiotic appropriateness was 100%. Simple cystitis was defined as a UTI confined to the bladder and lacking signs of upper urinary tract symptoms (fever, chills, flank pain, and costovertebral angle tenderness) in the setting of normal urinary tract anatomy and function.[11] Subjects were included based on the International Classification of Diseases, Tenth Revision (ICD-10) codes for UTI (N39) or acute cystitis (N30) with an antibiotic prescription at time of discharge. Exclusion criteria included catheter use, recent genitourinary tract surgery, pregnancy up to 6 weeks postpartum, immunosuppression, recent antibiotic prescription within 1-month, concurrent treatment of another bacterial infection, or prior microbial treatment of current UTI. Subjects treated for a concurrent vaginal infection, bacterial or fungal, remained in the study.

Antibiotic appropriateness was based on the 2011 IDSA guidelines for antibiotic selection, dose, duration and frequency (*Table 1*),[6] and cross-referenced with the local NYC antibiogram for outpatient UTIs from 2016 to 2017.[12] First line agents in the treatment of acute simple cystitis in the United States include nitrofurantoin, trimethoprim-sulfamethoxazole (TMP-SMX), and fosfomycin. If these are contraindicated due to availability, allergy, or intolerance, fluoroquinolones and beta-lactams are second-line agents. Based on local NYC resistance data, amoxicillin, ampicillin, ciprofloxacin, and TMP/SMX were not appropriate empiric therapies.[12] For a treatment to be considered appropriate, the prescribed antibiotic had to meet all 4 criteria for selection, dose, duration, and frequency.

Subject characteristics included age, race, ethnicity, diabetes, hypertension, and antibiotic allergies (*Table 2*). Diagnostic methods for UTI were recorded for each subject: urinary symptoms, urine dipstick, microscopic urine analysis (UA), and urine culture (UC). Dipstick and UA were categorized as positive, negative, contaminated, or not done. A dipstick result with leukocyte esterase and/or nitrites was considered positive. A UA result with bacteria was considered positive. If a UA had multiple epithelial cells and few bacteria without associated leukocyte esterase or nitrites on dipstick, it was considered contaminated. Pathogen type, number of colony-forming units (CFU), and susceptibility testing were collected for all UCs with bacterial growth. Only cultures with CFU >100,000 were considered positive, though some clinicians treat with CFU>50,000 in conjunction with urinary symptoms.

The time results were published to the electronic medical record was compared to the time of subject discharge to determine whether the provider was aware of the test results prior to prescribing treatment. Modalities used to empirically treat a UTI were then analyzed for each subject: symptoms only, dipstick, UA, and/or UC. Timing of UC collection and results before/after antibiotic prescription were also captured. Any reason for deviation from guidelines or changes in treatment after the UC resulted were also captured.

Table 1. **Antibiotic Appropriateness Criteria for the Treatment of Simple Cystitis in the United States.**

Antibiotic	Contraindications	Dose	Duration	Frequency
Nitrofurantoin*	Early pyelonephritis suspected	100 mg	5-7 days	Twice daily
TMP-SMX*	Local resistance >20%, used to treat UTI <3 months ago	160/800 mg	3 days	Twice daily
Fosfomycin*	Early pyelonephritis suspected	3 g	1 day	Single dose sachet
Fluoroquinolones	High local resistance	varies	3 days	Varies
Beta-lactams	Avoid ampicillin or amoxicillin	varies	3-5 days	Varies

Legend: Adapted from the 2011 Infectious Diseases Society of America Guidelines. *Considered first line treatment options.

Table 2. **Patient Demographics and Comorbidities.**

Characteristics	Monday (n=80)	Friday (n=80)	p value
Race			
White	5 (6.3)	2 (2.5)	0.454
Black/African American	13 (16.3)	15 (18.8)	
Asian	1 (1.3)	0 (0.0)	
Other	50 (62.5)	56 (70.0)	
Not Documented	11 (13.8)	7 (8.8)	
Ethnicity			
Hispanic	52 (65.0)	56 (70.0)	0.39
Not Hispanic	27 (33.8)	21 (26.3)	
Not Documented	1 (1.25)	3 (3.75)	
Comorbidities			
Diabetes	11 (13.8)	14 (17.5)	0.51
Hypertension	18 (22.5)	15 (18.8)	0.56
Allergies to antibiotics			
Nitrofurantoin	0 (0.0)	0 (0.0)	1
TMP/SMX	1 (1.3)	1 (1.3)	1
Fluoroquinolones	0 (0.0)	1 (1.3)	0.32
Beta-Lactams	17 (21.3)	7 (8.8)	**0.03**

Legend: Reported as n (%) and compared with chi square.

Categorical data is reported as frequencies and percentages and compared with Chi-square; nonparametric continuous data is reported as median (range) and compared with Mann-Whitney. Significance was defined as $p<0.05$. Sample size calculation estimated that 71 subjects were needed on each day to detect an effect size of 20% difference in our primary outcome (90% antibiotic appropriateness on Monday and 70% on Friday) with 80% power and an alpha error of 0.05. All available cases for 22 months were screened until 80 subjects were collected in each group.

The primary outcome of this study was to determine the percentage of antibiotic appropriateness (based on 4 criteria) in the treatment of simple cystitis in adult female subjects presenting to the ED and compare this between Monday and Friday. The secondary outcome was to determine the most common criteria for cause of inappropriateness.

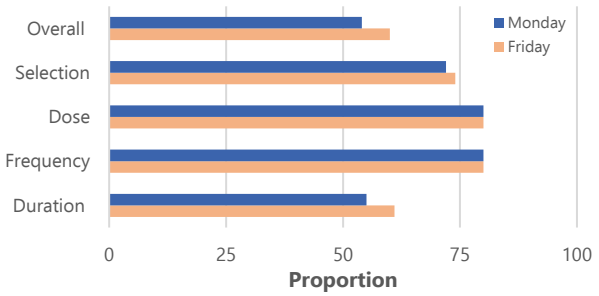
Results

Demographics and Antibiotic Prescriptions

The inclusion criteria for the study were met by 160 subjects, with an equal distribution of 80 subjects seen on Mondays and 80 seen on Fridays. Demographics were similar between groups, except beta-lactam allergy was higher in the Monday cohort (*Table 2*). The median (IQR) age was 46 (28) years in the Monday cohort vs. 41 (25) years in the Friday cohort. The majority of subjects self-identified as "other" race, and Hispanic ethnicity. The second most common race/ethnicity was Black, Non-Hispanic. Less than 5% of participants identified as white and less than 1% identified as Asian. Of the subjects, 25 (16%) had diabetes and 33 (21%) were diagnosed with hypertension. Out of 27 (17%) subjects with an antibiotic allergy, 24 were allergic to beta-lactams, with a majority in the Monday cohort.

Most subjects received nitrofurantoin: 55 (69%) on Mondays vs. 61 (76%) on Fridays. The second most common antibiotic was a beta-lactam: 19 (24%) on Mondays vs. 13 (16%) on Fridays. Prescribed beta-lactams included cefuroxime, cephalexin, cefpodoxime, and amoxicillin-clavulanate. In each group, 2 subjects (2.5%) were prescribed TMP-SMX, and 4 (5%) subjects received fluoroquinolones, such as ciprofloxacin. None of the subjects were treated with fosfomycin.

Figure 1. **Rate of Antibiotic Appropriateness on Mondays vs. Fridays, n= 160.**



There was no difference observed between the number of appropriate antibiotic prescriptions on Mondays (54, 68%) vs. Fridays (60, 75%; p=0.3. *Figure 1*). Prescriptions deemed inappropriate due to antibiotic selection included 8 (10%) on Mondays and 6 (7.5%) on Fridays, with a p-value of 0.58. For prescription duration, 25 (31%) prescriptions on Mondays and 19 (24%) prescriptions on Fridays were deemed inappropriate, with a p-value of 0.29. All prescriptions met criteria for dose and dosing frequency. Overall, 28.75% of subjects received inappropriate antibiotic prescriptions for UTIs.

Use of Diagnostic Tools in the Treatment of UTIs

More subjects in the Friday cohort presented with urinary symptoms compared to the Monday cohort: 71 (89%) vs. 60 (75%), respectively (p=0.024). The distribution of dipstick results was the same between groups: 68 (85%) had positive dipstick, 11 (14%) had negative dipstick, and 1 (1%) not performed. The UA results were also similar between groups (p=0.210). On Mondays, 68 (85%) were positive, 6 (7.5%) were negative, 4 (5%) were contaminated, and 2 (2.5%) were not done. On Fridays, 72 (90%) were positive, 7 (9%) were negative, 0 (0%) were contaminated, and 1 (1%) was not done. More subjects had a UC collected on Mondays (62, 78%) than Fridays (49, 61%; p=0.03). The decision to prescribe an antibiotic was based on symptoms only in 21 (13%) subjects, dipstick in 130 (81%) subjects, UA in 132 (83%) subjects, and UC in 1 (0.5%) subject. Of the 111 (69%) subjects with UCs, only 1 (0.9%) had UC results prior to antibiotic prescription. This subject was referred to the ED by an outside provider for the purpose of culture-directed antibiotic prescription for UTI. Among the subjects, 15 (9.4%) were treated concurrently for a vaginal infection: 13 were given fluconazole for candidiasis, and 2 were treated with metronidazole—one for Bacterial Vaginosis and the other for Trichomonas. Although most subject presentations did not warrant further testing, it was frequently ordered, with 87.5% of subjects receiving UA.

Overall, 29 (18%) subjects were given antibiotics due to a positive or contaminated UA without urinary symptoms. Presenting symptoms for this group of subjects included abdominal pain, nausea, dizziness, vaginal discharge, back pain without costovertebral tenderness, and pelvic pain. Of these 29 subjects, 11 had urine cultures, all of which were negative for UTI. We also noted that 28 subjects and 24 subjects were discharged from the ED while awaiting the results of their urine dipstick and UA, respectively.

Urine Cultures, Pathogens, & Antibiotic Sensitivity

Only 43 (39%) of the collected UCs were positive for a UTI. Meanwhile, 12 (11%) of the UCs had no growth. The remaining cultures had intermediate levels of bacterial growth: 44 (40%) with CFU <10,000, 6 (5%) with 10,000-49,000 CFU, and 6 (5%) with 50,000-99,000 CFU. Of the 43 patients with CFU >100,000, 43 (100%) had urinary symptoms, 42 (97.7%) had a positive dipstick, and 40 (93%) had a positive UA. The remaining patients had 1 negative UA, 1 contaminated UA, and 1 was not done. Of the 12

patients with negative UCs, 9 (75%) had urinary symptoms, 9 (75%) had a positive dipstick, and 11 (91.7%) had a positive UA.

Out of 111 cultures, less than half grew an identifiable pathogen: 41 strains of *E. coli,* 1 *S. aureus*, 3 *S. saprophyticus*, 2 *E. aerogenes*, 2 *P. mirabilis*, and 1 *K. pneumoniae*. There were also four cultures positive for *S. agalactiae*, one of which also grew *E. coli*. The remainder were contaminated, grew normal flora, or had no growth (*Table 3*). The following resistance frequencies were recorded based on which antibiotics were tested: 4/44 (9%) nitrofurantoin, 12.44 (27%) TMP-SMX, 4/43 (9%) fluoroquinolones, and 28/45 (62%) beta-lactams. We identified two instances where UCs showed resistance to the initial prescription with no record of those patients being contacted or offered alternative treatment.

***Table 3*. Pathogen Distribution from Urine Cultures.**

Pathogen	Total Cultures* (N=111)
E. Coli	41 (36.9%)
Non *E. Coli*	13 (11.7%)
Contaminated	7 (6.3%)
Normal Flora/No Growth	50 (45%)

Legend: Reported as n (%). *n=111, inclusive of all cultures collected on Mondays and Fridays combined.

Discussion

Although we found no difference in antibiotic appropriateness between the two groups, we did identify an overall high rate of inappropriate antibiotic prescriptions for UTI. Further data analysis allowed us to examine many aspects of how physicians approach the workup, diagnosis, and treatment of patients with suspected UTIs. While 99% of our subjects received empiric antibiotics, we were struck by the high rate of inappropriate antibiotic prescriptions and the inferred lack of unifying treatment guidelines in use. This underscores the utility of localized resistance data in the form of a hospital-wide antibiogram.

Antibiotics for UTI remain one of the largest drivers of antibiotic resistance in the US. Provider attention to prescribing guidelines can help address this issue. Studies in both an Australian and American ED have shown that adherence to antibiotic guidelines is low in the case of total antibiotics and those only prescribed for UTI/pyelonephritis, respectively.[7,8] Studies in a Danish out-of-hours primary care service and an Israeli ED showed an increase in total antibiotic prescriptions and a lower rate of appropriateness over the weekend.[9,10] In our study, we found a similar rate of overall antibiotic inappropriateness; however, there was no significant difference in the proportion of appropriate antibiotic prescriptions on Mondays vs. Fridays. We propose several factors that might contribute to this difference from the literature. Studies that found an increase in inappropriate antibiotic prescriptions over weekends speculated that this difference might be related to decreased access to healthcare during weekends, leading physicians to prescribe overly broad antibiotics during this time. Compared to Danish out-of-hours ambulatory care, American EDs are open 24/7 and thus providers do not have the same temporal regard to treatment on the weekend as outpatient providers.

In comparison to the Israeli ED, which looked at all antibiotic prescriptions, our study focused on the treatment of simple cystitis in women. While there may be a discrepancy in the ED provider's access to specialists for other infections during the weekend, UTIs can be safely treated empirically, regardless of day of the week. According to the American Urological Association (AUA), there is a low risk of progression to pyelonephritis in the setting of simple cystitis; thus, empiric treatment is appropriate, but a UC should always be collected.[13,14]

Almost one-third of patients received inappropriate antibiotics in this study. This represents a population at risk of treatment failure, resistant organisms, and side effects. Navigating patient allergies to antibiotics can justify departure from prescribing guidelines, however, there are appropriate beta-lactam and non-beta-lactam options for UTI and our review of patient allergies did not identify any reasonable deviations from prescribing guidelines for this reason. Physician education regarding appropriate antibiotic choices based on IDSA guidelines in conjunction with a hospital-specific antibiogram may help improve practices. Nys et al., found that educational interventions in the ED were associated with increased guideline-concordant antibiotic prescriptions, thus enhancing quality improvement, patient safety, and antibiotic stewardship.[15]

There was no significant difference in antibiotic appropriateness between the two groups, but data analysis allowed us to examine many aspects of how physicians approach the workup, diagnosis, and treatment of patients with suspected UTIs. Signs of infection on UA such as pyuria or bacterial growth from a UC are not necessary to make a UTI diagnosis. History and physical examination can be sufficient. The probability of cystitis is greater than 90% in women with frequency and dysuria in the absence of vaginal symptoms.[16] A small portion of subjects in our study were treated for concurrent vaginal infection. Subjects who present with symptoms such as vaginal discharge or itching warrant testing beyond history and physical as the presence of vaginal symptoms lowers the probability of cystitis in these subjects to 50%.[16]

Most patients were ordered a UA. This creates a scenario where some subjects without urinary symptoms were treated for an incidentally positive or contaminated UA. According to the IDSA guidelines for asymptomatic bacteriuria, incidentally positive UA in a patient with no urinary symptoms should not be treated unless the patient is pregnant.[17] Thus, these 29 subjects likely did not require treatment for their asymptomatic bacteriuria. Some patients were discharged on treatment without a resulted urinalysis. This brings the utility of ordering these tests into question if the physicians felt confident enough in their diagnoses to discharge the subjects with antibiotics before results were available.

Only 69% of our subjects had a UC collected. In uncomplicated female patients with urinary symptoms, it is acceptable to collect a UC and treat empirically until a UC can guide treatment.[13] The AUA advocates for waiting until culture results are available before providing antibiotics given the improvement in symptoms that can be achieved with increased fluid intake, acetaminophen, phenazopyridine, and NSAIDs.[13] A culture-directed treatment approach can help prevent inappropriate antibiotic treatment in cases of negative or resistant cultures. This treatment strategy was not favored in our study, likely due to the nature of the ED, where patients are easily lost to follow-up. Furthermore, it is essential for a provider to contact patients and switch them to more appropriate therapies if culture results show pathogens resistant to empiric therapies.

Compared to the NYC outpatient antibiogram, this study had more *E. coli* cultures sensitive to TMP-SMX, nitrofurantoin, fluoroquinolones, and cephalosporins but fewer sensitive to ampicillin/sulbactam, and amoxicillin (Fig. 3). An up-to-date hospital-specific antibiogram is essential for ensuring that prescribing practices are reflective of local pathogens and patterns of resistance. At the time of our study, the ED did not have a hospital-specific antibiogram in place, thus we referenced the NYC outpatient UTI antibiogram. The rates of antibiotic sensitivity from the cultures collected in our study still differed from those published in the NYC antibiogram, which further highlights the need for a hyper-local approach. Having a thorough understanding of local pathogens and their resistance can help physicians tailor their approach to antibiotic prescription and ensure that empiric therapies are appropriate and effective.

Strengths of this study include the diversity of the population and the collection of detailed data for each subject including their presenting symptoms, diagnostic modalities, results of dipstick, urine microanalysis, and urine culture growth and antibiotic sensitivity. This study provides detail beyond the primary aim that is useful for evaluating not only appropriate vs. inappropriate prescribing but also the nuances of working up and treating patients with UTI.

Our general conclusions regarding antibiotic prescribing practices may fail to capture the overall picture since we analyzed data collected from only 2 days of the week. Furthermore, we utilized the most recent 2011 IDSA guidelines to establish appropriateness criteria. Updated guidelines are currently in development and new recommendations may reflect emerging trends in pathogen resistance and antibiotic selection that are being considered in current clinical practice but are not yet reflected in established guidelines. As we retrospectively reviewed subject records, we were offered a limited view into the prescribing physician's decision-making process. Factors influencing antibiotic selection that were not explicitly outlined in the medical record were unable to be assessed. Many subjects captured in our study were older and may have presented with comorbidities affecting management that were not captured.

While we found no significant difference in antibiotic appropriateness between Mondays and Fridays, there was a high rate of inappropriate antibiotic use in both groups. Our findings represent an important opportunity for providers and institutions to assess their antibiotic prescribing practices and use up-to-date treatment guidelines. Physicians may be unaware of their institution's antibiogram; however, a quick review of this resource can help ensure that patients receive appropriate treatment. Antibiotic stewardship is essential to avoid driving antibiotic resistance further.

Summary – Accelerating Translation

Title: Antibiotic Appropriateness on Mondays vs. Fridays: Empiric Treatment of Simple Cystitis in the Emergency Department

Main Problem to Solve: Urinary tract infections (UTIs) are incredibly common infections, especially among female patients due to differences in anatomy. Many antibiotic prescriptions are written every year for these infections. It is important for physicians to ensure that the antibiotics they select for treatment of these infections are appropriate in terms of the actual drug selected, dose, frequency, and duration. Failure to properly take these factors into consideration can lead to treatment failure and drive the development of antibiotic resistance. The Infectious Disease Society of America (IDSA) has published guidelines that physicians can follow in conjunction with a local antibiogram when selecting antibiotics.

Prior studies have shown that adherence to prescribing guidelines for urinary tract infections has been poor. There are many factors that may contribute to poor adherence to guidelines. Studies performed in Israel and Denmark showed that there were different prescribing trends on weekdays vs. weekends.

Aim of Study: The primary aim of the study was to determine whether there is a difference in the percentage of antibiotic prescriptions for the treatment of uncomplicated urinary tract infections meeting the criteria for appropriateness on Mondays vs. Fridays. Our secondary aim was to determine the most failed appropriateness criteria.

Methodology: We performed our study by reviewing the medical records of 160 adult female subjects who presented to the emergency department for treatment of an uncomplicated urinary tract infection. 80 subjects presented on Mondays and 80 on Fridays. We reviewed the symptoms that each subject presented with such as urinary urgency, frequency, pain with urination, abdominal pain, etc. We also determined which diagnostic tests were ordered by the treating physician and how the results of those tests may have been utilized to decide what treatment the subject would need. Each antibiotic that was prescribed was evaluated using the IDSA criteria for antibiotic selection, dose, frequency, and duration to determine whether it was an appropriate prescription.

Results: The demographics including age and race as well as comorbidities such as hypertension and diabetes were similar between the Monday group and the Friday group. The only significant difference between the two groups was an increased number of allergies to beta-lactam antibiotics in the Monday group. When comparing the percentage of appropriate antibiotic prescriptions between Monday and Friday, there was no difference. We did note that overall, 28.75% of subjects received an inappropriate antibiotic prescription for their infection. The most common failed criteria for appropriateness were antibiotic duration (44 inappropriate) followed by selection (14 inappropriate).

Conclusion: Though no difference in appropriate prescribing practices was found between Mondays and Fridays, we did identify a large proportion of prescriptions that failed to meet appropriateness criteria and represent an important area for improvement to prevent treatment failure and further driving of antibiotic resistance. Practitioners should utilize relevant prescribing guidelines in conjunction with their local antibiogram to inform antibiotic selection

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Original Article

The Influence of Pre-Trip Medical Spanish Education on a US-Based, Medical Student Service Trip: A Cohort Study

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Abstract

Background: International service trips are increasingly common in medical school curricula. Medical Spanish is an essential tool in healthcare interactions with Spanish-speaking patients globally. Medical Spanish classes are offered at many medical schools, but it is not known whether they increase confidence for medical students on Spanish-speaking service trips. **Methods:** A prospective cohort study of medical students attending one of two sister campuses who completed pre- and post-international medical service trip questionnaires. Data collected includes demographics, confidence, and perceived experiences. Data analyses involved a multivariable regression assuming an ordered multinomial response, FREQ procedure, and the GLIMMIX procedure on SAS STAT v.9.4. **Results:** Demographics significantly associated with confidence categories are female sex, length of Spanish education, previously having lived in a Spanish country, and experience speaking Spanish with patients. Confidence communicating in Spanish shows the highest gain in significant categories post-trip while confidence working with interpreters and feeling adequately trained to treat Hispanics showed the lowest. Participants having taken Medical Spanish before did not improve their confidence. However, participants with prior Medical Spanish experience reported significantly higher benefit from this education in that it gave them an advantage and helped them connect better with patients. **Conclusion:** Our findings reinforce the importance of language-concordance and confidence in patient interactions while demonstrating that prior Medical Spanish experience may not significantly improve confidence on a Spanish-speaking international trip, especially among non-fluent students. Spanish experience and proficiency should not be a deterring factor for students looking to go on a medical trip.

Introduction

International trips and service learning have been increasingly used as educational tools for medical students since the 1990's.[1] Benefits of global service-learning trips include exposure to healthcare disparities and increased cultural sensitivity.[1] Many medical students perceive global health opportunities as favorable due to the benefit of improving clinical knowledge,[2] communication skills,[2] and self-reported clinical or language skills.[3] Beyond clinical experience, these trips enable an understanding of global health disparities, cultural sensitivity, and empathy toward patients' backgrounds.[4] Experiences like these can instill a sense of social responsibility, inspiring students to advocate for global health equity and address healthcare inequalities upon their return.[5] While global service trips have increasingly been studied, medical student confidence and experiences relating to prior Medical Spanish have not.

Medical Spanish courses offered at Rocky Vista University differ based on campus, instructor, level of student, and even semester taken. However, they typically contain some commonalities which include the following: essential vocabulary and common phrases for communicating in medical encounters spanning the various body systems, basic grammar reviews, and cultural tips for interacting with Spanish speaking patients from diverse areas and backgrounds. Methods of teaching also vary but include online and in-person sessions centered on interactive situational practicing with partners, groups, and standardized scenarios.

As Latin America is a popular destination for American medical student global service trips, one may assume Medical Spanish education could be beneficial pre-trip. Most medical schools in the United States offer Medical Spanish courses in formal curricular or extracurricular programs; many classes have a standard course length of 10 weeks.[6] These courses are created to increase student language and cultural competence,[7] yet have little research in their efficacy for international trips. There is a general recommendation for students to take a cultural class and learn some of the host country's language prior to a trip,[8] and studies show that students in a peer-led, interactive Medical Spanish course for credit have improved self-ratings and demonstrate increased markers of Spanish fluency.[9] However, not all international medical trips offer a language course tailored to

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the population of interest, there are no standardized courses, and only a small percentage of schools provide clinical experiences abroad where students can implement their language skills.[10]

However, brief Medical Spanish education does not equate to medical interpretation competency. Often, medical service trips utilize interpreters to facilitate communication,[11] which may increase medical student comfort and confidence in the patient interview. However, if there are a few to no qualified or trained interpreters on a trip, Medical Spanish and a basic understanding of the Spanish language could provide an advantage to those students. Untrained interpreters may convey incorrect information for the patient and increase the risk of poor outcomes.[12] This may negatively impact the experience for medical students, especially those who do not speak the language of the population with which they are interacting. To our knowledge, the influence of a Medical Spanish course on medical student's confidence pre- and post-global trip has not been studied.

This project aims to explore how a prior Medical Spanish education influences the self-perceived confidence and experiences of medical students before and after taking a one-week global medical trip to a Spanish-speaking country, something that has not been encountered in the literature. These findings can be used to guide medical schools' interest in implementing Medical Spanish curriculum, provide students with options for learning Spanish, and examine the effect of Medical Spanish classes on medical student confidence.

Methods

Design

This prospective cohort study focused on medical students from Rocky Vista University (RVU) who joined global medical trips to Ecuador, the Dominican Republic, or Panama in March 2023. A pre- and post-trip survey was applied to identify changes in students' confidence and perceptions related to global health and Medical Spanish proficiency. This project has been approved by the RVU Institutional Review Board with code #2023-029.

Participants

Participants for this study were selected from the pool of medical students from Rocky Vista University who attended any of the three Spring break global medical trips. Students from Rocky Vista University are primarily white adults, between the ages of 20 and 40, and from the mountain West region. Trip locations included Ecuador, the Dominican Republic (DR), or Panama and were organized by the medical school. These trips took place over Spring break in March of 2023. All students attending the trips were contacted for participation. Inclusion criteria included medical students attending a global medical trip, participants 18 years or older, and participants who could answer the questionnaire independently (excluding interpretation, writing capabilities, or technological capacity). The exclusion criteria included non-medical students, medical students not attending a global medical trip, and participants younger than 18. Participant emails, obtained from the list of participants attending the three global trips, were the only identifying information collected. Participants received links via email to complete a Qualtrics questionnaire, both pre- and post-trip.

Questionnaire

Questionnaires were sent to participants pre-tip (one month prior to leaving) and post-trip (immediately on return with one month to complete) and were completed between February and April of 2023. The questionnaire took a total of 10-20 minutes to complete (5-10 minutes each, pre- and post-trip) and was developed in several parts.

The first survey (pre-trip) collected participant demographics and then asked about their confidence levels. In the second survey (post-trip), participants reentered demographics, answered the same confidence questions, and answered new post-trip-specific questions regarding the trip and personal opinions on the benefit of Medical Spanish courses.[2]

The demographics section was designed from multiple studies and compared to established CDC categories. Questions, adapted from previous studies, were added regarding Spanish comfort levels,[13] Medical Spanish coursework,[13] and confidence.[14–16] Included in the demographics section was the question of a medical school track, which is a specialized pathway for students to gain additional learning opportunities while in medical school (ex. a Global Health track often teaches students how to work with interpreters and diverse communities).

Data Management and Data Analysis

Data was obtained through a Qualtrics survey and compiled into an MS Excel spreadsheet for analysis. Likert score values were converted to numeric (from 1 to 5); however, these were always analyzed as ordered multinomial responses and were assessed using Spearman's Correlation - this part would establish the pairwise associations across variables. A regression model was used to identify relationships between the variables of interest, these morels were run assuming an ordered multinomial response distribution. All correlation analysis was performed using the FREQ procedure and the modeling was performed using the GLIMMIX procedure on SAS STAT v.9.4 (SAS Institute Inc. Cary, NC). Significant differences were declared at $p \leq 0.05$.

Results

Demographics, and Prior Experiences

Of the 70 participants contacted for participation, 39 and 37 responded, pre- and post-international trip, respectively; two participants were lost to follow up. There was an average participant age of 26-27 years old (*Table 1*). The cohort was represented by mostly white females of a European-American background, with a similar number of first- and second-year medical students.

Table 1. **Participant Demographics, Pre- and Post-International Trip.**

Demographics	Pre-International Trip (n = 39)
Age, mean (standard deviation)	26.94 (4.22)
No answer	1
Sex	
Female	27
Male	12
Year in Medical School	
First-year medical student	17
Second-year medical student	22
Cultural background	
African	1
Asian	1
European	26
Hispanic	2
Mixed	3
Other	5
No response	1
Racial Origin/Lineage	
Asian	1
Black	1
Hispanic	2
Mixed	1
White	34

The sample is English-dominant with a minority of Spanish-proficient speakers (*Table 2*). Participants were equally enrolled in the Global Health Track (31%) or not involved in a track (23%). Although most participants had previous Spanish education (85%; 64% with more than two years of Spanish education), fewer participants received formal Medical Spanish education (33%; 27% with fewer than six months of Medical Spanish education). Regardless of education, reported Medical Spanish levels were low (46% of those who had Medical Spanish education reported a beginner level). Most participants have interacted with Hispanic communities, both in general (92%) and clinical (85%) spheres, have visited a Spanish-speaking country (92%), have not lived in a Spanish speaking country (74%), and have experience speaking Spanish with patients (59%).

Demographics Analysis

Participant demographics and self-reported confidence were analyzed using Spearman Correlation Coefficients. Results show an overall higher number of significantly correlated categories pre-international trip (*Figure 1*, *Table 3*). Female sex was highly associated with pre-trip confidence in nearly all categories but only remained significant when explaining conditions (p=0.0099) and in overall average confidence (p=0.0178) post-trip. Some demographics showed no significant associations (age, Medical Spanish level) or associations that remained significant both in pre- and post-trip surveys (female sex, p=0.0270 and 0.0099, respectively; with confidence explaining medical conditions). The only demographics significantly associated with confidence questions in the post-trip group were sex (confidence explaining conditions, p=0.0099), average (p=0.02), length of Spanish education (confidence taking complaints in Spanish, p=0.0425), having lived in a Spanish-speaking country (confidence taking complaints, p=0.0024), feeling adequately trained to treat Hispanics (p=0.0470), and experience speaking Spanish with patients (confidence taking complaints in Spanish, p=0.0383).

Table 2. **Participant Experiences with Languages, Education, and Hispanic/Latino Communities.**

Language, Education, Community Experience	Pre-International Trip (n = 39)
Native Language	
English	35
Spanish	3
Russian	1
English Speaking Proficiency	
Not Well	0
Slightly Well	0
Well	0
Very Well	39
Spanish Speaking Proficiency	
Not Well	11
Slightly Well	19
Well	4
Very Well	5
Medical School Educational Track	
Academic Medicine and Leadership Track	5
Digital Health Track	3
Global Medicine Track	12
Long Term Care Track	0
Physician-Scientist Track	2
Rural and Wilderness Medicine Track	4
Urban Underserved Medicine Track	4
None	9
Previous Spanish Education (Class Format)	
Yes	33
No	6
Duration of Spanish Education	
<2 years	7
>2 years	25
Previous Medical Spanish Education (Class Format)	
Yes	13
No	26
Length of Time Since Medical Spanish Class	
6 months	10
2 years	1
3 years	1
4+ years	1
Medical Spanish Level (Self-Reported)	
Beginner	6
Intermediate	4
Advanced	3
Interacted with Hispanic Communities (General)	
Yes	36
No	3
Visited Spanish-Speaking Country	
Yes	36
No	3
Lived in a Spanish-Speaking Country	
Yes	10
No	29
Duration Living in Spanish-Speaking Country	
1 year	2
2 years	6
5 years	1
No response	1
Clinical Experience with Hispanic Communities	
Yes	33
No	6
Experience Speaking Spanish with Patients	
Yes	23
No	9

Table 3. **Participant Demographics & Self-Reported Total Confidence in the Pre- and Post-Trip Questionnaires.**

Coded Question	Pre-Trip Total Confidence			Post-Trip Total Confidence		
	Estimate	Error	p-value	Estimate	Error	p-value
What is your age (each additional year)?	0.041	0.049	0.4164	-0.020	0.021	0.3612
What is your medical school rank?						
OMS I	Reference		0.0523	Reference		0.8966
OMS II	0.346	0.172		-0.023	0.179	
What is your sex?						
Female	Reference		0.0176	Reference		0.0178
Male	-0.449	0.181		-0.465	0.187	
How well do you speak Spanish?						
Not well	-0.778	0.263	0.0070	-1.111	0.287	0.0023
Slightly well	-0.702	0.245		-0.741	0.291	
Well	-0.083	0.327		-0.597	0.305	
Very well	Reference			Reference		
Are you in an Academic Global Track?						
No	-0.128	0.194	0.5145	0.105	0.200	0.6025
Yes	Reference			Reference		
Have you taken Spanish classes before?						
No	-0.333	0.243	0.1789	-0.392	0.198	0.0550
Yes	Reference			Reference		
For how long have you taken Spanish classes?						
Never	-0.323	0.256	0.4099	-0.320	0.207	0.1271
Under 2 years	0.053	0.241		0.230	0.240	
Over 2 years	Reference			Reference		
Have you taken a Medical Spanish class before?						
No	-0.380	0.180	0.0418	-0.083	0.184	0.6536
Yes	Reference			Reference		
How long ago did you take the Medical Spanish class?						
6 Months	-0.467	0.305	0.0053	-0.395	0.505	0.7534
1 Year	-1.889	0.411		-0.556	0.791	
2 Years	-0.444	0.411		2.9E-15	0.646	
4 or more years	Reference			Reference		
What level of Medical Spanish did you take?						
Beginner	-0.259	0.325	0.1951	-0.852	0.334	0.0773
Intermediate	0.324	0.351		-0.528	0.366	
Advanced	Reference			Reference		
Have you had social interaction(s) with Hispanics/Latinos in the past year?						
No	-0.306	0.334	0.3661	Not assessed		-
Yes	Reference			Reference		
Have you ever visited a Spanish-speaking country?						
No	-0.145	0.337	0.6692	Not assessed		-
Yes	Reference			Reference		
Have you ever lived in a Spanish-speaking country?						
No	-0.408	0.195	0.0434	-0.426	0.217	0.0571
Yes	Reference			Reference		
Have you had clinical experience with Hispanic/Latino patients?						
No	-0.465	0.237	0.0579	-0.516	0.385	0.1894
Yes	Reference			Reference		
Have you spoken Spanish with Hispanic/Latino patients?						
No	-0.315	0.213	0.1502	-0.215	0.184	0.2523
Yes	Reference			Reference		

Self-Reported Confidence Analysis

Analyses of Spearman Correlation Coefficients among self-reported confidence questions show significant values in every category (*Table 4*). Overall, the average confidence was significant for every category in both pre- and post-trip groups. Confidence communicating in Spanish showed the highest number of gains in significance from pre- to post-trip (4/8 categories) while confidence working with interpreters and feeling adequately trained to treat Hispanics were the lowest (1/8 categories). Confidence in working with an interpreter had the highest number of losses in significance (3/8 categories).

Prior Medical Spanish Education Analysis

Separating participants by Medical Spanish shows no significant differences in experiences during and after the global trips (**Figure 2**). However, participants who took Medical Spanish rated two questions significantly higher – they felt that taking a Medical Spanish course helped them connect better with patients and

Table 4. **Participant Post Trip Self-Reported Confidence Spearman Correlation Coefficients (top) and p-values (bottom).**

	ConfComplaint	ConfCommunicating	ConfComplaintSpanish	ConfWorkInterpreter	ConfPhysEngaging	ConfAsking	ConfExplainingConditions	ConfExplainManagement	AdeqTrainedTreatHispanics	ConfAVERAGE
ConfComplaint	1	0.67554	0.18174	0.19628	0.35885	0.54833	0.21555	0.28474	0.2159	0.60276
		<0.0001	0.1161	0.0892	0.0015	<0.0001	0.0615	0.0127	0.0611	<0.0001
ConfCommunicating	0.67554	1	0.35632	0.2511	0.54868	0.49117	0.35217	0.32371	0.22613	0.66906
	<0.0001		0.0016	0.0287	<0.0001	<0.0001	0.0018	0.0043	0.0495	<0.0001
ConfComplaintSpanish	0.18174	0.35632	1	0.33008	0.35605	0.25514	0.30385	0.24827	0.39353	0.61763
	0.1161	0.0016		0.0036	0.0016	0.0261	0.0076	0.0306	0.0004	<0.0001
ConfWorkInterpreter	0.19628	0.2511	0.33008	1	0.48561	0.42392	0.45782	0.40471	0.60481	0.61082
	0.0892	0.0287	0.0036		<0.0001	0.0001	<0.0001	0.0003	<0.0001	<0.0001
ConfPhysEngaging	0.35885	0.54868	0.35605	0.48561	1	0.60335	0.56573	0.43803	0.48073	0.71636
	0.0015	<0.0001	0.0016	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
ConfAsking	0.54833	0.49117	0.25514	0.42392	0.60335	1	0.56853	0.5083	0.39651	0.7205
	<0.0001	<0.0001	0.0261	0.0001	<0.0001		<0.0001	<0.0001	0.0004	<0.0001
ConfExplainingConditions	0.21555	0.35217	0.30385	0.45782	0.56573	0.56853	1	0.66975	0.53402	0.71785
	0.0615	0.0018	0.0076	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001
ConfExplainManagement	0.28474	0.32371	0.24827	0.40471	0.43803	0.5083	0.66975	1	0.60386	0.72449
	0.0127	0.0043	0.0306	0.0003	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
AdeqTrainedTreatHispanics	0.2159	0.22613	0.39353	0.60481	0.48073	0.39651	0.53402	0.60386	1	0.70775
	0.0611	0.0495	0.0004	<0.0001	<0.0001	0.0004	<0.0001	<0.0001		<0.0001
ConfAVERAGE	0.60276	0.66906	0.61763	0.61082	0.71636	0.7205	0.71785	0.72449	0.70775	1
	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	

Legend: ConfComplaint: I am confident in taking a patient's chief complaint/medical history. ConfCommunicating: I am confident in verbally communicating with patients. ConfComplaintSpanish: I am confident in verbally communicating with patients in Spanish. ConfWorkInterpreter: I am confident in my ability to work well with an interpreter. ConfPhysEngaging: I am confident in physically engaging with patients. ConfAsking: I am confident with asking sensitive or probing questions of patients. ConfExplainingConditions: I am confident in explaining medical conditions to patients. ConfExplainManagement: I am confident in explaining medical management to patients. AdeqTrainedTreatHispanics: I feel adequately trained to manage the needs of Hispanic/Latino patients. ConfAVERAGE: Average confidence levels.

that their prior courses gave them an advantage on the trip. It must be addressed that questions varied based on participants' status of Medical Spanish – those who have taken a class responded based on if they felt the Medical Spanish enhanced their experience while those without previous experience responded based on if they think taking a Medical Spanish course would have helped.

Figure 1. **Effect of Medical Spanish Experience on Confidence and Outcomes During International Medical Trips: Gender Differences in Confidence Levels.**

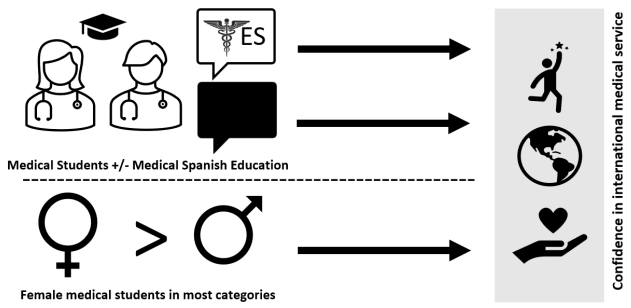
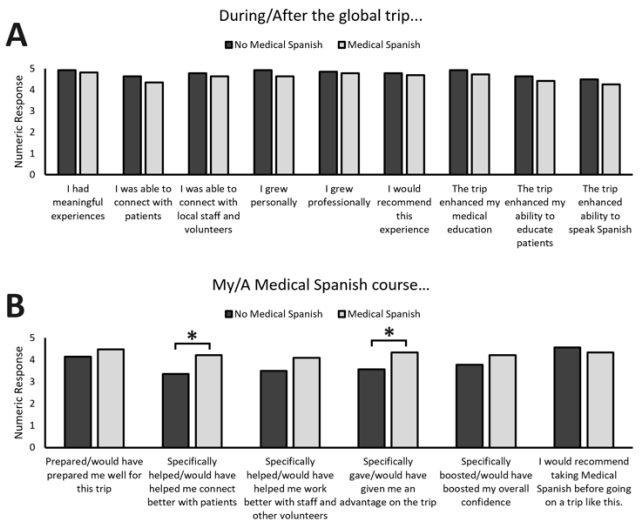


Figure 2: **Separating Participants by Medical Spanish**



Legend: Feelings/beliefs of Medical Spanish importance for a global trip, A) During and After the global trip. B) Post-Trip participant experiences and perceived benefits, based on Medical Spanish experience. Mean self-related scores rated from 1-5 (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree). Asterisk Indicates a significant association, $p < 0.05$.

Discussion

Analysis of participant demographics with responses to confidence questions demonstrates many expected and unexpected outcomes. Some expected outcomes include significant associations of confidence speaking Spanish with patients to Spanish education, living in a Spanish speaking country, and previous experience speaking Spanish with patients. These findings, while expected, reinforce the idea that previous experiences with language and patient populations of interest prove useful in language- and culture-concordant patient interactions.

Interestingly, the female sex showed many significant associations with confidence across most questions, including feeling more confident verbally communicating with patients, working with an interpreter, explaining medical conditions, and feeling adequately trained to treat Hispanics. The explanation for these findings is unknown. In fact, previous research found that female medical students demonstrate lower self-reported confidence in their abilities in medical school.[17] As far as we are aware, no studies have examined medical student confidence by sex with international educational medical trips.

Additionally, prior Medical Spanish education shows few significantly increased confidence levels in the pre-trip survey and no significant categories post-trip. While participants with prior Medical Spanish education are significantly more confident in their ability to engage physically with patients and ask sensitive questions (pre-trip survey), Medical Spanish does not significantly increase student confidence in speaking Spanish with patients, obtaining a medical history, or explaining managements and conditions to patients. These are unexpected findings – we expected that a better understanding of medical terms in Spanish would improve confidence in handling medical topics and previous research showed increased self-reported proficiency and preparedness in Spanish communication, post-Medical Spanish education, during clinical rotations.[18] These findings may be due to several factors, including the varying curricula established for Medical Spanish classes (i.e., the lack of standardized lesson plans across campuses), the duration and delivery of Medical Spanish courses (e.g., the varying timeframe for additional learning during medical school, the uncertainty of instructor qualifications, and the isolated classroom learning), the lower number of participants reporting past Medical Spanish education, and/or the reliance of medical students on interpreters to know the Spanish medical vocabulary. Additionally, while Medical Spanish takers are more confident pre-trip in these areas, the experience of working with trained interpreters during a service trip may equalize the language experiences of the participants, creating a more uniform presentation of confidence levels.

Data comparing confidence questions show additional expected and unique associations. Confidence in verbally communicating with patients in Spanish shows the highest increase in significant categories from pre- to post-surveys (4/9 categories). This is expected – the more experience one has speaking to a patient in their native language (whether directly or through an interpreter), the more likely they would be to engage with them, explain conditions and management, and feel adequately prepared to engage with this populations. However, confidence in verbal Spanish communication is the only category significantly associated with adequate training to work with the Hispanic population. These findings reinforce the importance of language-concordance to improve confidence in patient interactions, especially with preparedness to manage needs of Hispanic patients.

Unexpectedly, confidence working with an interpreter did not show many increases in category significance in the post-trip group. As the interpreter serves to bridge the communication gap between the medical student and the patient, we expected more significant categories for those well-adjusted to working with an interpreter. This expectation was based on previous research findings that indicated increased confidence among medical students when working with interpreters[11]. However, pre-trip significance in verbal Spanish communication and explaining conditions and management did not persist after the trip. These findings may be attributed to variations in interpreter experience and overall lower self-reported experience speaking Spanish with patients (65% self-reported experience in the post-trip group).

Confidence in being adequately trained to address the needs of Hispanic patients shows persistent significant categories across both survey collection times. Categories of sustained significance include working with an interpreter, physically engaging with patients, and explaining conditions and management with patients. These findings demonstrate that adequate training to work with a specific population is an important factor in determining medical student confidence in various aspects of international patient care. Additionally, confidence in training showed significance in communicating verbally in Spanish with patients post-trip, attesting to the importance of an international trip as a training experience for medical students.

The post-trip questionnaire data, separated by Medical Spanish education, demonstrates no significant differences in experiences during and after the global trips, which correlates with previously discussed findings of Medical Spanish education and confidence. It may be that the number of participants having prior experience was too small or the duration of education was too short to significantly impact the international experience. Subjectively, those participants who previously took Medical Spanish feel that this additional education prior to the trip gave them an advantage and helped them connect better with patients compared to those who did not. This data is contradictory to the findings in participant confidence, and it may be that, while subjectively it appeared to help more, objectively it did not have a significant impact. As mentioned, a conceptual explanation of our findings is also possible. Since a portion of the students were

asked to respond on their perceived value for something they do not have, there is a possibility of a conceptual discrepancy among respondents. Students who took Medical Spanish in the past responded on their perceived appreciation while students who did not take Medical Spanish in the past responded on a hypothetical basis. These two notions may not be equal or even comparable. However, because overall appreciation for the trip is high, we know that this discrepancy may not be the top determinant of their experience. These nuances could be further investigated.

Limitations

This research is limited primarily by the location of the service trips (i.e., three locations that are all Spanish-speaking) and traveling experiences of the participants while on the service trip. These may confound some of the findings since each location has its own context with its own limitations and challenges that affect the overall perception of the trip. For example, while students at the Panama trip lived in the urban city and traveled less than two hours to their location sites, students in Ecuador lived in a much more rural setting with less access to resources. These differences may have influenced how students perceived their trip and the challenges associated with their location.

Additionally, the sample size was small (n = 39 pre-trip and 37 post-trip) and consisted of participants from sister campuses of the same university. Therefore, this may not accurately represent the medical student body as a whole. However, this number is consistent with previous studies in terms of participant involvement.[19,20] Also, students may have been assigned roles on the trip where their interactions with the Spanish-speaking community was limited. For example, many students rotated at the pharmacy in 2-hour shifts where they did not interact with patients but filled medications ordered by providers. This may have changed their perceived experience by decreasing their total patient exposure time, although the trip leaders rotated students through these positions to vary experiences and no student worked more than one shift.

Future Research

Although research on global medical trips for medical students is increasing, there is still a dearth of knowledge. Future research can investigate the effect of sex on medical student confidence in international trips and variations in Medical Spanish education on medical student confidence. As far as we are aware, no studies have investigated the influence of sex on confidence for international trips, although, as mentioned, prior studies show lower confidence among female medical students in medical school.[17] More research is needed to understand the "why" behind this variation – is it a social phenomenon? Can males achieve the same increases in confidence? Etcetera.

Additionally, increasing the number of countries, participants, and medical schools involved in the survey may yield results that are widely applicable across populations, students, and educational programs. Although participant participation is similar to other studies,[19,20] limiting the scope of the data to three Spanish-speaking countries, 39 medical students, and two sister campuses does not yield the generalizability of results desired. If further research with higher numbers of the above categories finds similar (or different) findings, we may be able to make more accurate decisions on the efficacy of Medical Spanish classes and explore/invest in other methods of enhancing international medical experiences for medical students.

Finally, the subjective experiences of students who have and have not taken Medical Spanish can be investigated to explore the nuances of perceived versus actual confidence. Qualitative data is increasingly useful in healthcare research[21] and its collection from participants would provide insight into the students' own written perspectives of their experiences; a quantitative-only description of the experiences does not accurately represent the entirety of the medical student experience and may hint at future directions that medical students desire for improved education.

Summary – Accelerating Translation

This project aims to explore how prior Medical Spanish education influences the self-perceived confidence and experiences of medical students before and after taking a one-week global medical trip to a Spanish-speaking country. Key findings include 1) significant associations with confidence in verbally communicating with patients in Spanish, 2) significant associations with confidence being adequately trained to address the needs of Hispanic patients, 3) higher confidence levels of female participants across most categories, 4) no significant increase in student confidence with prior Medical Spanish in various categories, and 5) no significant differences in experiences during and after the global trips, regardless of previous Medical Spanish education. These findings reinforce the importance of previous, non-medical language experiences, patient population exposure, language- and culture-concordant patient interactions, and adequate training to work with Hispanic populations. Additionally, we find that lacking Medical Spanish education should not discourage medical students from participating in a Spanish-language medical trip. As such, school educators can encourage holistic exposure to medical and non-medical practices (to increase student confidence on international trips) and recommend Spanish-dominant, international medical service trips to students without prior Medical Spanish backgrounds (knowing that their confidence before and after will resemble those with prior experience).

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Author Contributions

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Original Article

Prevalence and Burden of Disorders of Gut-Brain Interaction Among UK Medical Students

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Abstract

Background: Disorders of Gut-Brain Interaction (DGBI) affect 40% of the general population and are associated with substantial health impairment. Medical students reportedly have among the highest rates of DGBI, although data is mainly from Asia and Africa. We addressed this issue within a UK-based university. **Methods:** An online survey was completed by 378 of 1621 medical students. Demographics, medical history, and gastrointestinal symptoms were collected, the latter using a modified Rome IV questionnaire to determine the presence of DGBI symptoms over the last 3 months. Additional validated questionnaires screened for somatization, psychological distress, eating disorders, quality of life, and burnout. **Results:** DGBI were present in 76% (n=289/378), of which two-of-three had multiple affected sites. The most frequent DGBI were gastroduodenal (57%), followed by bowel (49%), esophageal (29%), and anorectal (26%) disorders. Approximately 50% of students with DGBI experienced painful gastrointestinal symptoms at least one day/week. Students with DGBI, compared to those without, had significantly higher anxiety and depression scores, increased somatic symptom reporting, reduced mental and physical quality of life, poorer eating habits, and more frequent medication use (p-values, all<0.05). They were also at significantly higher risk of burnout, through study exhaustion and disengagement. The greatest health impairment was seen in those with multiple, painful, DGBI. Only 23% and 5% of students with DGBI had consulted a primary care provider and gastroenterologist, respectively. **Conclusion:** Medical students commonly experience DGBI and associated health burden, yet infrequently seek help. Greater awareness may lead to increased support, improved health, and better study engagement.

Introduction

Disorders of Gut Brain Interaction (DGBI), formerly known as functional gastrointestinal disorders, are defined as chronic gastrointestinal symptoms in the absence of organic gastrointestinal disease to explain the symptoms (i.e. no evidence of infection, inflammatory diseases, ulcers, or cancer).[1] The pathophysiology of DGBI is not fully known but can be best understood based on the biopsychosocial model of illness, and relates to any combination of visceral hypersensitivity, motility disturbances, alterations in mucosal and immune function, gut microbiota, and central nervous system processing.[1] Whilst irritable bowel syndrome (IBS) and functional dyspepsia are the most commonly recognized DGBI, there are a total of 22 DGBI which can arise from any of the following six anatomical regions within the gastrointestinal (GI) tract; the esophagus, gastroduodenum, bowel, biliary, centrally mediated, and anorectum.

A recent global epidemiological study reported that over 40% of adults fulfill symptom-based criteria for a DGBI and incur considerable physical and mental health impairment, high healthcare utilization, decreased work productivity, and reduced quality of life.[2] Furthermore, one-in-three individuals with DGBI in the general population have multiple anatomical regions affected, which is associated with even greater health impairment.[3] Finally, eating disorders are common in patients with DGBI attending tertiary care medical centers, although their prevalence among people with DGBI within the community is unknown.[4]

There is data to suggest that medical students have amongst the highest rates of DGBI, with prevalence rates exceeding those reported within the general population (*Supplementary Table*). This, in part, may be explained by medical students across the globe experiencing high levels of stress, anxiety, depression, and burnout,[5,6] which could lead to gut symptoms through the bi-directional communication between the brain-gut axis. As shown in *Supplementary Table* the prevalence of IBS in medical students ranges from 4.8-61.7% (compared to 3.8% in the global adult population),[2] while the prevalence of functional dyspepsia ranges from 0.66-34.8% (compared to 7.2% globally).[2] However, most of this literature comes from Asia and Africa, and predominantly focuses on IBS and functional dyspepsia as opposed to all other DGBI, and with limited information on the general overall burden of DGBI amongst this cohort. As such, the present study aimed to determine the prevalence and burden of DGBI amongst medical students in the United Kingdom (UK).

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Methods

Following internal university assessment and ethical approval (ref 044371), this cross-sectional study was conducted at the University of Sheffield medical school during the academic year 2022-2023. Individuals currently enrolled within the medical school were invited in November 2022 to complete an online survey (using Google forms platform) regarding general physical and mental health. Completing and submitting the online survey was deemed as informed consent. The study was anonymous as no personal identification details were recorded (i.e., name, date of birth, university registration number, e-mail address). No financial incentives were provided.

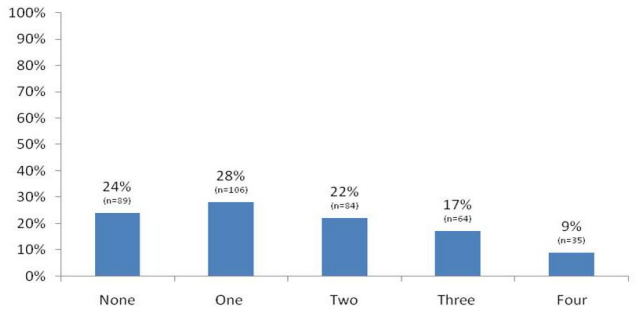
The following questionnaires were completed:

1. Demographics – age, gender, ethnicity, sexual orientation, year of study, and any substance use (i.e., tobacco, cannabis, alcohol, illicit drugs).
2. Medical history - this included any previous organic gastrointestinal diagnosis (i.e., inflammatory bowel disease, eosinophilic esophagitis, coeliac disease, gastrointestinal cancers), anxiety, depression, eating disorders, COVID-19 infection, and gastrointestinal surgery.

   Individuals were also asked whether they took any of the following medications more than once per week – laxatives, anti-diarrheal, antiemetics, antispasmodics, acid-suppressive drugs, non-opioid/opioid painkillers, and medication for anxiety and/or depression.
3. Healthcare utilization – individuals were asked if they had sought healthcare from their primary health care provider, a mental health specialist, or a gastroenterologist since starting at university.
4. Modified version of the Rome IV diagnostic questionnaire for DGBI[7] – in the interest of minimizing this 86 point questionnaire, we selected 17 questions that specifically enquired for the presence of the following gastrointestinal symptoms: a) feeling of a lump or something stuck in the throat, b) pain in the middle of your chest, c) heartburn, d) food sticking in your chest after swallowing or going down slowly, e) felt so full after a regular sized meal, f) unable to finish a regular sized meal because you felt too full, g) pain or burning in your upper abdomen, h) nausea, i) vomiting, j) food coming back up into your mouth after you swallowed it, k) belching, l) pain in your lower abdomen, m) bloating or noticed your belly looks unusually large, n) constipation (i.e. hard stools or going several days without having a bowel movement), o) diarrhea (i.e. watery mushy stools, or have many bowel movements in a day), p) accidental leakage of stool, and q) aching, pain or pressure in the rectum when you were not having a bowel movement.
   - Individuals were asked to record how frequently they experienced the above symptoms in the last 3 months, with the following options available - never, less than 2-3 days a month, 1 day a week, 2-3 days a week, most days, everyday, or multiple times per day.

     For DGBI to be considered then, in most instances, the relevant symptoms had to be present at least 1 day per week e.g., for functional dyspepsia, nausea and vomiting syndromes, IBS (abdominal pain and altered bowel habit), and functional bloating. However, for the other DGBI to be considered, the symptom frequencies were at least 1 day per month for functional anorectal disorders, at least 2-3 days per month for fecal incontinence or rumination, at least 2-3 days per week for functional chest pain/heartburn/constipation/ diarrhea, and most days for belching.
   - Based on these answers - and in the absence of known organic GI disease - we were able to consider 17 DGBI across 4 anatomical regions (esophagus, gastroduodenal, bowel and anorectal), with gallbladder disorders and centrally mediated disorders of gastrointestinal pain excluded due to their rarity in epidemiological studies.[2] In addition, some umbrella disorders were used instead of individual disorders, e.g. functional nausea and vomiting disorders was used to encompass chronic nausea vomiting syndrome, cyclic vomiting syndrome, and cannabinoid hyperemesis syndrome.
   - We further sub-divided DGBI into painful or non-painful, based on whether individuals experienced painful symptoms from any gastrointestinal organ domain at least one day per week.
5. SCOFF questionnaire[8] – this is a validated 5-question self-report screening tool for eating disorders, frequently used within primary care in the UK.[9] The validated cut-off of two or more positive responses was used to determine the presence of an eating disorder.[9]
6. Patient Health Questionnaire (PHQ)-12 somatization score[10] – this validated questionnaire asks how "bothered" individuals have been by twelve non-GI somatic symptoms over the past 4 weeks. Each answer ranges from 0 (not bothered at all) to 2 (bothered a lot). Thus, a higher score indicates a higher level of somatization, with the combined total ranging from 0-24. In addition, the number of affected somatic sites can be assessed, with a range of 0-12.
7. Hospital Anxiety and Depression Scale (HADS) questionnaire[11] - this validated questionnaire comprises 14 questions, with the results subsequently divided into two subscales for anxiety and depression score. A score of 11 or more in each subscale was considered to be evidence of clinical anxiety or depression, respectively.[11]
8. Short Form (SF)-8 questionnaire[12] – this validated 8-item questionnaire is used in epidemiological studies to assess general health related quality of life (QOL) over the past 4 weeks. The 8 items can be aggregated to form a physical component score (PCS) and mental component score (MCS), ranging from 0-100. A low MCS or PCS represents poorer QOL, whilst a high score represents better QOL.

Figure 1. **The Number of Anatomical Regions Affected by Disorders of Gut Brain Interaction (DGBI) Amongst 378 Medical Students.**



9. Oldenburg Burnout Inventory (OLBI)[13] – this validated questionnaire assesses burnout, specifically in relation to work, across the two dimensions of OLBI-exhaustion and OLBI-disengagement. A higher score indicates a higher rate of burnout, with each subscale score ranging from 8-32. The questionnaire was adapted to make it more applicable to this study population, i.e., each time the word "work" appears in the questionnaire it was replaced by "work/ study".

Statistical Analysis

Categorical variables were summarized using descriptive statistics and compared using chi-squared test, or Fisher's exact test, as necessary. In addition, odds ratios (OR) with 95% confidence intervals (CI) were calculated for some categorical variables between those with and without symptoms compatible with DGBI, and separately between those with painful and non-painful DGBIs. Continuous variables were summarized using mean and standard deviation, with between-group comparison obtained using an independent samples t-test. Finally, bivariate correlation was used to examine the strength and direction of the relationship between continuous variables.

Statistical analysis was conducted using IBM SPSS version 28 (SPSS Inc, Chicago, Illinois, United States). The level of significant was set at a p-value of <0.05.

Results

Prevalence of DGBI

The online survey was disseminated to 1621 medical students of whom 378 completed, giving a response rate of 23%. The mean age of respondents was 21 years (SD 2.5), with 73% being female, and 70% of white ethnicity.

The prevalence of having at least one DGBI over the last 3 months amongst medical student respondents was 76% (n=289), with almost half affected by DGBI across multiple anatomical regions (*see* ***Figure 1***). Prevalence of all individual DGBIs studied are displayed in ***Table 1***. Amongst the entire cohort, the most frequently met diagnostic criteria for DGBI were gastroduodenal (n=214, 57%), followed by bowel (n=184, 49%), esophageal (n=110, 29%), and anorectal (n=98, 26%) disorders. IBS and functional dyspepsia affected 17% and 28% of the cohort respectively, while other common DGBI included functional nausea and vomiting (37%), belching disorders (26%), anorectal disorders (25%), functional bloating (23%), functional chest pain (16%), globus (15%), and functional dysphagia (11%).

Table 1. **Prevalence of Specific Disorders of Gut Brain Interaction (DGBI) Diagnoses Amongst Medical Students (n=378).**

Anatomical Region	Disorder of Gut-Brain Interaction	n (%)
Esophageal (n=110, 29%)	Globus	57 (15%)
	Functional chest pain	61 (16%)
	Functional heartburn	35 (9%)
	Functional dysphagia	40 (11%)
Gastroduodenal (n=214, 57%)	Functional dyspepsia (FD)	106 (28%)
	Post prandial distress syndrome (PDS)	78 (21%)
	Epigastric pain syndrome (EPS)	45 (12%)
	Functional nausea and vomiting disorders	141 (37%)
	Rumination syndrome	26 (7%)
	Belching disorders	98 (26%)
Bowel (n=184, 49%)	Irritable bowel syndrome (IBS)	63 (17%)
	Functional constipation	16 (4%)
	Functional diarrhea	14 (4%)
	Unspecified bowel disorder	3 (1%)
	Functional bloating	88 (23%)
Anorectal (n=98, 26%)	Fecal incontinence	12 (3%)
	Functional anorectal disorders	93 (25%)

Note: Functional nausea and vomiting disorders includes chronic nausea vomiting syndrome, cyclic vomiting syndrome, cannabinoid hyperemesis syndrome. Functional anorectal pain disorders include levator ani syndrome and proctalgia fugax.

Comparison of Medical Students with DGBI vs. No-DGBI

Table 2 compares the DGBI cohort against those with no-DGBI. There was no difference in mean age or year of study, including when stratified into pre-clinical and clinical students. However, medical students with DGBI were over twice as likely to be female than those without (77% vs. 61%, OR 2.1, 95% CI 1.3-3.6). There was no difference between the two cohorts regarding self-reported smoking status, alcohol use or illicit drug use. However, a high number of individuals reported consuming alcohol in both groups (over 70%), although no quantification regarding frequency or amount of alcohol was obtained.

Medical students with DGBI were significantly more likely than those without DGBI to have previously been diagnosed with anxiety (28% vs. 12%, p=0.003) and depression (23% vs. 10%, p=0.01). They were also significantly more likely to use at least one type of GI medication (15% vs. 1%, p<0.001), and non-opioid painkillers (30% vs. 9%, p<0.001), compared to those without DGBI. Whilst those with DGBI were more likely to have sought healthcare at university for their gastrointestinal symptoms, this was still relatively low, with only 23% consulting a primary care provider, 33% a mental health specialist, and 5% a gastroenterologist.

In accordance with the SCOFF questionnaire, medical students with DGBI were almost three times more likely than those without DGBI to have an eating disorder (30% vs. 14%, p=0.002). They also had significantly worse mean somatization scores (6.3 vs. 3.5, p<0.001), more somatic sites affected (4.9 vs. 2.9, p<0.001), and worse mean anxiety (9.0 vs. 6.5, p<0.001) and depression (4.2 vs. 2.9, p<0.002) scores. Finally, those with DGBI reported significantly worse quality of life and higher levels of burnout, regarding both study disengagement and exhaustion, than those without DGBI.

Table 2. **Characteristics of Medical Students with and without Rome IV Disorders of Gut Brain Interaction (DGBI).**

Study Variables	Symptoms not compatible with a Rome IV DGBI (n=89)	Symptoms compatible with Rome IV DGBI (n=289)	p-value	Odds ratio (95% CI)
Demographics				
Mean age in years (SD)	20.6 (2.5)	20.8 (2.5)	0.69	--
Mean year of study (SD)	2.6 (1.5)	2.6 (1.5)	0.93	--
Pre-clinical	47 (53%)	167 (58%)	0.41	1.2 (0.8-2.0)
Female	54 (61%)	222 (77%)	0.003	2.1 (1.3-3.6)
Heterosexual	77 (87%)	201 (70%)	0.002	0.4 (0.2-0.7)
White	53 (60%)	212 (73%)	0.013	1.9 (1.1-3.1)
Drink Alcohol	66 (74%)	239 (83%)	0.074	1.7 (0.9-2.9)
Smoke Tobacco	5 (6%)	14 (5%)	0.78	0.9 (0.3-2.4)
Use Cannabis/ Marijuana	5 (6%)	17 (6%)	0.93	1.1 (0.4-2.9)
Use other illicit drugs	2 (2%)	16 (6%)	0.26	2.5 (0.6-11.3)
Past medical history				
Anxiety	11 (12%)	81 (28%)	0.003	2.8 (1.4-5.5)
Depression	9 (10%)	65 (23%)	0.01	2.6 (1.2-5.4)
Eating disorder	3 (3%)	18 (6%)	0.43	1.9 (0.5-6.6)
COVID-19 infection	45 (51%)	197 (68%)	0.002	2.1 (1.3-3.4)
Any abdominal surgery	7 (8%)	20 (7%)	0.76	0.9 (0.4-2.1)
Medication use				
Any GI medication	1 (1%)	42 (15%)	<0.001	15.0 (2.0-110.3)
Constipation	0 (0%)	9 (3%)	0.12	0.8 (0.7-0.8)
Diarrhea	0 (0%)	9 (3%)	0.12	0.8 (0.7-0.8)
Nausea	0 (0%)	7 (2%)	0.21	0.8 (0.7-0.8)
Antispasmodics	0 (0%)	9 (3%)	0.12	0.8 (0.7-0.8)
Stomach acid	1 (1%)	24 (8%)	0.02	8.0 (1.1-59.8)
Non-opioid painkillers	8 (9%)	87 (30%)	<0.001	4.4 (2.0-9.4)
Opioid painkillers	0 (0%)	3 (1%)	1	0.8 (0.7-0.8)
Anxiolytics/ antidepressants	6 (7%)	41 (14%)	0.06	2.3 (0.9-5.6)
Healthcare utilization				
Primary care	8 (9%)	66 (23%)	0.004	3.0 (1.4-6.5)
Gastroenterologist	5 (6%)	15 (5%)	0.79	0.9 (0.3-2.6)
Mental health	19 (21%)	98 (34%)	0.03	1.9 (1.1-3.3)
Burden				
Eating Disorder (SCOFF ≥2)	12 (14%)	87 (30%)	0.002	2.8 (1.4-5.3)
HADS-Anxiety ≥ 11	14 (16%)	101 (35%)	<0.001	2.9 (1.5-5.3)
HADS-Depression ≥ 11	3 (3%)	21 (7%)	0.19	2.2 (0.7-7.7)
Burden, Mean (SD)				
PHQ-12 score	3.5 (2.9)	6.3 (3.6)	<0.001	--
Number of PHQ-12 sites	2.9 (2.1)	4.9 (2.5)	<0.001	--
SF-8 PCS QOL	83.1 (1.45)	73.8 (18.5)	<0.001	--
SF-8 MCS QOL	72.1 (21.1)	61.9 (20.0)	<0.001	--
HADS-Anxiety score	6.5 (4.0)	9.0 (4.3)	<0.001	--
HADS-Depression score	2.9 (3.1)	4.2 (3.5)	<0.002	--
OLBI-Disengagement score	17.0 (4.0)	18.2 (4.0)	0.01	--
OLBI-Exhaustion score	19.3 (4.1)	21.5 (4.1)	<0.001	--

Legend: N (%) unless otherwise indicated.

Figure 2. **Venn Diagram Showing the Overlap Between Anatomical Regions in Those Medical Students with Disorders of Gut Brain Interaction (DGBI) (n=289).**

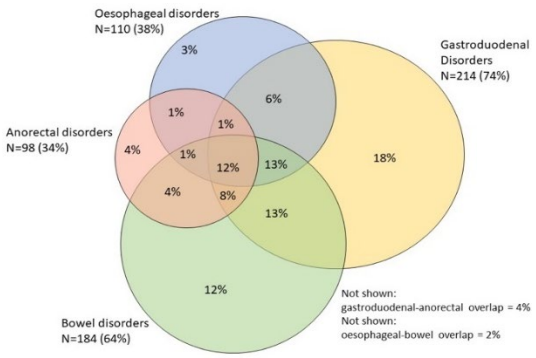


Table 3. **Relationship Between Psychological Distress and Number of Anatomical Sites Affected by DGBIs.**

Variable	Number of anatomical sites affected by DGBIs	
	Correlation	p value
SF-8 MCS QOL	-0.397	<0.001
SF-8 PCS QOL	-0.389	<0.001
OLBI-Disengagement score	0.245	<0.001
OLBI-Exhaustion score	0.314	<0.001
PHQ-12 somatic score	0.528	<0.001
Number of PHQ-12 sites	0.526	<0.001
HADS-Anxiety score	0.461	<0.001
HADS-Depression score	0.293	<0.001

Table 4. **Comparison Between Medical Students with and without Painful Disorders of Gut Brain Interaction (DGBI).**

Cohort with DGBI (n=289)	Non-painful DGBIs (n=142)	Painful DGBIs (n=147)	p-value	Odds ratio(95% CI)	
Demographics					
Mean age in years (SD)	20.5 (2.6)	21.0 (2.4)	0.06	--	
Mean year of study (SD)	2.4 (1.6)	2.8 (1.4)	0.05	--	
Pre-clinical	87 (61%)	80 (54%)	0.24	0.8 (0.5-1.2)	
Female	99 (70%)	123 (84%)	0.005	2.2 (1.3-3.9)	
Heterosexual	105 (74%)	96 (65%)	0.11	0.7 (0.4-1.1)	
White	96 (68%)	116 (79%)	0.03	2.8 (1.1-3.0)	
Past medical history					
Anxiety	23 (16%)	58 (40%)	<0.001	3.4 (1.9-5.9)	
Depression	15 (11%)	50 (34%)	<0.001	4.4 (2.3-8.2)	
Eating disorder	3 (2%)	15 (10%)	0.004	5.2 (1.5-18.6)	
COVID-19 Infection	95 (67%)	102 (69%)	0.65	1.1 (0.7-1.8)	
Any abdominal surgery	9 (6%)	11 (8%)	0.70	1.2 (0.5-3.0)	
Medication use					
Any I medication	12 (9%)	30 (20%)	0.004	2.8 (1.4-5.7)	
Constipation	4 (3%)	5 (3%)	1.00	1.2 (0.3-4.6)	
Diarrhea	3 (2%)	6 (4%)	0.50	2.0 (0.5-8.0)	
Nausea	2 (1%)	5 (3%)	0.45	2.5 (0.5-12.9)	
Antispasmodics	1 (1%)	8 (5%)	0.04	8.1 (1.0-65.7)	
Stomach acid	6 (4%)	18 (12%)	0.01	3.2 (1.2-8.2)	
Non-opioid painkillers	34 (24%)	53 (36%)	0.03	1.8 (1.1-3.0)	
Opioid painkillers	1 (1%)	2 (1%)	1.00	1.9 (0.2-21.7)	
Anxiolytic/antidepressants	10 (7%)	31 (21%)	<0.001	3.5 (1.7-7.5)	
Healthcare utilization at university					
Primary care	17 (12%)	49 (33%)	<0.001	3.7 (2.0-6.8)	
Gastroenterologist	4 (3%)	11 (8%)	0.07	2.8 (0.9-9.0)	
Mental health	30 (20%)	68 (46%)	<0.001	3.2 (1.9-5.4)	
Burden of DGBIs					
Eating Disorder (SCOFF ≥2)	33 (23%)	54 (37%)	0.01	1.9 (1.1-3.2)	
HADS-Anxiety ≥ 11	31 (22%)	70 (48%)	<0.001	3.3 (1.9-5.4)	
HADS-Depression ≥ 11	6 (4%)	15 (10%)	0.05	2.6 (1.0-6.8)	
Burden of DGBIs:				Number of painful DGBI sites	
Mean (SD)				Correlation	P value
PHQ-12 somatic score	4.9 (2.9)	7.5 (3.8)	<0.001	0.446	<0.001
Number of PHQ-12 sites	4.0 (2.2)	5.8 (2.5)	<0.001	0.432	<0.001
SF-8 PCS QOL	79.8 (14.6)	68.1 (20.0)	<0.001	-0.322	<0.001
SF-8 MCS QOL	69.1 (17.6)	55.0 (19.8)	<0.001	-0.348	<0.001
HADS-Anxiety score	7.7 (3.9)	10.3 (4.3)	<0.001	0.414	<0.001
HADS-Depression score	3.6 (3.1)	4.8 (3.7)	0.003	0.245	<0.001
OLBI-Disengagement score	17.6 (3.7)	18.8 (4.1)	0.01	0.184	0.002
OLBI-Exhaustion score	21.0 (4.1)	22.1 (4.0)	0.02	0.192	<0.001

Legend: N (%) unless otherwise indicated.

Multiple DGBI

Amongst those with at least one DGBI, almost 2-in-3 (63%) of individuals had multiple affected anatomical sites, and 12% had all 4 anatomical regions affected. The possible overlaps between anatomical regions are displayed **in** *Figure 2*, whilst *Table 3* demonstrates the correlation between increasing number of DGBIs and worsening quality of life (i.e., negative correlation), and greater burnout, somatization, anxiety, and depression scores (i.e., positive correlation).

Comparison of Painful vs. Non-Painful DGBI

Table 4 compares the painful DGBI cohort against those with non-painful DGBI. We defined painful DGBI as having pain at least one day per week from any anatomical GI region; this case definition was met by 51% (n=147/289) of those with DGBI. Amongst those with painful DGBI, 58% (n=85) had one painful anatomical site, 27% (n=39) had two, 14% (n=20) had three and 2% (n=3) had painful DGBI across all 4 anatomical sites.

Individuals with painful DGBIs, and in particular those with multiple painful sites, were significantly more likely to have higher levels of anxiety, depression, somatization, eating disorders, burnout, and reduced quality of life. They also reported significantly higher use of anti-spasmodic medications, acid suppressive drugs and non-opioid pain killers. While those with painful DGBI were significantly more likely to seek a healthcare provider, this was still relatively infrequent with 33% having seen a primary care provider, 46% a mental health specialist, and only 8% having seen a gastroenterologist.

Discussion

To our knowledge, this is the first study to examine the prevalence and burden of DGBI amongst UK medical students. We found that 76% of UK medical students who completed this anonymous online survey had symptoms compatible with a Rome IV DGBI, which is much higher than the reported prevalence of 37% amongst the UK general adult population.[2] Furthermore, almost two-thirds of medical students with DGBI had multiple affected anatomical sites, and over half experienced painful gastrointestinal symptoms at least once per week. The presence of DGBI was associated with psychological distress, somatic symptom reporting, eating disorders, burnout, and reduced quality of life, yet medical students infrequently seek help for their symptoms, even when painful.

The general health burden of DGBI as seen in medical students aligns with that reported for the general population, although it appears to be of a greater severity. For example, over 50% of medical students with DGBI experience frequent painful symptoms - which in itself correlated with increased physical and mental distress – in comparison to 26% of UK adults with DGBI having painful DGBI.[14] Many of the risk factors for painful DGBI (e.g. female sex, gastroenteritis, abuse, stress, poor sleep, obesity, psychological disorders, and somatic symptoms) were explored and apparent within our medical student cohort.[15] Protective factors against painful DGBI in adults include social support and optimism,[15] yet rates of healthcare utilization or support for DGBI symptoms were low amongst medical students. For instance, less than a quarter of those with DGBI, and only a third of those with painful DGBI, had consulted a primary care provider regarding their GI symptoms. This supports previous findings that medical students have low rates of healthcare consultation for DGBI symptoms[16-18] although reasons for this remain unclear. Possible fear of repercussions regarding training progression and general stigma surrounding ill-health can prevent medical students from seeking help for their physical and mental health.[19,20] DGBI are also under-taught within medical education which might lead to a lack of awareness of these disorders amongst medical students.[21]

A high proportion of medical students with DGBI had associated psychological distress, burnout (i.e., study exhaustion and disengagement) and eating disorders. These factors have been reported in DGBI within the general population, but are arguably more prevalent within medical students given the extensive demands placed upon them from a relatively young age.[5,6] Medicine has traditionally been considered as a highly demanding and stressful course, with a competitive admission process followed by frequent and rigorous examinations over a 5 to 6 year period.[5,6] Moreover, students face additional pressures to conduct research, publish in scientific journals, teach, build management and leadership skills and win prizes in order to choose the specialty of their choice. Additional stressors over this time-period include relationships, financial difficulties and housing issues, all of which have been heightened by the COVID-19 pandemic.[5,6] Hence, it is not surprising that high levels of psychiatric illness, burnout and substance use are being reported by medical students across the globe.[5,6] A recent study found that 29% of medical students respondents were given a mental health diagnosis whilst at medical school, and 82% could be classified as 'disengaged' and 85% 'exhausted' using the Oldenburg Burnout Scale.[22] In England and Wales, over 80% of medical students have high levels of burnout,[22,23] whilst a global systematic review and meta-analysis reported that medical students have a higher burden of burnout than age-matched peers.[24] An association between burnout and IBS has been reported,[25,26] which our study builds upon by highlighting the relationship between burnout and overall DGBI amongst medical students. Similarly, there is association between eating disorders and DGBI,[4] and a global systematic review found medical students have higher rates of eating disorders than the general adult population.[27] In summary, the combination of DGBI and its associated health impairment may lead to reduced academic performance, increased dropout, and potential long-term consequences for patient safety. Medical schools should therefore become familiar with the high prevalence and burden of DGBI, openly raise awareness of these conditions, and sign-post students to seek help via appropriate channels. Future research studies should investigate interventions suggested for DGBI but specifically within medical students (e.g., diet, lifestyle, exercise, antispasmodics, psychological support etc.). Hopefully, these measures will not just positively impact upon medical students as they progress to doctors, but also for patients and the healthcare system.

There are limitations to this study. First, the cross-sectional study design identifying an association between DGBI and other co-morbidities does not infer causality. Second, it was conducted at only one university, and may not be representative of medical students at other UK institutions. Moving forward, it raises interest to conduct further studies of DGBI in medical students elsewhere, but also among junior doctors in whom a high prevalence of stress and burnout, leading to career disengagement and reduced patient quality of care, is

increasingly being recognised.[28] Third, there was no comparative control group, either from another course within the university or the general population. However, the prevalence of DGBI within medical students reported in this UK study, and that from India, far exceed those reported within their respective general populations.[2,29] The study from India also reported DGBI to be significantly more common in medical students than its humanities students.[29] Fourth, the low response rate of 23% (n=378/1621) may mean that the reported prevalence of DGBI as 76% (n=289/378) is not reflective of the prevalence of DGBI amongst the entire cohort of medical students at the university. However, we aimed to reduce potential selection bias by promoting the study as an evaluation of physical and mental health, as opposed to specifically mentioning gastrointestinal symptoms. Nevertheless, the results could be extrapolated to calculate the minimum possible prevalence of DGBI for the entire population of medical students at the university, i.e., if all the non-responders were presumed to lack any symptoms compatible with DGBI, the minimum prevalence of DGBI in this cohort would be 18% (n=289/1621). This equates to almost 1-in-5 medical students and still suggests a high prevalence. Fifth, the predominance responders to the survey were female (73%), although the female to male ratio in the medical school is almost 1:1, again adding to potential selection bias. Sixth, we did not use the Rome IV diagnostic questionnaire in its entirety, as it encompasses 86 questions with a complex scoring algorithm, but rather selected 17 pertinent questions that captured the spectrum of gastrointestinal symptoms followed by using clinically relevant frequency cut-offs to determine the presence of DGBI and painful DGBI. Further, the Rome diagnostic criteria require symptoms to be active over the last 3 months but to have started at least 6 months prior. The latter we did not enquire for and might therefore have over-estimated the prevalence of Rome IV DGBI, although the frequent presence of symptoms, particularly those that are painful, is nevertheless of concern. Seventh, the use of an anonymous study questionnaire meant that results could not be corroborated through clinical notes, nor could investigations be done. As such, some of the reported symptoms may have been due to underlying organic disease, although this is unlikely in individuals of a relatively young age reporting chronic symptoms. Finally, the most common DGBI in this study was functional nausea and vomiting disorders, with a prevalence of 37%, which is much higher than the global prevalence of around 1.0% in the 18-39 age group.[2] This marked difference may be due to a high rate of alcohol use in the study population, with 78% of medical students drinking alcohol, although we did not quantify individuals' drinking habits. Previous research suggests that UK medical students have high rates of alcohol misuse.[30] Therefore, for some individuals in this study, the symptoms of functional nausea and vomiting disorders may have instead been caused by alcohol consumption.

In conclusion, DGBI are common and burdensome among UK medical students, yet they infrequently seek help for their symptoms, even when painful. Increased awareness of DGBI amongst medical students may lead to improved support, health status, and study engagement.

Summary – Accelerating Translation

Disorders of gut-brain interaction (DGBI) are chronic gastrointestinal symptoms that occur in the absence of organic disease. In this UK based study, the prevalence of symptoms compatible with DGBI amongst medical students at Sheffield University was 76% of whom two-of-three had multiple affected anatomical sites. Approximately 50% of medical students reported experiencing pain from a GI region at least once per week. The presence of DGBI (in particular, multiple painful DGBI) was associated with anxiety, depression, somatization, eating disorders, reduced quality of life, and burnout through study disengagement and exhaustion. Medical students with DGBI had low healthcare utilization relative to their symptom burden. Our findings will help increase awareness of DGBI amongst medical students and may lead to improved support, health status, and study engagement.

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Supplementary Material

Supplementary Table 1. **Prevalence of Disorders of Gut Brain Interaction (DGBI) in Medical Students from Across the Globe.**

Authors	Country	Year of study	Number of participants	Criteria	Prevalence
Any DGBI					
Gallas *et al.*	Tunisia	2022	343	Rome III	54.2%
Goyal *et al.*	India	2021	425	Rome IV	34.4%
Any functional bowel disorder					
Chu *et al.*	China	2012	1071	Rome III	68.5%
Irritable Bowel Syndrome (IBS)					
Tan *et al.*	Malaysia	2003	533	Rome I	15.8%
Jafri *et al.*	Pakistan	2005	245	Rome II	26.0%
Okeke *et al.*	Nigeria	2005	330	Rome II	26.1%
Shen *et al.*	China	2009	313	Rome II	13.4%
Mansour-Ghanaei *et al.*	Iran	2009	422	Rome II	12.6%
Okami *et al.*	Japan	2011	1768	Rome II	35.5%
Dong *et al.*	China	2010	728	Rome III	9.3%
Jung *et al.*	Korea	2011	319	Rome III	29.2%
Wells *et al.*	Canada	2012	228	Rome III	20.6%
Naeem *et al.*	Pakistan	2012	360	Rome III	28.3%
Ibrahim *et al.*	Saudi Arabia	2013	597	Rome III	29%
Liu *et al.*	China	2014	767	Rome III	33.2%
Al Ghamdi *et al.*	Saudi Arabia	2015	167	Rome III	21.0%
Darweesh *et al.*	Egypt	2015	86	Rome III	22.1%
Costanian *et al.*	Lebanon	2015	431	Rome III	20.6%
Wang *et al.*	China	2016	1874	Rome III	31.9%
Perveen *et al.*	Bangladesh	2016	293	Rome III	4.8%
Husain *et al.*	Romania	2016	102	Rome III	24.5%
Alaqueel *et al.*	Saudi Arabia	2017	270	Rome III	21.1%
Pozos-Radillo *et al.*	Mexico	2018	561	Rome III	61.7%
Elhosseiny *et al.*	Egypt	2019	382	Rome III	31.7%
Shafique *et al.*	Pakistan	2021	370	Rome III	41.1%
Javed *et al.*	Pakistan	2022	305	Rome III	5.57%
Gallas *et al.*	Tunisia	2022	343[1]	Rome III	7.6%
El Sharawy *et al.*	Egypt	2022	182	Rome III	27.5%
Jadallah *et al.*	Jordan	2022	1094	Rome III	30.9%
Jia *et al.*	China	2022	2739	Rome III	12.23%
Goyal *et al.*	India	2021	1309	Rome III	9.5%
				Rome IV	6.2%
Hasosah *et al.*	Saudi Arabia	2017	179	Rome IV	13.2%
Sehonou and Dodo	Benin	2018	315	Rome IV	14%
Alshammari *et al.*	Saudi Arabia	2018	133	Rome IV	28.6%
Hakami *et al.*	Saudi Arabia	2019	252	Rome IV	7.9%
AlButaysh *et al.*	Saudi Arabia	2020	232	Rome IV	31.9%
Anthea *et al.*	Malta	2021	135	Rome IV	17.8%
Alreshidi *et al.*	Saudi Arabia	2022	301	Rome IV	20.9%
Gravina *et al.*	Italy	2023	161	Rome IV	21.1%
Tran *et al.*	Vietnam	2023	400	Rome IV	5.5%
Wani *et al.*	Saudi Arabi	2020	90	*Unknown*	42.2%
Functional Dyspepsia (FD)					
Basandra and Divyansh	India	2014	200	Rome III	18%
Shankar *et al.*	Pakistan	2020	221	Rome III	34.8%
Gallas *et al.*	Tunisia	2022	242	Rome III	6.7%
Javed *et al.*	Pakistan	2022	305	Rome III	0.66%
Goyal *et al.*	India	2021	1309	Rome IV	15.2%
Loor *et al.*	Romania	2021	150	Rome IV	18%
Tran *et al.*	Vietnam	2023	400	Rome IV	6.5%

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IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Original Article

Medical Students' Stress Levels Are Correlated with Their Sleep Quality and Life Satisfaction

Ervin Ozdemir[1*], Yigit Yazarkan[1*], Bilge Pehlivanoglu.[2]

Abstract

Background: Stress and sleep disturbances associated with low life satisfaction is frequently reported during medical education, intervening with the academic achievements and general well-being of medical students. We aimed to investigate the effects of stress levels on sleep quality (SQ) and life satisfaction (LS) of the students in Hacettepe University Medical Faculty (HUMF). **Methods:** This cross-sectional study was conducted at HUMF between May and September 2022 after ethical approval. The participants (39 women and 48 men) completed a personal information form, State- Trait Anxiety Index (STAI)-I and II, Pittsburgh SQ Index (PSQI) and Satisfaction with Life Scale (SWLS). Their blood pressure, heart rate, and salivary cortisol levels were measured. **Results:** The men and women were comparable for age, body mass index (BMI), stress parameters and PSQI scores, except the higher LS in women (P=0.045). Gender-based analysis revealed positively correlated BMI and STAI-I (r=0.357) and II (r=0.501) scores in women (P<0.05), and a similar but a weaker correlation for STAI-II scores in men (r=0.291) (P<0.05). The study group exhibited poor SQ (>5). The higher STAI-II scores, cortisol concentration and caffeine consumption were significantly associated with poorer SQ and LS in both genders, however, the state scores and alcohol consumption exhibited a significant relation in men, only. Higher scores for trait inventory and cortisol concentrations correlated negatively with LS in all participants. **Conclusion:** Awareness, a proactive approach, and sufficient support can help the relieve and/or manage the stress of medical students and improve SQ and LS.

Introduction

Life satisfaction is a complex and multifaceted concept that involves an overall assessment of a person's own life, and it is an important indicator of the quality of life lived and how much pleasure one gets from the moment experienced.[1] Life satisfaction; is defined as the positive difference between one's expectations from life and the actual situation.[2] In other words, it is the emotional reaction or attitude of the person to life as a whole.[3] Life satisfaction is based on subjective reality and is affected by several internal and external determinants.[4] Genetics, mood, gender, and hormone levels are among important internal determinants, whereas geography, social status, and professional life constitute the main external determinants.[5-7] All of these factors affect the individual simultaneously and shape the perception of life which can be expressed as life satisfaction, as well.

Of the factors associated with life satisfaction two very important and closely related ones are sleep and stress. As these two factors systemically affect the body and change one's perceptions, they can modulate the life satisfaction.[4,8] The reasons for the possible interactions of these factors can be summarized as follows: Sleep is a biological process that accounts for approximately one-third of the average human lifespan. It allows the body to rest and regenerate, with positive effects on both our physical and mental health.[9-11] Therefore, decreased quality of sleep results in negative effects in parallel with disturbed daily performance, as well as impairments in neuropsychiatric, endocrinologic and cardiovascular systems in the long term, and consequently, a decrease in life satisfaction.[9,11,12] Similarly, an individual's stress level notably affects life satisfaction. Stress, which is an indispensable part of life, increases the performance of the person when it is at adequate level, while chronic and/or higher stress negatively affects the physiological and psychological functions of the individual through direct and indirect mechanisms.[13] Moreover, stress has been reported to decrease, especially slow wave sleep, and increase risks for sleep deprivation and/or worsened sleep quality-associated outcomes in medical students.[14,15] Similarly, the life satisfaction of medical students was reported to be low and exhibit gender differences in various countries.[16-18]

Regarding various factors that increase stress levels and negatively affect the sleep quality of medical students in daily life, such as high work and study load, inability to spare time for recreational activities, peer and family pressures, etc., we aimed to examine the effects of sleep quality and stress levels on life satisfaction in medical school students.

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Methods

Design

This research adopted a cross-sectional study design, aimed at evaluating the associations between sleep quality, stress levels, and life satisfaction among medical students. Participants were recruited from Hacettepe University Medical Faculty, with the study's protocols approved by the university's Non-interventional Clinical Research Ethics Board. The inclusion criteria targeted actively enrolled medical students without any chronic illnesses or medication usage history, to minimize confounding variables related to health status and medication effects on sleep or stress levels.

The study focused on measuring subjective sleep quality, anxiety levels (both state and trait), and overall life satisfaction through validated questionnaires administered in a single session. Biological markers of stress, specifically salivary cortisol levels, were also collected to provide objective measures of stress response. The combination of subjective questionnaire data with objective biological measures allowed for a comprehensive assessment of the study variables and their interrelations.

Study Recruitment and Participants

An invitation to participate in the study was made to all the students of Hacettepe University Medical Faculty, after the study protocol was approved by the Non-interventional Clinical Research Ethics Board (Issued by 2022/13-61) of Hacettepe University. An initial interview was conducted with students who responded to the announcement and satisfied the predefined inclusion criteria, which required them to be actively enrolled as medical students and have no history of chronic illnesses or medication usage. Subsequently, the study protocol was presented to those responders who qualified, and appointments were arranged for individuals who provided their informed consent to participate in the research.

Data Collection Procedures

The participants first filled out the participant information form on the day of the experiment. Then, they were asked to complete the Pittsburgh Sleep Assessment Questionnaire (PSQA), State and Trait Anxiety Scale (STAI)-I and II and Satisfaction with Life Scale (SWLS). All the scales/questionnaires were in Turkish, and their validity and reliability studies were performed previously.[19-21] Following completion of the questionnaires, we measured and recorded the heart rate and blood pressure (ERKA Sphygmomanometer, Germany and Littmann stethoscope, USA) of the participants and saliva samples were collected. The participants rinsed their mouths with distilled water, and five minutes later they were given saliva collection tubes (Salivette, Cortisol, Sarstedt, Germany) and asked to chew the tube content for about a minute and place the chewing material back into the tube. The samples were stored at -80°C until analysis. Salivary cortisol levels were measured by ELISA method using a commercial cortisol competitive ELISA kit (Invitrogen, USA) by the procedure provided by the manufacturer. Briefly, the samples were transferred to -20°C one day before the measurement and they were allowed to reach room temperature and centrifuged at room temperature on the day of measurement. The supernatants were transferred to new tubes and diluted (1:4) as instructed by the manufacturer and the optical densities of the samples were measured by a plate reader at 450 nm (Allsheng AMR-100, Hangzhou Allsheng Instruments Co., China). The concentrations were calculated by a standard curve generated by the curve-fitting software and multiplied by the dilution factor to find the salivary cortisol concentrations.

Instruments and Scoring

The questionnaires/scales were scored as explained below. PSQI consists of 19 items that generate seven "component" scores, including subjective sleep quality, sleep duration, and daytime dysfunction. To calculate the PSQI score, respondents needed to score each of the 19 items on a scale of 0 to 3, where 0 represents no difficulty and 3 represents severe difficulty. The scores of the items that comprise each of the seven components were then added together to generate the component scores. Once the seven component scores were calculated, they were added up to get the global PSQI score, which ranges from 0 to 21. The higher the score the worse the sleep quality, and lower scores indicate better sleep quality.

The STAI consists of two separate subscales: the state (STAI-I) and the trait (STAI-II) anxiety. The state anxiety measures the temporary, situational anxiety of the individual; "right now, at this moment". Participants were asked to rate how they are feeling using a 4-point Likert scale ranging from "not at all" to "very much so" for 20 items that inquired about feelings of apprehension, tension, nervousness, and worry. The scores for each item were then summed together to get the total state anxiety score, which ranges from 20 to 80. Higher scores indicate higher levels of anxiety. The trait anxiety, on the other hand, was designed to determine the individual's general tendency to experience anxiety over time. Participants were instructed to rate 20 items of the STAI-II for how they generally feel "on a typical day" using a 4-point Likert scale ranging from "almost never" to "almost always". The scores of the items that inquired about feelings of tension, worry, and apprehension, among others were summed together to get the total trait anxiety score, which also ranges from 20 to 80. Higher scores indicate a higher level of trait anxiety, or a tendency to experience anxiety in general.

The SWLS is a 5-item scale that measures an individual's global life satisfaction. The items in the scale were designed to assess the individual's satisfaction with different domains of life, such as work, relationships, and leisure time. The SWLS items are phrased positively, and respondents were asked to rate their agreement with each item on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree". To calculate the SWLS score, the scores of the five items were summed together. The total score ranges from 5 to 35, and higher scores indicate a greater satisfaction with life. At the end, the results are classified based

on scores, according to the original manual. Scores between 30 and 35 are categorized as "extremely satisfied," scores between 25 and 29 as "satisfied," scores between 15 and 19 as "slightly dissatisfied," scores between 14 and 10 as "dissatisfied," and scores between 9 and 5 as "extremely dissatisfied". In our analysis, these categories were represented by values ranging from 6 to 1, respectively.

Statistical Analysis

The minimum number of participants was predetermined by power analysis (G*Power software ver. 3.1.9.4; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) as 85 with α= 0.05 and power (1-β) = 0.80. Considering possible exclusions from the study, we aimed to involve 90 students to the study and finalized the study with 87 participants.

The obtained data were analyzed using the SPSS 23.0 data analysis software by a biostatistician who is blinded for the study. The distribution of the data was determined with the Shapiro-Wilks test and the normally distributed variables were evaluated with the student's t-test between groups. Mann-Whitney U test was employed for data that did not show normal distribution. Regression analysis was used to determine the relationship between sleep quality and life satisfaction with other variables. Pearson correlation was employed for the pairwise relation between parameters, and $p<0.05$ was considered statistically significant.

Results

Eighty-seven medical students, 38 women and 49 men, of all grades participated in the study. The demographic and general characteristics of the participants are given in *Table 1*. The smoking and alcohol consumption status of the students are as follows; 77 participants (88.5%) do not smoke, five students (5.7%) smoke 1-10 cigarettes/day, while five students (5.7%) smoke 10-20 cigarettes/day. In terms of alcohol use, while 39 (44.8%) of the 87 students do not consume at all, 31 (35.6%) of them consume less than once a month, 11 students (12.6%) consume every 2-3 weeks, and 6 (6.8%) students consume every week.

The parameters determining anxiety/stress and PSQI and SWLS scores are presented in *Table 2*. The trait and state anxiety scores, MAP, HR, and salivary cortisol levels were comparable between men and women, indicating similar stress levels. The sleep quality index pointed out poorer sleep quality in men however the difference wasn't significant. The life satisfaction of the women was significantly higher compared to men ($p<0.05$).

The entire study population was assessed for STAI scores, which were categorized into three subgroups: low anxiety (ranging from 20 to 37 out of 80), medium anxiety (ranging from 38 to 44 out of 80), and high anxiety (ranging from 45 to 80 out of 80). Statistically significant correlations ($p< 0.05$) are presented in *Table 3*.

Table 1. **Age, BMI, and Smoking Habits of the Study Participants.**

Characteristic	Participants	
	Men (n=49)	**Women** (n=38)
Age (years)	21.93±0.66	21.23±0.72
BMI (kg/m2)	24.70±2.98	20.41±2.68 †
Smoking (%)	16.32	2.63 †

Legend: † $p<0.05$ compared to men, Age and BMI is given as Mean ± SD, BMI: Body Mass Index.

Table 2. **Stress Parameters and Scores of Sleep Quality (PSQI) and Life Satisfaction (SWLS) Scales of the Study Participants.**

Characteristic	Participants	
	Men (n=49)	**Women** (n=38)
STAI-1 scores	42.44±4.53	41.89±5.42
STAI-2 scores	46.08±6.35	48.31±6.71
Salivary Cortisol (pg/mL)[a]	1354.29±647.05	1385.52±622.36
Mean Arterial Blood Pressure (mmHg)	89.38±5.86	88.52±5.81
Heart Rate (beats/min)	84.75±12.57	86.18±12.18
PSQI Scores	6.44±2.59	6.13±2.52
SWLS scores	4.08±1.22	4.60±1.15†

Legend: STAI: State Treat Anxiety Index, PSQI: Pittsburgh Sleep Quality Index, SWLS: Satisfaction with Life Scale. The values are given as Mean ± SD. †$p<0.05$ significant difference between men and women. [a] Reference Range: 100-3200 pg/mL

Table 3. **Significant Correlations for SWLS, PSQI and BMI Based on STAI Scores.**

STAI		SWLS	PSQI	BMI
-1	Low (n=18)	-	-	-
	Med (n=39)	-0.240†	-	-
	High (n=30)	-0.252†	0.269†	
-2	Low (n=7)	-0.481†	-0.401†	0.601†
	Med (n=21)	-0.241†	0.149†	0.449†
	High (n=59)	-0.361†	0.419†	0.419†

Legend: STAI: State Treat Anxiety Index, PSQI: Pittsburgh Sleep Quality Index, SWLS: Satisfaction with Life Scale, BMI: Body Mass Index. †$p<0.05$ significant difference between men and women

When groups were evaluated based on gender, BMI was positively correlated with both state (r=0.357) and trait (r=0.501) anxiety scores in women ($p<0.05$). A similar but weaker correlation was valid for trait anxiety scores in men (r=0.291) ($p<0.05$).

The multiple linear regression model was employed to analyze the factors influencing SWLS. In this model, life satisfaction, the dependent variable, was regressed on BMI, sleep quality (PSQI scores), and stress parameters (STAI-1, STAI-2 scores, and cortisol levels). However, the analysis indicated a statistically significant relationship solely between SWLS and gender ($p<0.05$).

The correlation analysis examining the relationship between sleep quality and life satisfaction concerning gender, smoking, alcohol and caffeine consumption, and stress parameters is presented in *Table 4*. Accordingly, the long-term stress scores were associated with poor sleep quality in both genders, however, the state scores exhibited a significant ($p<0.05$) relation in men, only. Of the other parameters of stress higher salivary cortisol concentration was related to poor quality of sleep, i.e., high grades in PSQI. Our results pointed out decreased sleep quality with increased caffeine consumption in men and women, whereas the effect of alcohol was prominent only in men. Similar results were obtained for life satisfaction, as well. So, higher stress scores for trait inventory (STAI-II) and cortisol concentration of participants were negatively correlated with life satisfaction in all participants.

Discussion

The findings of our study exploring the relationship between sleep quality, stress parameters, and life satisfaction, unveiled significant associations among these variables, providing valuable insights into their intricate interplay and implications for the overall well-being of the individuals.

Sleep is a fundamental biological process that profoundly impacts human health and well-being.[9] Previous reports underscore the critical role of sleep quality in diverse physiological functions and pathological processes.[9,11,12] In the context of medical school, students encounter significant changes, such as transitioning into adulthood, gaining professional status, trying to overcome the immense pressure of heavy educational and physical workload, further complicated by specialty entrance exams, and career planning. These challenges can readily contribute to higher levels of anxiety, depression, and other psychological issues, ultimately compromising sleep quality.[22,23] Our results pointed out poor sleep quality in the whole study population as a PSQI score of more than five is considered poor sleep quality.[24] The sleep quality, although did not achieve statistical significance, was worse in men in our study, even under the comparable stress parameters. A similar study investigating the sleep quality of medical students reported poor quality, as well. However, they did not analyze the effects of gender.[14] Furthermore, our results revealed a noteworthy correlation between sleep quality and stress levels, particularly with STAI-2 scores, which reflect long-term or trait-related stress.

Table 4. **The Relationship of PSQI and SWLS Scores with the Other Parameters Investigated in Female and Male Students.**

Gender	Covariate	PSQI		SWLS	
		Correlations	p-value	Correlations	p-value
Men (n=49)	STAI-I	0.323†	0.032	0.205	0.223
	STAI-II	0.481†	0.049	-0.327†	0.049
	Salivary Cortisol Concentration (pg/mL)	0.297†	0.033	-0.284†	0.044
	Mean Arterial Blood Pressure (mmHg)	0.171	0.713	0.096	0.143
	Heart Rate (beats/min)	0.095	0.539	0.137	0.554
	Smoking	0.236	0.113	-0.218	0.168
	Alcohol	0.302†	0.047	-0.273†	0.038
	Caffeine	0.386†	0.013	0.267	0.100
Women (n=38)	STAI-I	-0.122	0.456	0.072	0.687
	STAI-II	0.469†	0.013	-0.370†	0.023
	Salivary Cortisol Concentration (pg/mL)	0.319†	0.027	-0.431†	0.040
	Mean Arterial Blood Pressure (mmHg)	0.118	0.163	0.018	0.343
	Heart Rate (beats/min)	0.105	0.625	0.125	0.154
	Smoking	-0.195	0.319	0.145	0.498
	Alcohol	-0.010	0.961	-0.059	0.784
	Caffeine	0.282†	0.048	-0.191	0.304

Legend: STAI: State Treat Anxiety Index, PSQI: Pittsburgh Sleep Quality Index, SWLS: Satisfaction with Life Scale, BMI: Body Mass Index
†P<0.05 significant difference between men and women.

highlighting the adverse impact of chronic stress on sleep quality. A study conducted among preclinical medical students from Saudi Arabia, similar to our findings, indicated a significant correlation between sleep quality and stress levels, while reporting no meaningful association between gender and sleep quality.[25] They also emphasized the relationship between reduced sleep quality and increased stress levels during examination periods, which were administered on a 3–6-week block system, resembling our university's preclinical exam program.

Notably, women displayed significantly higher levels of life satisfaction compared to men, and this disparity was statistically significant. Previous reports on gender and life satisfaction among different age groups, questioning various occasions, indicate similar findings.[26,18] The gender-specific analyses revealed a positive correlation between BMI and both state and trait anxiety scores in women. Similarly, a correlation between BMI and trait anxiety scores was observed in men, although the strength of this correlation was comparatively weaker. These results are in line with the previous reports of low life satisfaction with deviations from healthy body weight. Overweight or obese women significantly expressed low life satisfaction whereas men rated low when they are underweight.[27,28]

The importance of life satisfaction for medical students should not be underestimated, as it greatly affects their general welfare, academic achievements, and prospects in their careers. Numerous factors contribute to life satisfaction, such as individual characteristics, financial situation, physical and mental well-being, career goals, personal achievements, and socio-cultural and environmental circumstances.[4,8] The results of our study notably exhibited gender differences and the impact of stress on medical students. Consistent with our findings, Machul et al., observed that Polish female medical students attained higher scores in life satisfaction compared to their male counterparts.[29] Guney et al., investigated the relationship between depression, anxiety, hope, and life satisfaction in Turkish university students and reported lower satisfaction with high anxiety, however they didn't consider any other factor e.g., gender, smoking, alcohol consumption etc.[30] Individuals who are unsatisfied with their lives are prone to academic, social, and personal problems and addictions of various types in their effort to increase life satisfaction.[26]

Our study bears a range of limitations. It should be reinforced with further studies with similar study groups before the results are generalized as it is cross-sectional. A prospective study with follow-up involving medical students throughout their education would provide more informative insights. However, the primary focus of the present study is to determine whether there is an association between the life satisfaction, sleep quality, and stress levels of medical students. To address this question, we conducted a cross-sectional study encompassing all grades within the faculty. In this context, our results are considered valid, and the methods employed are all validated and reliable. Since the resilience of the individuals is reported to be a protective factor in preventing risky behaviors,[31] a lack of a resilience scale in our study is another weakness. Lastly, it's important to note that a concept like life satisfaction is quite broad and can be influenced by various confounding factors. As mentioned before, academic level or socio-cultural factors are just a few possible examples. This underscores, once more, the importance of conducting follow-up studies to explore these complexities further.

To the best of our knowledge, this study represents the first investigation exploring the relationship between sleep quality and stress levels, assessed through validated and reliable scales, as well as various biological parameters including heart rate (HR), blood pressure (BP), and salivary cortisol levels, in relation to life satisfaction among medical students. Based on our findings, which indicate that poor sleep quality is associated with higher stress levels, lower life satisfaction, and gender-based differences among medical students, it is crucial to prioritize an action plan aimed at supporting the well-being of these students. This plan should incorporate both physical activities and psychological measures to provide them with essential support, with a particular emphasis on the potential positive impact of peer contributions in encouraging their well-being.[32,33] Medical schools were not only responsible for the continuous improvement of their curricula to keep up with the growing knowledge and changing world to graduate academically equipped doctors, but also follow them for the issues associated with overall well-being and life satisfaction. The improved sleep quality, life satisfaction, and controlled stress of the students can be provided by sufficient care and emotional support of the organizations and families. However, the students themselves should be aware of their condition and pay more attention to their quality of life.

Summary – Accelerating Translation

Başlık: Tıp Fakültesi öğrencilerinin stress düzeyleri uyku kalitesi ve yaşam doyumu ile ilişkilidir

Çözülmesi Gereken Ana Sorun: Stres ve uyku problemleri, tıp eğitimi sırasında düşük yaşam tatmini ile ilişkilendirilir ve tıp öğrencilerinin akademik başarılarına ve genel iyilik hallerini olumsuz etkiler. Tıp Fakültesi öğrencileri eğitim yükünün yanısıra, başarı baskısı, kariyer planları, sosyal ve kültürel zorluklarla da başa çıkmaya çalışmaktadırlar. Öğrencilerin büyük çoğunluğu yüksek entelektüel kapasiteye ve çalışma alışkanlığına sahip olsalar da stress ve başa çıkmak zorunda oldukları koşullar öğrencilerin genel iyilik halini etkileyebilmektedir. Bireyin sağlığın etkileyen bir diğer faktör kişinin uyku kalitesidir. Uyku bozuklukları çeşitli hastalıklar ve performas bozuklukları ile ilişkilendirilmiştir. Yaşam doyumu, bireylerin fiziksel ve ruhsal sağlığından, sosyal ve kültürel ortamlarından çeşitli şekillerde etkilenen bir olgudur. Bireyin stress yanıtı ve uyku kalitesi yaşam doyumunu etkileyebilir.

Çalışmanın Amacı: Bu çalışmada Hacettepe Üniversitesi Tıp Fakültesi (HÜTF) öğrencilerinin stress düzeylerinin uyku kalitesi (UK) ve yaşam doyumlarına (YD) olan etkilerinin araştırılması amaçlanmıştır.

Metodoloji: Bu çalışma 2022 yılının Mayıs-Eylül ayları arasında, etik kurul onayı alındıktan sonra gerçekleştirildi. HÜTF öğrencilerinden çalışma davetine yanıt verenler arasından uygun olan 39 kadın ve 48 erkek

katılımcı, onamları alındıktan sonra, kişisel bilgi formunu, Durumluluk ve Sürekli Kaygı Envanterini (STAI-I ve II), Pittsburgh UK İndeksini (PSQI) ve YD Ölçeğini (SWLS) doldurdu. Katılımcıların kan basınçları (KB), kalp hızları (KH) ölçüldü ve tükürük örnekleri toplandı ELISA yöntemi ile kortizol değerleri saptandı. Sonuçlar istatistiksel olarak analiz edildi.

Sonuçlar: Araştırmaya, farklı sınıflardan 87 tıp öğrencisi (38 kadın ve 49 erkek) katıldı. Katılımcıların demografik ve genel özellikleri benzerdir. Kadın ve erkekler arasında anlık ve durumluluk anksiyete skorları, KB, KH ve tükürük kortizol düzeyleri benzerdi. Uyku kalitesi indeksi, erkeklerde daha kötü uyku kalitesini gösterdi, ancak fark anlamlı değildi. Kadınların yaşam memnuniyeti, erkeklerle karşılaştırıldığında anlamlı şekilde yüksekti. Uyku kalitesi ve yaşam memnuniyeti ile cinsiyet, sigara, alkol ve kafein tüketimi ve stress parametreleri arasındaki ilişkiyi tahmin eden istatistik modeline göre, uzun süreli stress skorları her iki cinsiyette de kötü uyku kalitesiyle ilişkilendirilmiş, ancak durumluk skorları sadece erkeklerde anlamlı bir ilişki göstermiştir. Stres düzeyi daha yüksek olan öğrencilerin uyku kalitesinin daha kötü olduğu spatanmıştır. Sonuçlarımız, kadın ve erkeklerde artan kafein tüketimiyle uyku kalitesinin azaldığını, alkol kullanımının etkisinin ise sadece erkeklerde belirgin olduğunu gösterdi. Benzer sonuçlar yaşam memnuniyeti için de elde edildi. Katılımcıların yüksek stress skorları ve kortizol konsantrasyonu, yaşam doyumu ile negatif şekilde ilişkilendirildi.

Çözüm: Farkındalık, bilinçli yaklaşım ve yeterli destek ile tıp fakültesi öğrencilerinin stress düzeylerini azaltmak, uyku ve yaşam kalitelerini arttırmak mümkündür.

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Original Article

Residency Program Website Content May Not Meet Applicant Needs

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Abstract

Background: Residency program applicants use a variety of resources during the application cycle. Program websites can vary substantially, and it is unclear how the website information is used by applicants. We aimed to determine the most popular information source used by applicants. We also sought to identify specific online content that was deemed important in the decision-making process. **Methods**: A survey was distributed to fourth-year medical students at an academic institution. Demographic information was collected, and the importance of various online resources was gauged using a Likert scale. Subgroup analysis was performed for procedural versus non-procedural specialty applicants. **Results**: 91 of the 169 fourth-year medical students (54%) completed the survey. The most utilized sources for the students were residency program websites (41%), the Fellowship and Residency Electronic Interactive Database (FREIDA) website (36%), and the Doximity website (14%). The most valued (Likert scale of 4 and 5) website content for the students included information on resident wellness (86%), resident fellowship acquisition (85%), faculty data (84%), residency location and resident lifestyle (81%), and application point of contact (79%). There were significant differences between what procedural specialty applicants deemed important versus what those applying to non-procedural specialties deemed important. **Conclusion**: Residency program websites are commonly used among applicants during the residency match process. Content on resident wellness was highly valued irrespective of specialty choice; however, this information was often not present on residency websites. These findings may help guide website content development initiatives for residency programs to reflect applicant needs more adequately.

Introduction

Matching into a residency program is an annual competitive undertaking for fourth-year medical students. The decision to apply to and rank residency programs in the match is a multifactorial process and applicants have various resources that may be utilized to guide them.[1] However, there have been limited studies on how applicants use or value these resources in the application and ranking process.

The residency application and interview process are expensive and time-consuming ventures with an average expenditure between $4000 to $6000 for 12 to 17 interviews.[1,2] This cost can approach $20,000 when applying to multiple specialties or an even higher number of programs.[2] These costs arise from application fees, flights to interviews, hotels, and other travel expenses. While this may evolve as COVID19 has temporarily shifted to virtual interviews, it is likely that programs may continue the virtual model or incorporate a hybrid model of interviews once the pandemic is over. In fact, the COVID19 pandemic increased the role of website content as applicants are unable to visit the program and learn more in-depth information. These realities highlight the importance of accurate, easily accessible residency program information that allows medical students to make informed decisions during the application season.

Before the advent of the Internet, medical students largely accessed residency program information through printed

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brochures and word of mouth via faculty mentors or peers.[3] The American Medical Association-Fellowship and Residency Electronic Interactive Database Access (AMA-FREIDA) was first published in an electronic diskette in 1991 and made available on the Internet in 1996, propelling residency information access into the digital age.[4] Concurrently, residency programs also recognized the importance of maintaining websites for applicants. Studies showed that while only 67% of general surgery residency programs had a viable link to the program's website on the FREIDA page in 2003, 99.2% of the general surgery residency programs had a functioning program website in 2017.[5,6]

Currently, residency program information can still be obtained through individual sources such as attending mentors or peers, but it is mostly accessed online.[6,7] Some of the recognized and consistent online sources were individual residency program websites, the FREIDA website, and the Accreditation Council for Graduate Medical Education (ACGME) website.[8,9] Studies in different specialties showed that the majority of applicants consider residency program websites important in their application decisions, although website content varied significantly and may not present information that applicants deemed valuable.[3,5-7,10-19] There have also been some studies that examined the roles of online forums such as the student doctor network (SDN) or residency website components in different subspecialties.[10] However, the current literature has little information about what online sources residency applicants across all specialties used the most or what information was considered the most useful in their decision-making process. We sought to identify the most common online sources used by medical students when selecting residency programs and to identify online content that applicants considered important in their decision-making process.

Methods

This is a cross-sectional survey study in which a questionnaire was distributed to all fourth-year medical students at a single academic institution who applied to residency programs during the 2019-2020 application cycle. A cross-sectional study was implemented, as it is relatively inexpensive and straightforward to perform. Fourth-year medical students were invited to complete the survey, since they were in the process of learning about and applying to residency programs. These medical students were enrolled in a Doctor of Medicine (MD) program in the United States. The survey was conducted at the beginning of 2020, which was after the interview season and before residency match day in March. The Institutional Review Board (IRB) approval was obtained for this study (George Washington University School of Medicine and Health Sciences, IRB code: NCR191264).

The 30-question survey was designed to evaluate what the residency applicants used as their source of information during the application process and what the applicants considered important on the residency program websites. This survey looked for popular resources used during the residency applicant process and aspects of training that we deemed were relevant in ranking different programs. The survey collected information on participant age, gender, race, specialty, number of program applications, the most common information source, and the most useful source of information when researching a program. Applicants were asked to rate the importance of specific residency program website content during the application and ranking process using a 5-point Likert scale (1=not important at all to 5=crucial information that may influence one's decision). The rated residency website content was categorized into four categories of specific content: training structure, resident and faculty data, program logistics, and program environment (*Table 1*). Specific questions from the survey are included in *Table 2.*

Table 1. **Residency Program Website Content Evaluation Categories and Items.**

Question Categories	Question Items
1. Training Structure	1) Rotation structure 2) Description of training sites 3) Research requirements 4) Education components a) Morbidity & Mortality Conferences and Grand Rounds b) Morning Case Reports or Journal Clubs c) Question Banks d) Skills Simulations Lab e) Protected Time for Studying
2. Resident and Faculty Information	1) Resident Information a) Names and Photos, b) Medical School, c) Number of Publications 2) Fellowship Acquisition 3) Board Pass Rates 4) Faculty Information
3. Program Logistics	1) Application Specifics 2) Application Contact Information 3) Residency Policies
4. Program Environment	1) Primary Residency Location Site/Resident Living 2) Resident Wellness 3) Current Events Within the Department/Residency

Table 2. **Survey Questions on Applicant Perspectives and Prioritization of Information Needs in Residency Program Websites.**

Question Categories	Question Items
1. Demographics	1) What is your age? 2) What is your gender identity? 3) Are you of Hispanic, Latino, or Spanish origin? 4) How would you describe your race?
2. Resources	1) What was your most common source of information when searching for residency program? (ACGME Website, FREIDA website, Doximity website, program website) 2) What was the most useful source of information when searching for residency program? (ACGME Website, FREIDA website, Doximity website, program website)
3. Application Logistics	1) What specialty(ies) are you applying for? 2) How many residency programs did you apply to? 3) Do you plan on further training in a subspecialty?
4. Importance of residency program website content	In general, how important is the information on a residency program's website when you decide to apply to or rank that program?
5. Website Information on Residency Program Training Structure	Please rate how important it is, on a scale of 1-5, for the program website to include the following information: 1) Rotation structure 2) Description of training sites 3) Research Requirements 4) Education Components – M&M & Grand Rounds 5) Education/Didactic Components – Morning Case Reports or Journal Club 6) Education/Didactic Components – Question Banks 7) Education/Didactic Components – Skills Simulation Lab 8) Education/Didactic Schedule – Protected Time for Studying
Resident and Faculty Information	Please rate how important it is, on a scale of 1-5, for the program website to include the following information: 1) Resident Information – Names and Photos 2) Resident Information – Medical School 3) Resident Information – Number of Publications 4) Fellowship Acquisition 5) Board Pass Rates 6) Faculty Information
Program Logistics	Please rate how important it is, on a scale of 1-5, for the program website to include the following information: 1) Application Specifics 2) Application Contact 3) Residency Policies
Program Environment	Please rate how important it is, on a scale of 1-5, for the program website to include the following information: 1) Primary Residency Location Site/Resident Life 2) Resident Wellness 3) Current Events within the Department/Residency

Data analysis was descriptive, and percentages were used to present categorical variables.

The survey responses were anonymously reviewed. Subgroup analyses were performed comparing the preferences of applicants in procedural (surgical and anesthesia subspecialties) versus non-procedural specialties. *Table 3* includes the lists of the specialties in each category. The applicants' preferences for the most important (Likert scale 4 and 5) and not important (Likert scale 1 and 2) residency website contents were analyzed separately with Mann-Whitney U test / Wilcoxon Rank Sum test on the R statistical software and the comparison of the important elements are highlighted in *Table 4*.

Table 3. **List of Specialties in Subgroup Analysis Categories.**

Procedural Specialties (n=34, 37.4%)	Non-Procedural Specialties (n=57, 62.6%)
Anesthesiology (6, 6.6%)	Child neurology (3, 3.3%)
General surgery (7, 7.7%)	Psychiatry (4, 4.4%)
Neurosurgery (1, 1.1%)	Diagnostic Radiology (5, 5.5%)
Obstetrics and Gynecology (6, 6.6%)	Pediatrics (6, 6.6%)
Orthopedic surgery (8, 8.8%)	Emergency Medicine (7, 7.7%)
Otolaryngology (4, 4.4%)	Internal Medicine (13, 14.3%)
Plastic surgery (1, 1.1%)	Family Medicine (14, 15.4%)
Vascular surgery (1, 1.1%)	Ophthalmology (1, 1.1%); Pediatrics/Emergency Medicine (1,1.1%); Physical Medicine & Rehabilitation (1, 1.1%); Dermatology (1, 1.1%); Neurology (1, 1.1%)

Results

Ninety-one out of 169 fourth-year medical students completed the survey, a 53.8% response rate. Most of the respondents were female (70.3%) with an age range between 26 and 30 years old (58.2%). Race distribution consisted of 58.2% Caucasian, 22% Asian, 8.8% African American, and 8.8% Hispanic, Latino, or Spanish origin. Fifty-four percent applied to primary care specialties (family medicine, internal medicine, obstetrics and gynecology, and pediatrics), and 57.1% of applicants planned to subspecialize after residency. Thirty-four percent of applicants applied to more than 50 residency programs, 38% to 31-50 programs, and 21% to 21-30 programs.

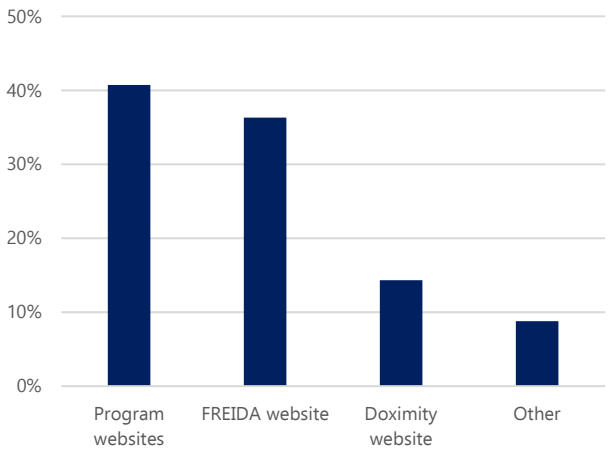
The three most used sources of residency program information were individual program websites (40.7%), the FREIDA website (36.3%), and the Doximity website (14.3%) (*Figure 1*).[8,20]

The three frequently used sources were also considered the most useful sources for obtaining residency program information. Other sources were considered useful, but they were only minimally cited by the study cohort. These included 21 spreadsheets (2.2%), ACGME website (2.2%), shared Google spreadsheets within the program (1.1%), Residency explorer website by the American Association of Medical Colleges (AAMC) (1.1%), American Academy of Family Physicians (AAFP) website (1.1%), and discussion with advisors (1.1%) (*Figure 2*).[8,9,20-23]

Residency program website content, in general, was rated as very important or crucial (60.5% for a combined Likert scale of 4 and 5) for medical students when deciding to apply or to rank a program. Specifically, information on resident wellness (85.8%), fellowship acquisition (84.6%), faculty data (83.5%), residency location and resident lifestyle (81.3%) and application contact information (79.1%) were ranked the most important (Likert scale of 4 and 5) information by applicants (*Figure 3*). Other information applicants considered important included training site information (76.9%), board pass rates (76.9%), residents' names and photos (73.7%), rotation structure (71.4%), residency policies (62.7%), application details (60.4%), residents' medical schools (58.2%), and current department events (55%). On the other hand, the number of publications by current residents (60.4%), morbidity and mortality conferences and grand rounds information (40.7%), access to question banks (35.2%), and research requirements (29.7%) were the top four topics rated as not important or maybe important (Likert scale 1 and 2) to participants.

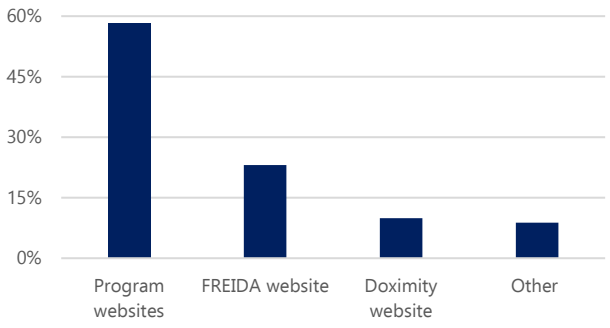
Subgroup analyses by specialty choice (*Table 5*) showed that for applicants pursuing procedural specialties, the most important residency website content included fellowship acquisition (94.1%), faculty information (88.2%), and application contact information (82.4%), while non-procedural specialty applicants valued resident wellness (91.2%), location training sites and resident life (84.2%), and description of training sites (80.7%) (*Table 4*). Of note, resident life (76.5%), resident wellness (76.5%), and skills simulation lab (76.5%) were also highly ranked important factors for procedural specialty applicants (*Table 4* and *Table 5*). Non-procedural applicants appreciated information on residency policies (p=0.005) significantly more than procedural specialty applicants while procedural specialty applicants appreciated skills simulation lab (p = 0.0001), research requirement (p = 0.014), number of publications by residents (p = 0.042), and fellowship acquisition (p = 0.007) information significantly more than non-procedural applicants (*Table 4* and *Table 5*).

***Figure 1*. Chart of the Most Common Source of Information when Searching for and Learning about Residency Programs. Other Includes the ACGME Website (3.3%), AAFP Website (2.2%), SDN Website (1.1%), Residency Explorer Website by the AAMC (1.1%), and Reddit Spreadsheets (1.1%).**



Legend: ACGME = Accreditation Council for Graduate Medical Education; FREIDA = Fellowship and Residency Electronic Interactive Database; AAFP = American Academy of Family Physicians; SDN = Student doctor network; AAMC = Association of American Medical Colleges.

***Figure 2*. Chart of the Most Useful Source of Information when Searching for and Learning About Residency Programs. Other Includes Reddit Spreadsheets (2.2%), ACGME Website (2.2%), Shared Google Spreadsheets within the Program (1.1%), Residency Explorer Website by the AAMC (1.1%), AAFP Website (1.1%), and Discussion with Advisors (1.1%).**



Legend: ACGME = Accreditation Council for Graduate Medical Education; FREIDA = Fellowship and Residency Electronic Interactive Database; AAFP = American Academy of Family Physicians,

Figure 3. Visualization of the Importance of Residency Program Website Information on a Likert Scale, Sorted by Questions that had the Most to the Least Percentage of Likert Scale of 5.

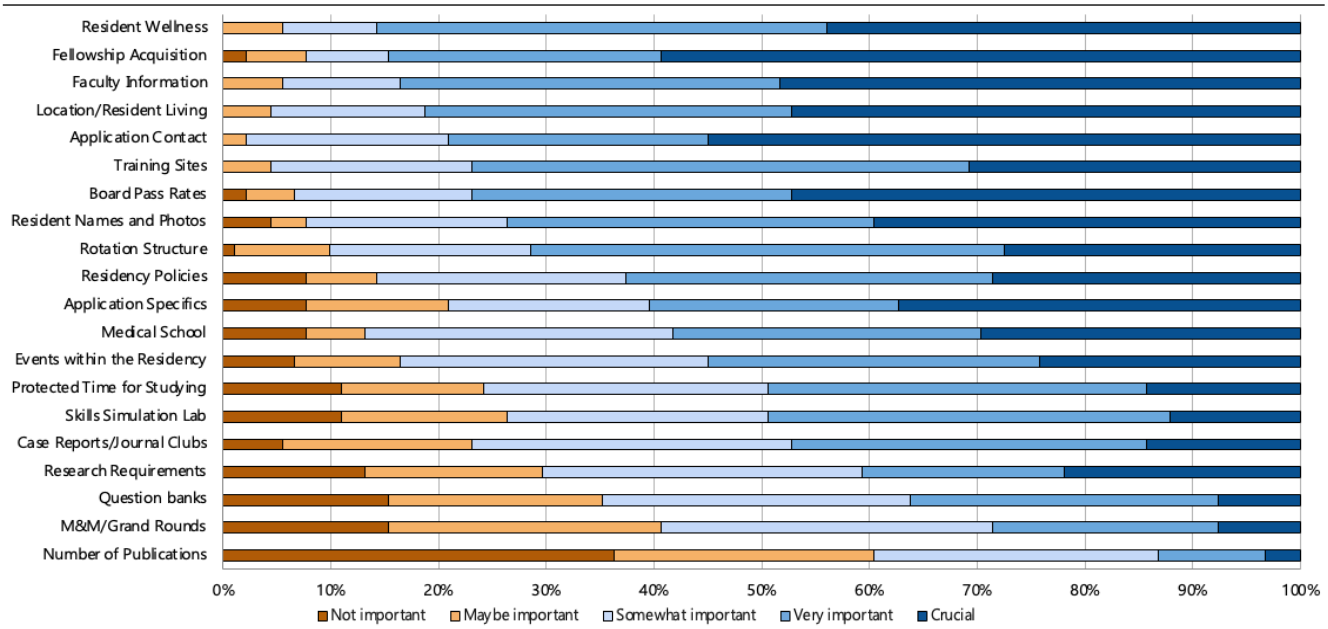


Table 4. **Comparison of Residency Website Content Importance by Procedural Specialty Applicants vs. Non-Procedural Specialty Applicants.**

Category	Question Topics	Procedural specialty applicants (n =34)	Non-procedural specialty applicants (n = 57)	p-value
1. Training Structure	Rotation Structure	21 (61.8)	44 (77.2)	0.389
	Description of Training Sites	24 (70.6)	46 (80.7)	0.111
	Research Requirements	18 (52.9)	19 (33.3)	0.014*
	M&M Conferences/Grand Rounds	9 (26.5)	17 (29.8)	0.923
	Case Reports/Journal Clubs	14 (41.2)	29 (50.9)	0.610
	Question Banks	12 (35.2)	21 (36.8)	0.899
	Skills Simulation Lab	26 (76.5)	19 (33.3)	0.0001*
	Protected Time for Studying	18 (52.9)	27 (47.3)	0.105
2. Resident and Faculty Information	Resident Names and Photos	23 (67.6)	44 (77.2)	0.490
	Resident Medical School	19 (55.9)	34 (59.7)	0.438
	Resident Number of Publications	5 (14.7)	7 (12.3)	0.042*
	Fellowship Acquisition	32 (94.1)	45 (78.9)	0.007*
	Board Pass Rates	25 (73.5)	45 (78.9)	0.982
	Faculty Information	30 (88.2)	46 (80.7)	0.837
3. Program Logistics	Application Specifics	23 (67.6)	32 (56.1)	0.490
	Application Contact Information	28 (82.4)	44 (77.2)	0.311
	Residency Policies	15 (44.1)	42 (73.7)	0.009*
4. Program Environment	Location Site/Resident Life	26 (76.5)	48 (84.2)	0.300
	Resident Wellness	26 (76.5)	52 (91.2)	0.273
	Events within the Department	17 (50.0)	33 (57.9)	0.370

Legend: Important includes Likert scale 4 and 5. Values in parentheses are percentages. (*) indicates statistical significance, with P-value < 0.05.

Table 5. **Top Five Most Important Residency Website Content for Procedural vs. Non-Procedural Applicants**

Procedural Specialties	Non-Procedural Specialties
1. Fellowship acquisition (94.1%)	1. Resident wellness (91.2%)
2. Faculty information (88.2%)	2. Location site/Resident life (84.2%)
3. Application contact information (82.4%)	3. Description of training site (80.7%)
4. Skills simulation lab (76.5%)	4. Faculty information (80.7%)
Location site/Resident life (76.5%)	5. Fellowship acquisition (78.9%)
Resident wellness (76.5%)	Board pass rates (78.9%)
5. Board pass rates (73.5%)	

Legend: Comparison of residency website content importance by procedural specialty applicants versus non-procedural specialty applicants. Important includes Likert scale 4 and 5. Values in parentheses are percentages. (*) indicates statistical significance, with P-value < 0.05.

Discussion

Since the early 2000s, studies in different specialties, including emergency medicine, internal medicine, general surgery, radiology, plastic surgery, orthopedic surgery, otolaryngology, and anesthesiology have illustrated that residency websites are widely used by residency applicants. These studies also evaluated the use and content of residency program websites.[3,6,7,10,12,19,24,25] However, no single study has surveyed residency applicants across specialties to determine the most useful online resource and content for applicants overall. While there is an array of resources, our study reveals that the most commonly used and most useful source for residency applicants is the individual residency program websites (*Figure 1* and *Figure 2*).

Our study also adds to the existing literature by identifying resident wellness as the most valued program content. A potential reason for this finding could be that burnout and wellness have gained increasing attention in recent years which has led the ACGME to add "residency wellness", comprised of psychological, emotional, and physical well-being, to its list of residency program requirements in 2017.[27] The ACGME's Clinical Learning Environment Review (CLER) program that was designed to improve and monitor resident engagement in safe, high-quality patient care during clinical training also adopted the term "well-being" to encompass areas formerly known as duty hours, fatigue management, and mitigation.[28] The Flexibility In duty hour Requirements for Surgical Trainees (FIRST) trial showed considerable variation in training program rates of resident reported burnout.[29] After this trial, the SECOND trial (*Surgical Education Culture Optimization through targeted interventions based on National comparative Data*) was created to examine whether providing programs with their performance data and tools to create wellness initiatives could improve residency program culture and wellness.[29,30] Given the now required focus on resident wellness and the value of wellness to applicants, an informative website that highlights program wellness and accurately represents the program will likely benefit programs .

Additionally, robust and comprehensive residency website information has become even more relevant not only due to our advances in technology but also in situations when in-person interviews and visits to programs may be limited and even discouraged, as we are currently experiencing with the coronavirus (COVID-19) pandemic. In response to the global pandemic, various organizations, including the AAMC and the Association of Program Directors in Surgery (APDS), have encouraged residency programs to offer online interviews, establish virtual tours, and expand website presence during the pandemic.[31-33] In this setting, digital resources such as FREIDA, ACGME website, Doximity, and residency program website may become even more important. An investment in website expansion or remote interviews is not only advantageous for programs to amplify their program to a larger audience and demonstrate adaptability on a digital platform, but it also prepares for future situations that would limit traveling and in-person interactions.

Our study reinforces the existing literature and suggests that programs need to highlight the needs of the applicants (*Table 6*). Additionally, our study meaningfully expands the literature by including applicants from different specialties. Our primary study team has an interest in procedural subspecialties, which is why we chose to perform a subgroup analysis looking at differences between procedural and non-procedural specialties. We found that there is a statistically significant difference in the importance of resident policy and skills simulation between procedural and non-procedural specialties. Applicants applying to procedural based specialties valued skills labs, while non-procedural applicants valued resident policy. Applicants applying into procedural specialties also valued information on research requirements, number of publications by residents, and fellowship acquisition (*Table 4*). This could be a result of structured research or professional development year(s) integrated into procedural residency programs; however, further studies are required to assess how programs can best structure their website to provide applicants with meaningful research-related information.

Table 6. **Preferred Website Content: Top 5 Content Comparison of Existing Literature And our Current Study.**

Study (Year)	Specialty (Number of Participants)	Response Rate	Most common source of information	Most important residency website content for participants (Top 5 content from most highly ranked to the least)
Embi et al[3] (2003)	Internal medicine (n=218)	51%	Residency websites	1. Schedule information 2. Career and fellowship placement 3. Resident information 4. Residency benefits 5. Residency contact information
Gaeta et al[7] (2005)	Emergency medicine (n=188)	82%	Not applicable	1. Application process 2. Alumni information and outcomes 3. Personal statements and candid narratives from the residents 4. Bulletin News about residency 5. Explanation of salary and benefits
Chen et al[25] (2018)	Plastic surgery (n=87)	46%	Residency websites	1. Faculty information 2. Residency curriculum 3. Current residents 4. Career and fellowship 5. Resident research
This study (2020)	All specialties (n=91)	54%	Residency websites	1. Resident wellness 2. Fellowship acquisition 3. Faculty information 4. Resident life 5. Application contact information

Our study also shows that applicants highly valued information on resident wellness or lifestyle, but the existing literature suggests that content on program websites is not always congruent with the information that applicants value most (*Table 7*).[6,7,13,16,25] Gaeta et al.,[7] reported that emergency medicine residency applicants preferred additional information such as the application process details, alumni information, and personal statements or candid narratives from the residents. Chen et al[25] showed that while plastic surgery residency applicants considered career and fellowship placement very important information, this information was not available on most program websites. Lambdin et al[34] showed that students applying into surgical specialties identified fellowship acquisition, faculty information, application contact information, and resident wellness as the most important website content; however, information on fellowship acquisition and resident wellness were identified only on 60% and 27% of residency websites, respectively. Our study further highlights the incongruence between the information applicants seek and what residency programs present.

Table 7. **Overview of the Existing Literature on Residency Website Content. Listed are Website Content Represented in More than 50% of the Residency Websites Reviewed.**

Study (Year)	Specialty	Number of Websites Reviewed	Website Content
Hansberry et al[16] (2018)	Radiology	179	Facility description (89%) Contact email (88%) Academic courses available (83%) Current residents (78%) Benefits (69%) Location/surrounding area information (66%) Past research projects (65%) Faculty listing (63%) Rotation schedule (62%) Call schedule (61%) Research description (59%) Link to ERAS (57%) Fellowship placement (55%) Salary (51%)
Silvestre et al[13] (2014)	Plastic Surgery	63	Faculty listing (93%) Resident listing (66.7%) Rotational schedule (61.4%) Faculty research interests (61.4%) Resident research requirements (59.6%) Salary (57.9%) Average work hours per week (50.8%)
Stoeger et al[6] (2019)	General Surgery	254	Program coordinator information (94%) Faculty names and specialty (85%) Rotations (88%) Hospital information (88%) Research requirements (85%) Resident names (83%) Morbidity and mortality conferences (82%) Alumni position/fellowship (69%) Resident salaries (64%) Skills lab (64%) Vacation (63%) Interview process (60%) Visa status (59%) Neighborhood information (51%)
Lambdin et al[34] (2022)	All specialties	91	Program description (100%) Faculty information (95%) Application contact (85%) Resident names and photos (85%) Residency location (79%) Didactics (78%) Meetings/Conferences/Courses (77%) Research requirements (74%) Rotation schedule (72%) STEP 2 information (53%) Journal club (51%)

The discrepancy between the information valued by applicants and information presented on residency websites may account for the use of crowdsourcing sites that provide the word-of-mouth component of residency information in online formats. Our study shows that some students are using Reddit spreadsheets and Student Doctor Network forums as their main resource, and some consider the Reddit spreadsheets the most useful source in their decision-making process (*Figure 2*).[21,26] The Reddit spreadsheets link to open-access shared Google Sheets for each medical specialty and applicants across the US share information such as interview dates and applicant experiences at the interviews with a question-and-answer section. This content may fill in the gap for students to learn about a program's culture, training environment, and resident life that is often not represented on residency websites or other online sources.[5,6,25] While this may be beneficial, this information may not be readily vetted by programs to ensure accuracy and may mislead applicants.

This study had several limitations. The is a survey study with lack of narrative input from the subjects. The study quality is limited by the survey design, which is not validated in the literature. Other similar studies in the literature did not include their survey questions, so we based our questionnaire from discussions within a focus group with our study team, which also included a dean of the medical school. The sample size is also limited, and the study was performed at a single institution. The study design subjects the findings to response bias. We anticipate that the findings of the study are readily translatable to other institutions and other cohorts since the residency application process does not change significantly from year to year. To bridge the gap between desired and available website content, residency programs can make these topics easily accessible on program websites. Additionally, the websites should be frequently updated to reflect pertinent changes in the aforementioned areas. These websites could also be advertised on platforms such as Instagram or Twitter to allow programs to enhance their online presence. Furthermore, although the sample size was limited, we had representation from applicants applying to a variety of specialties. Continued data acquisition over several application cycles and inclusion of multiple institutions could reveal more information and trends. Administering the survey after the interview season could have introduced some bias in students' response. Lastly, this study did not examine the role of other social media platforms in the applicants' decision-making process. Future study directions could examine the value of specific social media platform content in applicant decision making, with differentiation between decision regarding program selection, interview process, and matching rank list. Additionally, surveying residency website creators could provide further insight into the process of creating these sites and any mismatch that may exist between the advertised content and applicants' needs.

Summary – Accelerating Translation

Residency application is a competitive endeavor for fourth-year medical students. Among all the resources used, individual program websites often provide valuable information. However, the type of information presented on these websites can vary significantly. In this study, we used a survey to identify the most common resources utilized by applicants at a single institution. Additionally, we determined the specific content that were deemed most useful.

We found that 54% of fourth-year medical student completed the survey. The most commonly used resources included residency websites, the Fellowship and Residency Electronic Interactive Database (FREIDA) website, and the Doximity website. The most valued website content included resident wellness information, resident fellowship acquisition, faculty data, residency location and resident lifestyle, and the application point of contact. While resident wellness was the most valued content, this information was often not included on residency websites. Residency programs can more adequately use information from this study to address applicant needs.

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Review

A Review of Psychosocial Factors on Birth Outcomes in Women with Substance Use Disorder in the United States: The Importance of Preventing Relapse During Sustained Remission

Alexandra R. Dailey.[1]

Abstract

Infant mortality rate has been an area of concern for the United States for years. Many attributing factors, including psychosocial influences, have been identified. Pregnant patients with substance use disorder have also been shown to experience poor birth outcomes. This study examines trends related to socioeconomic hurdles and mental health in pregnant women with substance use disorder. Databases were searched to find resources that outlined these relationships. After assessing the study designs and associations of fifty-five resources, several patterns were observed, including an increased risk of adverse birth outcomes with higher maternal stress and lower socioeconomic status. In pregnant women with substance use disorder, post-traumatic stress and social stigma resulted in negative effects on mental health. Substance use-related pregnancy anxiety was amplified by triggers that resulted in feelings of fetal detachment and substance cravings. Most literature focused on pregnant patients with active addiction; however, these triggers may have an especially powerful effect on women who become pregnant while in substance use recovery. Studies on remission trajectories indicated a higher mortality risk in people with a history of substance use but have not yet calculated the proportion of women capable of bearing children in this category. This highlights the necessity to develop personalized treatment for pregnant women in sustained remission from substance use disorder to prevent relapse during this crucial time. This population would benefit from a screening tool that assesses for high-risk events like PTSD, psychological stress, and substance use triggers and intervention that includes evidence-based mental health resources.

Introduction

Infant mortality rate (IMR), defined as the number of deaths in infants under one year of age per 1,000 live births, has been a continuous area of concern for the United States (U.S.).[1] The U.S. has an IMR of 5.4, measuring poorly among other developed countries, and has fallen in rank from 6th in the world to 26th in the past 50 years.[2] Previous research has focused on the relationship between IMR and high preterm birth rate, of which a high prevalence of death and disability have been observed. Broader influences of infant mortality have also been identified, such as psychosocial factors like maternal anxiety and socioeconomic status (SES). A positive correlation between maternal stress and adverse birth outcomes has been described, as well as a negative correlation between SES and adverse birth outcomes.[3,4]

One group that is uniquely affected by both socioeconomic and mental health barriers is those with substance use disorder (SUD). In the context of infant mortality, it has been well-documented that this disorder causes an increased likelihood of adverse birth outcomes such as preterm delivery, growth restriction, spontaneous miscarriage, and infant death.[5] Low SES and mental health are often examined as distal foundations to the proximal behavior of substance use when an outcome such as infant morbidity is measured. Further, as these characteristics also affect birth outcomes independently, they are often regarded as confounding variables when studying their effect on substance-related birth adversities.[6] However, there are instances in which psychosocial factors may have a more direct influence on birth outcomes, such as women who struggle with substance use and develop mental health struggles specific to pregnancy.[5] This effect could be especially robust for those who are in an ongoing recovery from SUD and not in a treatment program, a population that has not been considered in the reviewed literature. These women have maintained abstinence long after assisted treatment, forming a group often overlooked in studies of pregnant women with current substance use disorder and those without the disorder. In one study taking place 13 years after substance abuse treatment, 37% of all women participants were in stable remission, defined as over 5 years in recovery.[7,8] The authors also found that patients in the stable remission group, both male and female, had lower overall survival rates than patients who had not struggled with substance use, underscoring the importance of maintaining personalized healthcare following substance abuse treatment. This may be especially important for pregnant women in recovery, as many psychosocial factors may

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increase the risk of stress, limited healthcare access, and relapse- all circumstances that have been associated with negative birth outcomes and IMR.

The social determinants of health must be explored in recovering women who become pregnant to understand the distinct set of obstacles this group faces. Such determinants can include financial stability, education, healthcare quality, and community support. This group may encounter specific obstacles such as pregnancy-related anxiety and post-traumatic stress disorder (PTSD) triggers.[5] Many of these factors are preexisting susceptibilities that precipitate due to the pregnancy itself or prenatal care.[4] As such, the mediating effect of these susceptibilities that may have surfaced from a history of substance use should be considered in future studies and their effect analyzed through multivariable analyses. Additionally, where a relationship can be demonstrated, a potential for intervention exists.

Based on important psychosocial factors, pregnant patients at risk of relapse could be screened and provided with appropriate resources to help prevent relapse. Screening tools are a quick and efficient way to evaluate the degree of risk associated with a healthcare outcome. In substance abuse patients, the implementation of Screening, Brief Intervention, and Referral to Treatment (SBIRT) has been proven effective by numerous randomized controlled trials.[9] Reductions in substance use were shown to be attributable to the screening techniques alone. Suggested treatment may include therapies like Motivational Enhancement Therapy (MET) and Cognitive Behavioral Therapy (CBT). Aside from improving the well-being of patients and communities, providing connections to necessary services helps prevent the costly sequelae of relapse for both the patient and healthcare organizations. SBIRT is a billable service and its sustainability can be used as an example of how valuable this type of screening and intervention can be.[10] Screening for at-risk pregnant women in remission from SUD would be a focused transition from the successful tools that are already in use.

This narrative review of literature serves to discuss the associations that have been previously outlined between psychosocial factors like mental health and socioeconomic class on both substance use and adverse birth outcomes and use these relationships to answer the question "Are pregnant women in stable recovery uniquely affected by psychosocial factors?". It can be hypothesized that this is a special group where these factors intersect and that evidence-based interventions may help reduce anxiety and relapse, ultimately improving birth outcomes. Guidance is provided for future studies as well as examples of how these interventions may be applied.

Methods

Search Strategy & Selection Criteria

We included studies that describe a relationship between two or more of the following factors: socioeconomic status, mental health, substance use disorder, and pregnancy. Electronic databases were searched during August, September, and December of 2022, and August of 2023 with the assistance of a university librarian. These databases include EBSCOhost, PubMed, Scopus, and Wiley Journals. Searches included terms such as 'history of substance abuse and birth outcomes', 'socioeconomic status and mental health on infant mortality rate', and 'pregnancy anxiety and substance use disorder'. U.S. government electronic resources such as the National Institute of Health, National Institute on Drug Abuse, the Organisation for Economic Co-operation and Development (U.S. department), and the U.S. Department of Health and Human Services were also consulted. The search terms were selected to find resources that summarized well-known effects of substance use and psychosocial factors on adverse birth outcomes. Each source was analyzed by study design, sample population, sample size, and statistical significance of the association described. By condensing these previously shown relationships and evaluating the populations affected, the research hypothesis was addressed by identifying a lack of literature describing psychosocial factors that impact pregnant women in substance use recovery. As a narrative review, the synthesis of the included studies was descriptive, and the data may have varying qualities. There is no assumption that the evidence of research is exhaustive, which is a limitation of this search strategy.

Inclusion & Exclusion Criteria

The included studies had to demonstrate a relationship between either mental health and pregnancy, SES and substance use, substance use and pregnancy, or a well-described combination of any of these factors. The population studied had to be adults and sampled from the United States. Modifying circumstances that were irrelevant to the parameters of the research question had to be absent or minimal. Types of studies included were systematic reviews, meta-analyses, randomized controlled trials, prospective and retrospective cohorts, cross-sectional studies, and government databases. After thorough screening and removal of duplicates, 66 resources were originally extracted for full review.

Exclusions were made due to studies having an inapplicable population (n = 3), taking place in a country other than the United States (n = 5), and having any other modifying factors that deemed the study irrelevant to this review's research question (n = 3). Such exclusions were made due to child and adolescent populations, studies performed in the context of the COVID-19 pandemic, and study countries such as Kenya, Austria, and Canada. Types of studies excluded were abstracts, news articles, webpage articles, editorials, and encyclopedias. Fifty-five resources were used for the final review. A summary of the population, sample size, and study design for each resource can be found in *Table 1*.

Table 1. **Characteristics of Studies with Relationships between Substance Use, Pregnancy, Mental Health, and Socioeconomic Status.**

Study	Population	Sample Size	Study Design
Asta et al. 2021	Pregnant women with OUD at a large academic women's hospital in Pennsylvania	50	Cross-sectional
Brogly et al. 2018	Pregnant women in treatment program where methadone and buprenorphine were administered	113	Prospective cohort
Buczkowski et al. 2020	Parents of infants admitted to NICU with neonatal withdrawal syndrome in Northern New England	15	Cross-sectional
Burris et al, 2017	Pregnancies from 2005-2009 in US birth certificate database	36,637	Retrospective cohort
Comfort et al, 1999	Pregnant women who were cocaine dependent enrolled in residential and outpatient treatment settings	Residential=32 Outpatient=32	Prospective cohort
Dunkel Schetter et al, 2012	Pregnancies documented in an HMO covering a public clinic and private suites of a metropolitan hospital	418	Prospective cohort
Fallin-Bennett et al, 2020	Postpartum women in an outpatient opioid use disorder clinic who had interacted with a peer support specialist at any time during pregnancy or postpartum	9	Cross-sectional
Fishman et al. 2020	National Center for Health Statistics linked birth and death data from 2007-2010	7,215,833	Retrospective cohort
Forray et al. 2015	Pregnant participants in a Psychological Research to Improve Drug Treatment in Pregnancy trial	152	RCT
Hargraves et al. 2017	Ten primary care practices within the Greater Cincinnati area	21,635	Cross-sectional
Havens et al, 2009	Women who participated in the 2002 or 2003 NSDUH	Pregnant=1800 Non-pregnant=37,527	Cross-sectional
Joshi et al. 2021	Pregnant women in the United States who used medication for OUD	3193 women	Meta-analysis
Kelley et al. 2021	Standardized patients making appointments for pregnant White and American Indian women with OUD at primary care and OB/GYN clinics in three rural Utah counties	34 calls to 17 clinics	Cross-sectional
Kelly et al, 2018	US adults who answered yes to the question: "Did you used to have a problem with alcohol or drugs but no longer do?"	2,002	Cross-sectional
Kline-Simon et al. 2017	Adults entering a substance use treatment program between 1994-1996 and adults without substance use disorder with similar demographics	997 with SUD, 4241 without	Prospective cohort
Knittel et al. 2022	Pregnant women with OUD in a women's prison in Southeastern United States	279	Retrospective cohort
Lewis et al. 2018	Adults in residential substance use treatment programs in Northern Florida from 2006-2015	945	Retrospective cohort
Madras et al. 2008	Patients who screened positive for substance use disorder using SBIRT across six states	104,329	Prospective cohort
McCarron et al. 2018	Women in a pregnant & postpartum substance use treatment program in the Northern Plains	18	Cross-sectional
Miele et al. 2023	Health record data from pregnant women with OUD who received buprenorphine, methadone, or naltrexone	5541	Retrospective cohort
Najavits et al. 1998	Women who reported substance use in the past 30 days and met the DSM-IV criteria for substance dependence and PTSD	17	Prospective cohort
Osterman et al, 2017	Pregnant women entering treatment for SUD in North Carolina, New Mexico, Kentucky, and Indiana	200	RCT
Rosenthal et al. 2021	Pregnant women who used methadone during pregnancy at a treatment center from 2012-2017	339	Retrospective cohort
Saloner et al, 2013	Patients who were discharged from publicly funded SUD facilities in 44 states, D.C., and Puerto Rico, 2007	1,026,332	Retrospective cohort
SAMHSA NSDUH	Residents of households and people in non-institutional group settings in 50 states plus D.C. in 2021	67,500	Cross-sectional
Sanjuan et al. 2019	Pregnant women with SUD and prior trauma enrolled in a treatment program at a public sector hospital in Southwest US	32	Prospective cohort
Schempf et al, 2008	Low-income women who delivered an infant at John Hopkins Hospital from 1995-1996	808	Retrospective cohort
Schiff et al. 2014	Women with OUD who had a live birth in Massachusetts between 2012-2014	4154	Retrospective cohort
Schmidt et al. 2023	Women in opiate treatment programs and homeless shelters in San Francisco and healthcare providers with reproductive health and SUD services	28 women, 26 providers	Cross-sectional
Stone, 2015	Pregnant women in a Midwestern city who had used substances during pregnancy	50	Cross-sectional
Suntai, 2021	2017 Treatment Episode Data-Discharges from SAMHSA	13,382	Retrospective cohort
Terplan, et al, 2012	Data from the NSDUH over a 5-year time frame	>140,000	Retrospective cohort
Travers et al. 2020	Infants born from 2007-2013 in 50 states plus D.C. using CDC WONDER linked birth and death data	28,526,534	Retrospective cohort
Trost et al. 2021	Pregnancy-related deaths from 2008-2017 reported by MMRCs of 14 states	421	Retrospective cohort
Tyson, et al, 2022	Emergency department visits by pregnant women in US from 2016-2019	2057	Cross-sectional
Verissimo et al, 2017	Civilian non-institutionalized adults living in the United States	532	Longitudinal survey
Vrana-Diaz et al. 2017	Women enrolled in an intensive community SUD treatment program	80	RCT
Walsh et al. 2019	Pregnant patients 18-45 years old in 1st or 2nd trimester at Columbia University Medical Center from 2011-16	187	Prospective cohort
Walton-Moss et al. 2009	Pregnant women in a university-associated hospital SUD treatment program in the US	84	Prospective cohort
Witte et al, 2023	Individuals in remission from moderate or severe substance use disorder in the US	494	Cross-sectional
Xu et al. 2014	Pregnant women with SUD	82	RCT
Yonkers et al. 2012	Pregnant women at two reproductive-health clinics in New Haven and Bridgeport, Connecticut who had used a substance in the last 28 days and were not already enrolled in SUD treatment	168	RCT
Zedler et al. 2016	Pregnant women with OUD who used buprenorphine or methadone for treatment	2146 studies	Meta-analysis

Legend: * NICU: Neonatal Intensive Care Unit; OUD: Opioid Use Disorder; US: United States; HMO: Health Maintenance Organization; SAMHSA NSDUH: Substance Abuse and Mental Health Services Administration National Survey on Drug Use and Health; OB/GYN: Obstetrics and Gynecology; SBIRT: Screening, Brief Intervention, and Referral to Treatment; DSM-IV: The Diagnostic and Statistical Manual of Mental Disorders IV; PTSD: Post-Traumatic Stress Disorder; SUD: Substance Use Disorder; D.C.: District of Columbia; CDC WONDER: Center for Disease Control & Prevention Wide-ranging Online Data for Epidemiological Research; MMRC: Maternal Mortality Review Committee. RCT: Randomized controlled trial.

Results

Theme 1: Mental Health & Socioeconomic Status

Many psychosocial factors affect birth outcomes, including maternal stress and anxiety, as well as socioeconomic status.[11] An estimated 30% of women have reported psychosocial stress in their daily lives during pregnancy and the rate of depressive disorders reported at birth has increased from 4.1 per 1,000 births to 28.7 from 2000-2015.[12,13] Dunkel Schetter and Tanner identified stressors that were associated with a high level of impact, including lack of material resources, poor workplace environment, excessive household responsibilities, and intimate relationship strain.[14] The measured depressive symptoms exhibited a linear relationship with adverse birth outcomes like low birth weight ($p<0.05$). Interestingly, perceived stress and daily troubles did not have a significant effect on any birth outcome ($p=0.27$, $p=0.59$) but stressors of a more chronic nature, such as racism and discrimination, demonstrated a robust effect on birth weight ($p<0.01$). This study was well-controlled for confounders such as smoking, education, income, and medical risks.

Walsh et al. described maternal stressors that resulted in clinically meaningful depression and anxiety phenotypes in the mother that could be measured physiologically.[13] These phenotypes were measured by quantifiable increases in allostatic load as well as increased fetal heart rate reactivity to stimuli. The allostatic load is defined as a cumulation of physiological stress indicators including blood pressure, heart rate, immune markers, and cortisol levels. Women who exhibited a higher allostatic load during the antenatal period had an increased risk of delivering both a preterm (OR=1.44, 95% CI=1.02-2.08) and low birth weight infant (OR=1.39, 95% CI=0.99-1.97). This study also included a psychologically stressed group that demonstrated high levels of depression and anxiety as well as daily negative mood and PTSD. The psychologically stressed group was significantly more likely to present with pregnancy complications ($p<0.05$) and reported higher instances of childhood trauma like abuse and neglect, as well as fewer years of education, lower income, and an increased likelihood of receiving public assistance. Among the greatest differentiators between tested groups, the most influential factor was social support. Lack of community support decreased hypothalamic-pituitary-adrenal axis regulation and magnified proinflammatory processes ($p<0.001$), which resulted in adverse birth outcomes and maternal depression throughout the perinatal period. The sample sizes for these groups were small, with a lack of representation for several ethnic minority groups, and the number of fetal neurodevelopment assessments were even smaller. As such, these results must be considered with caution.

Depression can reach severe enough levels in some patients to result in emergency room (ER) admission. Tyson et al. examined this trend, observing that mental health complaints comprised 6.2% of all ER admissions during pregnancy in their sample.[15] Women who experienced antenatal depression were more likely to deliver a preterm infant as well as have their infant admitted to the neonatal intensive care unit (OR=1.24, 95% CI=1.14-1.35). In some cases, mental health disorders in pregnant patients can result in maternal death, reported in one sample as nearly 11% of all pregnancy-related deaths.[12]

Anxiety surrounding the pregnancy itself is especially consequential, as explored in one study.[14] The authors demonstrated the effects of 'pregnancy anxiety,' a term described as a definable syndrome that presents as fear surrounding both childbirth and the postnatal period, as well as the well-being of themselves and the fetus, prenatal care, and transitioning into a maternal role. After controlling for risks, pregnancy anxiety was the only significant indicator of preterm birth when evaluating it alongside perceived stress and a state level of anxiety ($p<0.05$). The authors concluded that women with elevated pregnancy anxiety were 1.5 times more likely to deliver a preterm infant, a risk comparable to that of smoking. Certain characteristics predicted high pregnancy anxiety, such as unplanned pregnancy and fewer psychosocial resources. Lack of social and material resources can result in disadvantaged living conditions, education, environmental cleanliness, and employment.[16] These socioeconomic factors often produce circumstances with higher levels of chronic interpersonal discrimination and violence ($p<0.001$), which were two predictors of women who gave birth to very low birth weight infants (i.e., under 1500g) as summarized by Burris and Hacker.[16] Another study confirmed these results, showing that the odds of having a preterm infant were 1.9 times higher in women who had low social support due to a lack of resources that resulted in biologically-mediated maternal stress patterns.[17]

Socioeconomic disadvantage can be measured by neighborhood characteristics or by early life experiences, both of which have contributed to adverse birth outcomes.[18] Vast inequalities in SES have been speculated to explain the discrepancy between the United States' IMR compared to other developed countries, which is indicated by a Gini coefficient score of 0.38, the third highest among all measured countries in the Organisation for Economic Co-operation and Development (OECD).[17] The Gini coefficient ranges from 0-1, where 0 is equal distribution of wealth among all members of society and 1 is a single member possessing all wealth. Lorenz et al. confirmed this trend, demonstrating that SES disparities negatively impacted healthcare access as well as maternal behavior and disproportionately affected the poor, leading to a high IMR.[17] The United States' IMR also varies by maternal education, where babies born to mothers with a high school degree or less were approximately twice as likely to die within the first year of life compared to those born to mothers with a college degree ($p<0.0001$), as reported by Fishman et al.[19] The authors also suggest that negative maternal health behaviors that are socially patterned account for the socioeconomic distribution of poor birth outcomes. The data used for this cross-sectional study was expansive and represented a national population. However, several possible confounders were not examined, such as education, income, and health insurance, which could have influenced the results and weakened the strength of observed associations. A summary of the reviewed associations between psychosocial factors on birth outcomes can be found in ***Table 2***.

Table 2. **Summary of Associations between Socioeconomic Status, Mental Health, and Birth Outcomes.**

Factor	Observed Association	Statistical Value	Reference
Violence experienced by mother	Very low birthweight infants	p<0.001	Burris & Hacker, 2017
History of maternal depression	Pregnancy-related death	72% of deaths	Trost et al. 2021
Pregnancy anxiety	Risk of preterm infants	p<0.05	Dunkel Schetter & Tanner, 2012
Depressive symptoms due to socioeconomic stressors	Low birthweight infants	p<0.05	Dunkel Schetter & Tanner, 2012
High allostatic load due to maternal stressors	Risk of preterm and low birthweight infants	OR=1.44, 95% CI 1.02-2.08 OR=1.39, 95% CI 0.99-1.97	Walsh et al. 2019
Antenatal depression	Risk of infant being admitted to NICU	OR=1.24, 95% CI 1.14-1.35	Tyson et al. 2022
Preterm birth rates	Increased United States IMR	p<0.001	Travers et al. 2020
Maternal stress and anxiety, low SES, and race	Increased United States IMR	NA	Travers et al. 2020
Low social support leading to maternal stress	Risk of preterm infants	95% CI 1.7-2.1	Lorenz et al. 2016
SES disparities affecting the poor	Decreased healthcare access and negative maternal behaviors	NA	Lorenz et al. 2016
Socioeconomic disadvantage	Adverse birth outcomes	p<0.05	Blumenshine et al. 2010
Maternal education	Infant death within first year of life	p<0.0001	Fishman et al. 2020

Legend: OR: Odds Ratio; CI: Confidence Interval; NICU: Neonatal Intensive Care Unit; IMR: Infant Mortality Rate; SES: Socioeconomic Status; NA: Not Applicable

Theme 2: Poor Mental Health & Lower Socioeconomic Status Increase Risk of Substance Use Disorder

The U.S. Department of Health and Human Services estimates an annual impact of $442 billion from illicit drug and alcohol misuse combined, thus reflecting an extensive public health problem.[20] It is of special interest to examine the potential causal relationship of factors underlying substance abuse. A commonly researched association is that of socioeconomic status and substance use. Low socioeconomic status and substance use show reciprocity as the consequences of SUD result in socioeconomic burden, and the hardships of low SES can initiate drug use as a coping mechanism.[6] Social inequality can result in poor access to healthcare, including mental health facilities, which may exacerbate the potential for substance abuse.[21]

It is important to maximize beneficial health opportunities for those with SUD by considering both access and quality of healthcare, as well as provider attitudes toward addiction services, which have been shown to vary cross-culturally.[21] This is especially pertinent for minority groups where additional implicit bias from providers may be present, as reported by Saloner and Cook.[22] The authors also demonstrated that lower SES has been shown to increase the risk of substance use disorders in young adulthood, while highlighting that other studies have demonstrated a positive correlation between SES and substance use disorders in teenage populations. As this review is concerned with adult pregnant women, our selected studies did not primarily examine data for teenage substance use, although it is important to mention as a possible discrepancy in younger populations. Frequently, socioeconomic measures are employment-related characteristics, including education level and occupational prestige. Saloner and Cook also reported that lower levels of these factors have been shown to increase the risk of substance abuse and progression of SUD (p<0.01). This data set only included patients who were discharged from publicly funded treatment centers and may not represent outcomes for physician-provided assistance, including social support and therapy.

Correlations between mental health and SUD have been consistently demonstrated throughout literature and are a broadly studied topic. Results from the latest National Survey on Drug Use and Health (NSDUH) show that adults who had any mental illness or a serious mental illness were more likely to have used illicit drugs within the past year compared to those with no mental illness.[23] Chronic neurologic changes have been shown to develop following prolonged substance use and the resulting addiction can create a significant risk factor for suicide; SUD of any type resulted in a threefold increase in suicide risk in one study (p<0.001).[24] As substance use remains prevalent in the United States, it is important to recognize unique disparities in the groups that it affects. Some of these observed disparities and their associations with substance use are listed in *Table 3.*

Theme 3: The Intersection of Psychosocial Factors, Substance Use Disorder, & Pregnancy

Women are most likely to develop a substance use disorder during their childbearing years, and an estimated 5% of pregnant women use addictive substances.[24,25] These disorders are becoming increasingly common in women, including opioid use.[26]

Table 3. **Summary of Associations Between Socioeconomic Status, Mental Health, and Substance Use Disorder.**

Factor	Observed Association	Statistical Value	Reference
Poor access to healthcare due to social inequalities	Higher risk of substance abuse	NA	Lewis et al. 2018
Low education level and occupational prestige	Higher risk of substance abuse and progression to SUD	p<0.01	Lewis et al. 2018
Lower SES	Decreased rates of completion of substance use treatment	p<0.0001	Saloner & Cook, 2013
Implicit bias towards minority groups	Fewer substance abuse treatment options	NA	Saloner & Cook, 2013
Adults with mental health disorders	Higher likelihood of illicit substance use within the past year	p<0.05	SAMHSA, 2022
Prolonged substance use	Chronic neurologic changes	p<0.001	Forray & Yonkers, 2021
SUD of any type	Increased risk of suicide	p<0.001	Forray & Yonkers, 2021
Psychological and social factors	No significant effect on recovery identity	Psychological: p=0.191 Social: p=0.830	Witte, Amick, & Smith, 2023
Spirituality	Positive effect on recovery identity	p=0.012	Witte, Amick, & Smith, 2023
Mindfulness exercises	Reductions in drug use and cravings	p<0.001	Vrana-Diaz et al. 2017
Women in the first five years of SUD recovery	Discontent with psychosocial factors leading to low quality of life	p<0.05	Kelly, Greene, & Bergman, 2018
CBT for women with SUD and PTSD	Increase in substance abstinence over time	p<0.008	Najavits et al. 1998

Legend: NA: Not Applicable; SUD: Substance Use Disorder; SES: Socioeconomic Status; SAMHSA: Substance Abuse and Mental Health Services Administration; CBT: Cognitive Behavioral Therapy; PTSD: Post-Traumatic Stress Disorder.

A study conducted by Brogly et al. determined the Addiction Severity Index (ASI) scores for pregnant women undergoing opioid use treatment where buprenorphine and methadone were administered and birth outcomes were measured.[3] Upon admission, the ASIs were greatest in the psychological and employment categories, indicating that the greatest stressors for patients came from these areas. Expanding upon that concept, 26.5% of participants reported that most of their income came from employment, 18.6% from illegal activities, and 61.1% from public assistance. 56.6% reported ever being sexually abused, and 65.5% reported ever being physically abused. The average years of education completed were 12 ± 1.7. These characteristics are integrated into the complex population of pregnant women who suffer from SUD. These patients commonly reported experiencing economic instability and trauma histories, as well as multiple substance use disorders, comorbidities, and legal troubles. The study reported that 90.8% of women delivered live births and emphasized a need for obstetrics and gynecology departments to improve their knowledge of opioid use in expecting mothers. It may be difficult to postulate how directly the psychosocial factors in this study impacted birth outcomes because many of these factors are broad societal influences that may confound other variables' effects.

A thorough examination of the effect that SUD has on birth outcomes was demonstrated in a study by Walton-Moss et al.[27] While it was indicated that most women decrease or discontinue substance use during pregnancy, those who did not had a higher risk of delivering a low birthweight infant. Psychosocial factors that influenced this outcome were poorer self-perception of physical health (p=0.04), more years of substance use, and having a partner with past SUD history (p=0.03). Patient demographics showed that 91.8% were unemployed and the average years of education were 11.5, which reflected the sample population from Brogly et al.[3] The primary substance of abuse was heroin, followed by cocaine. Cocaine was the most significant risk factor for low birthweight and preterm birth (p=0.01).

Psychiatric disorders and other stressors are common among pregnant women with SUD.[12] Schempf and Strobino used a biopsychosocial framework to examine this relationship by reviewing medical records and administering a post-partum interview to women who delivered a baby at Johns Hopkins Hospital.[6] The authors showed that low birth weight was influenced more by moderate to severe stress than by cocaine and had twice greater odds of low birthweight than any substance in general (p=0.001). Living in public housing and having an external locus of control regarding the expected outcome of pregnancy were also associated with significant birth weight reductions (p=0.05). Multiple other risks were identified that contributed to drug use and adverse birth outcomes including stress, delayed prenatal care, poor nutrition, and lack of material resources. It should be noted that with any retrospective study, there is potential for recall bias. The authors accentuated the need to consider contexts like disadvantaged status when studying the causes of SUD and their outcomes on birth.

One study reported that 51.8% of pregnant patients with SUD reported having depressive symptoms within the past 30 days, and 44.7% reported anxiety.[27] More than half reported a history of some type of abuse, and 38.8% reported a history of suicide attempts. Suicidal ideation among perinatal women with SUD has increased from 1.8% to 9.3% among every 100 people in the past ten years, and it has been estimated that as many as half of pregnant women taking antidepressants discontinue them during the prenatal period.[24] Of all pregnancy-related deaths, mental health was found to be the leading preventable cause in a report reviewed by 14 state Maternal Mortality Review Committees.[12] The described mental health conditions included substance use, which was present in 67% of deaths. Among the risk factors associated with substance use deaths during pregnancy were previous suicide attempts (22%), having a child removed from the household by Child Protective Services (24%), and the cessation or dosage change of either psychiatric or substance use medications (39%). A different study elaborated upon this trend, finding that the women with SUD in their study had a 6.2-fold increased risk of suicide once they entered the postpartum period and that drug overdoses quadrupled in the 7–12-month period after delivery ($p<0.05$).[28]

Addiction is a cyclical disease characterized by chronic relapsing features, including disregard for negative consequences.[5] It is imperative to understand the specific challenges this group faces, with pregnant women being of particular interest due to the high associations with traumatic histories and accompanying psychological disorders, which may increase the risk of relapse.[5] Numerous mediators that contribute to continued substance use in pregnancy have resulted in a heterogeneous group of women that comprise an underserved population. In a study that analyzed data from pregnant women who participated in the 2002 or 2003 National Survey on Drug Use and Health, women who were less likely to have used any substance during their pregnancy were employed ($p<0.01$), married ($p<0.001$), or in their second or third trimester ($p<0.001$).[29] These results were adjusted for income, ethnicity, and age. Women who used substances during their pregnancy were more likely to be White and met the criteria for a current psychiatric illness. As a cross-sectional study, causal relationships cannot be assumed from this data. It should be noted that not all women who use substances during pregnancy have SUD or need treatment. In one study that also used NSDUH data, "treatment need" was either self-reported as needing treatment within the past year, or meeting the criteria for substance dependence or abuse.[30] After adjusting for confounding variables and pregnancy status, White women were more likely to need treatment than women of other races including Black (OR=0.61, 95% CI=0.54-0.69) and Hispanic women (OR=0.72, 95% CI=0.63-0.81). Participants who received government assistance were also more likely to need treatment (OR=1.15, 95% CI=1.03-1.28) and those who had at least a high school diploma were less likely to need treatment (OR=0.72, 95% CI=0.66-0.79). There were no significant differences in the likelihood of receiving treatment between all races and ethnicities. It is important to mention that with any self-reported data, there is the possibility of recall bias limiting the validity of the results.

The patients who receive treatment may be managed with several medications that are currently indicated for pregnant women with opioid use disorder, including methadone and buprenorphine. Studies have shown that buprenorphine is associated with better birth outcomes and a lower risk of preterm birth compared to methadone (RR=0.40, 95% CI=0.18-0.91), as reported in one meta-analysis.[31] No differences were noted for spontaneous fetal death or congenital anomalies, though the small sample sizes of the studies may have limited the power of these associations. Pregnancy may be a distinctive time when some women become more open to substance abuse treatment, although access to treatment can be difficult.[32] Kelley et al. compared the differences in access to opioid use disorder medications between White and American Indian pregnant women by having standardized patients call seventeen rural Utah clinics to set up an appointment.[33] 47.1% of clinical staff answering the calls were unaware of buprenorphine's indication for opioid use disorder in pregnancy or did not recognize its name. Although buprenorphine treatment was available in 26.5% of calls, only 17.6% offered an appointment to receive this treatment. The most frequent reason cited for not offering an appointment was a lack of prescribers (75.0%). A proportion of clinics reported not feeling comfortable providing a pregnant patient with buprenorphine (17.9%). Of the clinics that did not have this treatment option available, 87.5% offered referrals; however, these referrals were unreachable 67% of the time. Physical distance from sites that offered buprenorphine was an obstacle as well, with distances ranging from 0-126 miles and travel time reaching up to two hours and twelve minutes. No differences were seen among White and American Indian patients, although the sample size of the phone calls was relatively small at 34 calls.

Other barriers to treatment access for pregnant women with SUD are accommodation and acceptability of providers. In a meta-analysis conducted by Joshi et al, these barriers were commonly addressed by strategies like the provision of mental health care in 50% of studies, providing patient education on pregnancy and substance use (50%), and offering childcare (30.8%) and supplementary nutrition (23.1%).[34] A little over a quarter of studies utilized therapy that reinforced positive behavior (26.9%) and 19.2% focused on improving patient-provider trust and non-judgmental communication. The authors report that very few articles attempted to mitigate the financial burden of seeking care, including accepting Medicaid coverage (7.7%) and reduced treatment fees for pregnant women (3.8%). Only 15.4% of these studies provided office-based opioid use treatment.

One population of pregnant women with opioid use disorder sampled by Miele et al. demonstrated significant differences in receiving treatment based on demographic characteristics.[35] This population included 5,541 pregnant women from seven different

clinical sites across the United States, 79.1% of whom received treatment. Treatment medications included methadone, buprenorphine, and naltrexone. Although the authors report that some characteristics like race, ethnicity, and insurance status may have been misclassified due to clinical site differences, the data showed that patients were more likely to receive treatment if they were White ($p<0.0001$), older ($p<0.0001$), and had public insurance ($p<0.0001$). Rosenthal et al. reported that pregnant women of color with opioid use disorder received 36.2 milligrams less methadone than White women at the time of birth ($p=0.0003$), after adjusting for gestational age, maternal age, body mass index, parity, and type of opioid used.[36] It should be noted that the category "women of color" is limited in this study due to the unclear classification of Hispanic women. Pregnant women in prison have also been reported to receive varying doses of opioid use disorder medications, as demonstrated in a study by Knittel et al. that sampled pregnant women in a state women's prison facility.[37] Factors associated with a higher likelihood of receiving medication were women who had a closer level of custody (OR=2.31, 95% CI=1.41-3.77), used heroin as their primary substance (OR=2.07, 95% CI=1.17-3.66), and had received treatment before their incarceration (OR=8.47, 95% CI=4.73-15.19). There were no significant differences among age groups, race, duration of pregnancy, or education level. Of the women sampled, only 40.1% received medication during incarceration. 59.8% of this medication was methadone and 40.1% was buprenorphine. Following release, less than one-third of participants were offered a referral to an outpatient clinic that provided treatment in their community. The sample size of this population was small and only included one setting, which are limitations of this study.

Treatment program completion rates can also be affected by demographic characteristics. In a study assessing SUD treatment completion rates for pregnant women who used alcohol, marijuana, and other illicit substances, ethnicity and education differences were found to be statistically significant among the sample.[38] Black women were less likely to complete treatment than White women (OR=0.607, 95% CI=0.431-0.855), as were Hispanic women (OR=0.651, 95% CI=0.517-984). Women who had only a high school diploma were less likely to complete treatment than those who had higher levels of education (OR=0.776, 95% CI=0.606=0.993). Many factors were not significant, including age, marital status, having a mental health disorder, living arrangements, and health insurance. However, the frequency of substance use did have a significant impact, with women who used substances daily being less likely to complete treatment than those who only used sometimes (OR=0.665, 95% CI=0.527-0.840). Participants in residential treatment programs were less likely to complete the program than those in outpatient detox settings (OR=0.639, 95% CI=0.418-976). This data was collected only from publicly funded programs so selection bias may be present. In a different study examining cocaine-dependent pregnant women, the largest proportion of patients left treatment during the first three months of the program.[39] This trend was seen in both residential and outpatient settings. Residential patients reported more homelessness ($p<0.0001$), dissatisfaction with housing ($p<0.001$), and higher rates of psychiatric disorders and history of depression ($p<0.05$). All participants who had preterm births had completed three months or less of treatment. It should be noted that this study lacked a control group, which may limit the strength of the conclusions that were made. It is important to identify demographic characteristics that may lead to variations in treatment need, availability, and completion for pregnant women with SUD, as this is a chronic disorder that affects women of all socioeconomic backgrounds.

Martin and Parlier-Ahmad demonstrated that many experiences could prove to be traumatic in women with SUD during the prenatal period, including pregnancy-related PTSD experiences.[26] This occurrence can be especially intense in women who show concern for their baby developing neonatal withdrawal syndrome.[40] The anticipation of childbirth and associated pain is also a common stressor. Sanjuan et al. identified additional circumstances that influenced SUD-related pregnancy anxiety in their sample, such as unstable housing and income, incarceration concerns, racial discrimination, and domestic violence.[5] Participants included pregnant women currently in a treatment program for SUD who had been exposed to previous trauma. The factors that were identified all contributed to a PTSD response that resulted in temporary feelings of detachment from the fetus. This period of lowered fetal attachment led to an increase in substance craving, an instability that was shown to be transient. Further, craving was recognized as a valuable predictor of relapse as it created a significant source of distress for patients who were attempting abstinence. The authors emphasize that impediments such as fear of legal consequences, social stigma, and a deficit of trained professionals contribute to the underserved status of pregnant women with SUD.

Women who are younger and have a history of depression may also be more likely to relapse during the perinatal period, as reported in one randomized controlled trial of 152 women participating in the Psychosocial Research to Improve Drug Treatment in Pregnancy trial.[41] Participants who were over the age of 21 were less likely to relapse than younger women ($p=0.021$) and those who had a history of depression were more likely to relapse than those who did not ($p=0.002$). Cocaine use was less likely to recur in the perinatal period than other substances like alcohol ($p=0.004$). No other factors were significantly associated with relapse, including race, ethnicity, education, marital status, and other psychiatric disorders like dysthymia, generalized anxiety disorder, and post-traumatic stress disorder. These results suggest that many psychosocial factors may not have a strong influence on relapse risk, although the mental health disorders in this population were not specifically related to pregnancy. This study demonstrates that such disorders may affect populations differently depending on context and underscores the importance of treating women in different stages of SUD individually.

Table 4. **Summary of Associations Between Psychosocial Factors, Substance Use, and Pregnancy.**

Factor	Observed Association	Statistical Value	Reference
Substance use during pregnancy	Higher risk of low birthweight infants	NA	Walton-Moss et al. 2009
Stress, delayed prenatal care, poor nutrition, lack of resources	Substance use during pregnancy	NA	Schempf et al, 2008
Pregnant patients with SUD	Anxiety and depressive symptoms	44.7% and 51.8% of sample, respectively	Walton-Moss et al. 2009
History of some type of abuse	Substance use during pregnancy	58.8% of sample	Walton-Moss et al. 2009
Previous suicide attempts or child removed by CPS	Pregnancy-related death	22% and 24% of deaths, respectively	Trost et al. 2021
Women with SUD	Increased risk of suicide and drug overdose in postpartum period	p<0.05	Schiff et al. 2014
PTSD response to stressors in pregnant women with SUD	Feelings of detachment towards fetus and increased cravings	p<0.05	Sanjuan et al. 2019
Social stigma, lack of trained professionals	Underserved status of pregnant women with SUD	NA	Sanjuan et al. 2019
Patients in stable remission from SUD	Lower survival rates than patients without SUD	p<0.001	Kline-Simon et al. 2017
Economic hurdles in SUD patients	Difficulty seeking prompt prenatal care	NA	Daley, 2013
Incarcerated pregnant patients with medium/ close custody level, heroin as primary substance, pre-incarceration MOUD	Increased likelihood of receiving MOUD while incarcerated	OR=2.31, 95% CI 1.41-3.77 OR=2.07, 95% CI 1.17-3.66 OR=8.47, 95% CI 4.73-15.19	Knittel et al. 2022
Black and Hispanic women	Less likely to need treatment for SUD than White women	Black: OR=0.61, 95% CI 0.54-0.69 Hispanic: OR= 0.72, 95% CI 0.63-0.81	Terplan et al, 2012
High school diploma or higher	Less likely to need treatment for SUD	OR=0.72, 95% CI 0.66-0.79	Terplan et al, 2012
Receiving government assistance	More likely to need treatment for SUD	OR=1.15, 95% CI 1.03-1.28	Terplan et al, 2012
Women older than 21 years	Less likely to relapse during the perinatal period than women younger than 21 years	p=0.021	Forray et al. 2015
Women with major depressive disorder	More likely to relapse during the perinatal period than women without major depressive disorder	p=0.002	Forray et al. 2015
Cocaine use	Less likely to recur during the perinatal period than alcohol	p=0.004	Forray et al. 2015
White women	More likely to receive MOUD in pregnancy	p<0.0001	Miele et al. 2023
Receiving public insurance	More likely to receive MOUD in pregnancy	p<0.0001	Miele et al. 2023
Pregnant women having only a high school diploma	Less likely to complete SUD treatment	OR=0.776, 95% CI 0.606–0.993	Suntai, 2021
Pregnant women engaging in daily substance use	Less likely to complete SUD treatment	OR=0.665, 95% CI 0.527–0.840	Suntai, 2021
Pregnant women in residential SUD treatment programs	Less likely to complete treatment than outpatient detox programs	OR=0.639, 95% CI 0.418-0.976	Suntai, 2021
Pregnant Black women	Less likely to complete SUD treatment than pregnant White women	OR=0.607, 95% CI 0.431-0.855	Suntai, 2021
Pregnant Hispanic women	Less likely to complete SUD treatment than pregnant White women	OR=0.651, 95% CI 0.517-0.984	Suntai, 2021
Pregnant women of color	Received less methadone dosage than pregnant White women	p=0.0003	Rosenthal et al. 2021
Women who reported using substances during pregnancy	More likely to be White and have current mental health disorder	p<0.001	Rosenthal et al. 2021
Women who were employed, married, or in their 2nd or 3rd trimester	Less likely to have used substances during pregnancy	Employed: p<0.01 Married: p<0.001 2nd or 3rd trimester: p<0.001	Havens et al. 2009
Feeling of closeness with recovery network members	Decreased substance use during pregnancy	r= -0.26	Asta et al. 2021
Recovery network members who had used substances and provided informational support to pregnant patients	Decreased substance use during pregnancy	r=-0.25	Asta et al. 2021
Pregnant women with SUD receiving MET-CBT	Less preterm births than women receiving brief advice	p=0.08	Yonkers et al. 2012
Pregnant patients receiving MET that included brief motivational techniques	Decreased illicit drug use than patients who received treatment as usual	p<0.01	Osterman et al, 2017
Buprenorphine treatment in pregnant women with SUD	Lower risk of preterm birth compared to methadone	RR = 0.40, 95% CI = 0.18-0.91	Zedler et al. 2016
Pregnant women with cocaine dependence in residential treatment program	More likely to be homeless, dissatisfied with living arrangements, and have depression than patients in outpatient setting	Homeless: p<0.0001. Dissatisfied with housing: p<0.001. Depression: p<0.05	Comfort et al, 1999

Legend: NA: Not Applicable; SUD: Substance Use Disorder; CPS: Child Protective Services; PTSD: Post-Traumatic Stress Disorder; MOUD: Medications for Opioid Use Disorder; OR: Odds Ratio; CI: Confidence Interval; MET: Motivational Enhancement Therapy; CBT: Cognitive Behavioral Therapy; RR: Relative Risk.

In one study, pregnant participants who had completed treatment at a facility for SUD mentioned the importance of emotional support more commonly than practical support when completing the study.[42] Social support that was recovery-oriented and included family members or other community members that had shared similar experiences was listed as a helpful asset during recovery, including program staff that had adequate cultural competence, defined as the ability to effectively communicate with people from different backgrounds. This was a short study and only included women who had completed treatment, so the results may not be generalizable. The postpartum period generates yet more obstacles for many mothers, including altered sleep patterns and mental health struggles.[26] For those with SUD, these hardships can be exacerbated by unstable family dynamics, substance use recurrence, and stigma surrounding their substance use history. In a study of individuals who had successfully completed a treatment program 13 years prior, remission trajectories determined that those in stable remission had overall lower survival rates than non-SUD patients ($p<0.001$).[7] This emphasizes the need for personalized healthcare for patients well beyond the length of treatment programs, especially for patients in an imperative state of health such as pregnancy. A summary of the associations found between psychosocial factors, SUD, and pregnancy can be found in *Table 4*.

Discussion

It is estimated that under 13% of pregnant women and 10% of non-pregnant mothers who need SUD treatment receives it.[26] The underlying determinants of this condition in pregnancy often overlap and create a population that is difficult to treat. Women with SUD comprise a vulnerable population that may be more susceptible to relapse and craving than their male counterparts and more likely to endorse negative beliefs toward treatment such as pessimism and fear.[8,43] In one study, women experienced greater difficulty during the first five years of remission due to dissatisfaction with the psychological, social, and physical features of their lives, which led to a lower quality of life and self-esteem.[44] As the effect of SUD on adverse birth outcomes has been well documented, healthcare providers must focus on preventing relapse in those who are abstaining from use during pregnancy.

Most women who become pregnant have reported discontinuing the use of substances that they were previously taking.[27] Still, there is a gap in the literature addressing pregnant women who have been in sustained or stable recovery from SUD past the timeframe of treatment. Sustained recovery is defined as over one year with no substance use and stable recovery as over 5 years.[8] This distinctive population has only been mentioned a few times in current research. The proportion of women participants in sustained or stable remission following treatment could make up a sizable proportion of all people in remission and constitutes a group that has not been clearly identified. Further, the members of this population who become pregnant have not been outlined at all. Pregnant women in the maintenance phase of recovery are not synonymous with those actively engaging in addictive behaviors and substance use.

Addiction is a chronically recurring disorder and those at different stages of the cycle should be treated individually, as the triggers they experience may differ significantly. Depending on the history of the patient, it can be hypothesized that clinical triggers that precipitate substance use-related pregnancy anxiety may include the pregnancy itself, venous punctures, and pain management during and after birth. These aggravating factors may be more robust for patients with a history of intravenous drug use and opioid use disorder. Prenatal care is associated with a lower risk of low birthweight and preterm infants, but there are many reasons why women with SUD may not seek prompt prenatal care.[45] Economic hurdles that are common in patients with SUD, such as a past criminal record, unemployment, or dependence on welfare, can complicate their ability to seek prompt prenatal care when in remission.[4] Other studies assessing variables important to recovery have demonstrated that psychosocial factors did not have a significant effect on recovery identity, or how much a person identifies themselves as "in recovery", but spirituality did.[46]

Patient perspectives give us insight into the challenges that pregnant women with SUD face, which are important to consider when creating personalized treatment plans for this population. In a study conducted by Schmidt et al., surveys were administered to women in opiate treatment programs and homeless shelters in San Francisco to gather patient viewpoints on reproductive healthcare.[47] One participant described an appointed social worker as a valuable tool who provided a lot of care, direction, and assistance during her pregnancy. Another patient reported that healthcare providers could improve patient care of this population by treating them the same as other patients and stated, "You know [we] are normal people just like you and anybody else." Twenty-six healthcare settings that offered reproductive services and substance use treatment were also interviewed and mostly focused on improving logistical barriers, whereas the patients mostly advocated for an improved healthcare environment. It is important to acknowledge this discrepancy between the improvements that patients and providers prioritized, although this study only represents a small sample of one city.

Many women with SUD avoid seeking prenatal care altogether to minimize any fear and stigma they may face, regardless of their need for treatment or ability to receive it. A survey that was administered to thirty women in a Midwestern city who had used alcohol or other drugs during their pregnancy showed that many of the participants feared that their healthcare provider would detect their substance use, which resulted in 54.5% using avoidance strategies like scheduling appointments around their substance use, skipping visits, or not seeking prenatal care at all.[48] Others were honest with their care team and described the negative experiences that resulted. One patient said that she felt like being honest with her doctors would help her child but stated "All I did was damage that relationship and our early bonding". Another woman explained why she avoided prenatal visits after the first appointment, saying "They told me if they see THC or

something like that in my system, then protective services would get involved." Even the women who continued care and underwent substance use detoxification reported that the programs did not address how to deal with triggers, which was detrimental when they returned to the same environments that they had been in before treatment.

Mindfulness exercises have been used successfully to reduce drug use and cravings in pregnancy.[49] Using meditation as a tool, the participants in one study were able to directly approach unwanted emotions and memories versus defaulting to harmful avoidance strategies. Similar patient populations have been shown to benefit greatly from peer support specialists.[50] One participant described the experience of their newborn suffering from neonatal withdrawal syndrome and being removed from the room after birth as a "very traumatic, traumatic time" and outlined the confusion that ensued from a lack of guidance by healthcare providers. A greater trust was placed in peer support specialists than in healthcare professionals and the desire to have this support prior to, during, and after birth was expressed by several participants. Further, it was more helpful to have assistance in problem-solving than just instruction. It has been demonstrated in another sample that patients with SUD who felt their providers gave informational support and a feeling of closeness used less substances during pregnancy ($r = -0.25$).[51] Fostering a nonjudgmental and supportive environment as a healthcare provider is pivotal to increase the likelihood of patients being receptive to treatment. The literature has reported the efficacy of pharmacologic treatments for pregnant women with SUD but utilizing evidence-based mental health resources and screening tools may be beneficial as well.

Psychological interventions aimed at minimizing substance use and adverse birth outcomes in pregnant women with SUD have included SBIRT, MET, and CBT. Strategies of SBIRT include screening for high-risk patients and providing connections for treatment. This type of management has been described in several randomized controlled trials and has shown great benefit.[9] Therapies used in treatment can include MET and CBT. One study showed that women whose treatment included MET with brief motivational techniques demonstrated less illicit drug use over time than women who received control treatment ($p<0.01$).[52] In women with concurrent SUD and PTSD, CBT has been shown to increase the length of abstinence after treatment ($p<0.008$).[53] In a study that trained nurses during a multi-day workshop to administer both MET and CBT techniques to pregnant women with SUD, the treated group showed no statistical difference in the number of days that substances were used before or after delivery but did show fewer preterm births than those who received only brief advice ($p=0.08$).[54] Brief advice lasted around one minute and included guidance on the risks of substance use during pregnancy and the benefits of seeking treatment. This study may have been limited by the unequal treatment groups and a small sample size because the MET-CBT groups had lower attendance due to the longer time that was required versus the one-minute brief advice treatment. MET-CBT may also be more expensive for patients than brief advice. In a micro-costing study that assessed the monetary cost and resource utilization cost, including the time spent for each session, MET-CBT intervention cost $1469 per patient, whereas brief advice cost $316 per patient.[55] These types of therapies that have shown efficacy in pregnant women with SUD may also be beneficial to women who are in sustained remission and have been identified by a screening tool such as SBIRT.

Pregnancy is a unique time for observational studies due to the potential to minimize recall errors by recording real-time data as the patients experience it, notably as it relates to pregnancy-related triggers in SUD. Future studies should examine the independent effects of socioeconomic status and mental health on relapse rates in pregnant women who are in sustained or stable recovery. Continued evaluation should include the length and severity of relapse and ultimately the effect on birth outcome. By assessing the relative impact of each variable and developing a weighted prognostic system to predict relapse in this population, potential screening tools and interventions may be introduced.

Limitations

Narrative reviews are a collection and summarization of previous research to identify what is known about a subject and what needs further investigation. The process of finding resources to fulfill this objective makes this type of review susceptible to selection bias. Since the population of interest was in the United States, only English-language studies were selected. This also creates a bias that may have been mitigated through the inclusion of other languages. The heterogeneity of the included studies prevents meaningful quantitative comparison, which may reduce the predictive value of the clinical recommendations that were based on these relationships. Finally, the independent effects of psychosocial factors on health outcomes are difficult to measure because multiple factors are usually present that create confounding variables.

The limitations of this study were countered with mitigation strategies such as a search strategy with well-defined inclusion and exclusion criteria and assessing each source for study design, sample population, and statistical significance.

Future Directions

Future studies could be improved by observing and studying pregnant women who are in stable or sustained remission from substance use disorder. The use of ecological momentary assessments would provide the most valuable and unbiased data on real-time emotions being experienced throughout the study. Examples of measurable factors that may influence pregnancy-related psychological distress related to the maintenance of sobriety in this population include perceived physician bias, specific fears including relapse and pain, PTSD episodes, and substance use triggers. The magnitude of these effects should be analyzed using multiple linear regression. Rates of relapse and infant morbidity should ultimately be evaluated.

These studies' outcomes could help develop a screening questionnaire to identify pregnant women at the highest risk of relapse. Interventional strategies such as CBT, MET, peer-led

support personnel, mindfulness exercises, and spiritual groups may then be implemented. Physicians have reported a lack of time with patients as a major obstacle to screening questionnaires.[10] Utilizing a social worker or other appointed healthcare worker who could provide access to these resources or referral to psychiatric treatment after a patient has been identified as at-risk, may be the best practice. Healthcare providers must continue this degree of personalized care for pregnant women with a history of substance use disorder even if the patient is in sustained remission and does not spontaneously offer information about experienced stress.

Observational studies are the best approach to collect qualitative data describing how a pregnant patient feels in response to stressors. However, researchers using this method may experience limitations including selection bias and confounding bias, as variables are difficult to control. Further, the Hawthorne effect may be possible if data is being recorded in real time using ecological momentary assessments. Minimizing confounding variables as much as possible would be crucial to maintain the highest amount of validity when describing observed relationships.

Summary – Accelerating Translation

A Review of Psychosocial Factors on Birth Outcomes in Women with Substance Use Disorder in the United States: The Importance of Preventing Relapse During Sustained Remission

The United States has had a higher infant mortality rate (IMR) than other developed countries for years. Efforts have increasingly focused on psychological and social factors including socioeconomic status (SES) and mental health. One group of people who are uniquely affected by these factors during pregnancy are those with substance use disorder (SUD), and it has been well-documented that substance use during pregnancy leads to an increased risk of negative birth outcomes. Usually, when the relationship between substance use and birth outcomes is examined, broader influences like SES and chronic mental health disorders are considered indirect stimuli of substance use. Further, these psychosocial factors also affect birth outcomes independently so it can be hard to discern their individual effects on substance use during pregnancy. The purpose of this paper is to review what is known about the effect of psychosocial factors on birth outcomes as well as substance use on birth outcomes and to outline a group where these influences may have a more direct effect on substance use in pregnant women. This unique group is women who are in remission from SUD. This is an important distinction to make because most of the available research focuses on pregnant women who are in active addiction or those who have been recently enrolled in a rehabilitation program. Women who have been sober for years are not synonymous with the previously researched populations and may have triggers stemming from psychosocial factors that directly affect their desire to use or concerns about remaining sober while pregnant. It is important to consider the social aspects of health so personalized healthcare plans can be created for each patient.

To review the literature, several academic databases were used including EBSCOhost, PubMed, Scopus, and Wiley Journals. Searches included terms such as 'history of substance abuse and birth outcomes', 'socioeconomic status and mental health on infant mortality rate', and 'pregnancy anxiety and substance use disorder'. Many articles were originally extracted to demonstrate the previous associations that have been made between those variables. Eleven articles were excluded because they had a sample population that was inapplicable to the paper's purpose, the study took place in a country other than the United States, and miscellaneous reasons that deemed the study irrelevant to the topic. Fifty-five references were included for review and use.

After reviewing the included articles, a few themes were consistently demonstrated. Socioeconomic disadvantages such as lack of maternal resources, low social support, disparities disproportionately affecting the poor, and low maternal education led to an increased risk of very low birthweight infants, preterm infants, and infant death within the first year of life. Mental health obstacles like pregnancy anxiety, depressive symptoms due to socioeconomic stressors, and antenatal depression led to an increased risk of low birthweight infants, preterm infants, and an infant being admitted to the neonatal intensive care unit (NICU). Both maternal stressors and preterm births were shown to contribute to the United States' high IMR. The second theme observed was the effect of mental health and SES on substance use. Poor access to healthcare and lower education levels were shown to increase the risk of substance abuse. Implicit bias from providers was associated with fewer SUD treatment options and lower SES with decreased rates of treatment completion. Adults who had mental health disorders had an increased risk of SUD and those with SUD had a higher risk of suicide. Finally, several studies showed that women with SUD had a higher risk of low birthweight infants. Substance use during pregnancy was influenced by social stigma, economic hurdles, and lack of resources.

In conclusion, high levels of maternal stress and anxiety as well as lower socioeconomic status can lead to an increased risk of adverse birth outcomes. Women with substance use disorder also have an increased risk of infant morbidity and mortality, of which most cases were caused by preterm births. Pregnant women with SUD are an underserved population that may be influenced by a variety of psychosocial factors. A lack of trained professionals and delayed prenatal care due to social concerns are two of these factors. Most notably, one study described the idea of pregnancy anxiety in women with SUD, which was exacerbated by post-traumatic stress disorder (PTSD) responses to certain stressors. These stressors included concern for their baby developing withdrawal symptoms at birth, fear of legal consequences, and unstable housing and income. The resulting PTSD response led to temporary feelings of detachment from the fetus and increased cravings. However, this study used a sample of women who were in the active stages of addiction and not remission. Another study showed that all participants who were in ongoing remission from SUD 13 years after the study still had an overall increase in mortality risk than individuals who had never had SUD. This highlights the importance of considering women who are in remission from SUD as a distinct population that may have different levels of stress directly associated with maintaining sobriety throughout pregnancy as opposed to someone who is actively using or in a rehabilitation facility. This stress and/or SES hurdles could result in instability that may make relapse and adverse birth outcomes more likely during this imperative time.

These findings provide background information and guidance for future studies that may use techniques like ecological momentary assessments to measure the anxiety experienced by pregnant women in remission from SUD. Screening questionnaires may be used to screen for high-risk factors that may increase the risk of relapse and ultimately adverse birth outcomes and IMR in this population.

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Review

Medical Students' Study Habits Through a Sociocultural Lens: A Systematic Literature Review

Hamzah Shahid Rafiq,[1] Erik Blair.[2]

Abstract

This study investigates the literature on medical students' study habits and the surrounding sociocultural factors. A systematic literature review was undertaken, aiming to establish what is known, identify gaps in the literature and suggest what further research needs to be done. The review followed the PRISMA guidelines and identified 13 papers that were within the inclusion criteria. These papers were analyzed and discussed through a sociocultural lens, dividing the results into four sociocultural groupings: Personal, Behavioral, Environmental and Cognitive. The findings suggest that while sociocultural factors influence medical students' study habits, individual behaviors and attitudes predominantly guide their study decisions. The findings also suggest that there is little research into the intersection of these factors. It is recommended that the factors drawn from this systematic review be used to formulate more direct research into study habits with a magnified approach to help provide medical institutions, policymakers, and students with information to better inform their decisions and produce efficient, healthy study habits.

Introduction

Study habits are the routines and activities students undertake to support their learning. Sociocultural components, such as socioeconomic background, religion, ethnicity, and family, are among the many factors that can influence a student's study habits.[1-3] Study habits are regular activities, and it is this regularity of use that makes them a 'habit'. These habits are not limited to one form of study or one study technique, nor are they solely about revision for assessment. Study habits are systems developed by individuals that they think will best support their learning. Students have different study strategies, different study timetables, and can get distracted during their studies; however, good study habits can make a difference to the likelihood of academic success.[4-5] Not all students will have effective study habits and some study habits may be detrimental to academic development.[6] However, previous studies have demonstrated that academic performance can be improved if students can develop purposeful and regulated approaches to their studies. For example, Miller has suggested that students from 'at risk' backgrounds (e.g., economically disadvantaged students) can improve their approach to study and their academic outcomes if they have appropriate study plans.[2] This shows that student outcomes may be enhanced if we provide medical institutions and students with information to better inform their study decisions. This review aims to achieve this by examining the literature regarding medical students' study habits and the surrounding sociocultural factors.

One of the main indicators of success in medical students is past academic performance; however, this only accounts for 23%.[7] This means that there is scope to investigate wider, non-academic factors. Modern medical education has placed students at the center of their learning with the introduction of key documents that emphasize a curriculum focused on knowledge, skills, attitudes, and behaviors (see for example, the General Medical Council's (GMC) 'Tomorrow's Doctors' and 'Outcomes for Graduates').[8-9] These documents have motivated institutions to modernize their curricula to better support student development. This modernization of the curriculum has led to a more personalized approach to education.[8] However, despite curricular modernization, Wynter et al. found that the design and implementation of medical curricula did not support a wide range of students' study needs.[10] This raises issues of curricula misalignment and simultaneously demonstrates the need for students to become metacognitively aware of what they are studying, how they study, and the habits they have developed either before or during medical school.

The resources that are available to students can be seen as a form of capital, where a student's finances and connections can help them prepare for effective study. Bourdieu discussed the idea of social capital being the networks and relationships you have with other people and the way you use them.[11] In the context of education, if a student has higher social capital, then they are more likely to interact with their seniors and colleagues which can lead them to gain skills that might benefit their academic outcomes.[12] Through collaborative learning, students engage in enactive learning, gathering multiple perspectives and developing a critical approach to the world.[13-14] Sociocultural factors affect how students can attain this capital. Those from

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lower socioeconomic backgrounds may have worked hard to maximize their limited social capital to gain entry into medical school; however, once in medical school, they might struggle to operationalize new social relationships, hindering their educational growth.[15] The conceptions of learning that students build structure the way they study and this perception is shaped by their upbringing and by those around them, so it is pivotal that the relevance of sociocultural factors is understood.[2,16]

Students from more privileged, more supportive, or more closely bonded backgrounds may have been supported to develop good study habits at an early age, while other students may not have had this guidance.[17] To understand this, Harden et. al. suggest we look beyond students' cognitive structures into non-cognitive components such as student motivation, student identity and student attitudes towards studying.[18] If educators can increase their contextual understanding of factors such as these, then they may be better able to develop approaches that will help enhance methods to support a range of students' study habits.

The development of study habits can be explained by Bandura's social cognitive theory, which states that if we observe someone perform a behavior with positive consequences then we use this information to guide our subsequent behaviors.[19] In the context of medical education, this modelled behavior can be seen with students revising with friends - where social interactions contribute to the development of semantic networks. Schunk describes how Bandura's social learning theory highlights the personal, behavioral, environmental, and cognitive aspects of human development.[20]

This paper seeks to critically analyze the current literature to establish what is known about the impact of sociocultural factors on student study habits. This systematic literature review identified appropriate studies using Boolean search terms and various inclusion and exclusion criteria. These studies were then critically appraised. In doing so, core themes were identified and gaps in the literature were highlighted for future research. There have been many meta-analyses and systematic reviews on study habits and how they link to academic achievement, but few have looked at how these study habits are influenced by non-cognitive factors. Where papers have looked at sociocultural factors (see for example, Gilavand & Emad, 2021, Munusamy & Ganesan, 2021, Khan et al., 2021) these studies tend to focus on the academic side more than the contextual making of a student.[21-23] In this way, this paper offers a new perspective as it asks the question, 'How do sociocultural factors impact medical students' study habits?

Methods

A systematic review of the literature was undertaken, following the guidance of Peters et al. and Xiao and Watson to explore the extent to which sociocultural factors impact medical student study habits.[24-25] This systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines as well as further literature which informed decisions made during the process.[26-27] Following the PRISMA guidelines increases transparency; allowing readers to assess the appropriateness of the methods and the trustworthiness of the findings.[27]

To establish a clear scope for the study and to establish the parameters around study selection, two key terms from the research question, 'study habits' and 'sociocultural factors', need defining.[26]

The term 'study habits' refers to an individual's unique approaches to learning. Study habits are the repeated practices an individual has developed when conducting learning activities to gain information; these can be systematic or disorderly, efficient, or inefficient.[28-29] Students who develop productive and efficient study habits are more likely to attain higher academic outcomes.[30-33] The term 'sociocultural factors' refers to the social and environmental constitution of an individual. Sociocultural factors are central to human experience and sense-making.[34] Such factors include socioeconomic status, epistemological beliefs, cultural values, ethnicity, living situation and health status.[35] Social learning theory and sociocultural theory draw from these factors saying that an individual's development is confined to an overarching sociocultural system which interacts with internal cognitive structures.[19,35-36] Through these interactions, we learn and progress both in educational and non-educational contexts.

Search Strategy & Databases Used

This systematic review covered the period 2009-2023 applying a Boolean search using keywords formed of derivatives of the terms 'medical student', 'sociocultural' and 'study habits'. Search terms were used in combination with a series of Boolean "AND/OR" operators and asterisk wildcards (*Table 1*). These terms were used to search several databases including PubMed, Education Research Complete, Web of Science, Scopus, and PsycINFO.

***Table 1*. Search Terms Used During the Database Search.**

Key search term	"Medical students"		"Sociocultural"		"Study habits"
Derivatives	medic*, undergrad*	AND /OR	sociocultur*, socio-cultur*, socio*	AND /OR	revis*, habit*, study
Wider / aligned derivative terms	MBBS MbChB		divers*, religio*, ethnic*, famil*, age, gender, female, male		study skills, academic study, study approach study attitude,

Eligibility Criteria

For articles to be included in this review, they had to meet the following criteria. Articles were included if they were original research conducted with quantitative, qualitative, or mixed methodologies. Only peer-reviewed research was considered; therefore editorials, dissertations, reports, book chapters and essays were excluded. The reason for this is that peer-reviewed articles tend to have gone through a rigorous process of analysis and evaluation; therefore, their outcomes are more trustworthy. Only research published in English was considered to avoid any translation errors. The papers included were published from 2009 onwards. The start date was drawn from the publication date of the GMC document 'Tomorrow's Doctors' which outlines standards for undergraduate medical education in the UK, where the research team is situated.[8] This publication is the basis on which the current 'Outcomes for Graduates' document was developed.[9] This document is relevant to this study as it outlines that part of the medical education curriculum should be focused on examining how external factors can affect learning about health and disease. The exclusion criteria related to the type, rigor, language, and dates of the articles. Articles that were not original research were excluded; articles that had not been peer reviewed were excluded; articles that were not published in English were excluded, and articles that were published outside the set timeframe were excluded.

Screening

Although the date parameters of this study were defined by key documents from the UK, the scope of search was much broader and included all relevant literature published in English. Once databases were searched and studies found, the initial findings were exported to Endnote reference software and duplicates identified by the software were deleted. Following this, the titles and abstracts were screened against the criteria (*Table 2*) by one of the research team. The screening process ensured that the selected studies matched the aims of this systematic review and met the inclusion criteria. Studies that passed the initial screening process were then read thoroughly to check that the full texts met the inclusion criteria. Through an initial scoping review, the term 'study skills' was found to be used synonymously with 'study habits'—despite some differences between these terms—and was, therefore, included within the search terms to allow for a comprehensive review. Data screening was undertaken by one researcher as part of a student project; however, measures were put into place to ensure consistency of results through regular meetings with their supervisor. If this study were to be repeated, multiple researchers could be involved to reduce possible selection bias and provide inter-rater validation.

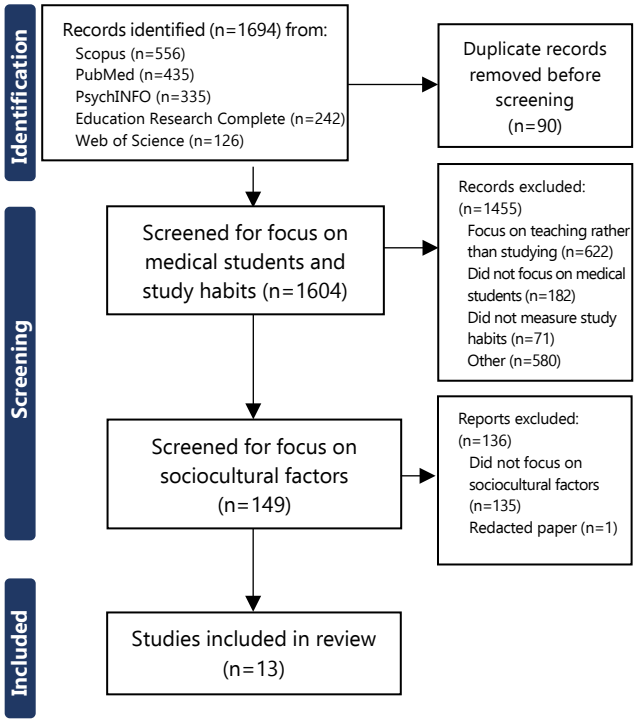
Table 2. **Screening Criteria Following Database Search.**

Screening Criteria
Discussed the population of interest – Medical students
Measured study habits/skills
Touched on any aspect of sociocultural factors
Original research conducted

PRISMA Screening

A total of 1694 papers were found in the database search. These papers were exported to Endnote referencing software and 90 were excluded due to being duplicates. Following the screening of titles and abstracts, 1455 papers were removed as they did not meet the inclusion criteria for the population or area of focus. For example, some papers did not focus on medical students and others focused on researching different formats of teaching interventions rather than students choosing a format as a regular resource for study. Following this, 149 papers underwent full text screening, all of which were retrievable. This led to a further 136 papers being excluded. Of these, 135 were removed due to not focusing on sociocultural factors, and one paper was excluded due to being redacted. This left 13 papers that met the screening criteria. A full account of the screening system, following the PRISMA guidelines, can be seen in *Figure 1.*

Figure 1. **Overview of the Screening Process, PRISMA Study Flowchart.**



Methodological Limitations

The analysis of the 13 papers used a holistic approach to examine how the papers aligned with the four themes drawn from Bandura and Schunk.[19-20] This meant that the alignment was based on researcher review of the core messages found in the papers, rather than objective standards. There is the potential that different researchers may have found different themes; however, the research team discussed each instance, and no discrepancies were found. This meant that the assurance of quality comes from the rigor of the review process rather than from the application of objective tools. Potential publication bias could also be a slight concern as articles are published based on a journal's aims and scope; therefore, there may be unpublished findings that may be

relevant but to which the research team did not have access. There may be some limitations regarding the inclusion and exclusion criteria – as there will be research that falls outside these criteria and has not been examined; however, in setting transparent criteria, this review hopes to offer an honest review of what was identified through the criteria.

Results

The breakdown of papers, following guidance from Ahtisham and Parveen[37], can be seen in *Table 3* where the identified papers are coded into the four themes drawn from Bandura and Schunk: Personal, Behavioral, Environmental and Cognitive.[19-20]

***Table 3*. Thirteen Articles Coded Using Themes from Bandura (1977) and Schunk (1989).**

Authors (Date)	Sample Size & Data Collection Method	Summary of Findings	Theme
Didarloo & Khalkhali (2014)[38]	A cross-sectional study of 340 students selected using a simple sampling method.	Positive correlation between study skills and the students' family housing status and academic level. Poor study skills can potentially jeopardize academic performance.	Environmental
Qaiser et al (2020)[39]	A sequential mixed method study involving a questionnaire and three focus groups.	The barriers faced by medical students in achieving self-regulated learning are contextual. Institutional policies may affect the autonomy and confidence of learners.	Personal Behavioral Environmental Cognitive
Samarasekara (2022)[40]	A cross-sectional descriptive study of 778 undergraduates and pre-med graduates, using self-administered questionnaire.	Most students encountered problems when using e-learning methods, and most of these problems were related to poor economic status.	Personal Environmental
Jouhari, Haghani & Changi (2015)[41]	Content analysis of 19 medical students, purposively sampled, in semi-structured, in-depth interviews.	Five main themes were found to affect self-regulated learning: family, peers, instructors, educational environment, and student.	Behavioral Environmental
Shukri and Mubarak (2019)[42]	A semi-structured, self-administered questionnaire given to 261 students.	Academic performance of senior medical students is influenced by many factors that are responsible for 21.5% of variability in grade point average.	Personal Environmental
Miller (2014)[2]	34 students given surveys pre and post enrolling on the course.	At-risk medical students may have inappropriate study plans that can be improved through participation in a program that emphasizes study skills development.	Cognitive
Jiang, Horta & Yuen (2022)[43]	Semi-structured interviews with 40 international students from developing countries.	Positive factors affecting academic success were students support systems and campus resources. Negative factors were language barriers, adjusting to the medical education system, problems with online learning, sociocultural issues, and wellbeing issues	Personal Behavioral Environmental
Wynter et al. (2019)[10]	350/1083 medical students from two universities completed an online survey.	Notes and textbooks were the most frequently used resources for learning new material. Question banks were the most frequently used revision resource.	Behavior Cognitive
Amin et al. (2009)[44]	Questionnaire-based survey with stratified random sampling among 192 medical students.	Students' study is determined by factors such as educational incentives, learning support, assessment, and competition. External factors such as family, job prospects and expectations about the future play a critical role.	Personal Environmental Cognitive
Henning et al. (2015)[45]	275 medical students completed two WHO surveys. Four students took part in a focus group.	Having a belief system assisted students in coping with the academic learning environment. However, religious expressions did not translate into hours of study or academic achievement.	Personal
Haas et al. (2019)[46]	Cross-sectional study. 698 students from two universities filling a questionnaire at the start and end of classes.	Psychostimulant misuse patterns do not support effective study. Strategies to address psychostimulant misuse should take local factors (institutional or cultural) into consideration.	Personal
Kommelage & Thabrew (2011)[47]	Four focus groups with eight medical students per group. Seven in-depth, one-on-one interviews with other students.	Students use informality, familiarity, and social bonds to acquire the knowledge required for their examinations. Findings suggest the need for implementing a peer assisted learning process.	Environmental Cognitive
Isik et al. (2017)[48]	A cross-sectional study as part of a longitudinal study. 618 students were involved.	Autonomous motivation has a positive association with GPA through strategic approaches for the ethnic majority students only.	Cognitive

Personal Factors

Personal factors are the ideas and values people hold which they act upon in their daily lives and that form their characteristics. Seven papers fitted into this theme and within these papers, three core concepts were identified: socioeconomics, religiosity, and the use of 'study drugs'. This search found differing results on whether socioeconomic background influenced study habits. For example, both Samarasekara[40] and Jiang, Horta and Yuen[43] suggested the modality of learning appears to be influenced by family income where financial support allows individuals to purchase learning materials and contribute to their general wellbeing. However, while Shukri and Mubarak[42] found that students' academic performance was influenced by several factors; they found no significant association between financial factors and academic performance. These different perspectives can be explained when we look at the context in which these three studies were undertaken. The studies by Samarasekara[40] and Jiang, Horta and Yuen[43] were based in Sri Lanka and Iran respectively — these are low to middle income nations. The study by Shukri and Mubarak[42] was set in Saudi Arabia where the participants' family income was described as high. From this we can clearly see the impact of socioeconomics — when students have little disposable income it affects their study decisions but, for students from wealthy backgrounds, socioeconomics is not even considered to be a relevant factor. The findings also suggest that socioeconomics can be perceived in different ways where a lack of disposable income can be a source of stress in the short term; however, for some students, the idea of becoming a doctor can reduce this stress, as becoming a highly paid and economically independent individual motivates them to study to achieve a good grade.[43-44]

Another personal factor to consider when looking at sociocultural factors is religion. In the UK Census (2021)[44], over half of the respondents identified as having a religion and in the UK's National Health Service workforce, approximately 73% of licensed doctors identify with a religion.[50] Henning et al.,[45] although not directly looking into study habits, found that religious observance did not negatively impact study hours and Sta. Maria et al.,[51] investigating religiosity within undergraduate students, found that religious activity was associated with deep and strategic learning habits. The findings of these studies demonstrate the importance of examining the contextual nature of research outcomes. The study by Sta. Maria et al. was undertaken in the United States of America where there is a high level of religious observance. Previous studies in the United States had already established some links between religiosity and academic performance in the Southern and Midwestern regions and Sta. Maria et al. were able to support such findings with their work in the Northeast region. The study by Henning et al.[45] was based in New Zealand where rates of religious belief are lower, for example, in their study, 117 of the 275 participants identified as being non-religious. So, when we look at religion and its impact on study habits, we need to consider the relationship between religion and its context. There was further contextual evidence in the literature. A related study by Salem et al. took place in Saudi Arabia, where the use of transportation seemed to affect the study habits of students.[52] Women were not allowed to drive in Saudi Arabia at the time of the study so male students, who often had their own cars, had more freedom of movement, spending more time partaking in social activities. Females had reduced movement, giving them more time to study and less time to socialise.[39] In these instances, it seems that religious observance can impact study time *per se* and that there is a wider impact of religion on the capacity to study.

As well as being impacted by socioeconomics and religion, evidence was found of the link between 'study drugs' and study habits; however, there was no evidence of this link yielding effective outcomes. Haas et al. investigated the use of unprescribed amphetamine medication amongst 707 Brazilian medical students and found that 22 had used them the month before the investigation and 56 had done so more than one month beforehand, with motivations largely linked to longer study hours and increased concentration.[46] These authors also found that non-prescribed drug use for academic performance was significantly associated with studying at a private university, being in an older age bracket, recent cannabis use and rates of alcohol consumption. These patterns of drug use are in line with previous research on nonmedical prescription stimulant use among college students.[53-54] Motivations for non-prescribed drug use included longer study hours and increased concentration; however, beyond stimulated attention, medical students did not report that the drugs helped them to develop enhanced learning strategies. The findings related to 'study drugs' and study habits showed that drug misuse was related to local cultural factors and the general prevalence of nonprescribed use, but the authors did not identify any learning benefits.

Behavioral Factors

Behavioral factors refer to the attitudes and perspectives medical students have on studying and how they act upon these opinions. Four papers were coded under this theme and discussed behavior in relation to culture, learning preferences, and interaction. Bandura's social learning theory illustrates that as an individual interacts with the people around them, this can produce both positive and negative outcomes.[19] Jouhari, Haghani and Changiz reported that positive attitudes towards self-regulation skills in students were facilitated by family environment and emotional support, aligning with other research.[41] Parental support and expectations differ from culture to culture, for example, students from non-Western backgrounds reported higher parental expectations as compared to those from Western backgrounds.[55-56] While this may appear to be positive, it was also found that those coming from backgrounds of higher expectations had an increased rate of burnout.

Different cultures can imbed certain traits within students that might affect their studies in medicine. Khoo found that the cultural behaviors of medical students from Eastern countries (described as countries from Pakistan to Korea) created difficulties when implementing problem-based learning.[57] Such factors included a fear of confrontation, strong respect for authority, reluctance to ask questions, and low participation in class discussions. Trends seen in Frambach et al. describe other differences between Eastern and Western cultures and found that

students with Western educational experiences were seen to be more vocal and more likely to offer their opinions in class.[58] In relation to study habits, increased confidence in speaking English and talking in groups means students might engage in more discussion-based study activities. Due to the substantial involvement of contextual factors, Frambach et al. suggest that discussion-based methods are likely to pose challenges in any culture as cultural values might be incompatible with the method.[58]

Another behavioral factor was identified by Wynter et al. in the study of penultimate and final year medical students in Australia.[10] They found that attending small group tutorials was statistically insignificant when revising old material and attending lectures was identified as the least used resource for revision. These findings were also supported by a lack of student engagement - where they limited their attendance in these study sessions. Jiang, Horta and Yuen demonstrated further how certain behaviors can negatively impact students.[43] They found that Chinese teachers' behaviors towards international students, due to language barriers, caused a lack of confidence in their students, leading to ineffective teaching and a lack of interaction with students. This exacerbated learning difficulties which most likely led students to have to spend more time outside of scheduled teaching time catching up. From these studies, the educational environment is a significant determinant of the behavior and attitudes of medical students from an array of educational and cultural backgrounds.[39]

Environmental Factors

The environment people interact with in their daily lives is a personal attribute which constitutes part of their non-cognitive being. It was found that factors such as the home and academic environment are relevant to good study. This aspect of the environment was discussed in four of the eight papers within the review.[39-41,43] Familial support was a reoccurring theme. In the study by Jiang, Horta and Yuen, participants reported that family and friends supported them during academic struggles.[43] Similarly, Jouhari, Haghani and Changiz noted that self-regulated learning (SRL) is supported through family networks and that interaction and motivation from peers were positive aspects for SRL.[41] The motivation to study is linked to study habits and is seen in the Hullian equation: Performance = Drive (motivation) x Habit.[59]. As students improve their SRL, they develop study habits and develop a reflexive understanding of the individual and their environment allowing them to better plan and organize their learning.[56--63] However, Shukri and Mubarak found that wider contextual factors such as a student's marital status, residence pattern and parental educational levels, do not directly impact the efficiency of the learning process.[42]

The medical institution also has a role in student motivation through providing a variety of placement sites and exposing students to a breadth of medical conditions. Qaiser et al. highlight that a poor institutional environment can decrease motivation to study – something that is likely to influence study habits.[39] Further evidence of the impact of the environment came from Didarloo and Khalkhali who revealed a statistically significant difference in study in relation to students' housing status.[38] The findings show that students living in better facilities had mental peace whereas those in poorer conditions were impacted by noise, interruptions, and discomfort. However, depending on cultural norms and economic background, students may not have a choice on whether they live at home or move out to external accommodation. Relatedly, findings from Kommelage and Thabrew show students use informality, familiarity, and social bonds to acquire the knowledge required for their examinations – thus their interaction with peers was part of the study process.[47] However, Frambach et al. found that cultural factors can influence whether students engage in positive peer interactions and that interaction could be impacted due to hierarchical relations and uncertainty.[58]

Cognitive Factors

Sociocultural factors can affect an individual's cognition and the way they think. Six papers were coded as focusing on cognition and highlighted concepts such as the underperformance of specific cohorts, the motivation to learn, and self-efficacy. Miller found that some 'at-risk' students lacked a detailed understanding of the significance of scheduling their work.[2] Simply putting in more study hours was found not to work; instead, students were found to benefit from study plans that allowed for a range of cognitive inputs. The role of variety in supporting metacognition was also found in Wynter et al. where students reported using a variety of e-learning tools in addition to the use of traditional methods.[10]

Isik et al., based in the Netherlands, found that there was some difference in the ways that some ethnic groups adopted study strategies which mediate the relationship between motivation and academic performance.[48] Dutch students were associated with strategic learning and non-Western students were associated with deeper learning.[48] The way students are treated and spoken to can influence the way they think about learning. Qaiser et al.[39] reported that the regulations set in place in institutions and countries can affect self-efficacy and self-regulated learning. Such factors include the likelihood of humiliation and degradation or the enforcement of gender segregation and uniform. These policies were resented and reported to affect motivation, self-efficacy, confidence, and student interaction. Most of the students in Kommelage and Thabrew felt that interaction helped reduce cognitive barriers; however, it should be noted that where interaction takes place within homogeneous groups, outcomes may be limited.[47] Here we see that the interactions guide how students think about study, and that this can be impacted by certain sociocultural norms and groupings.

Other sociocultural factors relating to cognition were highlighted in Wynter et al.[10] and Kommelage and Thabrew[47] where there was evidence that study habits were affected by general trends in education. For example, Wynter et al found that changes in the way that educational technology is used have led to medical students being more selective and more self-directed in their study habits.[10] Kommelage and Thabrew also found evidence that the increased use of technology and peer-to-peer learning have

affected how students choose to learn, reporting that these approaches to study reduce the cognitive distance between students and their learning.[47]

Discussion

A variety of sociocultural factors influence medical students and their study habits. Using the work of Bandura and Schunk, this study was able to organize the extant literature into four key factors: Personal, Behavioral, Environmental and Cognitive.[19-20] The personal factors that impact study habits include religious beliefs, socioeconomic status, and study motivation. Behavioral factors are the approaches students take to study, the resources they use, and the cultural norms that influence their study habits. Environmental factors are wider social determinants such as family networks, friendship groups, the physical environment, geographical location, and the teacher-student relationship. The cognitive factors that influence study habits include self-efficacy, language barriers, attitude towards studying medicine and opportunities for strategic or deep learning. While these four themes are presented as separate items, the fact that many sources coded into more than one theme showcases that multiple factors intersect to form medical students into different people with different study habits. This suggests a multifactorial impact on study habits.

This systematic review critically analyzed the literature to establish the influence of sociocultural factors on medical students' study habits. The findings show that sociocultural factors impact study habits to a certain extent but, beyond a certain point, it seems individual behaviors and attitudes are more important to students' decision making. Analysis of the identified papers demonstrates that multiple factors shape medical students' study habits. Personal factors such as motivation, identity and attitude towards studying were found to impact choices regarding study habits.[18,35,41] There was also some discussion on personal choices regarding the use of 'study drugs'.[46,53-54] It was also found that study habits are affected by sociocultural factors such as familial support networks and expectations,[39-41,43] the study environment,[60-61] Western/non-Western cultural norms and expectations,[39,48,57-58] and national norms regarding specific qualities such as the gender[39,52] or religiosity.[39,45]

This systematic literature review offers insight into how sociocultural factors impact study habits. From this review, we can see that individuals internalize their sociocultural circumstances, this influences their inner values and beliefs, and this impacts the development of their study habits.[11,19,20] The international variety of the studies examined in this review makes the generalizability of these findings more likely; however, gaining primary data regarding these findings would mean that the contextualized study habits of medical students could be better understood. These findings can now be used to formulate primary research into the study habits of medical students to help provide medical institutions and students with strategies to develop efficient, healthy study habits. In doing so, future research may wish to consider the following list of research questions. In developing research projects to address these five questions, it is expected that individuals, policymakers, and institutions will be able to develop practical strategies to support the study habits of diverse student populations:

- What is the impact of external factors such as housing and socioeconomics on medical students' study habits?[38,40,42,44,47]
- What is the impact of internal factors such as confidence and autonomy on medical students' study habits?[39,45]
- What self-regulatory measures do medical students employ to enhance their study habits?[41,48]
- What institutional interventions can be employed to enhance medical students' study habits?[2,43]
- How do medical students regulate their study habits?[10,46]

Summary – Accelerating Translation

Medical Students' Study Habits Through a Sociocultural Lens

This systematic review critically analyzes the literature to establish the influence of sociocultural factors on medical students' study habits. A systematic literature review was undertaken to establish what is known, identify gaps in the literature and suggest what further research needs to be done. The review followed the PRISMA guidelines and identified 13 papers that were within the inclusion criteria. These papers were analyzed and discussed through a sociocultural lens. From a sociocultural perspective, students from certain backgrounds may have been supported to develop good study habits at an early age, while other students may not have had this guidance. To understand this, this study looked beyond students' cognitive structures into the many non-cognitive components such as student motivation, student identity and student attitudes towards studying. This was done in the expectation that, if educators can increase their contextual understanding of students, then they may be more likely to develop educational approaches that better support student learning. The sociocultural lens for the analysis of the literature was drawn from social cognitive theory, dividing the results into four sociocultural groupings: Personal, Behavioral, Environmental and Cognitive. The findings show that sociocultural factors impact medical student study habits to a certain extent but, beyond a certain point, it seems individual behaviors and attitudes influence students' decision making. Analysis demonstrates that factors such as motivation, identity, attitude, family, support networks, network expectations, gender and religion all have some impact on medical students' study habits. These factors can now be used to formulate more direct research into the domain of study habits in the hope of generating empirical data that will set out practicable applications of this new insight. This will help provide medical institutions, policymakers, and students with information to better inform their decisions and support the development of efficient, healthy study habits. The international variety of these studies makes the generalizability of these findings more likely; therefore, many medical institutions can look at these findings to help identify any trends applicable to their setting. Gaining primary data regarding these findings would mean that the contextualized study habits of medical students are better understood. Therefore, specific support systems can be developed to ensure the university experience caters for student learning through addressing sociocultural needs.

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Case Report

Fulminant Hepatic Failure as the Initial Presentation of Hodgkin's Disease and Liver Transplantation: A Case Report

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Abstract

Background: Hodgkin's disease, a B-cell neoplasm, primarily impacts lymph nodes or extranodal lymphoid tissue. It includes two distinct entities: classical (95%) and lymphocyte-predominant nodular. While the disease commonly manifests as the growth of cervical and intrathoracic lymph nodes in 60-90% of cases, there are rare instances where Hodgkin's disease has been linked to fulminant liver failure, carrying a very poor prognosis. **The Case**: We present the case of a 13-year-old Hispanic female, who started with an insidious condition that evolved to fulminant hepatic failure of unknown etiology with an AST of 770 mg/dl. It was decided to perform an orthotopic liver transplant, the histopathological analysis of the explant and a lymph node reported mixed cellularity Hodgkin's disease. Subsequently, the hematology service requested a lumbar puncture, with no evidence of infiltration. It was decided to initiate six cycles of chemotherapy (CTX) with BEACOPP (bleomycin, etoposide, adriamycine, cyclophosphamide, vincristine, procarbazine, and prednisone) scheme, evolving without complications and achieving a complete response eleven months later; currently, she has been free of disease for three years. **Conclusion**: The etiology of Hodgkin's disease in our 13-year-old patient remains elusive, emphasizing the importance of early diagnosis and diverse treatment approaches. Despite limited hospital resources, the decision to proceed with the transplant was driven by the potentially fatal outcome if left untreated. Future considerations may necessitate individualizing each case, and carefully assessing the risks and benefits associated with transplantation.

Introduction

Hodgkin's disease is a neoplasm of B lymphocytes, that affects the lymph nodes and has a bimodal distribution, with the first peak between 15 and 30 years of age and the second around 55 years of age.[1] Moreover, the World Health Organization classifies this neoplasm into two types: predominantly lymphocytic nodular Hodgkin's disease (5%) and classical Hodgkin's disease with the presence of Reed-Sternberg cells (95%).[2]

It affects different parts of the body, leading to variations in its clinical presentation. The most common presentation involves cervical and intrathoracic lymph node growths in 60-80%,[3] contrasting with the rare initial presentation through hepatic infiltration, since it constitutes approximately 0.44% of all cases,[4] the clinical presentation is usually nonspecific, leaning more towards one consistent with fulminant hepatic failure, which is defined as the development of coagulopathy and encephalopathy within eight weeks of the onset of hepatic dysfunction in patients without the pre-existing liver disease,[5] many of these cases with fatal outcomes, however, for years it has been an absolute contraindication to receive a transplant to have an untreated active neoplasm,[6] and it is still maintained to this day.[7] We present a case of a 13-year-old female who received a liver transplant at the time she had Hodgkin's disease.

Highlights:

- Currently, receiving a liver transplant having a neoplasm is a contraindication.
- The presentation of Hodgkin's disease with hepatic infiltration is extremely rare.
- There are only a few reported cases of liver transplantation at the time the patient has a neoplasm.

The Case

A 13-year-old Hispanic female, previously healthy, who began 6 weeks earlier with fatigue, nausea, and fever, went to the doctor for evaluation and requesting laboratory tests, iron deficiency anemia was diagnosed, being managed with acetaminophen at adequate doses for her weight and oral supplemental iron at conventional doses, remaining asymptomatic for six weeks. Afterwards she restarted with asthenia, intermittent fever, nausea and vomiting, going again for medical evaluation, finding data of pancytopenia, jaundice, abdominal pain, nausea, vomiting, hyperlipidemia and hyperthermia for which she was sent to the local emergency department, on admission in poor general condition, with evidence of grade I encephalopathy, generalized icteric tinge, hepatosplenomegaly, paraclinical data included

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anemia, transaminase elevation, cholestasis, alterations in coagulation times test and findings suggestive of acute liver failure (*Table 1*). Supportive management was initiated, and the patient was admitted to the pediatric intensive care unit, broadening the diagnostic approach to determine the etiology. Upon questioning family members, there was no reported ingestion of herbal medicine, illicit substances, or others.

She was evaluated by the transplant service of the hospital (*Table 2*), fulfilling the criteria for liver transplantation, classifying the case as UNOS status 1A. The next day, a cadaveric liver transplant was performed, and the explant with a lymph node was sent to pathology for histopathological studies. The report indicated a liver weight of 1.160 kg, measures 21x17x5cm, irregular surface, rough, greenish color with purplish areas. The lymph node measures 1.1x0.6cm, grayish-brown, irregular, and soft. The pathology report shows a hepatic hilum lymph node consistent with Hodgkin's disease of mixed cellularity and hepatic infiltration; immunohistochemistry is positive for CD15, CD30, CD45, and fascin in neoplastic cells. A week later, a bone marrow biopsy was performed, without evidence of neoplastic infiltration. Afterwards, the Hematology service classified the lymphoma as stage IV.

Due to the diagnosis, management with chemotherapy BEACOPP (Bleomycin, Etoposide, Adriamycin, Cyclophosphamide, Vincristine, Procarbazine and Prednisone) scheme of six cycles was started, which lasted for nine months; during her management a cervical lymph node was found in Computed Tomography, which was kept under follow-up, and a biopsy of the lymph node was performed without finding infiltration. The rest of the clinical evolution was towards improvement, maintaining stable liver enzyme levels throughout the CTX sessions, complying with immunosuppressive management, achieving complete response, currently free of disease for three years and in her last consultation with good general condition and adequate hydration, as well as steady laboratory levels (*Table 3*).

Discussion

It can be seen in the case as the patient evolved satisfactorily achieving a complete response and remaining free of disease at present, even though different guidelines mention that it is a contraindication to perform a liver transplant in fulminant hepatic failure secondary to neoplasms,[7] some cases have been reported in the literature of favorable evolutions after undergoing liver transplantation.

Kirsten M. et al. reported a case involving a seven-year-old male with fulminant hepatic failure requiring emergency liver transplantation, during surgery, enlarged lymph nodes were located around the portal vein, and Hodgkin's disease was later diagnosed, the patient had a relapse when an enlarged cervical lymph node was located, so chemotherapy was performed, achieving a complete response, even some time later he needed a retransplantation at 13 months due to chronic graft rejection.[8]

Table 1. **Blood Test Results After Admission.**

Paraclinical Report	Value	Normal Values
Hemoglobin	10.6	12.2-18.1 g/dL
Leukocytes	3.8	4.2-10.2 K/uL
Neutrophils	2.4	2.0-6.9 K/uL
Lymphocytes	0.1	0.6-3.4 K/uL
Platelets	94.7	142-424 K/uL
Hepatitis B Virus (HBV)	Negative	Not applicable
Hepatitis C Virus (HCV)	Negative	Not applicable
Total bilirubin	12.04	0.1-1.2 mg/dl
Direct bilirubin	8.86	<0.3 mg/dl
Indirect bilirubin	3.18	0.2-1.2 mg/dl
Alanine Aminotransferase (ALT)	1144	4-36 U/L
Aspartate Aminotransferase (AST)	770	8-33 U/L
Human Immunodeficiency Virus (HIV)	Negative	Not applicable
Lupus anticoagulant	Normal	<1.2

Table 2. **Blood Test Results to Evaluation for Transplantation Department.**

Paraclinical Report	Value	Normal Values
Total bilirubin	17	0.1-1.2 mg/dl
Direct bilirubin	11.9	<0.3 mg/dl
Indirect bilirubin	5.6	0.2-1.2 mg/dl
ALT	1014	4-36 U/L
AST	716	8-33 U/L
Lactate Dehydrogenase (LDH)	418	105-333 U/L
International Normalized Ratio (INR)	8.3	1
Ammonium	285	15-45 µg/dl
Procalcitonin	>10	<0.5 ng/ml

Table 3. **Last Consult Blood Test Results.**

Paraclinical Report	Value	Normal Values
Hemoglobin	13	12.2-18.1 g/dl
Leukocytes	3.9	4.2-10.2 K/uL
Platelets	126	142-424 K/uL
INR	1	1
Total bilirubin	0.30	0.1-1.2 mg/dl
ALT	19	4-36 U/L
AST	24	8-33 U/L
Sirolimus levels	6.8	5-15 ng/ml

Brannigan et al. reported the case of a 12-year-old pediatric patient who developed fulminant hepatic failure, initially, parvovirus was considered as the main cause, a living-donor liver transplant was performed with his mother; when the explant was examined, Hodgkin's disease was diagnosed, the patient up to the date of publication remains in remission at one year.[9]

There are other cases in which a liver transplant was performed despite a previous diagnosis of Hodgkin's disease, which is also considered a contraindication at present.
Frank S Hong et al. reported two cases of fulminant hepatic failure, one of a 19-year-old male with a pre-transplant diagnosis of Hodgkin's disease who achieved a complete response to the disease; the other 55-year-old patient died without having received a transplant due to posterior fossa hemorrhage.[10]

Also, Hope et al. reported a similar case of a five-year-old pediatric patient with a history of Hodgkin's disease diagnosed at the age of two, who developed fulminant hepatic failure, a percutaneous biopsy was performed in which areas of portal infiltration by lymphocytes were found without detection of cells suggesting cancer, It was decided to perform the transplant, during surgery a plaque was located in the patient's liver, and a intraoperative biopsy was performed with a high possibility of being Hodgkin's disease, it was decided to continue with the transplant as it was not entirely diagnostic; histopathologic examination was performed diagnosing Hodgkin's disease, sometime later there was a recurrence of cancer, which was successfully treated with rituximab, the patient is in remission five years later with no apparent complications.[11]

Although it is not intended that all patients with hepatic infiltration by undiagnosed Hodgkin's disease who evolve to fulminant hepatic failure receive a transplant, due to the scant information available to date, it is important to observe how the reported cases have achieved favorable results, likely since this type of neoplasm has good survival rates depending on the stage.

We believe it would not be appropriate to dismiss this hypothesis. Therefore, we might consider, in the future, individualizing each case to evaluate whether receiving the transplant would be beneficial or not.

In addition, Given the limited resources in many hospitals to obtain an early diagnosis meeting the criteria for Hodgkin's disease, it was decided to perform the transplant since, it had not been performed, it is very likely that the patient would have a fatal outcome.

Summary – Accelerating Translation

Falla hepática fulminante como la presentación inicial de enfermedad de Hodgkin y trasplante hepático: Reporte de un caso.
Desde hace tiempo es una contraindicación recibir un trasplante al tener una neoplasia diagnosticada y se mantiene hasta nuestros días, sin embargo, ha habido casos reportados en la literatura sobre pacientes que recibieron un trasplante hepático en esas mismas circunstancias. En este caso presentamos a una paciente femenina la cual inicio con un cuadro insidioso, posteriormente progreso a falla hepática fulminante de etiología desconocida, decidiéndose realizar un trasplante hepático de receptor cadavérico no emparentado al cumplir con criterios del King's College. Posteriormente se reportó enfermedad de Hodgkin en el hígado y un ganglio peri hepático, iniciándose quimioterapia con esquema BEACOPP (bleomicina, etopósido, adriamicina, ciclofosfamida, vincristina, procarbazina, y prednisona), evolucionando favorablemente y estando libre de enfermedad en la actualidad.

Es importante ver como la paciente evoluciono de manera favorable y que, en el caso que se hubiera diagnosticado primero la neoplasia, no hubiera recibido el trasplante y probablemente hubiera fallecido por complicaciones mismas de la falla hepática fulminante. Por lo cual pudiera ser de importancia a futuro para individualizar cada caso y decidir si se beneficiaria de recibir un trasplante o no.

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Case Report

Severe Hyperkalemia: Electrocardiographic Tips for Early Recognition Based on a Case Report

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Abstract

Background: Rapid correction of severe hyperkalemia is mandatory to survival due to its induction of fatal cardiac arrhythmias. The electrocardiogram serves as the diagnostic tool that can provide insight into such fatal arrhythmias. We present two relevant alterations seen in an 84-year-old female patient with previous anterior myocardial infarction, angioplasty of the circumflex coronary artery, left ventricular ejection fraction of 35%, hypertension, dyslipidemia, paroxysmal atrial fibrillation, and diabetes. **The Case:** The patient had 4-days with asthenia, adynamia and dyspnea. Lung auscultation showed bilateral base rales with cardiomegaly and interstitial edema identified on chest x-ray. Lab work revealed severe metabolic acidosis, increased plasma urea, creatinine, and severe hyperkalemia (7.9 mEq/liter) considered secondary to acute renal failure. Treatment was initiated with 0.9% sodium chloride, bicarbonate, ASA diuretics and polarizing solution (insulin), resulting in a reduction of hyperkalemia to 6.1 mEq/liter. The patient suffered a cardiorespiratory arrest with recovery and needed intubation and dopamine for hemodynamic support but died 15 hours after admission. **Conclusion:** The electrocardiographic findings characteristic of severe hyperkalemia were: (i) regular rhythm (cycle length 920-950 ms) without discernible P-waves, which may have a junctional or ventricular origin and less probably could be a manifestation of sinoventricular conduction (preferential conduction from the sinus node to the AV node through specialized tracts without activation of the atrial cardiomyocytes), and (ii) sine wave morphology (markedly wide QRS, absence of ST-segment and broadly based T-waves). These electrocardiographic features, typical of hyperkalemia exceeding 7.0 mEq/liter, are harbingers of malignant arrhythmias and should prompt immediate therapy.

Introduction

Hyperkalemia is a potentially lethal electrolyte disturbance which needs urgent care as it could led to fatal cardiac arrhythmias. The kidneys (with the capacity to handle high amounts of potassium) play the most important role in the maintenance of normal concentrations of this electrolyte,[1] and consequently renal failure is one of the most prevalent causes for this disorder.

The 12-lead electrocardiogram constitutes a valuable tool for rapid diagnosis and shows a wide spectrum of alterations:[2] (i) peaked high-amplitude and narrow-based T-waves (usually later replaced by broad-based T-waves and widening of the QRS), (ii) decreased amplitude or absence of the P-wave, (iii) conduction disturbances, (iv) ST-segment elevation, (v) absence of ST-segment and merging with the wide QRS, (vi) pulseless electrical activity, (vii) non-shockable ventricular tachycardia and (viii) ventricular fibrillation.

A case of severe hyperkalemia and typical electrocardiographic changes constitutes the subject of our presentation.

Highlights:

- Critical importance of early electrocardiographic recognition in severe hyperkalemia through a patient case.
- Urgency of treatment for hyperkalemia exceeding 7.0 mEq/liter to prevent fatal arrhythmias.
- Challenges in managing complex cases with delayed presentation, underscoring the need for rapid diagnostic and therapeutic interventions.

The Case

An 84-year-old woman presented to the emergency room with 96-hour evolution of asthenia, adynamia, and dyspnea. She had prior history of an anterior myocardial infarction treated with angioplasty of the circumflex artery, severe depression of the left ventricular systolic function (ejection fraction 35%), hypothyroidism, chronic obstructive pulmonary disease, arterial hypertension, paroxysmal atrial fibrillation, dyslipidemia, and non-insulin dependent diabetes mellitus type 2. The patient was on inhaled budesonide, bisoprolol, amiodarone, enalapril, aspirin, rosuvastatin and metformin. Anticoagulation was not indicated because of frailty and low compliance. The patient lived by herself and her income was limited. Her mother (deceased) had suffered hypertension and she ignored the medical history of her father.

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Her vital signs on admission: Blood pressure 100/60 mmHg, heart rate 50 per minute, oxygen saturation 87%, and temperature 36°C. Auscultation of the heart and lung fields revealed normal sounds and absence of murmurs, with bilateral lung base rales. There was lividity in the lower limbs.

The patient was awake and disoriented in person, place, time and situation. She had no fever or chills. Abdominal palpation revealed soft and mildly tender abdomen, with no guarding or peritoneal signs.

An anteroposterior chest X-ray showed no evidence of acute lung disease (*Figure 1*).

Lab work was performed including cell counts, metabolic and urinary profiles, and cardiac biomarkers. Renal panel showed markedly elevated urea (228 mg/dl) and creatinine (3.75 mg/dl). There was severe hyperkalemia (7 mEq/liter) and severe metabolic acidosis, with a pH of 7.11 and bicarbonate of 11 mmol/liter (Table). Hematologic investigations (cell counts, INR) were normal, as well as CPK, while ultra-sensitive troponin was elevated (81.3 ng/liter for a normal value <19 ng/liter). Initial urinalysis was not suggestive of urinary tract infection The patient was diagnosed with hyperkalemia (7.9 mEq/liter) secondary to acute renal failure. The 12-lead ECG showed regular rhythm with a cycle length of 920-950 ms without discernible P-waves, marked widening of the QRS complex (200 ms) and absence of ST-segment (*Figure 2*). In the emergency room, IV insulin was started at 10 units/hour and IV dextrose (5% in 500 ml for 8 hours) to prevent hypoglycemia. Treatment was complemented with 0.9% sodium chloride, bicarbonate and ASA diuretics.

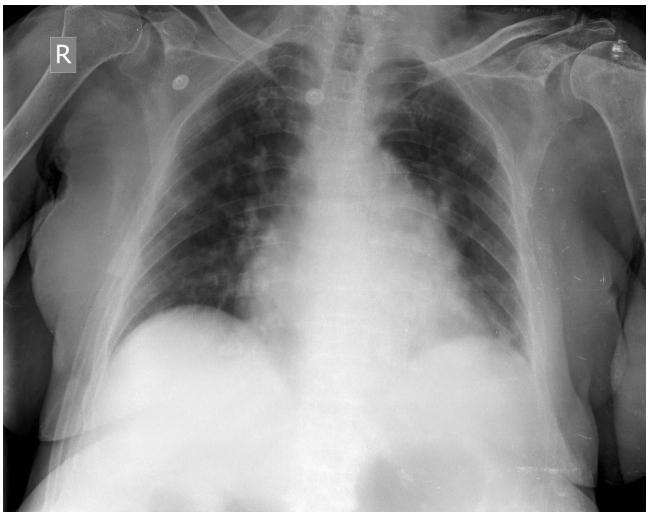
Two hours after hospital admission, she suffered a cardiorespiratory arrest which required advanced resuscitation maneuvers followed by rapid sequence intubation for mechanical respiratory assistance with O2 at 50% and hemodynamic support with vasoactive drugs (dopamine). Three hours later, a lab work showed K+ of 6.1 mEq/liter, and initial normalization of the 12-lead ECG (*Figure 3*).

The patient´s decompensation and persistent hypotension progressed gradually despite the increase in the dose of dopamine and the addition of noradrenaline. The marked hypotension and progressive decompensation precluded dialysis, and she died 15 hours post-admission.

Discussion

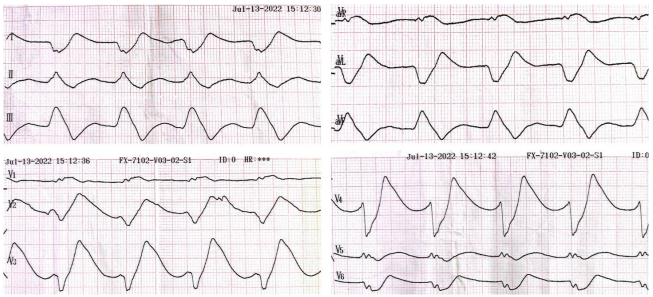
Sir Humphrey Davy was the first to isolate potassium (K+) by electrolyzing plant ashes "soaked in *pots* of water" (the term "pots" gives origin to the name of the electrolyte), as Weiss et al. point out in an interesting review.[3] The largest amount of potassium in our bodies (98%) is intracellular, with a significant gradient in relation with the extracellular space. An increase in the serum concentration of potassium (above 5.5 mEq/liter) leads to electrophysiological disturbances mainly characterized by shortening of the action potential and slow conduction. With increasing values, the electrocardiographic manifestations aggravate and may trigger malignant arrhythmias and death.[4]

Figure 1. **Antero-Posterior Chest X-Ray Showing Cardiomegaly and Features of Interstitial Pulmonary Edema.**



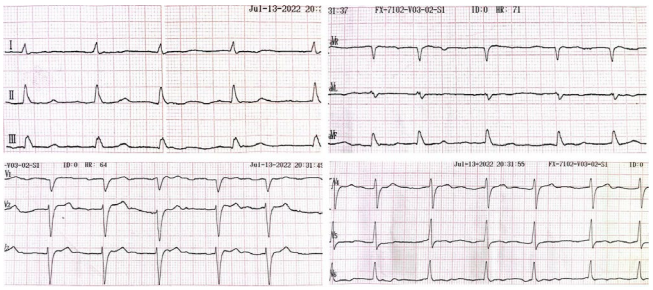
Legend: There are signs of interstitial pulmonary edema including poorly defined large pulmonary vessels, appearance of septal lines, interlobar septal thickening and diffuse reticular pattern associated with cardiomegaly.

Figure 2. **Initial 12-Lead ECG Indicative of Severe Hyperkalemia.**



Legend: The figure shows a regular rhythm with the typical sine-wave pattern: extremely wide QRS, absence of ST-segment and broadly based T-waves.

Figure 3. **Follow-up 12-Lead ECG Showing Normalization Post-Treatment.**



Legend: With a potassium level of 6.1 mEq/liter and atrial fibrillation, the QRS complex is narrow and the ST-segment reappears with normal voltage of the T-wave.

The 12-lead ECG is a readily available tool and helps establishing the potential risks better than the mere potassium level, which in fact should be considered in conjunction with the rate of increase and the duration of the elevated values. [4] In a study from a single institution,[5] the electrocardiograms recorded within one hour of potassium determination in 188 patients with concentration of the electrolyte >6.5 mEq/L were reviewed and the correlation between the electrocardiographic abnormalities and the occurrence of adverse events (symptomatic bradycardia, ventricular tachycardia or fibrillation, necessity of resuscitation maneuvers or death) was analyzed. The authors found adverse events in 15% and all occurred before calcium administration and all but one prior to interventions to lower potassium. Three electrocardiographic alterations were associated (alone or in combination) with adverse events: wide QRS (relative risk [RR] 4.74), bradycardia <50 beats/min (RR 12.29) and junctional rhythm (RR 7.46). Despite the need for a rapid intervention, the diagnosis may be challenging, especially in the presence of the so-called "dialyzable current of injury", as some electrocardiographic changes seen in hyperkalemia may resemble pericarditis, STEMI (ST-elevation myocardial infarction)[6] or type I Brugada pattern.[7]

Two Signs are Characteristic of Severe Hyperkalemia

1) **Junctional Rhythm:** The *regular* rhythm (***Figure 2***) with a cycle length of 920-950 ms may have a junctional or ventricular origin as P waves were not discernible. In the context of hyperkalemia could also be an example of "sinoventricular conduction", in which the rhythm originates in the sinus node but – as a result of the alteration in transmembrane atrial potential- P-waves are not discernible because the impulse is supposed to be transmitted to the AV node through internodal tracts without activation of the cardiomyocites.[8-10] This would have been definitively proved in case the P-wave appeared at a similar rate once the electrolyte disturbance had been solved, but in this patient we may only mention the existence of the phenomenon as P-waves cannot be seen (in ***Figure 3*** the underlying rhythm was atrial fibrillation once the potassium level had been lowered).

2) **Sine-Wave Morphology:** Our case, with a potassium level of 7.9 mEq/liter, shows the typical sine-wave morphology: (i) markedly wide QRS due to reduced influx of sodium and slower rise of the action potential,[2] and (ii) absence of ST-segment and broadly based T-wave (which differs from the "tenting" T-waves of high amplitude and narrow base seen in less pronounced hyperkalemia). Early recognition of this pattern may result in saving the life of a patient, as it correlates with hyperkalemia exceeding 7.0 mEq/liter.

In conclusion, electrocardiographic patterns present in this patient are characteristic of severe hyperkalemia and must prompt measures to lower potassium concentration and prevent death.

Summary – Accelerating Translation

La hiperpotasemia se define por una concentración de potasio en sangre mayor de 5,5 miliequivalentes por litro. Este trastorno puede tener diferentes causas, pero dado que los riñones tienen un rol primordial en su eliminación, la causa más común es la insuficiencia renal.

El tratamiento de la hiperpotasemia severa (cuando la concentración supera los 7 miliequivalentes por litro) es una urgencia ya que de lo contrario puede ocurrir un paro cardíaco.

En esta presentación se describe el caso de una paciente de 84 años que sufría de enfermedad coronaria (inclusive había padecido un infarto de miocardio), era hipertensa, tenía aumento de los lípidos en sangre, enfermedad pulmonar obstructiva crónica (EPOC), fibrilación auricular (una arritmia relativamente común en personas de edad avanzada) y era diabética.

Llegó a la sala de Guardia con 4 días de evolución de un cuadro de disnea (falta de aire) y cansancio. Estaba desorientada y, si bien en el examen físico no había hallazgos específicos, la radiografía de tórax mostraba agrandamiento del corazón e infiltrados pulmonares que eran claramente anormales. El electrocardiograma resultó de gran valor ya que había signos que no solo son característicos de la hiperpotasemia, sino que se asocian con un aumento del potasio superior a 7 miliequivalentes por litro.

Se iniciaron de inmediato todas las medidas que contribuyen a reducir el potasio, pero el cuadro generalizado de la paciente, con enfermedad multiorgánica, y el hecho de que la consulta se hubiera demorado 4 días desde el comienzo de los síntomas, impidieron una evolución favorable y lamentablemente falleció a las 15 horas del ingreso.

Este caso es importante porque muestra en el electrocardiograma dos de los hallazgos que multiplican el riesgo de muerte en presencia de potasio aumentado. El pronto reconocimiento de esos trastornos electrocardiográficos permite un tratamiento que muchas veces resulta efectivo.

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Experience

Public Health Outreach in Impoverished Areas of Cambodia: Addressing the Issues Related to Prescription Practices

Chisato Iba,[1] Mira Namba,[1] Yudai Kaneda,[2] Takayuki Ando.[3]

The Experience

The first and second authors of this manuscript participated in a two-week public health internship organized by Projects Abroad in Phnom Penh, the capital of Cambodia, from February to March 2023. During this period, we visited various locations such as elementary schools, community spaces, and facilities for people with disabilities in impoverished areas on the outskirts of Phnom Penh, conducting activities such as basic health check-ups and outreach lessons on health. In Japan, we engaged in fieldwork as medical students, focusing on identifying community challenges and considering how medical students could offer solutions. Our focus area was characterized by single-parent households whose children frequently suffer from relative poverty and a diverse foreign resident population, especially from the Asian region.[1] We participated in this internship to learn lessons on how to sustain and enhance our outreach activities in Japan. In this paper, we address the issues related to prescription practices observed through health check-ups during our internship, such as polypharmacy and medication misuse.

We visited each location every 1-2 weeks for health check-ups with a local pediatrician and staff from Projects Abroad. We brought simple diagnostic equipment such as thermometers, sphygmomanometers, glucometers, pulse oximeters, paper-based medical records, and a medication box (*Figure 1*).

The primary target of the health check-ups was older people residing in the surrounding areas. Since we visited during the day, most consisted of women, who kept to their houses. We conducted brief health interviews and vital sign checks for patients. We also prescribed medications from a limited range of drugs based on the patient's symptoms without making a specific diagnosis since the diagnostic equipment and medications were limited. For example, if a patient complained of stomach aches, we prescribed omeprazole as a response, irrespective of the specific location or nature of the abdominal pain. This may not happen in high-income countries, but this is not a rare practice in low and middle-income countries, especially in impoverished areas.

Figure 1. **Health Check-Up Station Operated by Medical Interns in Phnom Penh, Cambodia.**

Through this internship, we noticed two prescription-related issues: polypharmacy and medication misuse. First, easy access to medicines may promote polypharmacy in Cambodia. As there are over 3000 pharmacies in cities in Cambodia,[2] citizens could get medications without prescriptions at lower costs compared to medical institutions, potentially leading to self-medication.[3] When self-medication is the main source of pharmacotherapy, it can easily lead to polypharmacy, especially considering that our targets were older women, who generally have multiple symptoms. The clinical implications of polypharmacy cannot be overlooked; for instance, studies have reported that elderly patients prescribed more than five medications experienced a 4.5-fold increase in the incidence of falls,[4] and free-drug combination regimen increased the risk of medication non-

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compliance by 24% compared with fixed-dose combination.[5] In our check-ups, the most commonly prescribed medication for suspected hypertension was calcium channel blockers, which have numerous adverse effects such as constipation. To treat these adverse events, patients took medicines themselves from pharmacies, resulting in prescribing cascades. However, through these repetitions, we could neither identify if patients took medications through pharmacies nor what kind it was, since in some cases, patients themselves did not even know. Therefore, we proposed introducing documentation similar to Japan's prescription record books, which have been widely adopted to address polypharmacy. The prescription record book enables different facilities to share patients' medication records and serves to prevent excessive or duplicate prescribing. It would be helpful if patients could record the medications, they purchased at the pharmacy so that physicians would know what medications patients take during their health check-ups.

The second issue was medication misuse. The local physician verbally explained to patients about the effects, dosage, timings (such as morning, afternoon, evening, or before or after meals), and quantities of each prescribed medication. It is difficult to remember the details of medications just by listening to the explanation, especially when multiple medications are prescribed. Some people overdose on their medications, while others have low adherence due to a lack of understanding of the role of their medications. A previous study focusing on impoverished areas of Cambodia has indicated that individuals with lower family income tend to exhibit lower adherence rates.[6] Since our target area was characterized by relative poverty, addressing the medication information was significant. Therefore, we designed Drug Information Leaflets (DILs) indicating detailed information about each medication, which has been reported to improve medication adherence (*Figure 2*).[7]

***Figure 2*. Sample Drug Information Leaflets Utilized in Cambodian Public Health Outreach.**

ឈ្មោះថ្នាំ	ពេលណា (○=1 គ្រាប់)			អាហារ		តង្វិតាល
	ព្រឹក	ថ្ងៃត្រង់	ល្ងាច	មុន	ក្រោយ	
Multivitamin					○	អស់កម្លាំង, ភាពអត់ឃ្លាន, ភាពស្លេកស្លាំង ※ម្តងក្នុងមួយថ្ងៃ
PARACETAMOL	○	○	○		○	ឈឺក្បាល, ក្រុន, ក្រដាក់
AMLOCOR					○	5mg, 10mg សម្ពាធឈាមខ្ពស់
CALVIT-D	○	○	○			កង្វះជាតិកាល់ស្យូម, ជំងឺពុកឆ្អឹង
eyedrop						ចក្ខុវិស័យព្រិល ※1-3 ដងក្នុងមួយថ្ងៃ
LOKIT	○		○	○ (15 នាទីមុន។)		ឈឺពោះ
CTZ						អាស់ក្អែក,អាស់ច្រមុះ ※ម្តងក្នុងមួយថ្ងៃ
Diabetmin					○	ជំងឺទឹកនោមផ្អែម ※អាស្រ័យលើអ្នកជំងឺ
DECOLGEN						ឈឺក្បាល, ក្រុន ※រៀងរាល់ 6 ម៉ោងម្តង

ឈ្មោះថ្នាំ	ពេលណា (○=1 គ្រាប់)			អាហារ		តង្វិតាល
	ព្រឹក	ថ្ងៃត្រង់	ល្ងាច	មុន	ក្រោយ	
Multivitamin					○	អស់កម្លាំង, ភាពអត់ឃ្លាន, ភាពស្លេកស្លាំង ※ម្តងក្នុងមួយថ្ងៃ
PARACETAMOL	○	○	○		○	ឈឺក្បាល, ក្រុន, ក្រដាក់
AMLOCOR					○	5mg, 10mg សម្ពាធឈាមខ្ពស់
CALVIT-D	○	○	○			កង្វះជាតិកាល់ស្យូម, ជំងឺពុកឆ្អឹង
eyedrop						ចក្ខុវិស័យព្រិល ※1-3 ដងក្នុងមួយថ្ងៃ
LOKIT	○		○	○ (15 នាទីមុន។)		ឈឺពោះ
CTZ						អាស់ក្អែក,អាស់ច្រមុះ ※ម្តងក្នុងមួយថ្ងៃ
Diabetmin					○	ជំងឺទឹកនោមផ្អែម ※អាស្រ័យលើអ្នកជំងឺ
DECOLGEN						ឈឺក្បាល, ក្រុន ※រៀងរាល់ 6 ម៉ោងម្តង

Legend: The DILs included a photograph of the medication, names, effects, dosage, and timings (morning, afternoon, evening; before or after meals) written in the Khmer language.

Considering the low literacy rates, we tried to use more charts and photographs than text. In Cambodia, the literacy rates for individuals aged 15 and above were reported to be 73.6% (males: 84.7%, females: 64.1%) in 2007,[8] and 84% in 2021.[9] The area we visited for health check-ups consisted mainly of older women, and considering the particularly impoverished nature of our target region, the literacy rates would be much lower than the national average. The DILs were collaboratively discussed with the local staff, physicians, and other volunteers, focusing on their necessity.

Issues of polypharmacy and medication misuse can inadvertently jeopardize health. In Cambodia, non-communicable diseases (NCDs) are becoming a prevalent health issue. However, the untreated rates of NCDs in Phnom Penh are high, with reported rates for hypertension being 46.1% in males and 39.9% in

females, and for diabetes, 44.3% in males and 37.2% in females.[10] Our project plays an important role in caring for NCDs by continuously visiting specific areas. It is necessary to address polypharmacy and medication misuse to maximize the effectiveness of these health check-ups. Our medication record book and DILs could help solve some of these problems.

Recent outreach activities in Japan have been challenged by the need to respect local cultures and customs in targeted areas without overstepping boundaries as outsiders. However, our experience highlighted the potential to incorporate new approaches and methods from external perspectives. For example, introducing medication record books and DILs could improve local healthcare. Based on this experience, we aim to actively explore approaches that consider the resources and needs of the local community, examining the issues from an overarching perspective rather than feeling constrained as outsiders. Embracing the role of people from different areas or regions, we aspire to explore implementable approaches that could gradually disseminate and become integrated into the region's healthcare landscape, even in the years and decades to come.

Summary – Accelerating Translation

プロジェクト・アブロードがカンボジアの貧困地域で企画した2週間の公衆衛生インターンシップで、著者らはアウトリーチ活動の一環として地域住民の健康診断に参加した。私たちは、医療機器や薬剤の制限から、個々の患者の状態を診断したり考慮しない症状ベースの処方に起因する、ポリファーマシーや薬剤の誤用などの問題を特定した。私たちはこれらの問題に対して日本のお薬手帳や薬剤情報提供書のような文書の作成を提案した。お薬手帳は、患者が薬局で購入した薬を自身で記録してもらい健康診断の際に医師に提示することで患者がどのような薬を服用しているかを共有しポリファーマシーの予防につながると考えられた。さらに本地域の識字率が低いことを考慮し、薬剤情報提供書には薬の詳細とイラストを掲載した。私たちは、非感染性疾患の対処において持続的な治療の必要性と、革新的な医療アプローチや改善を地域社会に導入するための外部からの視点の可能性を強調した。

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Experience

Grassroots HPV Vaccine Education in Phnom Penh, Cambodia: A Personal Reflection

Mira Namba,[1] Miyu Shinohara,[2] Samrith Sela,[3] Ken Khouch,[4] Yudai Kaneda,[5] Rei Haruyama.[6]

The Experience

In March 2023, I embarked on a field study in Phnom Penh, Cambodia's capital. The study's primary objective was to enhance awareness about the HPV vaccine among school-aged girls and to assess how this awareness affects their willingness to be vaccinated. This initiative was especially pertinent given the Cambodian government's plan to introduce a school-based vaccination program targeting nine-year-old girls within the year's end, which started from October 2023.[1] However, my interactions with a local pediatrician in Cambodia highlighted a significant gap in public awareness of the HPV vaccine. Indeed, a pilot vaccination program was trialed in primary schools in two provinces in 2017; a recent study indicates that a substantial number of girls, 61% and 72%, respectively, in the two surveyed provinces, were unaware of the health implications associated with HPV infections.[2] These figures underscore a serious knowledge gap in the crucial role the HPV vaccine plays in preventing HPV infection and its related health complications.

The situation in Cambodia mirrors my experiences in Japan, where the HPV vaccine has recently become more accessible after a hiatus in government endorsement from 2013 to 2022.[3] I finally got a catch-up vaccination at the age of 21 in 2022. As there were suspected serious reports of adverse events following HPV vaccination in Japan in 2013, when I was at the target age of routine vaccination, the whole country including me, was in distrust of the vaccine. I have strongly wished I had been informed of HPV vaccine with reliable information early on in my decision to get vaccinated. Since then, I have been engaged in research and awareness efforts regarding the HPV vaccine issue in Japan.[3-7] Therefore, in Cambodia, I felt a sense of the need to address this issue considering my own experience.

For the field study, I coordinated with a local pediatrician to schedule meetings with primary school principals, whose school he routinely visits to deliver health promotion classes, aiming to conduct awareness classes for the schoolgirls, while simultaneously evaluating the girls' and teachers' understanding of the HPV vaccine. I visited two primary schools for my study: Koh Dach Primary School (KDPS) and Children's Basic Education School of Salvation Centre Cambodia (SCC-CBE School), based on our connections and their accessibility. The former is a public school on Silk Island, a 10-minute-ferry-ride from central Phnom Penh, and the latter is a small English-teaching private school. First, I disseminated a questionnaire in the Khmer language, referring to the pilot study,[2] among the teachers to gauge their knowledge of the HPV vaccine and their willingness to recommend it to students. I also assembled the schoolgirls in a classroom, distributing a similar questionnaire to assess their understanding and potential acceptance of the HPV vaccine. (*Figure 1* and *Figure 2*) Written informed consent was obtained before the survey. Overall, seven teachers and 43 girls (age 10-14) at KDPS, and three teachers and two girls (age 10-16) at SCC-CBE School participated in the study. The results revealed a concerning fact: more than half of the teachers had never heard of HPV or HPV vaccine. Furthermore, the students demonstrated limited knowledge of HPV or the vaccine to the extent that they struggled to comprehend the questionnaire. While our results corroborate the findings of a previous report regarding specific knowledge gaps,[2] they also extend the understanding of this issue by revealing even the lack of awareness prevalent among both teachers and students, highlighting the unique contributions of this initiative.

Of note, the ultimate decision regarding whether to get vaccination should be left to the individual. Educating Cambodian girls about the HPV vaccine and elevating their understanding can facilitate positive health decisions based on comprehensive and well-informed grounds.[8] Therefore, I delivered a 15-minute lecture to the girls, employing a handwritten poster in the Khmer

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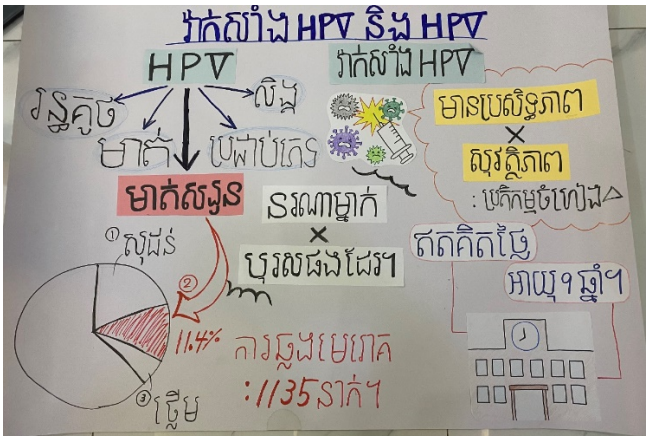
Figure 1. **Students Answering a Questionnaire in Koh Dach Primary School.**

Figure 2. **Students Answering a Questionnaire in Children's Basic Education School of Salvation Centre Cambodia.**

language (*Figure 3*). The presentation delineated four key points: firstly, HPV is a virus causing a myriad of cancers; secondly, cervical cancer is estimated to be the second most common cancer among Cambodian women;[9] thirdly, there exists an approved and effective vaccine to prevent HPV infection; and lastly, this vaccine is to be introduced in schools by mid-2023. Post-lecture, the students completed another questionnaire, enabling me to examine shifts in their understanding and intentions to get vaccinated. Though the questionnaire responses indicated that only a few students gained a comprehensive understanding of HPV and its vaccine, it was encouraging to note an increase in the number of students expressing an intention to get vaccinated.

While the government decided to introduce routine vaccination by the end of the year and subsequently started the program in October 2023,[1] it became clear that until now, health education, including sexual health, has not been sufficiently implemented in primary schools,[10] and thus, knowledge about HPV has not been

Figure 3. **Handwritten Poster Employed in the Lecture in the Khmer Language.**



provided by teachers sufficiently. Particularly, female sexuality is considered taboo due to conservative Khmer values.[11] Moreover, considering the difficulty of children of the target age group to properly understand the issue, as seen by the result of the post-lecture questionnaire, the intention of teachers and parents is considered to have a significant influence on the vaccination of children. In a previous awareness research conducted in Phnom Penh, only 1% of the teachers correctly answered HPV as the cause of cervical cancer.[12] In contrast, though more than around half of the teachers were unaware of the issue, since this questionnaire was asked an open-ended question, asking "Do you know HPV?", the result might have been underestimated, meaning not many teachers understand sufficiently about HPV and the relationship with cervical cancer. Therefore, expanding this type of educational intervention to deliver reliable information is necessary, prioritizing teachers and parents as targets.

In fact, it has been reported that teachers with higher levels of knowledge tend to be more willing to recommend vaccinations to their students.[13] On the other hand, though I did not have the opportunity to approach the parents this time, as indicated by the fact that when pilot vaccination was administered, more than half of the girls in the two provinces (54% and 64%, respectively) consulted with their parents about the vaccination,[2] providing parents with reliable information about the vaccine would be of good significance.

Through this experience, I have learned the significance of considering the targets' cultural contexts and cognitive habits when striving to raise awareness, and this would also be the case in Japan. A world free of cervical cancer can only be achieved through continuous education and awareness initiatives especially at the grassroots level, facilitating informed decision-making.

I would never forget the loveliness of the children I met in Cambodia. Children's big smiles are a treasure for me and the world, and I will never stop my endeavors.

Summary – Accelerating Translation

カンボジアの首都プノンペンにおける草の根HPVワクチン啓発： 情報に基づいた意思決定に向けて

2023年3月、私はカンボジアの首都プノンペンで、女子生徒を対象にHPVとHPVワクチンに関する啓発授業を実施し、同時に女子生徒と教師のHPVワクチンに関する認知度や接種意向を評価することを目的とした現地調査に赴いた。これは私自身がHPVワクチンキャッチアップ接種世代の当事者であることから現在日本でHPVワクチンに関する研究や発信を行っていることに加え、カンボジア政府が2023年半ばから小学校におけるHPVワクチンの定期接種化を計画していたため、啓発には絶好のタイミングでもあると考えたからだ。

私は2つの小学校を訪問したが、懸念すべきことに、半数以上の教師がHPVやHPVワクチンについて聞いたことがなかったようだった。さらに、生徒たちはHPVやワクチンについての知識が乏しく、アンケート内容を理解するのに苦労していたほどであった。そのワクチンの存在を知らない以上、接種意向についてもほとんどの人が有していなかった。一方で私がHPVやHPVワクチンについて15分間の授業を行った後、同様に行った調査ではワクチン接種の意向を示す生徒が増えたのは心強い事実であった。

今回の結果から、カンボジアでの小学校ではセクシュアル・ヘルスを含む健康教育が十分に実施されてこなかったため、HPVやそのワクチンに関する知識が学校教育で十分に提供されてこなかったことが明らかになった。したがって、信頼できるHPVワクチンに関する情報を提供するためにこのような教育的介入を拡大することが必要であり、教師や保護者の意向が子どものワクチン接種に大きな影響を与えると考えられることから、彼らを優先的にターゲットとする必要があると考えられた。子宮頸がんのない世界は、私がカンボジアで実践したような草の根レベルでの継続的な教育と啓発活動により十分な情報に基づいた意思決定を促進することで初めて達成できる。私はカンボジアで出会った子供たちの笑顔が忘れられず、これからも世界中で子供たちの笑顔を守るためにもこのような挑戦を続けていきたいと強く願う。

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IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Experience

From Theory to Practice: Reflections of a Medical Student's Rural Posting in a Leprosy Hospital

Glorious Kate Akpegah.[1]

The Experience

In Nigeria, rural postings are included in the medical school curriculum to help undergraduates experience healthcare in resource-low settings. It is an opportunity for medical students to become acquainted with Primary Health Care as introduced by the 1978 Declaration of Alma-Ata to achieve health for all.[1] The rural postings also take the students out of the classroom for a firsthand experience of some Neglected Tropical Diseases (NTDs) such as Hansen's disease, widely known as Leprosy.

Overview of Leprosy as a Neglected Tropical Disease

Leprosy is a chronic infectious disease of humans caused by bacteria called *Mycobacterium leprae*. It primarily affects the skin, peripheral nerves, and other cooler regions of the body.[2] Leprosy progresses slowly, often taking years for symptoms to manifest.

This disease is considered an NTD because of its association with poverty, social stigma, and limited access to healthcare in marginalized communities. Leprosy mainly affects people in developing nations, especially those in overcrowded, unsanitary conditions, due to poverty, lack of healthcare, and limited awareness.

In 2000, Leprosy was globally classified as eradicated i.e., reaching a prevalence of fewer than 1 per 10,000 population.[2] However, World Health Organization (WHO) records still show that Nigeria is one of the countries with a high burden of the disease despite the country's success in reaching the Leprosy elimination target in 1998.[3,4] The Nigerian Center for Disease Control and Prevention (NCDC) records that approximately 3,500 new cases of Leprosy are diagnosed annually, and roughly 25% of patients experience some form of disability. Hence, Leprosy continues to be a disease of public health significance in Nigeria.[5]

Leprosy transmission remains incompletely understood, but it is thought to spread through prolonged close contact with an infected person. It is not highly contagious as most people have natural immunity. Yet, those with weakened immune systems are more susceptible.

***Figure 1*. A Ward Built for the Care of Leprosy Patients in Memory of Dr. Esther Davis (OBE), a Missionary Doctor with The Leprosy Mission.**

Fortunately, Leprosy is curable with Multidrug Therapy (MDT), a combination of antibiotics recommended by the WHO.[2] MDT is highly effective in treating Leprosy and preventing its transmission. Early diagnosis and prompt treatment are crucial for preventing disabilities and reducing transmission rates in this condition.

In this article, I will be sharing my experience as a medical student from the University of Calabar, Nigeria at the Qua Iboe Church Leprosy Hospital, Ekpene Obom, Etinan LGA, Akwa Ibom State, Nigeria (*Figure 1*).

Preparing for the Rural Posting and Arrival at the Leprosy Hospital

Before our sojourn on this rural posting, my colleagues and I had a series of lectures to help us understand the pathophysiology of Leprosy. These lectures set the tone for the posting and gave us an idea of what the experience would be like.

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Arriving at the Leprosy Hospital was a profound experience. Away from the bustle and activity of urban life in Calabar, the serenity and greenery of Ekpene Obom was a beauty to behold, even with the presence of sandflies that were fervent in their activity.

The initial impressions were both humbling and eye-opening. The sight of patients with Leprosy, some with visible deformities, simultaneously evoked empathy and curiosity. Interacting with these resilient individuals and compassionate healthcare professionals sheds light on the holistic care approach that extends beyond medical treatment. Here, I fully grasped the significance of a multidisciplinary approach in Leprosy care, where dermatologists, physiotherapists, mental health experts, and social workers need to collaborate seamlessly.

Challenges Encountered and Lessons Learned

At the Leprosy Hospital, I encountered several challenges and learned valuable lessons. For one, the difference in language was a barrier as some of my colleagues and I were not familiar with the local dialect —*Ibibio*—which most of the people affected by Leprosy (PALs) could only speak. However, we were able to get interpreters to enable us to take the history of the patients and hear about their experiences as PALs. This highlighted the importance of effective communication in showing empathy and ensuring patient-centered care. I learned that overcoming stigmatization and dispelling misconceptions about Leprosy required patience and education, emphasizing the importance of community awareness campaigns.

Adapting to a resource-low setting taught me innovative problem-solving skills and the significance of maximizing available resources. For instance, many PALs could not afford ideal Micro Cellular Rubber (MCR) footwear to protect their anesthetic feet. Instead, they relied on affordable locally-made Crocs for cushioning and protection. Furthermore, gaining insights into the psychosocial aspects of Leprosy underscored the vital role of mental health support in holistic patient care.

Impact on Personal and Professional Growth

The rural posting at the Leprosy Hospital left an indelible mark on my personal and professional growth. It significantly enhanced my clinical skills and diagnostic acumen as I encountered a range of dermatological presentations, deepening my understanding of Leprosy's clinical nuances. More importantly, it cultivated empathy and reinforced the importance of patient-centered care, as I witnessed the resilience of patients and their unwavering spirits.

This experience prompted profound reflections on the broader social implications of Leprosy and other NTDs, including stigmatization and the need for societal acceptance and inclusion. It strengthened my commitment to serving underserved populations, highlighting the pivotal role of healthcare professionals in advocating for equitable healthcare access and championing the rights and dignity of those affected by neglected diseases.

Reflections on the Future

Reflecting on my rural posting at the Leprosy Hospital, I find myself pondering the role of medical students in the ongoing efforts to eradicate diseases endemic to their community. Medical students can contribute by raising awareness, dispelling myths, collaborating with health organizations, and engaging in outreach programs to identify cases early. By addressing the medical, social, and psychological aspects of Leprosy and other neglected tropical diseases such as Onchocerciasis, Buruli ulcer, and Schistosomiasis, we can work towards a future where these diseases are no longer a source of suffering and exclusion.

Summary – Accelerating Translation

Title: From Theory to Practice: Reflections of a Medical Student's Rural Posting in a Leprosy Hospital

Main Problem to Solve: The rural postings in Nigeria offer medical students a chance to experience healthcare in resource-low areas and learn about primary healthcare and Neglected Tropical Diseases (NTDs) like Leprosy. Despite global progress in eradicating Leprosy, Nigeria still faces a significant burden of the disease.

Aim of Study: This experience aimed to understand the clinical, psychosocial, and holistic aspects of Leprosy Care. It involved exploring the challenges and lessons learned during the rural posting at the Qua Iboe Church Leprosy Hospital, Ekpene Obom, Etinan LGA, Akwa Ibom State, Nigeria.

Methodology: Medical students, including the author, underwent preparatory lectures to grasp the pathophysiology of Leprosy. They then worked at the Leprosy Hospital in Ekpene Obom, Akwa Ibom State, Nigeria, interacting with leprosy-affected individuals and healthcare professionals.

Results: The experience revealed language barriers, the need for community awareness campaigns, and the importance of mental health support in Leprosy care. Adapting to a resource-low setting emphasized innovative problem-solving and maximizing available resources. The exposure enhanced clinical skills, and diagnostic acumen, and deepened empathy.

Conclusion: This experience underscores the importance of healthcare professionals advocating for equitable healthcare access and the rights of those affected by neglected diseases. By addressing medical, social, and psychological aspects, we can work towards a future where these diseases no longer cause suffering and exclusion.

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Experience

The Importance of Understanding Social Determinants of Health as Medical Students: My Experience with the Cincinnati Homeless Coalition

Shivatej Dubbaka,[1] Taylor Lentz.[1]

Introduction

When faced with the heavy focus placed by most medical schools on academic studies in preclinical years, it can be challenging for medical students to branch out and search for areas in healthcare that lack support. Becoming involved in community care can help students understand social determinants of health: non-medical factors like income and education that strongly influence health outcomes. These determinants can range from environmental hazards to transportation accessibility, and all play an impact on the distribution of healthcare in society.

As part of the Physician and Society course at the University of Cincinnati College of Medicine, students are paired with community partners to identify and approach a problem from a healthcare perspective. Our student group was partnered with the Cincinnati Homeless Coalition, an organization focused on eradicating homelessness in the city through offering services, educating the community, and advocating for policy change.

As a first-year medical student weeks into my medical education, I wondered why my school was abruptly throwing me into an experience outside of the classroom. I contemplated if our time would be better spent preparing for the rigor of preclinical coursework. The following piece shares my experience understanding social determinants by building a relationship with a community partner, and how similar experiences can benefit medical students in every community. The piece follows my experience with the Cincinnati Homeless Coalition, working on a project to bring awareness and gain support for a fund to combat homelessness in Cincinnati. It also includes personal reflection and discusses how this experience impacted my early career in medicine.

The Experience

Initial Encounter

Before our group could develop a project, we needed to understand the goals of the Cincinnati Homeless Coalition to identify an issue pertinent to their ongoing efforts. Our first two meetings were simply conversations with staff at the Coalition, all of whom had empowering background stories that led them to dedicate their life to serving those experiencing homelessness.

Listening to the first-hand accounts of individuals facing homelessness gave me insight into the everyday struggles hundreds of thousands of Americans face. However, I still lacked a full understanding of its connection to healthcare, but the final staff member who spoke with us changed my outlook completely.

Like the other staff members, she has faced homelessness throughout her life - living on the streets, in abandoned buildings, and even in shelters run by the Coalition. She explained how her partner had diabetes but did not have access to a primary care physician. He instead relied on infrequently offered free medical clinics with no continuity or relationship building between physicians and their patients. Today, while she dedicates much of her time to helping the Coalition, she continues to face housing and healthcare insecurity. Upon hearing this, I recognized social determinants are possibly the most crucial factors contributing to health disparities throughout the world.

Our group reflected on this first encounter and wanted to learn more about how housing insecurity can negatively impact health. In addition, we began to think about how we could apply our research to a project that could directly benefit the Coalition and its mission.

Project Development

As a group, we wanted to conduct a secondary literature search into the relationship between homelessness and inadequate healthcare. We decided to examine several variables such as redlining, lack of green space access, lack of health insurance, lack of access to quality food, etc. Using these keywords and pairing them with "impact on healthcare," we used databases such as PubMed and Google Scholar to find these relationships. One example we came across was that many individuals who face

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homelessness lack access to reliable transportation, a necessity that causes delays in healthcare[1]. This can be harmful for both those with exacerbations of chronic disease and those who have more acute medical needs.

Now recognizing the impact homelessness often has on individual health outcomes, we wanted to bring awareness to this relationship. Our original project idea involved distributing a brochure around the University of Cincinnati undergraduate campus which included information about both the Coalition's efforts and ways to get involved with their organization. However, we felt we could make an even larger impact by raising awareness within the healthcare community. We decided to host a presentation in the medical school which covered the Coalition's efforts and their connection to the healthcare needs of the community.

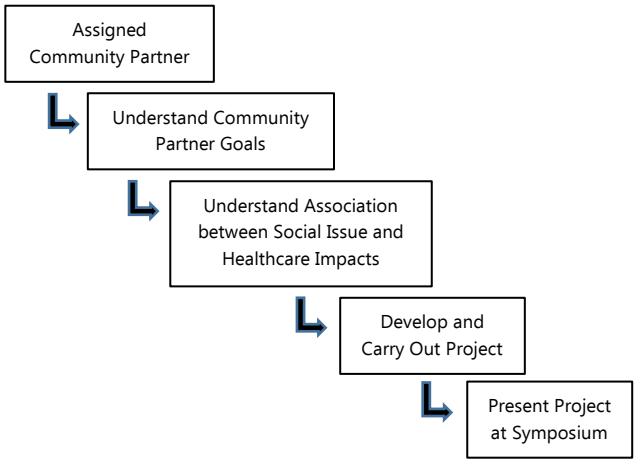
The presentation consisted of an informational session followed by a panel discussion. We focused on highlighting the importance of supporting the Affordable Housing Trust, which is a fund that looks to increase access to affordable housing through the construction and preservation of affordable housing units. We also emphasized the negative impact of housing insecurity on individual and community healthcare outcomes. The panel discussion consisted of Coalition leaders who answered questions from the audience. We decided to give participants a survey before and after the event to understand its impact on them. The survey included questions such as "On a scale of 1-5, how much do you know about the housing crisis in Cincinnati", and asked the same questions after the presentation to see if there was a change. Overall, the survey revealed an increase in attendees' knowledge and awareness of the role homelessness plays in healthcare outcomes. These survey results showed that the public could learn and benefit from similar seminars that raise awareness.

While our project had many successful aspects to it, we also faced some challenges. One challenge we faced was deciding who our target audience would be for our presentation and how we would encourage them to attend. We decided we should target multiple audiences, so we had an email sent to everyone on the Coalition's weekly email list, as well as to staff at the University of Cincinnati College of Medicine. It was initially difficult to contact the administration, but after continued communication throughout the semester, we distributed the invitation.

Discussion

My experience with the Cincinnati Homeless Coalition is just one example of the small steps medical students can take to become involved with their community. While focusing on academics in preclinical years is important, this experience allowed me to understand *why* I am dedicating my time to these studies: to apply what I have learned to help those in need in my community.

Figure 1. **Flow chart depicting stages of project development, from conception to implementation. After establishing a relationship with an assigned community partner, we worked to understand their goals and create a project that bridged the gap between that goal and healthcare disparities faced in that community.**



Medical students should be encouraged to take part in service projects in their locality to gain firsthand experience with different social determinants of health. Our project was shared with classmates at the annual Learning Community Poster Symposium along with the diverse projects our peers were involved in, covering a wide range of these determinants.

Many studies show that encouraging relationships between medical students and community partners can result in positive changes in the health outcomes of a community[2]. In addition, community partnerships with medical schools have been shown to influence both the medical specialty students pursue and the location they choose to establish a practice[3]. In a study done on understanding medical student experiences with community partners, researchers found that long-term relationships with partners resulted in understanding community issues and developing key communication and interpersonal skills with individuals from these communities.[4] Even mentoring relationships with individuals from under-resourced communities has shown development in medical students outside of the classroom and allows them to envision themselves as physicians serving these communities.[5]

Understanding social determinants of health is the first step for medical students to shape their careers as physicians to help their community. Physicians must spend time individually with patients to understand the many factors that can affect their care such as reliable transportation, safe home environments, access to quality food, and like the focus of our project, access to secure housing. On a macro-level, physicians also need to advocate for their patients, working with community leaders to enact systemic policy changes that can mitigate the impact social determinants of health can have on equitable care.

There were many takeaways from our project that could be implemented in the future. The clearest conclusion was that we realized much of the healthcare community is unaware of the connection between social determinants and negative health impacts. Similar seminars should be in place to inform members both inside and outside of the healthcare community, and the first step in implementing this would be having future first-year medical students at the University of Cincinnati continue our project. Many aspects of the project can be improved, such as finding ways to increase seminar attendance and including a more robust quantitative survey to study the seminar's impact on participants. These improvements can be made by future cohorts of students.

Conclusion

I now have a clear understanding that my role as a physician is not simply to treat my patient's symptoms, but also to identify external obstacles they may face and search for solutions to combat social determinants of health. While the project only focused on homelessness as a social determinant of health, I hope to build relationships with other partners, understanding the gaps in healthcare in my community to address healthcare disparities. This experience has also shown me that while I must spend time with my patients to determine their medical needs, I must take the extra step in understanding the other factors that are affecting their quality of life. It is now clear to me that medical students should have to involve themselves in an immersive community experience focusing on the impact social determinants of health have on access to quality care. In addition, outside of the healthcare community, there are policies in place that directly affect the care we can provide to patients. The Affordable Housing Trust Fund illustrates the importance of physician awareness of political issues relevant to the healthcare needs of their community. What initially felt like a task in a first-year course became one of my most impactful experiences with takeaways that I plan to carry with me throughout my medical career.

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Experience

Becoming a Physician: A 40-year Retrospective on Medical Socialization

Michael McGee.[1]

I recently was cleaning out my files when I came across a long-forgotten paper I had written in 1982, at the tender age of 24, during my fourth year of medical school. I entitled it, "Becoming a Physician." I wrote it during a time of distress and confusion as I struggled with what I experienced as harmful about the medical socialization process.

I read it to my wife, who remarked, "that sounds a lot like you!" I too felt struck by the relevance, 40 years later, of much of my thinking about the medical socialization process. While much has changed, medical socialization is largely the same 40 years after writing this paper.

I'd like to share my observations, now nuanced by my 40 years of experience as a psychiatrist. I think you'll find that much of what I have to say is as relevant now as it was 40 years ago, if not more so.

As for many of us, those medical school years were trying, turbulent years filled with anxiety, confusion, self-doubt, conflict, and anger, and also with excitement, joy, and a profound sense of fulfillment. A large part of my struggle was an attempt to understand what I was going through, to know myself better, and to begin to change parts of myself that were causing me pain. And then there was a part of me that struggled to maintain true to what my gut told me was healing in the face of what seemed harmful. My suffering was focused both internally and externally. In particular, I frequently experienced anger towards "the system" for what I slowly realized were its inadequacies and its harmful effects on me and my classmates. My resistance to looking inward intensified my anger. Still, the system made us suffer unnecessarily at times, didn't give us support when we did suffer, and taught us a technologically-oriented brand of medicine which is sometimes inhumane and incomplete. And this was at Stanford, supposedly once of the best medical schools in the country. Then, as now, modern medicine is in a crisis of imbalance, in which it serves science more than humanity.

I did several things to reduce my distress. I read avidly about medical training, professional socialization, and about effective healing and the inadequacies of our profession. I saw a counselor, joined a support group, took time off to pursue some of my other interests, and started keeping a journal.

Developing an understanding of my training process, and a set of personal guidelines for negotiating it, were essential for my own well-being. The following is a distillation of this understanding. Little of what I have to say is new; I have abstracted from the many who have affected my own thinking. Most of all, I hope this will be helpful to other medical students and new doctors who struggle with the same universal stresses, conflicts, and hardships. At the least, may it stimulate thought and awareness of some issues important to our growth and health, and promote further personal exploration.

One caveat: while many of the issues discussed below persist from 40 years ago, we have also seen progress. Largely gone are the grueling 36-hour shifts and chronic sleep deprivation. More and more, medical schools recognize the importance of compassionate care, and prioritize wellness and the cultivation of interpersonal skills.[1] Educators increasingly recognize the connection between clinician vitality and clinical outcomes.[2]

A Process of Change

Our metamorphosis, symbolized by our taking on the name "doctor," entails not only the addition of skills and knowledge, but an evolution of the way we see ourselves. We develop a new identity by shedding old parts of ourselves and growing new ones. We lose our prohibitions against probing naked strangers' bodies, sticking needles into people, and asking people about their sex lives, and we also learned to make life-or-death decisions.

Inevitably, change occurs with pain, for we are creatures of habit. Changing is challenging and demanding for all of us. Someone once said life is like practicing the violin in public. Practicing such a difficult art as medicine for the first time can indeed be frightening and unnerving.

Changing is easier if we know that any change, especially in our identities, inevitably stirs up an inner turmoil. This feeling is

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natural. If we remember that to change is to become something new and hopefully better, we have some control of how we change. With a sense of control and self-responsibility, change becomes a rewarding process of approaching the goals that contribute to the richness of our lives.

A Demanding Process

Becoming a physician requires that we confront stresses on par with those of boot camp training. Perhaps the major difference is that boot camp does not last nearly a decade. These stresses arise from dealing with illness and death and from the structure of our training. The stresses we experience are several:

- *The stress of high expectations:* Our culture sees physicians as brighter, harder working, and more dedicated than other people. Patients expect us to provide a cure for every ill, since Modern Medicine has all the answers. Moreover, most of us adopt these demanding expectations for ourselves so that stress now comes from both without and within. Almost every psychiatrist experience this when a patient commits suicide. Many physicians find it traumatic when a patient dies of a serious illness.[3]
- *Information stress:* Another stress arises from the difficulty our brains face in processing and storing the overwhelming amount of information required to be a doctor. We are overworked, and experience both emotional and physical exhaustion, as well as isolation from the world. If we are perfectionist—as most of us are—attempting to reach this impossible summit will cause us pain. With this dilemma, we face an arduous task of allocating our limited time between work and personal life as we attempt to acquire necessary knowledge.
- *Stress of failure and success:* And what if we don't learn enough? The threat of failure always looms large. Success is also threatening; when we succeed, we become different in the world's eyes and must take on the major responsibilities of doctoring, with all its trials and frustrations.
- Status stress: Coming from the top of our class in college and finding ourselves at the bottom of the pile in medical school. When I came to Stanford, one of my classmates was a genius who had won thousands of dollars on Jeopardy. I suddenly felt that I didn't belong. I loved histology, and studied the textbook thoroughly. I was humbled when I didn't do as well on the exam as many of my classmates.
- *Existential stress*: There is nothing like immersing ourselves in death, illness, and suffering to prompt us to ponder our mortality. While stressful, this is beneficial. For some, it happens while dissecting our mortality in anatomy lab. For me, the miracle of the human body manifested from the instructions of 23 pairs of molecules was a spiritual experience of awe and wonder.
- *Stress of the learning process:* learning clinically irrelevant material from basic scientists who have little empathy for the practices of medicine, taking and possibly failing exams, suffering the humiliation of superiors who may deride us for our ignorance, "pretending" to be doctors when we are not, probing the various orifices of people's naked bodies, and facing the pain of sickness, suffering, disability and death**.** My first assigned physical exam was of a woman who was dying of metastatic brain cancer. I was to go in and do a "complete" physical exam, including a rectal exam. To my enduring regret, I did as I was told, and subjected this poor, dying woman to this unnecessary exam.

The list goes on. Depending on who we are, (our attitudes, beliefs, values, and ways of coping), each one of these stresses affects us differently. Some adapt without even a flinch; Some suffer tremendous pain. Suffering manifests as anxiety, depression, strains in relationships, doubts about continuing in medicine, or even as Medical Student's disease—believing we have some disease we have recently studied.

Like change, these stresses are unavoidable. They are an inevitable part of our profession and of life. Becoming a physician is stressful for everyone; there is virtually no one who is not anxious, depressed, or who does not think about quitting medical school. We all resolve our conflicts differently, by changing whatever it is about us that causes us to suffer in response to stress.

Like changing, coping with the many stresses of our work brings rewards. With awareness and acknowledgement of these stresses, we are less confused and understand our experiences better. We have clues to what causes our pain and can make changes either in ourselves or the world to lessen our discomfort.

Satisfying Our Needs

In his book, Coping in Medical School, Virshup suggests that the primary task of medical school (and of life) is to optimally satisfy our many needs.[4] We all have universal, powerful needs that, when satisfied, leave us feeling well. We classify these needs as physiological needs (for food, sleep, rest, sex, etc.) and psychological needs. Psychological needs include:

1. *The need for attachment*—close, supportive, relationships with other people. This can include a partner or friends with whom we share everything that is happening, and everything we are thinking, feeling, and doing. Life is a team sport; we need the support of others to survive and thrive.
2. *Individualization*—our own personal identity, authenticity, and independence; the synthesis of autonomy and interdependence is the greatest of all human challenges, especially when as trainees we are subject to power differentials. I once told a professor during an operation that I was uncomfortable with his homophobic remarks. It was terrifying to be true to myself, but it met my need for authenticity and to voice my distress over hateful speech.
3. *Self-esteem*—a feeling that we are basically good, competent people. Supervisors can threaten this need if we receive harsh criticism of our work.
4. *Self-approval*—acceptance by our internal critics of our thoughts, feelings and actions. We develop competence from

a place of incompetence: "Every master was once a disaster." At times we experience a lack of coherence between our ideal and our actual thoughts, feelings, and actions, such as when we avoid spending time with a challenging patient. Richard Schwartz, in his book, "No Bad Parts," provides a model of health based on integration and acceptance of all of who we are.[5]

5. *Security*—for example, money, a steady job and stable relationships. In our profession, this threat arises most commonly when we suffer mental or physical impairment that jeopardizes our ability to work. In many states, consumer advocates promote a punitive approach by medical boards that favor license revocation over rehabilitation.
6. *Creativity and self-expression*. Working 16 to 36 hour shifts up to 7 days a week can preclude the satisfaction of our need for creativity and self-expression. I felt this in medical school; I took off a year in the middle of medical school to study and play jazz piano, but had to give this up during my internship.

We can trace nearly every woe of the world back to not satisfying one or more of these needs. When our needs are unfulfilled, we feel pain--a clear message that something is wrong. With pain comes depression, anxiety, frustration, confusion, or anger. We must be able to cope with this deprivation, a skill that medical school and our careers provide us many opportunities to learn.

We cope poorly when we do not satisfy our needs--when we react to pain by becoming anxious, alienated, chronically angry, or depressed, when we deny our pain, or when we treat it ineffectively, with food, drugs, overwork, or suicide.

We cope well when we take responsibility for satisfying our needs. To start, we must first look at ourselves squarely and honestly, so we know who we are, what our needs are, and when these needs are not being met. Accepting we have needs we would rather not have is also a must. This acceptance requires being sensitive to our feelings, listening to that "wise person" inside us who knows when things are not right and what to do. When we suffer, we can then understand the problem and work out a solution.

Coping well is difficult, especially in medicine, where the demands and stresses are great. We must endure our dependence on our profession, risk our self-esteem in our unending incompetence, face our internal critics' demands for impossible perfection, and compromise relationships and other interests to the overwhelming demands of medicine. We must even forego some of our most basic needs, such as sleep.

We must cope with the conflicts that arise by coming up with personal, creative solutions that provide us with optimal satisfaction. We should consider as many options as possible, including leaving medical school. Our solutions vary with our coping styles, as well as the relative strengths of our needs. However, we all end up making compromises and sacrifices.

We must also set limits and say "no" self-confidently to other's demands. But *we* must strike the balance, not our superiors. For example, I don't do well without sleep. On one of my clinical rotations, I fell in to bed, exhausted, around 2AM. My resident chewed me out the next morning for my "laziness" and "lack of dedication." I felt bad, but knew I couldn't stay up any longer and be effective. Sometimes setting limits like this will meet with stern disapproval.

If, however, our calling to become a physician is great enough, the decision to persevere brings us the greatest satisfaction, despite these hardships.

A Unique, Individual Process of Becoming

As we become doctors in medical school, we also grow and change in all aspects of our lives. We are each becoming someone who is like no other individual. Ideally, we will know our needs as we grow, and satisfy them in creative, personal ways. Rogers coins this process "becoming who we are," because in it we shed masks and games and discover our true feelings, emotions, talents, strengths, weaknesses and "hang-ups."

Self-Honesty

Being who we are is not being what our professor or mother tell us we should be, or denying feelings we would rather not have, such as anxiety on our first clerkship. It is ridding ourselves of unrealistic or inappropriate expectations of what a doctor should be and of that malignant perfectionism so common among us.

This candid self-honesty can be painful or disturbing when we discover our "undesirable" qualities. But with that pain comes self-knowledge, a reward that frees us to choose to live our lives in a way that brings us the greatest fulfillment. We can discard old expectations and a skewed self-image cast in our upbringing to adopt an image and an ideal that best fits who we are and who we wish to become.

Self-Acceptance

To be ourselves, we must accept ourselves. We must value ourselves as competent, worthwhile beings, regardless of our achievements, human flaws, and inner contradictions. If we value who we are, then we are okay, regardless of what others think. If we acknowledge our unskillful traits, we save ourselves from much grief.

Self-acceptance also strengthens our ability to accept others and forgive them for their faults; thus, we avoid an inappropriate judgmentalism that prevents us from caring. Acceptance also tempers our anger when others do not meet our expectations. With self-acceptance comes humility, a much-needed antidote to the hubris of our profession. Yet when we are arrogant or even hate our patients, our self-value remains secure because we attempt to understand what we're feeling and why rather than denying or condemning those feelings.

Being true to ourselves

Becoming who we are involves making choices based on what *we,* and not others, believe is best for us. Our profession places

heavy demands on us to act "professionally", to neglect our well-being and deny our universal human needs. If we are true to ourselves, we eventually find ourselves not conforming with the world and facing, in our dependency, the criticism of our superiors and peers. With self-knowledge and acceptance, we can meet our conflicts with the world with confidence in our internal evaluation of what is best for us. We can withstand criticism without becoming hostile or defensive, and satisfy our needs assertively (respectfully, kindly, and firmly).

Usually, our respect and care results in harmonious relationships, but this is not always possible or desirable. One former mentor of mine even believed it is a step forward to have an enemy or two. Freeing ourselves from external "shoulds," and placing more trust in our experience are essential to our well-being.

Becoming who we are is a lifelong process of self-awareness, not a discrete achievement like getting into medical school. As life is a process, so are we, and our willingness to acknowledge this frees us to change and grow as we live our lives. Self-knowledge provides a sense of direction and personal meaning to our continual self-discovery and change. Our years of medical training are then a rewarding process of becoming the physician we are, the only people we can be truly happy being.

Self-Responsibility

We all feel responsible for meeting whatever demands our profession makes of us, since we depend on it for our training, and our relationships with colleagues have such a powerful impact on our well-being. In fact, we are responsible to others for honoring our commitments, interacting with honesty, respect and care, giving both technologically and humanistically competent care. But our primary responsibility is to "be who we are", to satisfy our needs and live our lives as we see fit. If our educational needs are not being met, we should take action to satisfy them. If the "ideal doctor" others prescribe does not fit us, then we must take responsibility to craft our own ideal. We must not be afraid to be different or to disagree with those around or "above" us.

Self-responsibility is an attitude of active control; we do not settle passively for what others hand us or allow ourselves to sculpt us after someone else's image. We are responsible for resisting the harmful aspects of our professional socialization. Only we can ensure that we become who we are. Self-responsibility requires becoming self-aware, self-accepting, and confident, not an easy accomplishment in the face of our inexperience in an intimidating profession. Not easy, but not impossible, and certainly essential to our well-being.

Need for Direction—An Ideal

"It is more important to know what kind of patient has the disease then what kind of disease the patient has." - Sir William Osler

As we "practice" medicine, we constantly judge our actions against an internal ideal-self that guides our growth. We develop this ideal-self with input from society, our teachers and our colleagues. Unfortunately, many of the ideals prevalent today, such as "the doctor is inexhaustible", "the doctor puts medicine before all else" or "the doctor is a scientist", harm us or decrease the quality of our care. We all need work that is effective and rewarding; therefore, we must have an ideal that fits who we are and optimizes our ability to heal others.

What are the qualities of an effective healer? Many gifted writers, such as Reiser, Preston, Remen, Cousins, and Engel provide helpful answers to this question. (See suggested readings).

A Healing Relationship

A universal theme is the profound importance of the relationship between the doctor and the patient. Deckert, in his review of over fifty studies on physician qualities vs. patient outcomes, found that the most important qualities were the doctor's abilities to give nurturance, to educate patients about their diseases, and to involve patients in their care.[6] Location of training and Board scores do not correlate with patient outcomes.

Strong interpersonal skills

An optimal patient outcome therefore requires that we have well-developed interpersonal relationship skills. We must understand human psychology, accept the patient non-judgmentally, empathize (understand what another person is experiencing), and communicate in a skillful and sensitive manner. Above all, we must be willing to establish close, personal relationships with patients, for only then can we effectively inspire, encourage, nurture, support, and instill hope.

"The essence of the practice of medicine is that it is an intensive personal matter... at first sight, this may not appear to be a very vital point, but it is, in fact the crux of the whole situation. The treatment of disease may be completely personal. The significance of the intimate personal relationship between physician and patient cannot be too strongly emphasized. For and an extraordinarily large number of cases both diagnosis and treatment are directly dependent on it, and the failure of the young physician to establish this relationship accounts for much of his ineffectiveness in the care of patients."- F. W. Peabody.[7]

A Holistic, Biopsychosocialspiritual Perspective

Engel's biopsychosocial model provides an understanding of how social, cultural, familial, and psychological factors contribute to a person's illness.[8] These factors are parts of an indivisible totality. We must understand patients in their entirety to most effectively help them. We must approach each patient with the attitude that this is a unique person struggling with an illness, not an interesting "case". The doctor who treats only disease avoids responsibility for the problem. He is treating himself rather than serving the patient.

A narrow biomedical perspective has the potential for great harm. For example, we label a person with a disease process and then prolong suffering with unnecessary treatments that do not

address the cause of the person's suffering. We also do harm when we are insensitive and shatter hope, withhold support, neglect feelings, or cause panic. Stress and emotions have a tremendous impact on the healing process. We are therefore incompetent if we do not address them as part of our work.

Unlike learning the differential diagnosis for abdominal pain, healing requires more than intellectual commitment. We must not only diagnose and treat, but also "assist human nature and provoke no needless upset." This requires that we relate effectively, nurture, inspire, and encourage—skills that stem not so much from what we know, but from who we are—our life philosophy and values and our relational capacities. Medicine is an art, practiced with reverence for human life. The quality of our work depends on our qualities as people: humility, dedication, wonder, understanding, respect, and care.

Care

Above all, care is the most important quality we bring to our work. Care gives us the motivation to serve despite the hardships of medicine. From care comes our ability to relate to others closely and promote healing. With care, science serves our humanity, and not vice versa.

Fletcher and other medical ethicists believe that care, (or love, in the sense of valuing others well-being as we value our own), is the ethical foundation of medicine.[9] They argue that, since we are servants assisting others in their healing, our actions are ethically justified only if our motivation to arises from an altruistic concern for our patients' well-being. With this as our primary concern, we address the patient's suffering, not only their disease, and thus serve them, not ourselves.

Care is not an action, but a character trait. In his book, The Art of Loving, Fromm describes care, (a component of love) as an "inner activity" that unites us with others.[10] This unity soothes the unbearable pain caused by the awareness of our mortality, separateness, and helplessness before the forces of nature and society. This need for a union, through sex, drugs, conformity, creativity, or love, is a basic psychological need, for an experience of aloneness without union leads to insanity—the alleviation of separateness by a total withdrawal from the world. Of these solutions to the problem of human separation, love is the most satisfactory answer.

The Role of Love in Medicine

Love, therefore, is not only ethically required for the practice of medicine, and practically required for effective healing, but existentially required for our own well-being. Love, like medicine, and like life, is an art. Love, like medicine and life, requires an active way of being that no one can teach us, but can only be experienced by and for ourselves. Practicing love, like any art, requires the discipline of an athlete, the concentration of a surgeon, the patience of a child learning to walk, and an attitude of supreme concern, in every moment.

Loving presupposes we have attained a productive orientation in our lives, and have overcome our dependency, our narcissistic omnipotence, and our wish to exploit others. Loving requires humility based on an inner strength. It requires that we be able to see the world as it is, rather than only in the terms of its use or threat to us. Love is an act of faith-based on experience--in ourselves, in another person, and in humankind.

Finally, love requires courage, to judge certain values to be of ultimate concern, to stand by them, and to risk pain and disappointment.

Love is not something we can consciously will, but can experience only by meeting the above prerequisites. We cannot legislate care; But we can nurture it in others and practice it ourselves. Our training can address care and explicitly value it as the most important element in the practice of medicine. Caring role models can provide valuable guidance and inspiration. We can elicit our caring by placing ourselves in the proper environment; we experience care working closely with patients, especially the young and the dying. We must practice good self-care—satisfy our needs—so that we may experience the enrichment which loving brings. Caring for others and for ourselves are parts of the same process.

Regardless of our personalities and needs, caring for others is essential to our well-being. If we are to feel fulfilled in our lives and work, we must understand intellectually its importance and make a life-commitment to practice the art of loving in our practice of medicine.

Our Profession Can Harm Us

Entering medicine is dangerous. The extent of physician impairment, as manifested by substance misuse, including alcoholism, other mental illnesses, divorce, and suicide, is greater than in the general population. Male physicians have 40% higher rates of suicide than the general population, and female doctors have rates of suicide up to 130% higher.[11] 12.9% of male physicians and 21.4% of female physicians meet diagnostic criteria for alcohol use disorder.[12] This is partially because of the personality characteristics we bring with us to medicine, as well as the inherent stresses of our work. It is also a result, however, of the inhumane and negligent treatment we receive from our profession. It is critical that we understand the forces that can hurt us, so we can cope with them most effectively.

As modern medicine, with this biomedical orientation, neglects the well-being of the patient in its desire to cure disease, so it neglects the well-being of its members in its desire for their complete devotion. Medicine encourages personal imbalance through self-denial, neglect, and self-sacrifice. Broadhead and Coombs have documented that the harm caused by "the untempered influence of professionalism" induces a change in motivation from an initial altruism to a concern for self and family, pecuniary gain, individual autonomy, and professional prestige.[13]

Graduating students are less creative, more conservative, more homogeneous, and more cynical than those who enter medical school. The excessive demands of training encourage obsessive-compulsive coping techniques that hurt our ability to have close relationships with friends or patients.

Blame and Shame

Our socialization is in some ways "punishment-centered". Because of our dependence upon our profession for our training, our degree, and a license to practice medicine, we must risk blame, criticism, humiliation, ridicule, even condemnation by our colleagues and superiors. Too often, we let fear of failure and intimidation motivate us. The combination of these stresses and our dependency stimulates the "Patty Hearst Effect", in which we "identify with the aggressor", escaping pain and gaining acceptance by conforming. While this process of professional socialization is beneficial in that we become doctors, it is harmful in that it may hinder our becoming who we are.

Medical Machismo

In our socialization, teachers and colleagues pressure us to bury our humanity and adopt the "Medical Persona." We feel the pressure to develop our Medical Machismo - to strive for perfection, to be strong, to conceal our weaknesses, and to never reveal our troubled feelings. We are, dehumanized by these expectations, just as we dehumanize our patients by expecting them to be trusting, unquestioning, undemanding, incurious, emotionally controlled, stoical, easily diagnosed, and curable.

This "John Wayne-ism" fosters arrogance, pressures us to be decisive (resulting in over certainty), and prevents us from being genuine and close to others. Instead, role models teach us to detach ourselves from the patient and isolate ourselves in a cloak of "Professional Objectivity." Affective Neutrality is valued over self-disclosure, genuineness, and warmth. We are often not taught effective communication skills, or encouraged to understand human nature and the human psyche. As a result we neglect the social, psychological, and interpersonal aspects of illness and healing. The doctor-patient relationship is then sterilized of its potency for healing.

Detachment occurs, in part, because we work so close to death, and deal with such tremendous pain and tragedy. We lessen our pain by separating ourselves emotionally. Since the demand for denial of our emotions prevents us from working them through, detachment becomes our primary coping method.

Our superiors teach us to deny our uncomfortable feelings from the moment we enter anatomy lab. Instead of coping with feelings, we intellectualize them. Often, we avoid resolving our suffering and instead use inappropriate coping techniques to numb or prolong it. We not only learn insensitivity to ourselves but to others as well. As we fail to deal with the emotional impact of our work, so we fail to deal effectively with the emotional impact of our patient's illness. Our ability to empathize atrophies.

Technical focus

Rather than nurturing caring in our training by valuing it as the most important element of medicine, and by immersing students in a caring environment with caring role models, the training system largely neglects it. We are first immersed in science taught by basic scientists. On the wards, where according to one study, attending physicians spend an average of 14.73% of their time with patients, they stress scientific competence over caring.[14] Our profession rewards us not so much for our caring as for our crisp presentations, our command of the facts, and our technical expertise.

While medical schools treat medical students and residents more humanely than 40 years ago, the continuing inhumane demands of our training system virtually eliminate our ability to practice the art of caring and, as a result, experience the greatest reward of our work. This is in part because the system hurts us. Overworked, we learn to resent each new patient, who symbolizes another deprivation of our needs rather than an opportunity to practice our art. "Professional Objectivity", and an enormous workload and too little time separate us from our patients.

Financial pressures and high work demands allow us less opportunity to experience caring through close contact, and the rewards of giving. Since caring is a concern for the well-being of all, including ourselves, and since our role models teach us self-denial and neglect, we are taught not to care for others. Since knowledge, the basis of faith, is essential for caring, our lack of self-awareness, exploration and insight also prevents us from caring.

Anger

It is understandable that most of us feel anger. This is natural and justified; our expectations are not being met and we are being hurt. It is essential, however, that we work through our anger and, while recognizing the harmful parts of our training, accept the system, just as we must accept ourselves and others. No human work is perfect, including medicine.

There are good reasons our system is as it is. One is its evolution from the mechanistic era of Newtonian physics in the 17th century, when authorities only allowed anatomists and physicians to dissect if they left the issues of mind and spirit to the church. Engel considers this to be the source of our current biomedical orientation. The fantastic success of the scientific method, and the resulting belief that science can solve all problems, have spurred this approach to healing. During the early part of this century, our profession experienced increasing competition with other forms of medicine, and responded in part by elevating the doctor's status to an elite level; with this elevation, training became more demanding, and unfortunately more inhumane.

The achievements of modern medicine are among the greatest of humankind. While there is much that is wrong, there is also much for which we can be grateful. With understanding, acceptance, and faith, our anger becomes manageable, so that we can join and improve medicine, and practice our care not only for our patients, but for those who hurt us.

Self-Care

Take Control We can best care for ourselves by knowing who we are, what our needs are, and then taking responsibility for satisfying them. We must remember we are free to choose to live life as best fits us. Only we can decide what is best for us and strike the many necessary balances accordingly. When you feel discouraged or conflicted, remind yourself of your values and why you decided to become a doctor.

Make Self-Health a Priority We can only care for others as we care for ourselves. To teach health, we must practice it. The healthy person balances work, love, and play. Make time for rest and exercise. Eat a healthy diet. We are doctors, but are more than doctors; we must attend to all our needs in a balanced way. This requires setting limits on our responsibilities and self-expectations, pursuing our non-medical interests, and making time for other activities outside of medicine.

Explore Yourself Discover your feelings. your needs, your strengths, and your weaknesses. Develop ways to be with yourself, such as exercise, walks, meditation, or listening to music. Keeping a journal is not only an excellent technique for self-discovery, but can also enrich the experience of life. Practice self-honesty and try to understand why you feel as you do. Try not to be afraid of what you might find. Practice a moment-to-moment mindful self-awareness in your daily living.

Accept Yourself We are all okay, independent of who we are or what we do. We must also accept that we are imperfect, and that we all have a darker side that fears, feels anger and aggression, or wishes to exploit others to meet our needs. Accept that you have personal limitations, that you cannot do and be everything you would like; this will help you have realistic self-expectations that save you from disappointment.

Find Good Role Models and Mentors Seek out those whose values match your own. Remember that human qualities are far more important in our work than anything else. Work with those whose personal qualities make them effective healers; those who treat both their patients and you with respect and care, who are not afraid of being close, who addressed the patient's suffering, and who value you for who you are without condemnation.

Maintain Your Relationships Stay involved with your lover or spouse, friends, classmates, and family. Even though our careers may compromise these relationships, we must never sacrifice them, as they are essential to our well-being. They provide us with support, with opportunities to care, and with the experience of closeness so essential to our work.

Work on Your Interpersonal Skills The more effective we are in our interactions, the more rewards we will experience in our work and lives. Take counseling classes. Practice acceptance, nonjudgment, and empathy. Practice listening. Develop an understanding of such processes as transference, projection, denial, and displacement, and learn to recognize them in yourself and others.

Learn to Cope Well When pain comes, learn to recognize it, and attempt to understand it. Take breaks from what you're doing, remove yourself from a stressful experience for a time to work things through. Hash things out with people you trust. Be open to recognizing the parts of yourself that cause you pain, and to changing them. Take care of yourself. Do not deny your pain, work harder, self-medicate, or abandon relationships.

Read Attempt to understand the process you are immersed in. The references at the end of this article are all invaluable.

Join a Support Group Not only do groups help us deal with what we are going through, they also provide us with an opportunity to be close to colleagues in a supportive, acceptant, non-competitive way. We can practice being who we are with others in a safe setting. If we have difficulty being close to others, this is the ideal setting in which to develop this ability. The experience of closeness and caring is in itself rewarding.

Get Help If you feel you could benefit (and most of us can), get good counseling or therapy to work on your personal life issues. Shame or embarrassment not only indicate a lack of self-acceptance, but are inappropriate given that all people have problems. Also, refusing to receive help for our suffering is inconsistent with helping others with theirs.

Make Changes Do not feel inhibited about trying to make changes. Talk to the people in charge when you are upset about something you feel is unfair or inappropriate. Become politically active, work with committees, write articles, or circulate petitions.

Practice Medicine, and Life, as an Art The practice of any art requires discipline, concentration, patience, and supreme concern. Remember that no great reward comes in a day, but neither will medical school last forever. With patience, you will reach your goals. Like Osler, practice living each day to the fullest, concentrating your awareness on the details of each moment. Life is not so much a goal as a process; the quality of our experience lies in our attention first to the process, and second to our goals

Conclusion

Medical training is a crisis for all medical students and new physicians because we must change our entire identities, endure many stresses, and meet heavy demands through hard work. The Chinese symbol for crisis is the superposition of the two symbols for danger and opportunity. Medicine is hazardous to our health, as evidenced by the current tragedy of widespread physician impairment. But it is also an opportunity for us to grow in ways which enhance our fulfillment. Being a physician is a privilege that, for all its hardships, brings us many rewards. By understanding our own needs, the process we are undergoing, and by practicing good self-care, we can avoid the dangers along the way as we become physicians who experience meaning, fulfillment and satisfaction in work and life.

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