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IJMS

INTERNATIONAL JOURNAL *of*
MEDICAL STUDENTS

International Journal of Medical Students

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Should a Scientific Publication be a Prerequisite to Graduate from Medical School?

Iqra Nawaz,¹  Jonaviva Anthony Thomas,²  Prakash Gupta,³  Duha Shellah,⁴  Mihnea-Alexandru Găman,⁵  Juan C. Puyana,⁶ 
Francisco J. Bonilla-Escobar,⁷ 

Medical research serves as a pivot upon which the advancement of clinical practice oscillates.¹ As the future medicine continues to rely on the transition of medical research from evidence to practice, it becomes imperative that those who are involved in this transition are trained well and mentored diligently to ensure optimal patient care and improved health outcomes.¹ Medical students are important contributors to the body of scientific knowledge. The discovery of heparin, insulin, sinoatrial node, Klumpke paralysis, and sphincter of oddi are some examples of groundbreaking contributions made by medical students, which serve as proof of their role in the research field.² Thus, encouraging early engagement of medical students in research assumes primary importance.

Participating in research allows medical students to evaluate scientific literature, analyse data, interpret findings, and enhance their critical thinking and problem-solving skills. By keeping up with recent advancements, students remain updated about current guidelines and treatment procedures.³ Furthermore, involvement of medical students in research projects during early years in medical schools is also positively associated with sustained publication after graduation.⁴ Also, this undergraduate research experience enhances their inclination towards pursuing an academic medical career and enrolling in prestigious academic programs and specialties. Moreover, as advancement of medical knowledge rests on a balance of collaboration between physician-scientists and clinicians, insufficient contribution from one side may restrict the advancement of the other,¹ therefore, to counteract the growing decline of physicians undertaking clinical research, introducing research as a core competency during the formative years gains further relevance.⁵

Challenges to conducting undergraduate research

Prior to introducing research as a prerequisite for graduation, it is crucial to address the challenges that medical students may

encounter while pursuing research as a core competency. Several barriers to conducting undergraduate research have been identified. These challenges along with potential solutions have been summarized in [Table 1](#). In many academic programs, research training is offered during the later stages of undergraduate studies which is often brief and fails to impart comprehensive knowledge and practical skills. As a result, students have limited exposure to essential aspects of research methodology which may lead to confusion, delays, and compromised research quality.⁶ Inadequate support is another significant barrier that medical students may face when it comes to conducting research. One aspect of this support is the availability of funds. Undergraduate students often encounter a lack of financial resources, as there are few funding opportunities specifically targeted at facilitating undergraduate research.⁷ Without adequate funding, students may struggle to access research materials, equipment, or specialized software, hindering the quality and scope of their work.

Inadequate support from mentors is another barrier to conducting research among undergraduates. Dedicated mentors play a crucial role in guiding students through the research process, offering valuable expertise, and providing constructive feedback. However, in many cases, undergraduate students find themselves lacking supportive mentors to offer them the necessary guidance.⁷ Structural challenges pose additional barriers that hinder undergraduate research efforts. One such challenge is the scarcity of time allocated for engaging in research activities. This can be primarily attributed to the demanding nature of university curricula, which prioritize coursework and other academic requirements.⁸ Furthermore, the lack of well-established structures and programs to facilitate and promote undergraduate research within many universities exacerbates the issue. Without clear guidelines, initiatives, and support systems in place, undergraduates may struggle to navigate the research

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landscape and access the resources necessary to conduct impactful research.⁶

Ways forward: how to enhance medical students' involvement in research

To guarantee that the intended outcomes of establishing scientific publication as a prerequisite to graduation are achieved, the role of relevant stakeholders becomes imperative. This role includes ensuring undergraduates are exposed to research as early as possible, which can be achieved through interactive training programs and workshops specifically designed to motivate and engage students in research activities.^{6,8} Small research grant opportunities, specifically tailored to the needs of students, could be established as part of a larger fund obtained from an institution or organization. These provide a means for students to obtain necessary resources, ultimately enhancing the quality and scope of their projects.⁷ Strengthening the mentor-mentee relationship in universities is crucial to establishing a framework that values and reinforces this vital relationship.⁶⁻⁸ By acknowledging and rewarding effective mentorship, universities can create a supportive environment that motivates mentors to actively engage with undergraduate students and encourage them to invest their time, knowledge, and expertise.⁶ Additionally, universities can create dedicated platforms for undergraduate medical students to share their research activities. This can be in the form of research symposiums, poster sessions, conference attendance or online platforms. Furthermore, incentives such as awards can serve as powerful motivators for undergraduate researchers which can inspire students to strive for excellence, fuel their passion for research, and reinforce the value placed on research endeavours within the university community.⁶

In order to establish research as a prerequisite for graduation, it is crucial to devise appropriate metrics that can measure current understanding of students regarding the technicalities of research which can help identify areas where improvements are needed and to make informed decisions about the most effective strategies.⁹ Evaluating research comprehension among medical students often entails assessing their perspectives and abilities linked to research methodology, critical evaluation, data processing skills, and results dissemination and scientific communication. These metrics may differ across universities, but they may include creating a research proposal, study design, methodology, literature review, research ethics, data collection, scientific writing, and publishing. Participation in oral or poster presentations, participation at research conferences, and research partnerships are also significant indicators for assessing not only the degree of research knowledge among medical students but also for developing competent worldwide researchers.^{10,11} Thus, students' capacity to think critically, analyze the evidence, and apply scientific reasoning in research-related settings may be examined to assess their research knowledge.¹²⁻¹⁴

Emphasizing research as a core competency in the medical school curriculum demands ensuring its full implementation, namely reaching the stage of publication. Publishing research projects serves as the only true measure for evaluating the effectiveness of the strategies aimed at addressing barriers to conduct research

at the undergraduate level. The delay may become especially longer for medical students as they lack expertise in scientific writing.^{15,16}

Table 1. Summary of Barriers to Conducting Undergraduate Research and Potential Solutions.

Barriers to Conducting Undergraduate Research and Potential Solutions			
	Imparting Knowledge and Skill	Providing Adequate Support	Introducing Structural Programs
Barriers	Lack of trained faculty. Research training offered during later stages of undergraduate studies.	Few funding opportunities specifically targeted at facilitating undergraduate research. Lack of mentorship.	At institutional level, lack of well-established structures and programs to facilitate and promote undergraduate research.
Consequences	Limited exposure and understanding of essential aspects of research methodology. Compromised research quality.	Due to lack of funds, students struggle to access research materials, equipment, or specialized software and travel expenses. Without guidance from mentors, students struggle with designing their studies, analyzing data, and interpreting their findings accurately.	With greater focus on course, undergraduates struggle to dedicate themselves fully to research projects.
Potential Solutions	Interactive training programs for both the students and the staff should be introduced. Workshops specifically designed to motivate and engage students in research activities should be held.	Organizing small research funding opportunities. Strengthening the Mentor-mentee relationship by acknowledging and rewarding effective mentorship.	Create dedicated platforms for medical students to share their research activities such as research symposiums, poster sessions, conference attendance or online platforms. Incentives such as awards can serve as powerful motivators.

It is also important to highlight the inequalities that emerge when students undertaking research from high-income countries (HICs) and low-income countries (LICs) are compared.¹⁷⁻¹⁹ Students belonging to institutions based in HICs benefit from easily accessible research infrastructure, modern laboratories, and an abundance of tools that promote their research involvement. HICs encourage scientific inquiry and incorporate research into their curriculum, building important abilities and providing early exposure to research opportunities.²⁰ On the other hand, LICs encounter many challenges that prevent students from conducting research in their institutions.²¹⁻²³ Additionally, the focus on research in HIC and LIC varies. Certain HICs incorporate research from elementary through secondary school, encouraging a research-oriented attitude and developing research-related abilities. In contrast, LICs concentrate academic

information and tests, giving students little experience in research technique, critical thinking, and scientific inquiry.²⁴⁻²⁶ Efforts are being made to bridge the gap and advance research in LICs. Organizations, institutions, and multinational partnerships are all actively participating in capacity-building projects. These projects offer training, mentoring, and resources to improve research opportunities, skills, and culture in LICs.^{27, 28} Students belonging to institutions based in LICs can achieve a research edge by expanding resource accessibility and incorporating research into the instructional system. Prioritizing research empowers students, promotes scientific curiosity, and allows them to make significant contributions to scientific advancement and solve local healthcare concerns.^{29, 30}

Articles in this issue

In their cross-sectional study, Mediboina and Bhupathi examined the impact of COVID-19 on the health of police personnel in Eluru, India. Data were collected from 82 personnel using a three-part questionnaire. The findings revealed significant levels of stress (30.4%) and anxiety (17.07%) among the police personnel due to the pandemic, although no significant levels of depression were observed. The findings highlight the importance of addressing the mental and physical health issues faced by police personnel during this challenging time and emphasize the need for further research in this area.³¹

Haïy A ul et al. in their study aimed to investigate the patterns of coronary artery dominance and explore the relationship of these patterns with coronary artery disease. They analysed data from coronary angiographies of 631 patients. The researchers concluded that there is a positive correlation between right dominance and the severity of coronary artery disease. Their results also indicated that the distribution of coronary dominance in Pakistan differs from what has been reported in the existing literature suggesting that individuals with right coronary artery dominance may be more susceptible to developing severe forms of coronary artery disease. Furthermore, it highlights the need for further investigations and studies to gain a deeper understanding of coronary artery dominance patterns specific to the Pakistan population.³²

In their original research titled 'Global Impact of the COVID-19 Pandemic on Medical Students in 2021 and 2022', the authors discuss how the pandemic impacted medical students' knowledge, experiences, perspectives on relevant policies and resources. The authors highlight perspectives of both US and international students in addition to comparing how these outlooks may have changed as the pandemic progressed from 2021 and 2022.³³

In the systematic literature review, Patra investigated the relationship between psoriasis and pregnancy, specifically examining potential treatment options. The review analyzed 14 articles and identified five major themes: immunology, general sex hormones, estrogen, progesterone, and the HLA-Cw6 allele. The findings emphasize the individual nature of psoriasis and shed light on the role of genetics and hormones in its development.³⁴

Yu Xuan Lee presents a case of a 54-year-old man, with a prolonged history of a prolapsed intervertebral disc, presenting with symptoms of tetraparesis and paraparesis, which were initially misdiagnosed. However, further laboratory tests confirmed the diagnosis of Guillain-Barre Syndrome (GBS). The patient was then treated with immunoglobulin therapy, resulting in significant improvement. This case report emphasizes the challenges in diagnosing GBS in patients with underlying neurological comorbidities. It highlights the importance of conducting a comprehensive physical examination and obtaining a detailed medical history in diagnosing GBS in patients with underlying neurological conditions.³⁵

Mićić et al. describe a case of a 32-year-old woman presenting with left-sided common peroneal nerve palsy located at the knee level resulting from open reduction and internal fixation of acetabular fracture. The patient was surgically managed via external neurolysis, decompression, and complete nerve deliberation, with the preservation of all nerve branches.³⁶

The article by Tzioti recounts a Greek medical student's experience in an IFMSA research exchange program in Argentina. The student studied vitamin D and antioxidant effects on vascular function in hypertension models at the biomedical physiology department at the Medical Faculty of the National University of Tucuman. The exchange experience improved self-confidence, perspective, and progress. The student urged people to pursue overseas adventures for personal and professional growth despite language and cultural limitations.³⁷

The article by Jigish et al. focuses on a medical student's experience learning Latin and Greek, especially in the context of medical terminology. Prior to entering medical school, the student earned a Concurrent Certificate in the Language of Medicine and Health. By using roots, the learner reduced the amount of rigorous memorizing required and gained a contextual understanding of new ideas. The use of medical etymologies has been proven to improve learning in anatomy lessons, with classical language students surpassing their counterparts in anatomical examinations. However, it is crucial to recognize that classical roots should only be used for basic explanations and not as a basis for clinical judgment. Applying these early definitions requires clinical context and more instruction, and the formulaic method has trouble with non-classical eponyms and drug names.³⁸

In light of increased use of medical masks during the pandemic years and consequently an increase in production of plastic waste, Suteja et al. share their experience of organizing a community service that was directed at counselling the community regarding proper disposal of medical masks and their reuse as a step to introduce small and sustainable ways to enhance environmental awareness. Later, invited to speak at a local radio station, the authors were able to educate the community about the impact that improper handling of medical waste may have on their physical health.³⁹

Wei Zhuen Chew et al., share their experience regarding the changing regulations and disinformation hindered evidence-based medicine (EBM) during the COVID-19 epidemic. The

COVID-19 Evidence Retrieval Service (CERS) was created to provide doctors with reliable information. Librarians, physicians, public health professionals, and medical students analyzed medical literature and answered COVID-19-related queries from practicing clinicians. CERS deployment demonstrated that EBM must be adapted to the pandemic, online work methods are efficient, and resource-limited healthcare systems require services like CERS. Medical students helped establish an integrated evidence-based retrieval service, which proved feasible and effective.⁴⁰

Conclusion

Prior to introducing research as a prerequisite for graduation, it is essential to address institutional, financial, and intellectual

barriers that hinder students from conducting research at their institutions. A thesis or a paper should only be made mandatory for graduation when barriers to conducting and executing sound research are recognized and relevant measures are set in place to ensure that students are equipped to conduct studies that are truly impactful. Mandating scientific publication at undergraduate level instills scientific rigor, advances medical knowledge, develops transferable skills, fosters professionalism, and promotes career prospects. Thus, through establishing research as a prerequisite, medical schools can cultivate a generation of physicians who are not only skilled clinicians but also actively contribute to the growth and advancement of medical science.

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Effect of COVID-19 Lockdown on Health of Police Personnel in Eluru, Andhra Pradesh

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Abstract

Background: COVID-19 has had an impact on all sectors of society. However, the impacts on police personnel has not been discussed enough. This study aims to identify the effects that COVID-19 lockdown duties had on the police personnel of Eluru, India. **Results:** Among the total respondents, 30.4% of the total respondents have significant levels of stress and 17.07% have significant levels of anxiety. Psychological impact had a positive correlation with gender, marital status and age group. Females, married officers and officers in older age groups were found to have higher levels of anxiety. Majority of the respondents got 7 hours or more sleep. The police regularly use stimulants with tea being the most common (84.1%), drinking an avg. 2 cups per day. This study found no correlation between BMI, presence of comorbidity (Hypertension, Diabetes Mellitus), and the sleeping habits with psychological impact; however, there was a notable increase in the blood pressure and blood sugar levels post-lockdown. **Conclusion:** Due to the retrospective nature of the study, the police personnel of Eluru have grown accustomed to the lockdown duties and appear to have developed coping mechanisms. Regardless, it is recommended to encourage further studies regarding the health of police officers and the COVID-19 impacts on the health of police personnel.

Key Words: COVID-19, Police Personnel, Mental Health, Lockdown Duties (Source: MeSH-NLM).

Introduction

COVID-19 is caused by the novel coronavirus, SARS-CoV-2. WHO first learned of this new virus on 31 December 2019, following a report of a cluster of cases of 'viral pneumonia' in Wuhan, People's Republic of China.¹ The lockdown due to COVID-19 has affected individuals from all walks of life, both in terms of mental and physical health. Increased levels of stress, depression and anxiety were observed during the pandemic.²

Stress is associated with chronic musculoskeletal pain, hypertension, heart attacks, and peptic ulcers and thus, this negative impact on mental health can cause subsequent effects on the physical and physiological health.³ Sleep disorders due to the pandemic are also being observed, as shown by Iagnoli et. al., which in turn, are both cause and complications of various health disorders.⁴ The effects of the pandemic can especially be seen in the frontline workers, who were more exposed to the virus. While there is much literature regarding the health effects on healthcare workers, not much information is available regarding the impacts on police personnel and law enforcement officials, who were also placed at the frontline during the pandemic. These officers are already exposed to a number of occupational stressors such as long working hours, violence, confrontation, etc. on a daily basis, all of which are causative factors for a number of mental health issues such as stress, anxiety, depression and sleep disorders. Police officers also suffer

from a number of physical and physiological problems such as cardiovascular disease, gastric ulcers, musculoskeletal problems, etc. Due to COVID-19, police personnel faced the additional stress of maintaining law and order while being exposed to the virus, thus causing and further exacerbating their mental and physical health issues.

In India, the training of police personnel includes dealing with natural and man-made disasters. However, there was little emphasis on pandemic control. As a result, the onset of the COVID-19 pandemic has required the police to assume a number of unconventional responsibilities, such as creating social awareness, checking on public mask usage, monitoring check posts and COVID-19 infection hotspots, ensuring lockdown and containment, and other essential services.⁵ More importantly, the police force has been working under life-threatening conditions, since many of them do not have access to personal protection equipment (PPE). They risk catching the infection, taking it home and exposing their family. These duties, along with demanding work conditions and the added fear of contracting the virus can be considered as additional sources of occupational stress among the Indian police personnel.^{6,7} Moreover, there have been an increasing number of aggravated assaults by the public, with about 260 policemen being injured in various incidents since the onset of the pandemic.⁸ In many instances the police personnel have been attacked by dangerous weapons, hurled abuse and

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stoned at a number of places. Such incidents are causing concerns over the protection at work, and can lead to increased psychological distress. Aside from psychological effects, there are negative physical effects as well; for example, it has been reported that the sleep cycle and sleep quality of the police personnel has been negatively impacted due to the lockdown duties.⁹

There are limited studies on the effects of the pandemic on police personnel of India, especially in a rural setting. Thus, the rationale of this study is to identify the various effects of the COVID-19 lockdown on the police personnel of the Eluru City of West Godavari District in Andhra Pradesh State, India. The observations and results of this study can be further used to formulate interventions and awareness programs such as training, counseling, and environmental workplace changes as needed for the police personnel to ensure optimum well-being in all aspects of their health.

Aims and Objectives

- This study aims to identify the effects of the lockdown duties on the mental health and physical health of the police personnel in Eluru, Andhra Pradesh.
- To evaluate the health conditions of the police personnel, and if any health problems were aggravated due to the lockdown duties.
- The study also aims to identify any correlation between socio-demographic factors with the psychological impact and between the physical factors and the psychological impact.

Methods

Study Design

This study is an analytical cross-sectional study and meets the STROBE guidelines.

Study Setting and Population

All the police personnel available in the substations of Eluru, Andhra Pradesh were approached to be a part of the study. A total of 82 personnel were available and willing to give consent during the period of data collection.

Study Period

The data collection took place for duration of 2 months, starting from mid-August and was completed mid-October, 2021.

Inclusion and Exclusion Criteria

All Police Personnel who were willing to participate and give consent were included in the study, while police personnel who were on leave during the period of data collection were excluded.

Study Tools

A pre-designed and pre-validated questionnaire was administered to collect data regarding socio-demographic profile, blood pressure and blood sugar levels, sleep schedule and

any existing comorbidities. The blood pressure and sugar levels were checked using BP apparatus and Glucometer, respectively. The Depression, Anxiety, Stress Scale-21 (DASS-21) is a validated questionnaire containing a set of three self-report scales designed to measure the emotional states of depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content, to assess depression, anxiety and stress. Overall score is calculated by summing the scores for the relevant items.¹⁰

Data Entry and Analysis

The data was entered in Microsoft Excel 2010 and processed in SPSS version 20. All the quantitative variables are expressed as means and frequencies as percentages. The scores of DASS-21 subscales were expressed as mean and standard deviation (SD). Association analysis using the Chi-square test was performed. P value < 0.05 was considered statistically significant.

Ethical Issues

The study was conducted after taking necessary permissions from the following authorities: Superintendent of Police, West Godavari District, Andhra Pradesh, and the Institutional Ethics Committee of Alluri Sita Ramaraju Academy of Medical Sciences, Eluru. The study did not involve any invasive procedures. Participant were not forced to take part in the study against their wish. The individual data obtained was kept confidential. The names of the participants were not used for identification during data entry, and instead an ID was assigned to each participant.

Results

During the survey period, a total of 82 responses were collected during the survey period, i.e., from mid-August to mid-October. The mean age of the participants was 37 years. The majority of the participants (n=68) were males and married (n=53).

Prevalence of Stress, Anxiety, Depression among the Police Personnel on Lockdown Duty during COVID-19 Pandemic

Respondents' depression, anxiety and stress levels were measured using DASS-21 scale and revealed a sample mean score of 4.10 (SD=3.74).

Table 1. Socio-Demographic Profile.

Variables	Frequency/mean
Age	37.43
Gender	
Male	68
Female	14
Marital Status	
Unmarried	29
Married and without children	1
Married and with children	52

For the stress subscale 57 (69.5%), it reported normal scores (score <10); 23 (28%), mild stress signals (scores 11-18), 2 (2.4%), moderate stress signals (scores 19-26), and none reported severe to extremely severe stress signals (scores 27-42). For the anxiety subscale 68 (82.9%), it reported normal scores (score: 0-6); 2 (2.4%), mild anxiety symptoms (score: 7-9); 11 (13.4%), moderate anxiety symptoms (score: 10-14); and 1 (1.2%) reported severe to extremely severe anxiety symptoms (scores 15-42). For the depression subscale, all respondents were considered to have a normal score (0-9).

Table 2. Association of Socio-Demographic Factors with Psychological Impact.

Variable	n (%)	Normal (%)	Stress (%)	p-value*	Normal (%)	Anxiety (%)	p-value*
Gender				0.08			0.0003
Male	68 (82.9)	50 (73.5)	18 (26.4)		61 (89.7)	7 (10.3)	
Female	14 (17)	7 (50)	7 (50)		7 (50)	7 (50)	
Marital Status				0.00059			0.015
Married	53 (64.6)	30 (56.6)	23 (43.3)		40 (75.4)	13 (24.5)	
Unmarried	29 (32.9)	27 (93.1)	2 (6.9)		28 (96.5)	1 (3.5)	
Age				0.05943			0.00667
25-30	21 (25.6)	16 (76.2)	5 (23.8)		19 (90.4)	2 (9.6)	
30-35	18 (21.9)	16 (88.8)	2 (11.2)		17 (94.4)	1 (5.6)	
35-40	14 (17)	8 (57.1)	6 (42.9)		10 (71.4)	4 (28.6)	
40-45	5 (6)	2 (40)	3 (60)		4 (80)	1 (20)	
45-50	12 (14.6)	9 (75)	3 (25)		10 (83.3)	2 (16.7)	
50-55	9 (2.3)	3 (33.3)	6 (66.7)		3 (33.3)	6 (66.7)	
60-65	3 (3.6)	2 (66.7)	1 (33.3)		3 (100)	0 (0)	

Legend: *The Chi-square statistic is significant at $p < 0.05$ level.

Table 2 shows that male respondents had significantly lower scores for anxiety ($p=0.0003$). Unmarried respondents had significantly low stress ($p=0.00059$) and anxiety ($p=0.00667$) scores. 40-45 and 50-55 age groups showed significantly higher anxiety scores, while the other age groups showed lower anxiety scores. There is no significant correlation between gender and stress, and age groups and stress.

Table 3 tabulates the data collected regarding physical health. As observed, there is no significant relationship between the physical factors and psychological impact.

Effects of Lockdown Duty on Physical Health of Police Personnel

Common comorbidities diagnosed among the police personnel of Eluru prior to lockdown duties include hypertension ($n=10$),

Table 3. Association of Physical Health Factors with Psychological Impact.

Variable	n (%)	Normal (%)	Stress (%)	p-value*	Normal (%)	Anxiety (%)	p-value*
BMI				0.65			0.14
Normal Weight	70 (85.3)	49 (70)	21 (30)		60 (85.7)	10 (14.3)	
Overweight	8 (9.7)	6 (75)	2 (25)		6 (75)	2 (25)	
Obese	4 (4.8)	2 (50)	2 (50)		2 (50)	2 (50)	
Comorbidity				0.949			0.727
Hypertension	25 (30.4)	19 (76)	6 (24)		20 (80)	5 (20)	
Diabetes	13 (15.8)	10 (76.9)	3 (23.1)		11 (84.6)	2 (15.4)	
Time taken to fall asleep				0.429			0.1
Immediately	26 (31.7)	19 (73)	7 (27)		23 (88.4)	3 (11.6)	
5-10 minutes	3 (3.6)	1 (33.3)	2 (66.7)		2 (66.7)	1 (33.3)	
10 minutes	5 (6)	2 (40)	3 (60)		2 (40)	3 (60)	
30 minutes	28 (34.1)	19 (67.8)	9 (32.2)		23 (82.1)	5 (17.9)	
30 minutes-1 hour	12 (14.6)	9 (75)	3 (25)		9 (75)	3 (25)	
1 hour	8 (9.7)	4 (50)	4 (50)		8 (100)	0 (0)	

Legend: *The Chi-square statistic is significant at $p < 0.05$ level.

diabetes mellitus (Type 2) ($n=7$), hypotension ($n=4$) and hyperthyroidism ($n=2$), the latter two which are seen among the female officers.

At the time of collecting data, BP and post-prandial blood sugar levels were checked, with which several officers exhibiting hypertension ($n=25$) and diabetes mellitus (Type 2) ($n=13$) were identified.

Height and weight were also checked, with which BMI of the officers was calculated. The stress, anxiety and depression scores were then tabulated in comparison to their BMI levels.

Table 4. BMI Levels Compared to Frequency of Stress, Anxiety and Depression Levels Among the Police Personnel.

BMI Levels	Frequency of Stress	Frequency of Anxiety	Frequency of Depression
Normal Weight ($n=70$)	21	10	0
Overweight ($n=8$)	2	2	0
Obese ($n=4$)	2	2	0

Figure 1. Bar Graph Depicting Comorbidities Diagnosed Prior to Lockdown Duties.

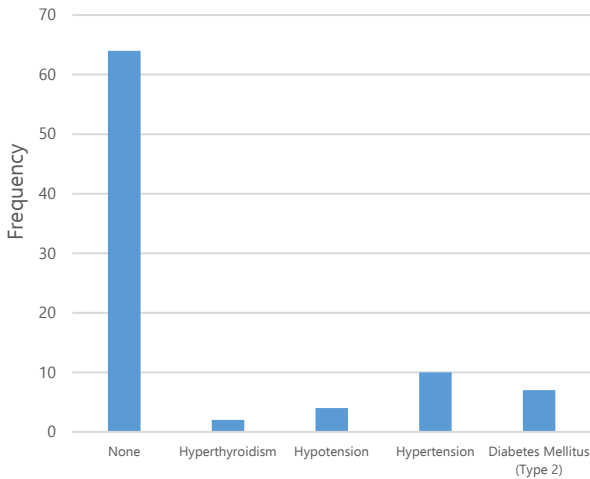
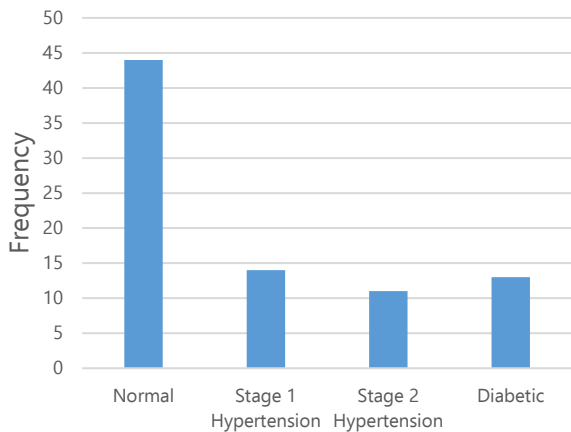


Figure 2. Bar Graph Depicting Hypertensive and Diabetic Levels among the Police Officers.



Data regarding the sleeping habits of the police personnel was collected. **Figure 4** depicts the amount of time taken to fall asleep, ranging from a few minutes to 1 hour with 31.7% being able to fall asleep immediately.

On average, police personnel got an average of 7 hours of sleep at night during lockdown duties, with 64.6% of personnel reporting 7 hours or more of sleep at night, as depicted in **Figure 5**.

Lastly, data regarding the stimulants used by the police personnel during lockdown duties was collected (**Table 3**), where "n" is the no. of people. Tea is the most common stimulant used, followed by cigarettes and coffee.

Number of cups of tea/coffee taken per day were also noted, as shown in **Figure 5**. On average, the respondents drink 2 cups per day. Those who take cigarettes reported smoking 1-2 cigarettes per day.

Table 5. Stimulants commonly used.

Stimulant	Frequency (n)
Coffee	16
Tea	69
Cigarettes	17
None	4

Figure 3. Bar Graph Depicting Time Taken to Fall Asleep during Lockdown Duties.

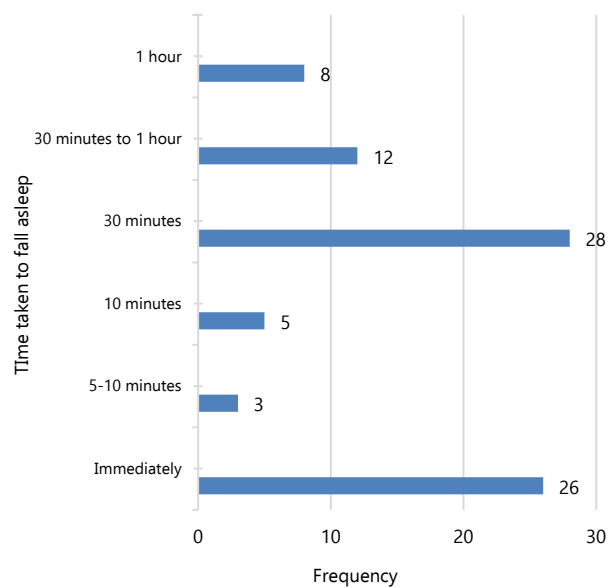


Figure 4. Bar Graph Depicting Hours Slept at Night during Lockdown Duties.

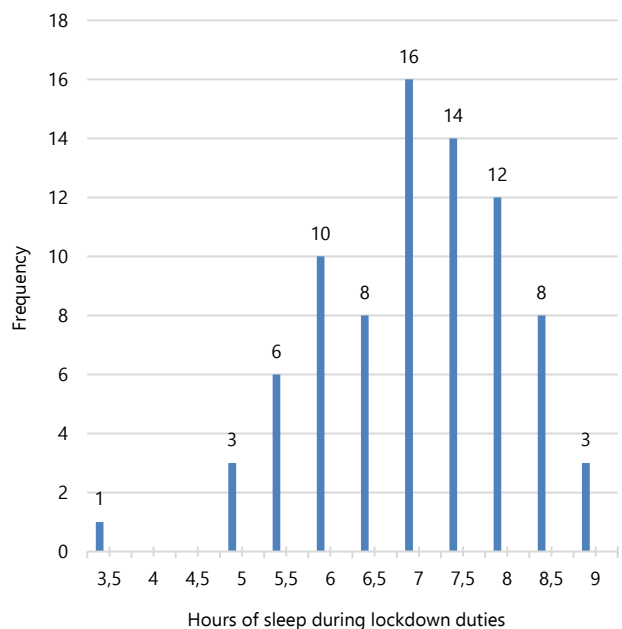
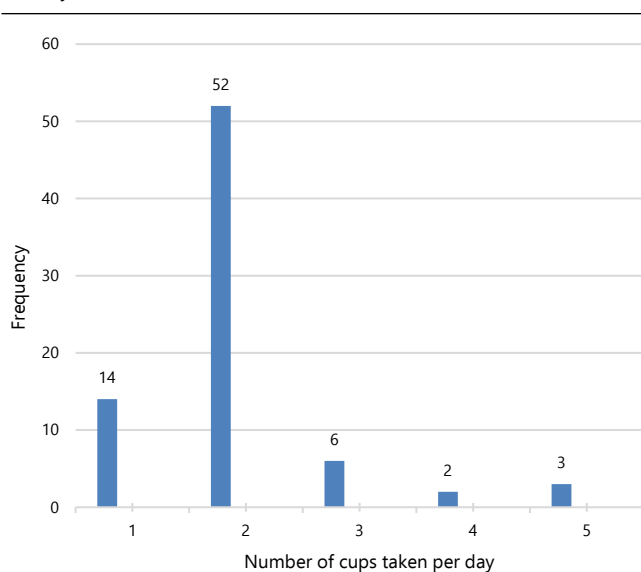


Figure 5. Bar Graph Depicting Number of Cups of Coffee/Tea Taken Per Day.



Discussion

This study revealed that overall, the police personnel of Eluru show significant levels of stress (30.4% of respondents) and anxiety (17.07% of respondents), but no significant levels of depression.

Females and older age groups showed higher levels of anxiety as compared to the male officers, which is in accordance with multiple studies such as those by Grover et. al., Hussain et. al, and Tsehay et. al, while no significant correlation was found between gender and age groups with stress.^{11,12,13} This could be attributed to the fact that females generally face lack of recognition from both their male colleagues and the general public and also face the strain of doing their household chores along with their police work. Females are also more likely to express fear of the virus,¹⁴⁻¹⁵ according to multiple studies, therefore contributing to higher anxiety levels.

Anxiety was also found to be highly significant in married officers, which could be due to the concern about being a source for infection of COVID-19 for family members, as stated by previous literature.

For the physical health parameters, the present study found no significant correlation between BMI and psychological impacts, which is in accordance with the study by Vancini et. al., who found that while police officers in Brazil presented with moderate levels of anxiety and mild depression, they found no significant differences between normal and excess weight groups.¹⁶

There was a notable increase in the blood pressure and blood sugar levels in the police personnel after the lockdown duties. A total of 10 respondents were known hypertensive, while 7 of the respondents were known diabetics, i.e. they were diagnosed prior to lockdown duties. At the time of data collection, however, it was observed that 25 respondents had hypertensive levels of blood pressure, and 13 respondents had diabetic levels of blood sugar;

thus indicating that there was a notable increase in the blood levels of the known cases, and an increase in the number of new cases of hypertension and diabetes mellitus (type 2) after lockdown duties.

However, the present study did not find any significant correlation via Chi-square test between hypertensive and diabetic states with stress and/or anxiety, which goes against previous literature. This could be due to the sample size of the study.

Sleep habits were found to be altered in many police officers during their lockdown duties, as reported by Arindam Dey et. al.¹⁵ In this present study, no significant correlation between the sleeping habits and psychological impact was found. Majority (64.6%) of the respondents reported getting 7 hours of sleep or more, which is the required amount. However, many police officers (58.5% of the respondents) reported taking around 30 minutes to an hour to fall asleep both during lockdown duties and at present. An inference can be made here that the prolonged time taken to fall asleep can be attributed to the occupational stressors police generally face, based on previous existing literature.

Limitations

The present study has several limitations. Firstly, Eluru is a small city, with only a small number of police personnel available. Furthermore, the study took place in the months of August, September and October 2021, more than one year after the initial lockdown duties. Thus, a majority of police personnel reported that they have grown accustomed to the stress and pressures of the COVID-19 duties, which could be the reason for the variations in the outcome of the study. Another limitation is the lack of traffic personnel in the respondents; studies by Hua Chen et. al., and Dey et. al., have reported that traffic police face significantly higher levels of mental and physical health problems among police personnel.^{17,18}

The lack of reported depression symptoms could be attributed to the stigma surrounding mental health issues still prevalent in India, especially in rural areas. Studies by Sneha et. al., Kallauri, and Guttikonda et. al., have all reported that people in rural areas tend to have low levels of awareness and knowledge regarding mental health illnesses, and thus view mental health issues to be shameful.^{19,20,21} Additionally, males have a low tendency to seek hospital care for health conditions, even more so in regards to mental health issues, which could further explain the decreased levels of psychological impacts in the present study.²¹

The low levels of stress and anxiety in the present study could also be attributed to positive coping mechanisms in the police personnel. Healthy coping mechanisms such as exercise, sleep, seeking support and religiosity have been shown to have positive outcomes with regard to perceived stress and anxiety. Moreover, positive work characteristics such as colleague support, supervisor support, supervisor relationship and work support were found to be inversely related to depression.²²

Conclusion

To summarize, there is a significant correlation between gender and psychological impact; with females showing higher levels of

anxiety than their male colleagues. There is a highly significant correlation between marital status and psychological impact; married personnel showed higher levels of stress and anxiety than unmarried personnel. There is also a significant correlation between age and psychological impact, with the older age groups of 50-55 showing higher levels of anxiety. This study also found no correlation between BMI, presence of comorbidity (hypertension, diabetes mellitus), and sleeping habits with psychological impact.

Despite the limitations, this study can play a role in contributing to the scientific literature on the effects of COVID-19 pandemic on police personnel in India, an area which is, at present, severely lacking. Further studies regarding the health of police officers and the COVID-19 impacts on the health of police personnel, especially the potential increase in incidence of mental health issues such as PTSD and burnout due to the pandemic, would be beneficial.

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Author Contributions

Conceptualization: AM; Methodology: AM, MB; Software: AM; Validation: AM; Formal Analysis: AM; Data Curation: MB, AM; Resources: AM, MB; Writing – Original Draft: AM, MB; Writing – Review and Editing: AM, MB; Project Administration: AM; Funding Acquisition: AM.

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Patterns of Coronary Artery Dominance and Association with Severity of Coronary Artery Disease at a Large Tertiary Care Hospital in Pakistan

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Abstract

Background: In cardiac anatomy, the term "dominance" refers to the supply of the posterior descending artery (PDA). Therefore, the PDA might arise from the left circumflex artery (LCX), the right coronary artery (RCA), or both, resulting in left dominant (LD), right dominant (RD), or co-dominant (CD) anatomy, respectively. Few studies have examined the relationship between coronary dominance and coronary artery disease (CAD) severity. CAD severity is defined as single, double, or triple vessel disease based on degree of stenosis. Our study intends to identify coronary dominance trends in Pakistan and show a correlation between coronary dominance and the severity of CAD. **Methods:** Between Jun 17, 2018 and August 4, 2018 data from coronary angiographies of 631 patients at a tertiary care hospital in Pakistan was collected. Patients were classified as LD, RD, or CD as reported in the results of coronary angiograms. We utilized a chi-square and multinomial logistic regression analyses to assess whether a correlation exists between coronary dominance and CAD severity. **Results:** Subjects were 78.9% RD, 10.5% LD, and 10.6% CD. A significant relation between dominance and severity of CAD was noted, $\chi^2(8, N=631) = 17.58, p=0.025$. Individuals with right dominance had a greater chance of developing triple-vessel disease than single-vessel ($p = 0.025$; OR = 0.451; 95% CI for OR: 0.224–0.906) and two-vessel disease ($p = 0.029$; OR = 0.471; 95% CI for OR: 0.239–0.926). **Conclusion:** In our study, right dominance has a positive correlation with severity of coronary artery disease.

Key Words: Coronary Artery Disease; Coronary Angiography; Coronary Circulation; Coronary Arteries (Source: MeSH-NLM).

Introduction

The right and left coronary arteries are responsible for supplying blood to the entire heart. They originate from the anterior coronary sinus and the left posterior sinus respectively, both of which are present in the proximal part of the root of the aorta.¹ The left coronary artery (LCA) branches off into the left anterior descending artery (LAD) and the left circumflex artery (LCX), while the right coronary artery (RCA) diverges into the acute marginal arteries and the posterior descending artery (PDA).²

The term 'dominance' when considering coronary anatomy refers to the supply of the PDA. The PDA can thus originate from the LCX, RCA or both.³ Consequently, the anatomy is described as left dominant, right dominant, or co-dominant, respectively. The reported patterns of coronary artery dominance vary, with studies reporting a majority of the general population as being right dominant, ranging from 82%- 89%. Studies show that 5%-12% of the population has a left dominant coronary system, and 3% - 7% of the population has co-dominant coronary vasculature.⁴⁻⁶ Coronary artery disease refers to the disease process in which a

plaque forms within the wall of a coronary artery.⁷ These plaques obstruct blood flow within the coronary vessels, resulting in their constriction or stenosis. This decreases blood circulation to the myocardium, resulting in ischemia.^{8,9} A lack of a national database makes it difficult to determine the prevalence of CAD in Pakistan. Nevertheless, according to a 2017 global survey, CAD is the second leading cause of mortality and disability in Pakistan (DALY).¹⁰ There are few prior studies exploring a relation between coronary dominance and severity of coronary artery disease (CAD). A study by Yan et al in 1654 patients in Shaanxi Province, China, concluded that right dominance correlates positively with the severity of CAD.¹¹ Another study in 2225 patients in Shanghai, China, by Peng et al offered similar conclusions, with a reported OR of 1.768 (95% CI 1.057–2.956).¹²

Scant data exists regarding the patterns of coronary dominance and their correlation with the severity of CAD in Pakistan. The aim of this study is to quantify the patterns of coronary dominance in Pakistan and compare these findings to existing literature.⁴⁻⁶ We also aim to establish whether a correlation between dominance

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and severity of CAD exists in this patient population, which could impact decision making regarding intervention for patients with a certain pattern of coronary artery dominance. This can be true especially during cardiac catheterization for acute coronary syndrome. If a particular coronary artery dominance is directly associated with greater severity of coronary artery disease or increased morbidity and mortality, the decision to perform Percutaneous Coronary Intervention (PCI) in a patient with the said form of coronary dominance can become an important decision. Knowing that there would be greater chances of developing more severe CAD if PCI were to be delayed, ensures that early intervention can take place in patients with subcritical stenosis in their coronary vessels.¹³

Methods

Study Design and Population

This is a retrospective cross-sectional study based on data obtained from the coronary angiography reports of a total of 631 patients between June 17, 2018, and August 04, 2018, who presented to the Cardiology department in Mayo Hospital, located in Lahore, Pakistan. The instrument of evaluation used for this study was the STROBE checklist for a cross-sectional study. The Institutional Review Board at King Edward Medical University approved the study.

Definitions

Coronary Artery Dominance: The term 'dominance' when considering coronary anatomy refers to the supply of the PDA. The PDA supplies blood to the inferior one-third of the interventricular septum and the inferior part of the left ventricle.¹⁴ Patterns of coronary dominance were recorded as left dominant, right dominant, or co-dominant.

Coronary Artery Disease (CAD): Presence of CAD was determined by the interventional cardiologist carrying out the angiographic procedure. CAD was denoted by findings of stenosis in any of the three main coronary arteries. Stenosis less than 50% was reported as non-obstructive CAD. Obstructive CAD, however, was further categorized as a single-, double-, or triple-vessel disease. Degree of obstructive occlusion as reported by at least two interventional cardiologists via visual estimation was noted as total occlusion being 100% stenosis of vessel, subtotal occlusion as 90-99% stenosis, severe stenosis as 70-89% occlusion, and moderate stenosis as 50-69% occlusion.

Data Collection

The selection criteria included all those patients who presented for angiographies at our tertiary care hospital between June 17, 2018, and August 4, 2018. Demographic and clinical data was extracted from patient reports from the cardiac catheterization laboratory. The demographic variables included sex categorized as male or female, and age at the time of angiography.

The clinical data was obtained from the results of coronary angiography. It included coronary artery dominance, presence of

CAD for each patient as single-, double-, or triple-vessel disease. Disease (both obstructive and non-obstructive) in the middle and proximal segments of LAD, LCX, and proximal segments of PDA and Posterior Left Ventricular Artery was included in the study, as was disease in good sized first- third Obtuse Marginal arteries (OM1, OM2, OM3), and first-third Diagonal arteries (D1, D2, D3). Patients with congenital heart defects, previous angioplasties, those with missing/ambiguous data, and those with disease in the distal segments of LAD, LCX, small-, and fair-sized OM1, OM2, OM3, D1, D2, D3 were excluded from this study.

We were unable to account for risk factors, other than sex and age, due to lack of sufficient records.

Data Analysis

All statistical tests were executed via SPSS Version 23.0 (IBM, Armonk, NY). A p-value of <0.05 was determined to be statistically significant. A chi-squared test of independence was computed for dominance and severity of CAD, age and severity, and sex and severity. Multinomial logistic regression analysis was carried out to examine a correlation between the severity of CAD with sex, age, and coronary artery dominance. The categorical variables were shown as percentages and numbers while quantitative variables were recorded as mean \pm Standard Deviation (SD).

Results

Six hundred and thirty-one patients were studied, of which four hundred and forty-five (70.5%) were male and one hundred and eighty-six (29.5%) were female. The patients ranging in age from 23 years to 85 years (interquartile range = 15) were included in the study with a mean age of roughly 53.3 years and an SD of 10.7 years. Among the 631 patients that underwent coronary angiography, 78.9% (95% CI 75.5–82.0) were right dominant, 10.5% (95% CI 8.2–13.1) were left dominant and 10.6% (95% CI 8.3–13.3) were co-dominant. This data is detailed in [Table 1](#).

Table 1. Variables Used in the Study with their Mean Value and Standard Deviation from Mean.

Variables	Values
Age (n \pm SD)	53.3 \pm 10.7
Sex, n (%)	
Male	445 (70.5)
Female	186 (29.5)
Dominance, n(%)	
Left dominance	66 (10.5)
Right dominance	498 (78.9)
Codominance	67 (10.6)
Type of Disease, n (%)	
CAD absent	48(7.6)
Single-vessel Disease	135 (21.4)
Double-vessel Disease	135 (21.4)
Triple-vessel Disease	247 (39.1)
Non-Obstructive CAD	66 (10.5)

A total of 7.6% of patient angiography reports showed absence of CAD. 10.5% had non-obstructive CAD (e.g., coronary artery ectasia, arterial wall thickening), 39.1% had triple-vessel disease, 21.4% had two-vessel disease and 21.4% had single-vessel disease. Details of the severity of disease in individual arteries are tabulated with percentages in [Table 2](#).

Table 2. Severity of Disease in Left Anterior Descending Artery (LAD), Right Coronary Artery (RCA), Left Circumflex Artery (LCX), and Ramus Intermedius, described as either Absent, Mild, Moderate, or Severe Disease, Based on Percentage Occlusion in the Respective Arteries.

Vessel Name	Absent disease, n(%)	Mild disease, n(%)	Moderate disease, n(%)	Severe Disease, n(%)	Subtotal Occlusion, n(%)	Total Occlusion, n(%)
Left Anterior Descending	174 (27.6)	16 (2.5)	84 (13.3)	258 (40.9)	18(2.9)	81(12.8)
Left Circumflex	296 (46.9)	17 (2.7)	86 (13.6)	167 (26.5)	26 (7.8)	39 (6.2)
Right Coronary artery	287 (45.5)	12 (1.9)	54 (8.6)	188 (29.8)	14 (2.2)	76 (12.0)
Ramus Intermedius	608 (96.4)	0 (0)	5 (0.8)	14 (2.2)	0 (0)	1 (0.2)

To examine the relation between coronary dominance, sex, and severity/type of disease in our cohort of patients a chi-square test of independence analysis was conducted. A significant correlation between dominance and severity of disease in patients was found $\chi^2(8, N = 631) = 17.58, p = 0.025$. The strength of association was moderate with Cramer V = 0.118. Moreover, we found a significant association between sex and type (severity) of disease $\chi^2(4, N = 631) = 67.113, p = 0.000$, with a strong strength of association; Cramer V = 0.326.

To examine the effect of the independent variables (dominance, age, and sex) on the dependent variable (type/severity of disease), a multinomial logistic regression test was utilized. The regression model was identified with triple-vessel disease as the reference category. Regression analysis showed that individuals with right dominance were less likely to develop single vessel ($p = 0.025$; OR = 0.451 ; 95% CI for OR: 0.224–0.906) and two vessel disease ($p = 0.029$; OR = 0.471; 95% CI for OR: 0.239–0.926) as compared to triple vessel disease. Moreover, the chances of developing triple-vessel disease increased significantly with age as compared to other types of diseases ($p = 0.00$, OR = 0.887, 0.948, 0.978, 0.934 for CAD absent, single-vessel disease, two vessel disease and non-obstructive CAD respectively). A significant relation between sex and type of disease was also found, whereby patients were more prone to mild disease such as non-obstructive CAD and absent CAD than three-vessel disease if they were female. Results of the multinomial logistic regression analysis are shown in [Table 4](#). Only significant values are shown.

Discussion

Coronary dominance is divided into RD, LD and CD on the basis of the artery supplying the posterior descending artery. Coronary

Table 3. Distribution of Obstructive (Single-, Double-, and Triple-Vessel Disease) and Non-Obstructive Coronary Artery Disease Among Patients with Left, Right and Codominance.

Dominance	Severity of Disease					Total
	CAD* Absent	Single-vessel Disease	Double-vessel Disease	Triple-vessel Disease	Non-Obstructive Coronary disease	
Left Dominance	5(7.6%)	21 (31.8%)	13 (19.7%)	17 (25.8%)	10 (15.2%)	66 (100%)
Right Dominance	40(8.0%)	95 (19.1%)	102 (20.5%)	211 (42.4%)	50 (10.0%)	498 (100%)
Codominance	3 (4.5%)	19 (28.4%)	20 (29.9%)	19 (28.4%)	6 (9.0%)	67 (100%)
Total	48 (7.6%)	135 (21.4%)	135 (21.4%)	247 (39.1%)	66 (10.5%)	631 (100%)

Legend: *CAD: Coronary Artery Disease

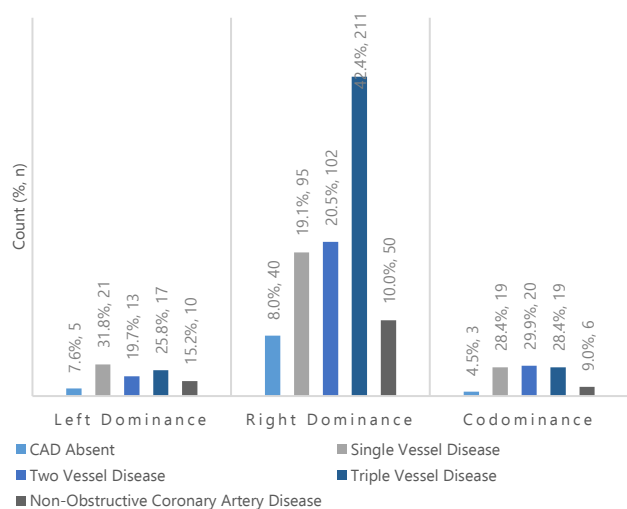
Table 4. Outcomes of Multinomial Logistic Regression with Triple-Vessel Disease as the Reference Category.

Type of Disease	B	Std. Error	Wald	P-value	OR	95% Confidence Interval for OR	
						Lower Bound	Upper Bound
CAD Absent							
Age	0.120	0.019	39.985	0.000	0.887	0.855	0.921
Sex	2.523	0.386	42.795	0.000	12.465	5.854	26.544
Single-vessel Disease							
Age	0.054	0.011	24.064	0.000	0.948	0.928	0.968
Right Dominance	0.797	0.356	5.004	0.025	0.451	0.224	0.906
Two Vessel Disease							
Age	0.022	0.011	4.298	0.038	0.978	0.958	0.999
Right Dominance	0.753	0.345	4.764	0.029	0.471	0.239	0.926
Non-Obstructive Coronary Artery Disease							
Age	0.069	0.014	22.574	0.000	0.934	0.908	0.961
Sex	1.333	0.302	19.553	0.000	3.794	2.101	6.851

Legend: CAD: Coronary Artery Disease. A multinomial regression analysis was carried out to determine a correlation between the severity of CAD with sex, age, and coronary artery dominance, with triple-vessel disease as the reference category.

artery dominance patterns vary with different geographical areas. The coronary artery dominance pattern that we observed in our population sample was 78.9% right dominant, 10.5% Left

Figure 1. Patterns of Coronary Artery Dominance and the Severity of the CAD in Pakistan.



dominant and 10.6% Codominant, with sex having no significant effect on the pattern of dominance. This is significantly different from previous literature whereby RD and LD have a general prevalence of 82–89% and 5–12% respectively, while CD is reported to have a prevalence of 3–7%.^{4–6} In a study conducted in Islamabad, Pakistan in 2011 by Mian et al, it was found that the percentage of RD, LD and CD patients was 60.5%, 19.5%, and 20%, respectively.¹⁵ In another study conducted in 2020 among the Kashmiri population by Samoon et al, the pattern of dominance was 86.67%, 10% and 3.33% for RD, LD, and CD respectively.¹⁶ Another study conducted in Nepal in 2017 reported RD, LD, and CD circulation in 85.5%, 10%, 4.5% patients, respectively.¹⁷ In another study conducted in Tehran, Vashegani et al found that 84.2% were RD, 10.9% were LD, 4.8% were CD.¹⁸ Khona et al in India, after studying coronary artery anatomy in cadaveric hearts, found that 83% were RD and 17% were LD.¹⁹ This again, differs from the findings in the present study.

The differences in patterns of coronary artery dominance may be due to a number of reasons. First, prevalence of artery dominance is likely to vary among different regions owing to differences in population characteristics including sex and ethnicity. Secondly, differences may be attributable to factors determining what proportion of the general population presents to the hospital and undergoes angiographic evaluation. However, one thing that can be said with certainty is that RD is more prevalent than either LD or CD in all reported studies.^{4–6} This is in accordance with our results as well. That being said, it should be noted that patterns of coronary artery dominance in different areas/communities within Pakistan itself greatly vary. A large-scale multi-institution research could be carried out to ascertain the differences in coronary dominance between the hospital and general population, and to map the differences in patterns among different communities as well.

This study evaluating a relation between patterns of coronary dominance and severity of CAD, to our knowledge, is the first of its kind to be conducted in Pakistan. Previous studies in Pakistan have solely focused on the prevalence of coronary artery dominance. Our study shows a significant correlation between right sided coronary dominance and severity of CAD. In a study conducted on 12,558 patients in Tehran, Iran by Vasheghani et al (2018),¹⁸ patients with RD were more predisposed to triple-vessel disease than others. According to our study, people with right dominant coronary artery vasculature are more prone to developing triple-vessel disease in comparison to other types of disease, thus confirming the finding in an earlier study done by Vasheghani et al (2018).¹⁸ This finding is also consistent with the study done by Yan B et al (2018) on patients in 1654 patients in Shanxi Province, China.¹¹

In contrast, a study by Goldberg et al³ (2007) showed a greater correlation of mortality in patients with left dominance. It must be noted however, that the patient population included in the above study was followed prior PCI and looked at mortality instead of presence of CAD.

Our study demonstrates that increasing age has a positive correlation with severity of CAD, as would make sense, considering older age leads to greater chances of coronary events/atherosclerosis. Moreover, the present study also concluded that females are more predisposed to absent CAD and non-obstructive CAD than to severe, triple-vessel disease. This finding is in accordance with previous literature.²⁰

Limitations of the study

This is a retrospective review based on past coronary angiography data. The sample size is modest. In addition, patient sampling was from a population of patients presenting to the hospital. Consequently, our study showed more than twice as many men as women subjects. An ideal study design to determine true population prevalence of coronary artery dominance would involve a multi-center study with random sampling from various population groups in Pakistan to accurately analyze patterns of dominance. While our study accounted for age and sex in the impact of coronary patterns on CAD, there are likely other confounding variables including comorbid conditions, family history and medications that might contribute to the severity of CAD. Furthermore, the angiographies were done by different cardiologists, thus a bias may be present in this study since angiograms may be interpreted differently. This study was unable to link CAD in individual coronary arteries with dominance; extensive studies are recommended for that.

Conclusion

This study showed that the prevalence of coronary dominance of the population presenting to a large tertiary hospital in Lahore, Pakistan is significantly different from estimates reported in literature. The study shows a correlation between right sided coronary artery dominance and severity of disease. We further note a strong relationship between age, sex, and severity of

disease. The cause of this difference and association is yet to be ascertained and warrants further investigation.

Summary – Accelerating Translation

Title: Patterns of Coronary Artery Dominance and Association with Severity of Coronary Artery Disease at a Large Tertiary Care Hospital in Pakistan.

Main Problem to Solve: The study aims to investigate the patterns of coronary dominance in Pakistan and determine if there is a correlation between coronary dominance and the severity of coronary artery disease (CAD) in the Pakistani patient population.

Aim of Study: The study aims to quantify the prevalence of different patterns of coronary dominance in Pakistan and compare these findings to existing literature. It also seeks to determine if there is a relationship between coronary dominance and the severity of CAD in Pakistani patients.

Methodology: The study is a retrospective cross-sectional analysis based on data obtained from coronary angiography reports of 631 patients who presented to the Cardiology department in Mayo Hospital, Lahore, Pakistan. The study utilized the STROBE checklist for cross-sectional

studies. Demographic and clinical data were collected from patient reports, including coronary artery dominance, presence and severity of CAD, and patient characteristics such as age and sex. Statistical analyses, including chi-squared tests and multinomial logistic regression, were conducted to examine the relationship between coronary dominance, age, sex, and severity of CAD.

Results: The study found that among the 631 patients, 78.9% had right dominance, 10.5% had left dominance, and 10.6% had co-dominance. The prevalence of coronary dominance in the Pakistani population differed from previous literature. A significant correlation was observed between right dominance and the severity of CAD. Increasing age was positively correlated with the severity of CAD, and females were more prone to absent or non-obstructive CAD.

Conclusion: The study concluded that the patterns of coronary dominance in the Pakistani population differed from those reported in previous studies. Right-sided coronary dominance was associated with a higher severity of CAD. The study also highlighted a relationship between age, sex, and the severity of CAD. However, due to limitations, further research is needed to confirm these findings and explore other potential factors influencing CAD severity.

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Impact of the COVID-19 Pandemic on Medical Students and Students' Perspectives on COVID-19 Policies and Social Media in 2021 and 2022

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Abstract

Background: The COVID-19 pandemic affected medical students in several ways in 2021 and 2022. In continuation of a previous study, this study sought to determine how the changing nature of the pandemic affected medical students' knowledge, experiences, perspectives on the policies and resources in 2022 compared to 2021. **Methods:** A qualitative study was conducted via open-ended journaling in 2021 and 2022. Participants were recruited from medical students in the U.S. as well as in Central America and the Caribbean, who were enrolled in a "Global Seminar for Health and Environment". **Results:** A total of 142 and 72 responses were obtained in 2021 and 2022 respectively. Regarding the COVID-19 policies, U.S. students were thankful for vaccinations and approved of initiatives in their regions in 2021. Later, they were equally divided regarding region-specific pandemic policies. International students mainly approved of the policies in both years. Students consistently noted negative mental health impacts and difficulty with social limitations. U.S. students noted decreased academic opportunities in both years while international students noted family concerns in 2021. U.S. students held negative views about social media due to fearmongering in 2021 and politicization in 2022. International students held neutral and/or positive views about social media. U.S. students relied on the CDC as a source of information while international students utilized the WHO. **Conclusion:** U.S. students had a more negative outlook as the pandemic progressed. It is difficult to draw comparisons within the international cohort due to limited responses obtained in 2022.

Key Words: COVID-19; Pandemics; Medical Students; Medical Education; Global Health; Policy; Vaccination; Sources of Information; World Health Organization; Centers for Disease Control and Prevention, U.S.; Social Media (Source: MeSH-NLM).

Introduction

With the progression of the COVID-19 pandemic, academic institutions adapted to changing guidelines in order to reduce infections.¹ In 2021, 31,453,440 students across eight countries socially distanced themselves, shifted to online learning, and remained in their homes due to the shutdown of academic institutions.¹ Medical students in particular demonstrated growing rates of depression, deteriorating mental health, suicidal ideation, anxiety, burnout, and fatigue.^{2,3} A survey-based qualitative study by Skoczek et al. assessed how medical students in the U.S., Central America, and the Caribbean were affected during the pandemic in 2021 and found that all medical students reported mental health impacts, and U.S. students reported decreased academic opportunities and performance.⁴

Additionally, increased demands for vaccinations in 2021 brought new distribution challenges.⁵ Around the same time, the U.S. political environment and policies changed with the election of a new President. From November 2021 to January 2022, the global

rate of COVID-19 infections declined from 20% to 5%, which was attributed to an increase in vaccination rates, asymptomatic or milder cases, increased awareness, enhanced prevention strategies, and growing immunity.^{6,7} In the U.S., January 2021 was the deadliest month of the pandemic with a reported 3,200 daily COVID-19 related deaths.⁸ Later in April 2022, a declined number of 425 cases daily were reported.⁸ Access to COVID-19 vaccination noticeably changed the course of the pandemic.⁹

Given the many changes that occurred between 2021 and 2022 related to vaccination distribution, disease severity and mortality, political leadership, and national policy, we questioned how medical students, who were identified as a vulnerable population during the pandemic, were affected differently in the two years.² We refer to the 2021 and 2022 pandemic years as phase 1 and phase 2 of the study respectively. This qualitative analysis was completed in continuation of the study by Skoczek et al., which focused on phase 1.

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As osteopathic medical students, we wanted to investigate how our peers were impacted by the COVID-19 pandemic, in mind, body, and spirit. We questioned how the changing nature of the pandemic affected medical students' knowledge, experiences, overall health, perspectives on the policies and resources differently in phase 2 compared to phase 1. We hypothesized that the perception of the COVID-19 pandemic and its effects on medical students had changed from 2021 to 2022 due to several factors including: vaccinations, political environments, social media and restrictions.

Methods

This qualitative and thematic study took place from February to May of 2021 and 2022. Prior to its start, questions used within the study were developed by a panel of experts, including a retired CDC infectious disease physician with 8 years of experience in Central America. U.S. and international physicians provided content validity instrument items to match research objectives. For this study, participation was voluntary, and subjects were recruited from cohorts of medical students enrolled in a "Global Seminar for Health and Environment" course. Eligible students maintained active enrollment at one of the following medical schools: Edward Via College of Osteopathic Medicine (VCOM) campuses in the U.S. based in Virginia, South Carolina, Auburn, and Louisiana, and three international medical schools: El Instituto Tecnológico de Santo Domingo in Dominican Republic, Universidad Evangélica de El Salvador in El Salvador, and Universidad Tecnológica Centroamericana in Honduras. Facilitators at each medical school assigned a three-digit code to each student which was used to retrieve the survey. Qualtrics, a web-based software, was used to collect medical students' perspectives on the following variables (main themes): COVID-19 policies, social media, news outlets, and their knowledge of the pandemic.¹⁰

During the thematic analysis, responses from the four VCOM campuses were classified under "U.S." and the remaining responses were categorized as "international." Responses to each individual question (main theme) were tallied for both phases. Subtheme percentages for each question were calculated by tallying the subthemes and dividing them by the total number of responses for each main theme ([Table 1](#)). Each data set was blindly analyzed by two members of the study and were compared with one another to ensure accurate analyses. This study was approved by VCOM Institutional Review Board (Ref# 2020-013).

Results

Total responses obtained in 2021 and 2022 were 142 and 72 respectively. In 2021, there were 67 international and 75 U.S. responses and in 2022, there were 7 international and 65 U.S. responses. [Table 1](#) shows major themes studied in the two phases and subthemes found with percentages calculated for U.S. and international responses.

Perspective on Prevention Initiatives Taken in Respondent's Country

When asked about students' perspectives on initiatives taken in their region, 34.9% of U.S. students in phase 1 reported appreciating vaccination availability and encouraging vaccination. Additionally, 30.2% approved of the initiatives implemented in their region as seen in [Table 1](#).

"I think the US has done a fantastic job on vaccine distribution especially compared to other countries." -U.S. 2021 response, subtheme #1

"I believe our country did a great job with the interventions that have been placed for this virus. I would not change anything." -U.S. 2021 response, subtheme #2

In contrast, responses in phase 2 were divided with equal percentages of students disapproving (31.1%) and approving (31.1%) of initiatives taken in their region ([Table 1](#)). The vaccination subtheme was found in phase 2 but it was not as prominent as phase 1. Additionally, the subtheme of 'a divided country noting better policies needed in the southern states' was mainly seen in phase 2.

"I am severely disappointed in the response from the U.S. As the country to always act/speak first in a global issue, we were severely trumped by other countries." - U.S. 2022 response, subtheme #1

"The United States of America has been largely divided...I feel that Alabama has largely failed to address COVID-19 with appropriate severity, especially when compared to non-Southern states such as New York and Washington." -U.S. 2022 response, subtheme #4

International students generally approved of initiatives in their region with 68.5% reporting approval in phase 1 and 50.0% in phase 2 ([Table 1](#)).

"In El Salvador, the pandemic has been well controlled with different health measures that were imposed from the beginning." -International 2022 response, subtheme #1.

Perspective on Prevention Initiatives Taken in Country Other than Respondents

When asked about interventions taken in other countries, 2021 U.S. students either believed other countries had stricter precautions (39.7%) or were unfamiliar with international policies (25.8%) ([Table 1](#)). Phase 2 followed this same trend with 31.1% of students believing that other countries had stricter initiatives and 28.9% reporting unfamiliarity with international initiatives ([Table 1](#)).

"I admire Australia and New Zealand for the measures they took. They took COVID-19 very seriously and did not allow anyone to enter or leave the country...which allowed the number of cases to remain low and not super spread as they did here in the United States." -U.S. 2022 response, subtheme #1

Table 1. A Comparison of Themes from Medical Student Journal Entries in 2021 and 2022.

Major Theme	Location	2021 Subthemes and % of Responses		2022 Subthemes and % of Responses	
		Subtheme	%	Subtheme	%
Perception of COVID-19 in Respondent's Own Country/Region	United States	1. Thankful for vaccination/encourage it	1. 34.9%	1. Disapproval of policies or initiatives	1. 31.1%
		2. Approval of policies or initiatives	2. 30.2%	2. Approval of policies or initiatives	2. 31.1%
		3. Disapproval of policies or initiatives	3. 14.3%	3. Thankful for vaccination/encourage it	3. 26.7%
	International	4. Divided country. Better policies needed in U.S. southern states	4. 17.8%	4. Divided country. Better policies needed in U.S. southern states	4. 17.8%
		1. Approval of policies or initiatives	1. 68.5%	1. Approval of policies or initiatives	1. 50.0%
		2. Some individuals show a lack of regard	2. 24.1%	2. Good initiatives but would have placed more restrictions	2. 50.0%
Perception of COVID-19 Policies and Intervention from Countries other than Respondents'	United States	3. Disapproval of policies or initiatives	3. 16.7%	3. Stricter precautions that are harmful, political, or only concerned about economic impact	1. 31.1%
		1. Stricter precautions that are harmful, political, or only concerned about economic impact	1. 39.7%	2. Others or unfamiliar	2. 28.9%
		2. Other or unfamiliar	2. 25.8%	3. Countries performed assessments to meet the needs of the country	3. 24.4%
		3. Less precautionary due to less vaccines or delays in prevention actions	3. 11.8%	4. Other countries developing new ideas	4. 11.1%
		4. Other countries developing new ideas	4. 11.8%	5. Less precautionary due to less vaccines or delays in prevention actions	5. 4.4%
	International	5. Countries performed assessments to meet the needs of the country	5. 11.8%	1. Stricter precautions that are harmful, political, or only concerned about economic impact	1. 50.0%
		1. Countries performed assessments to meet the needs of the country	1. 38.3%	2. Other or unfamiliar	2. 50.0%
		2. Stricter precautions that are harmful, political, or only concerned about economic impact	2. 23.4%		
		3. Other countries were innovative during the COVID-19 pandemic	3. 17.2%		
		4. Less precautionary due to less vaccines or delays in prevention actions	4. 14.9%		
Beliefs, Knowledge, and Impact from COVID 19	United States	5. Other or unfamiliar	5. 8.5%	1. Good understanding of COVID-19 policies and prevention methods	1. 30.4%
		1. Recognized that COVID-19 is a serious disease	1. 27.8%	2. Decreased academic opportunities and performances	2. 26.1%
		2. Social limitations were difficult	2. 24.1%	3. Social limitations were difficult	3. 23.9%
	International	3. Impacted education and learning experience	3. 24.1%	1. Good understanding of COVID-19 policies and prevention methods	1. 40.0%
		1. Recognized that COVID-19 is a serious disease	1. 32.1%	2. COVID-19 impacted mental health	2. 40.0%
		2. Family impacted	2. 23.2%	3. Social limitations were difficult	3. 20.0%
Perspective on Social Media's impact on COVID-19	United States	3. Anxiety, emotional, and/or mental health impact	3. 19.6%		
		1. Negative, due to inciting fear	1. 29.4%	1. Negative due to false or political information on COVID-19 or the vaccine	1. 51.1%
		2. Negative due to false or political information on COVID-19 or the vaccine	2. 25.5%	2. Neutral (states positives and negatives or neither)	2. 28.8%
		3. Neutral (states positives and negatives or neither)	3. 21.6%	3. Positive, spreads useful information and prevention efforts	3. 11.1%
		4. Others, non-specified	4. 17.6%	4. Negative, due to inciting fear	4. 6.7%
	International	5. Positive, spreads useful information and prevention efforts	5. 7.8%	5. Others, non-specified	5. 2.2%
		1. Negative, due to inciting fear	1. 57.4%	1. Negative due to false or political information on COVID-19 or the vaccine	1. 40.0%
		2. Positive, spreads useful information and prevention efforts	2. 12.8%	2. Negative, due to inciting fear	2. 20.0%
		3. Negative due to false or political information on COVID-19 or the vaccine	3. 10.6%	3. Neutral (states positives and negatives or neither)	3. 20.0%
		4. Neutral (states positives/negatives or neither)	4. 10.6%	4. Positive, spreads useful information and prevention efforts	4. 20.0%
Sources of Information	United States	5. Others, non-specified	5. 8.5%		
		1. CDC	1. 89.7%	1. CDC	1. 88.7%
		2. WHO	2. 63.7%	2. Social Media	2. 7.5%
		3. Social Media	3. 41.2%	3. Regional/State/Municipal Health Systems	3. 1.9%
		4. Scientific Journals	4. 30.1%	4. Other	4. 1.9%
		5. Regional/State/Municipal Health Systems	5. 23.6%		
		6. National Ministry of Health	6. 6.8%		
International	7. Other	7. 1.5%			
	1. WHO	1. 69.4%	1. WHO	1. 60.0%	
	2. Social Media	2. 44.6%	2. CDC	2. 20.0%	
	3. CDC	3. 42.9%	3. National Ministry of Health	3. 20.0%	
	4. National Ministry of Health	4. 35.7%			
	5. Regional/State/Municipal Health Systems	5. 25.0%			
	6. Scientific Journals	6. 14.3%			
7. Other	7. 1.8%				

In phase 1, an equal percentage (11.8%) of U.S. respondents felt there were either less precautions in other countries, new ideas were developing in other countries, or that countries performed assessments to meet the needs of that country ([Table 1](#)). In contrast, in phase 2, the idea that countries performed assessments to meet the needs of that country grew to 24.4% of responses.

"There were many different ways that different parts of the world handled their situations. Some were more strict, but necessary, while others were more lax." -U.S. 2022 response, subtheme #3.

International students in phase 1, primarily perceived that countries performed assessments to meet the needs of that country (38.3%) with reports of other countries having strict precautions (23.4%) coming in second ([Table 1](#)).

"I like how many countries adopted all the measures necessary swiftly with the support of their government to avoid new infections. Thus, they managed to contain the virus and avoided major losses." -International 2021 response, subtheme #1

Fifty percent of international students in phase 2 felt there were stricter precautions in other countries while 50% indicated they were unfamiliar with other countries' initiatives ([Table 1](#)).

"I think that those countries that closed the entering of tourists to decrease the positive cases and ordered their people to wear mask made the best decisions." -International 2022 response, subtheme #1

Beliefs, Knowledge, and Impact from COVID-19

In phase one, 32.1% of international and 27.8% of U.S. students recognized the serious nature of COVID-19 ([Table 1](#)). A year into the pandemic, 40.0% of international and 30.4% of U.S. responses noted that students had a good understanding of COVID-19 policies and prevention methods ([Table 1](#)).

"I still think that COVID-19 has been one of the worst viruses the world has ever experienced because of its wide-reaching effects. These effects impact everyone regardless of if they have been infected or not." - U.S. 2021 response, subtheme #1

"My knowledge has also increased about various symptoms or no symptoms that infected individuals can present with." - U.S. 2022 response, subtheme #1

Difficulty with managing social limitations were seen in 24.1% of U.S. phase 1 and 23.9% of U.S. phase 2 and 20.0% of international phase 2 responses ([Table 1](#)).

"It has been hard to live mainly in isolation for the past year. Not feeling comfortable hanging out with friends in public is hard." -U.S. 2021 response, subtheme #2

Another common subtheme was that students felt the pandemic impacted their education and academic performance. This was

seen in 24.1% and 26.1% of U.S. students in phase 1 and phase 2 respectively ([Table 1](#)).

"My education...was majorly affected as well with no anatomy labs and online lectures." -U.S. 2021 response, subtheme #3

"I did not have certain shadowing opportunities I was planning to have, and I did not get to attend an international missions trip." -U.S. 2022 response, subtheme #2

In phase 1, 19.6% of international students noted impacts on anxiety, emotional, and mental health ([Table 1](#)). In 2022, 40.0% of international students noted impacts on mental health. Of note, 23.2% of international participants reported that COVID-19 impacted their family in 2021.

"My anxiety and panic have risen to such levels that it is hard for me to tolerate casual touch and proximity. I don't remember the last time I hugged a friend." -International 2021 response, subtheme #3

"[COVID-19 has impacted me] emotionally and in my study methods. Everything became a disaster." -International 2022 response, subtheme #2

"My dad is a pilot who lost his job during the pandemic. Even though I'm in my last year of medical school, since my university is private, I'm still paying so it's been a difficult time." -International 2021 response, subtheme #2

Social Media's Impact on the Perspective of COVID-19

In phase 1, 29.4% of U.S. and 57.4% of international students held negative views on social media due to it inciting fear in the general population ([Table 1](#)).

"They have presented the topic in an informative but slightly drastic way...sometimes I feel that news outlets incite more fear to their viewers rather than educating them." -U.S. 2021 response, subtheme #1

Beyond this, 25.5% of U.S. students in phase 1 held a negative view of social media due to false or political information on COVID-19 or the vaccine ([Table 1](#)).

"There is so much false news about the vaccine right now." - U.S. 2021 response, subtheme #2

While 10.6% of international students in phase 1 also held a negative view of social media due to false or political information, another prevalent subtheme among these students was positive views on social media due to its ability to spread useful information (12.8%) as seen in [Table 1](#).

"We have been actively informed by the news about COVID-19 in our country thanks to the platforms of our health institutions." -International 2021 response, subtheme #2

When examining the subthemes among U.S. students, the primary subtheme of negative views about social media due to inciting fear (29.4%) in phase 1 switched to negative views due to false or political information on COVID-19 or the vaccine (51.1%) in phase 2. The second most prevalent subtheme for U.S. students

in phase 2 was neutral, sharing both positive and negative views about social media (28.8%) ([Table 1](#)).

"Many people are against the vaccine and continue to post false articles that display the "negative consequences" of the vaccine." -U.S. 2022 response, subtheme #1

"While some of the information put out on social media in my region was accurate and helpful, there was a lot of misinformation being spread." -U.S. 2022 response, subtheme #2

Finally, 40.0% of international students in phase 2 held a negative view of social media due to false or political information ([Table 1](#)). Beyond this, in phase 2, an equal percentage of international students held the view that social media was negative due to inciting fear (20.0%), positive due to spreading useful information (20.0%), and neutral (20.0%) ([Table 1](#)).

"Some social media spread a lot of disinformation about COVID-19, so people were scared about some things about the virus. I always try to read trustworthy media, scientific articles, or magazines." -International 2022 response, subtheme #1

Sources of Information Utilized

In phase 1, most U.S. students indicated they relied on the CDC (89.7%) and the WHO (63.7%) to learn about the pandemic. In phase 2, 88.7% of U.S. students indicated using the CDC followed by 7.5% of students that reported using social media ([Table 1](#)).

International students during both phases reported WHO as the primary source of information. This was seen in 69.4% of phase 1 and 60.0% of phase 2 responses. Beyond this, 44.6% of international students in phase 1 relied on social media compared with 0.0% in phase 2. The second most common source of information used in phase 2 was tied with 20.0% of respondents indicating the CDC or the National Ministry of Health.

Discussion

Perception on COVID-19 Policies and Intervention

A year into the pandemic, with more knowledge about the virus and vaccination availability, students' perspectives on the initiatives taken in their regions changed between the two phases.⁷ While the majority of U.S. students reported approval of the policies in their region phase 1, the second phase lacked a unanimous response. This could be due to the presence of political division around COVID-19 in 2022. The vaccination subtheme may have been more prominent in 2021 due to political changes in the U.S. contributing to hopes that vaccinations can end the pandemic. Reports of the country being divided and southern states needing better policies were prominent in phase 2 only. According to Stoto et al., "a narrative of two Americas" emerged in summer 2021 with high demand for COVID-19 vaccination seen in some areas and vaccine hesitancy and opposition seen in others.¹¹ Stoto et al. reported that compared to the rest of the U.S., southern parts of the country had higher mortality rates and noted that 62% of the south's

death rate was avoidable.¹¹ This finding supports criticism found in phase 2 responses and was attributed to differences in mask usage, social distancing, and school attendance policies between the states.¹¹

In both phases, the most common subtheme for international students was approval of policies and initiatives within their regions. Prior to distribution of COVID-19 vaccinations, countries in Latin America were significantly impacted by the pandemic, but noted improvements in containment of the virus after vaccination availability increased.¹² Both phases were conducted after availability of vaccines, which explains the positive views of the international students.

Most U.S. students in both phases consistently reported feeling that there were stricter precautions taken in other countries. This belief could be attributed to the increased availability of epidemiological statistics showing top performing countries (i.e. countries with lower mortalities) having longer lockdowns.¹² From March to August 2020, the U.S. had the highest case rate and number of deaths globally.¹³ This could imply a level of bias among U.S. students but it may also suggest that U.S. students felt the impact of the worse disease statistics.

Beliefs, Knowledge, and Impact from COVID 19

From the onset of the pandemic, medical students consistently noted that social limitations were difficult to manage, including restrictions on mass gatherings and reduced contact with peers.¹⁴ Although social media had been incorporated into the healthcare community in unique ways, concerns specific to medical students included lack of family interactions at major milestones and living in isolation during their education.¹⁵ U.S. medical students were consistently worried about the impact of the pandemic on their education and academic opportunities, noting concerns about missed in-person anatomy labs, shadowing opportunities, and missed experiences in global healthcare through international mission trips. Though these concerns are specific to the experience of a medical student, a study conducted by Biber et al. found that students in all disciplines had difficulties in managing their resources and engaging in self-regulated learning.¹⁶ U.S. and international students shared a belief that COVID-19 is a serious disease and reported being confident in their knowledge about the virus. One cross sectional study found that when asked basic scientific questions about the virus, over 86% of the students recognized main symptoms and basic treatment.¹⁷ Interestingly, a study completed in Turkey in 2020, found that clinical students were found to have higher knowledge levels and a slightly more positive attitude about the virus than preclinical students.¹⁸ International students in our study noted increased levels of anxiety, emotional, and mental health concerns associated with the pandemic in 2021 and 2022. O'byrne et al. found that these concerns may be attributed to transitions associated with online learning and testing and concerns about family members.¹⁹ Of note, international students

in phase 1 shared concerns about the impact the virus had on family members.

Perspective on Social Media's Impact on COVID-19

When asked about the impact of social media on perspectives of COVID-19, U.S. and international medical students in phase 2 shifted toward a negative view with the primary reason being its political nature. This shift might be due to the growing divide between far-left and far-right political parties.²⁰ In one study, the two political extremes led to severe criticism of the government, which fostered distrust of public health authorities, including decisions related to COVID-19 and vaccines.²⁰ While this might account for the negative view related to politics, other negative views could be due to growing online misinformation. One study in Taiwan found a significant negative relationship between "fake news" and vaccination doses administered.²¹ The idea of fake news has yet to be fully developed, though many studies suggest that fake news or misinformation is due to cultural factors, marketing incentives, and poor legal supervision.²² Additionally, other studies attribute negative effects of social media to the overwhelming amount of information available leading to panic transmission, manipulations, and unverified data.¹⁵ Regardless of the reason for negative views, several studies indicate that health organizations should have created and promoted more shareable graphics and/or information to reduce misperceptions.²³ While the 2022 U.S. students primarily demonstrated a negative view on social media, some 2022 international students considered social media to be a positive and/or beneficial way to spread information. This might be due to ease and the ability to rapidly share data, interact with other healthcare professionals, and increase awareness of COVID-19.¹⁵

Sources of Information

The majority of U.S. students consistently reported using the CDC while international students primarily relied on the WHO during both phases. These differences might be due to the mission of each of these organizations. The CDC is primarily there to "protect America from health, safety and security threats, both foreign and in the U.S."²⁴ In contrast, the WHO is a United Nations organization that serves in a global health capacity, reaching many nations.²⁵

Limitations

The 2022 survey was severely limited by the number of responses received. We were particularly limited in comparing our international data collected in phase 2 to phase 1. This might have been potentially due to the declining severity of COVID-19 or changes in staff facilitators at each campus. Additionally, there was a measurement bias as participants had diverse backgrounds and may not have spoken English as a first language.

Conclusion

From 2021 to 2022, the global response to the pandemic shifted due to increasing access to vaccinations, social media, and political and national restrictions. During this time, medical

students changed perspectives about prevention strategies, personal and family impacts, social media, sources of information, and social opportunities. In general, phase 2 medical students indicated that while they had more information on the pandemic, the pandemic itself had become more political and still limited future opportunities. Further research might indicate whether these fears of lost opportunity remain in the future careers of medical students. Learning about the differences in pandemic's impact on medical students in 2021 compared to 2022 and students' insights on the initiatives taken in their regions during the COVID-19 pandemic can potentially help inform academic institutions and policymakers regarding medical students' concerns, perspectives, and experiences during the pandemic.

Summary – Accelerating Translation

Title: Impact of the COVID-19 Pandemic on Medical Students and Students' Perspectives on COVID-19 Policies and Social Media in 2021 and 2022

Background: Medical students are a vulnerable population, and were affected in several ways during the COVID-19 pandemic in 2021 and 2022. A previous study found that U.S. and international medical students reported mental health impacts, and U.S. students reported decreased academic opportunities and performance in 2021. With the progression of the pandemic, students had to adapt to changes in guidelines in their academic institutions and regions. From 2021 to 2022, knowledge of the virus increased, COVID-19 vaccinations became more readily available and COVID-19 mortality rate overall decreased. Additionally, there were changes in the political environment of the U.S.

Aim: Given the changes that occurred between 2021 and 2022 affecting factors such as vaccination distribution, disease severity and mortality, political leadership, and national policy, we questioned how medical students were affected differently during the two years.

Methods: We electronically surveyed medical students in the United States (Louisiana, Virginia, Alabama, and South Carolina) and in El Salvador, Honduras and Dominican Republic. Survey results were collected in 2021 and 2022. We were specifically interested in finding out how the pandemic impacted medical students personally, their knowledge about the virus, their thoughts on public health policies in their region compared to other states or countries, sources they used to get information about the pandemic, and thoughts on how social media spread pandemic related information. When analyzing the responses, we developed concise subthemes that summarized the nature of the students' opinions.

Results: A total of 142 and 72 responses were obtained in 2021 and 2022 respectively. Students in both years reported that pandemic-induced social limitations were difficult to manage. Further, international students during both years reported a negative impact on their mental health. U.S. students noted decreased academic opportunities in both 2021 and 2022 while international students noted concerns about impacts on family in 2021. Regarding COVID-19 policies and restrictions, most U.S. medical students reported being thankful for vaccines and approved of initiatives taken in their region in the 2021 survey. In the 2022 cohort, there was an equal mixture of U.S. students who disapproved of the policies in their region and those who approved of them. Most international students reported approval of policies in their region in both years. In 2021, when asked about the impact of social media, U.S. as well as international

students, held negative views of platforms primarily due to its role in inciting fear. In 2022, U.S. students had negative thoughts due to social media's political nature while in 2021, international students held neutral and/or positive views of social media. Regardless of the year, most U.S. students relied on the CDC as a source of information while international students tended to turn to the WHO.

Conclusion: The lives of U.S. and international medical students were impacted by the pandemic in both years. In general, phase 2 medical students believed that while they had more information about the virus,

the pandemic had become more political and still limited future opportunities. Due to the limited number of students participating in 2022, particularly international students, it is difficult to determine the changes and impacts caused by the pandemic from 2021 to 2022. Further research might be warranted to determine whether these fears of lost opportunity remain in the future careers of medical students.

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Exploring the Relationship between Psoriasis and Pregnancy: A Systematic Literature Review

Pratiksha Patra,¹ 

Abstract

This systematic literature review examines the relationship between psoriasis and pregnancy to elucidate possible new routes of treatment. Findings from this review help reduce the gap in the literature on the topic as well as educate physicians and pregnant women with psoriasis on how psoriasis may present along the course of pregnancy and thereafter. Searches were primarily conducted in three databases: PubMed, Scopus, and Embase. Articles considered for inclusion in this literature review focused on the presentation of psoriasis during pregnancy. The literature sample obtained consisted of 14 peer-reviewed articles published from 2012-2022. As codes were identified, a master code list was developed. Second cycle coding involved categorizing of the data allowing for codes to combine and emerge as themes. Five themes were identified through categorical analysis: immunology, general sex hormones, estrogen, progesterone, and the HLA-Cw6 allele. Collectively, these findings elucidate the individual nature of psoriasis and identify progesterone as a possible non-teratogenic therapy. Primarily, the presence of the HLA-Cw6 allele in a woman's genome along with the individual variation of estrogen receptors reinforces the researcher's recommendation of genetic testing following a psoriasis diagnosis. This genetic testing may allow patients and physicians to best understand what to expect of psoriasis during pregnancy as well as help determine the most efficacious treatment course to follow for therapy.

Key Words: Pregnancy; Psoriasis; HLA-Cw6; IL-23; Therapy (Source: MeSH-NLM).

Introduction

Psoriasis affects millions of adults nationally-- typically around 3% of the population in the US. It predominates in non-Hispanic white individuals and is one of the most common autoimmune disorders in the US.¹ Current treatments include topical medications (usually steroids which weaken the skin over time) and regular injectable biologics such as adalimumab (Humira), certolizumab pegol (Cimzia), and guselkumab (Tremfya).² Previous studies stress the possible negative teratogenic effects of continuing biologic medications during pregnancy, and recommend the use of topical treatments during as alternatives.^{3,4} It is commonly believed that psoriasis symptoms tend to improve during pregnancy, however, there is limited research documenting the extent to which this occurs,^{3,4} and how. The aim of this literature review is to examine the published literature on the relationship between psoriasis and pregnancy to elucidate possible new routes of treatment. Findings from this review will help reduce the gap in the literature on the topic as well as educate physicians and pregnant women with psoriasis on how psoriasis might progress during gestation and thereafter.

Background

Psoriasis is a heavily understudied disease globally. Up to 81% of countries have inadequate data on the epidemiology of psoriasis, let alone the disease pathogenesis.⁵ From the data available, it has been observed that the prevalence of psoriasis is variable

geographically—it seems to be more common in high income countries and in regions with older populations.⁵ The researcher theorizes that this may be due to increased availability of medical resources in those regions, leading to higher rates of diagnosis. Psoriasis can be defined simply as a dysregulation of keratinocyte differentiation and proliferation.⁶ These keratinocytes are responsible for early innate immune responses, which is why psoriasis is considered an auto-immune disorder—dysregulation of the body's innate immune responses leads to the body attacking itself.⁶ The systemic disease of psoriasis is associated with a number of comorbidities for pregnant women, including metabolic syndrome, obesity, depression, arthritis, and low birth weight for the infant.⁴ It is therefore of great interest to find a sustainable and safe treatment for psoriasis that is suitable even for pregnant women.

Achieving an accurate diagnosis of psoriasis can be arduous. It is often confused with eczema, particularly in children, because, although psoriasis can present at any point in one's life, it often presents during the reproductive years (20s) or during late adulthood (50s-60s).⁷ Biopsy can be used to confirm a clinical diagnosis, but it isn't suggested until several topical treatments have been tried in order to reduce possible scarring from the procedure. Mild psoriasis is defined as having affected Body Surface Area (BSA) under 10 and Psoriasis Area and Severity Index (PASI) score under 10.⁴ Moderate to severe psoriasis will have one

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or both of these scores over 10, indicating significant surface area affected to a high level of severity.⁴

The management of psoriasis following a diagnosis is highly individualized. For some, topical creams control the plaques, using reapplication with flareups as needed. For others, the plaques are persistent or recalcitrant to topical treatments, requiring more intensive treatment. Traditional biologics have focused on reducing Th1-mediated inflammation, as it was believed that this was the primary driving factor behind lesion formation.⁸ Modern therapies also include the Th17 response in their effects, specifically targeting IL-17 and IL-23.⁹ Still, no one single therapy is a perfect fit for every patient, and particularly for pregnant women, there is a gap in intensive treatments available for use due to concern of teratogenic effects. The researcher theorizes that sex hormones could be a possible new route for treatment that would be safe for use during pregnancy, pending genetic compatibility testing.

Methods

Role of the Researcher

The researcher recognizes personal bias in embracing a pragmatic framework. The researcher was diagnosed with moderate to severe psoriasis at the age of 22 after nearly 2 decades of dermatologic issues from the age of 4. As a patient, she struggled with numerous dermatologists and medications to find treatment, and this experience furthered the motivation to understand the pharmacology and pathogenesis behind the disease. Psoriasis during pregnancy is of particular interest to the researcher who is currently a first-year medical student and is interested in specializing in dermatology or women’s health.

Search Strategy and Selection Criteria

Searches were primarily conducted between April and June 2022 in three databases (PubMed, Scopus, and Embase) available via the University of South Florida library network. Searches were also conducted in Cochrane and clinicaltrials.gov and yielded no relevant results. Articles for consideration to be included in this literature review focused on the presentation of psoriasis during pregnancy. Keywords used in the searches included psoriasis, pregnancy, severity, and surface area. Estrogen and progesterone were also relevant search terms used to identify the physiology behind any relationships observed. Medical subject headings (MeSH) such as gestation, pregnancies, and psoriasis were used to capture any relevant articles related to the search terms. The filter for English only was used because it is the only language the researcher can speak with academic fluency. Publication dates were originally limited to 5 years in order to find current, medically relevant information, however, limited search results led the decision to increase the range to the last 10 years (2012–2022).

Inclusion and Exclusion Criteria

The researcher intended to identify articles focused on the changes in presentation of psoriasis during pregnancy. Because of the general search terms used, many articles relating to the safety of available drug treatments for psoriasis during pregnancy

were found and subsequently excluded from analysis. Due to the fluctuating hormones in pregnancy, articles investigating the effects of sex hormones on psoriasis were included in the review. From the initial search results, titles and abstracts were reviewed for potential relevance. Articles were included if the article was peer-reviewed and mentioned about changes or factors of psoriasis presentation during pregnancy.

Coding

Data coding followed Saldaña’s (2016) methods of first cycle and second cycle coding. All data sources (i.e., articles; N = 14) were entered into the Excel data collection matrix (Appendix A). First cycle coding began with the researcher hand coding all articles using an a priori code list adopted from Boote and Beile’s (2005) Literature Review Scoring Rubric.¹⁰

As codes were identified, a master code list was developed. Second cycle coding involved theming of the data allowing for codes to combine and emerge as categories.¹¹ Coding ended with code weaving to create a narrative to see how categories and emergent themes fit together to answer the guiding questions for this review.¹¹

Table 1. Search Strings Used Per Database.

Database	String	Results
PubMed*	Progesterone and psoriasis	9
	Estrogen and psoriasis	38
	(severity[tiab] OR "surface area"[tiab]) AND ("Psoriasis"[Mesh] OR Psoriasis[tiab] OR Plaque[tiab] OR Psoriasis[tiab]) AND ("Pregnancy"[Mesh] OR pregnancy[tiab] OR Pregnancies[tiab] OR Gestation[tiab]) AND ((y_10[Filter]) AND (english[Filter]))	57
Embase	('psoriasis'/exp OR psoriasis:ti,ab OR plaque:ti,ab OR psoriasis:ti,ab) AND ('pregnancy'/exp OR pregnancy:ti,ab OR pregnancies:ti,ab OR gestation:ti,ab) AND (severity:ti,ab OR 'surface area':ti,ab) AND [2012-2022]/py	132
Scopus	(ABS(severity OR "surface area") AND ABS(Psoriasis OR Pustulosis OR Psoriasis OR plaque) AND ABS(pregnancy OR Pregnancies OR Gestation)) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012))	45

Legend: Table of strings used for each database searched for the purposes of the literature review. Results were counted on 5/25/2022. *PubMed searches were performed on 5/20 and the results were counted on 5/25.

Table 2. Example Coding List

Author	Code	Category	Theme
A. A. Simionescu, B. M. Danciu and A. M. A. Stanescu	IL23 stimulates Th17	Th17 mediation	Immunology
G. A. Vena, N. Cassano, G. Bellia and D. Colombo	psoriasis is th1 and th17 mediated	Th17 mediation	Immunology
G. A. Vena, N. Cassano, G. Bellia and D. Colombo	pregnancy decreases th17 response	Th17 mediation	Immunology
M. B. Hoffman, M. Farhangian and S. R. Feldman	Th17 and IL-23 involvement	Th17 mediation	Immunology
M. Danesh and J. E. Murase	psoriasis is th17 mediated, driven by IL-23. th1 is secondary	Th17 mediation	Immunology
M. Danesh and J. E. Murase	psoriasis is driven by IL17 producing T cells (Th17) not Th1	Th17 mediation	Immunology
M. Danesh and J. E. Murase	IL23 required for Th17 expansion th17 is	Th17 mediation	Immunology
M. Danesh and J. E. Murase	decreased in healthy pregnancies	Th17 mediation	Immunology
M. B. Hoffman, M. Farhangian and S. R. Feldman	mediated by T helper cells	T cells	Immunology
S. Hellberg, J. Raffetseder, O. Rundquist, R. Magnusson, G. Papapavlou, M. C. Jenmalm, et al.	CD4 T cells are activated in disease pathogenesis	T cells	Immunology
S. Hellberg, J. Raffetseder, O. Rundquist, R. Magnusson, G. Papapavlou, M. C. Jenmalm, et al.	P4 dampens T cell activation by affecting genes	T cells	Immunology
S. Hellberg, J. Raffetseder, O. Rundquist, R. Magnusson, G. Papapavlou, M. C. Jenmalm, et al.	STAT1 and STAT3 are enriched in disease genes	T cells	Immunology

Legend: This table contains real sample codes from the master list showing how categories and themes were extracted. These codes were all taken from the "Immunology" theme to show how multiple articles can converge on the same codes and categories to elucidate a higher-order theme. Under a particular theme, there may be multiple categories. For example, under the theme "Immunology," the categories "Th17 mediation" and "T cells" were discussed.

Sample

The literature sample obtained consisted of 14 peer-reviewed articles published from 2012-2022. Six of the articles were qualitative studies and eight were quantitative studies. Articles came from a wide range of countries including the United States, Lithuania, Slovenia, Taiwan, and Great Britain.

Limitations and Delimitations

The researcher recognizes limitations in the literature review. Only the databases Embase, Scopus, and PubMed were used because they were most readily accessible as per the University of South Florida library network. After obtaining articles for review, one source was excluded because the full text of the article could not be obtained; only the abstract was available. Future research should repeat the search strategy of this paper, while also including other relevant databases to capture all pertinent information related to the topic.

Definitions

Koebner Phenomenon- presentation of a psoriatic skin lesion following trauma.¹²

Results

Findings

After completing the coding process for the 14 articles included in this review, five themes were identified through categorical analysis of the data: immunology, general sex hormones, estrogen, progesterone, and the HLA-Cw6 allele. Collectively, these findings elucidate the individual nature of psoriasis. Primarily, the presence of the HLA-Cw6 allele in a woman's genome along with the individual variation of estrogen receptors supports the researcher's recommendation for genetic testing following a psoriasis diagnosis. This genetic testing may allow patients and physicians to best understand what to expect of psoriasis during pregnancy as well as help determine the most efficacious treatment course to follow.

Sex Hormones

Given that keratinocytes are the main cell type of the epidermis, it is helpful to explore the factors that affect cell differentiation. Keratinocytes are responsible for regulating early innate immune responses, and androgens specifically are involved in skin cell pigmentation, aging, proliferation, wound healing, and inflammation⁶. Sobolev et. al found that there are significant differences in levels of sex hormones between psoriasis patients and healthy controls.¹³ Estradiol (E2) and progesterone (PG) were significantly higher in healthy subjects whereas testosterone levels were sharply risen in psoriasis patients. This is supported by data from post-menopausal psoriasis patients who have further reduced E2 and PG levels and increased testosterone levels compared to post-menopausal healthy controls, reinforcing the role of sex hormones in psoriasis.

The relationship of psoriasis with sex hormones goes further, impacting ovarian reserve (the remaining follicular pool). Patients with psoriasis have been found to have higher FSH levels, particularly, a higher FSH/LH ratio than healthy controls.¹⁴ AFC (antral follicle count) was also reduced. Although these findings did not correlate with the severity of disease, diminished ovarian reserve can lead to POF (premature ovarian failure). Tuğrul et. al explains that ovarian antibodies attack the ovarian reserve, causing autoimmune oophoritis.¹⁴ This is clinically relevant for

women with psoriasis who are having trouble conceiving, with the altered sex hormone levels also contributing to poorer pregnancy outcomes. Therefore, it is of interest for physicians to recommend reproductive fertility testing for women who have been diagnosed with psoriasis to identify possible sex hormone deficits that can be addressed during pregnancy to address both psoriasis presentation and pregnancy outcomes.

Estrogen

The role of estrogen is highly debated in the pathogenesis of psoriasis. Oral contraceptives have been shown to decrease the severity of psoriasis, but the exact mechanism is unknown.^{3,8,13,15} Estrogen is known to have both immune dampening and immune activating properties.^{6,16} At high doses, estrogen can improve the symptoms of psoriasis, whereas at low doses it is considered inflammatory;¹⁵ however, this finding contradicts the effects of oral contraceptives which are typically low-dose estrogen. Pharmacologically, in the context of psoriasis, estrogen upregulates Th2 cells and downregulates Th1 and Th17 cells.⁸ This promotes T cell conversion into T regulatory cells, which helps prevent symptoms.⁶ Estradiol also inhibits IL-1B production, which inhibits IL-17 producing cells (which are key in psoriasis pathogenesis).¹⁷ Furthermore, Cemil et. al found that a serum estradiol of less than 43.7pg/mL is indicative of a currently worsening PASI (Psoriasis Area and Severity Index) score.¹⁸ There is an inverse correlation between serum estradiol and PASI score, indicating that this version of estrogen is protective against psoriasis.¹⁸ Cemil et. al theorizes that the reason for this phenomenon is that estrogen inhibits induction of an enzyme that is key in DNA replication and therefore cell proliferation.¹⁸ Thus, in a period of high estrogen such as pregnancy, one can expect their psoriasis symptoms to improve.⁸

Even in male patients, estrogen level is inversely correlated with psoriasis severity.¹⁵ This is likely due to the fact that estradiol (E2) and estrion (E3) receptor activation both show antioxidant effects and radical scavenging activity, reducing the detrimental angiogenesis needed for keratinocyte and sebocyte differentiation and proliferation (plaque formation).⁶ However, a study conducted by Lin and Huang in 2016 shows that in vivo, E2 increases the effects of TNF-alpha on angiogenesis, and VEGF expression can be induced by E2.¹⁵ Higher levels of VEGF lead to more severe psoriatic presentation and increased intimal thickness along with increased vascularization, which is detrimental for ovarian reserve and makes women lose their ovarian follicles faster.¹⁴ This contradictory data pushes the hypothesis that the variability of different estrogen receptors in women could account for why psoriasis symptoms may improve for some during pregnancy but not others.¹⁹ There are an infinite number of estrogen receptor combinations and presentations on a woman's cells, and so estrogen therapy can be suitable for some and detrimental for others. In such cases, further studies should be conducted regarding genetic testing for those with psoriasis to determine if estrogen-based treatments could be a viable option for the patient.

Progesterone

Unlike estrogen, progesterone is more associated with anti-inflammatory properties.⁶ In the context of psoriasis, progesterone (P4) has been shown to dampen T cells and downregulate STAT1 and STAT3, all of which are involved in the pathogenesis of psoriasis. Following conception, P4 elevates in the woman to establish and maintain pregnancy, which may contribute to the decreasing severity of psoriasis presentation often seen in pregnancy. P4 therapy reduces preterm risk and has been shown to reduce inflammation in animal models of autoimmune disorders such as multiple sclerosis, and should be explored as a possible mild, non-teratogenic treatment option for psoriasis as well.¹⁶

Immunology

The pathogenesis of psoriasis relies primarily on the activation of CD4 T cells.^{7,16} Specifically, psoriasis is Th1 and Th17 mediated, both of which are pro-inflammatory types of cells. IL-23 is required for Th17 expansion, which is why many new psoriasis biologic therapies have begun to target IL-23.^{3,8,17} The genes STAT1 and STAT3 are enriched in disease states, and P4 progesterone dampens T cell activation and psoriasis symptoms by downregulating them.

Physiologically, pregnancy decreases the Th17 response.^{8,9} This is because the woman's body sees the fetus as an allograft—and in order to not reject the fetus as a foreign transplant, the woman's immune responses must be dampened. Given that psoriasis is Th17 mediated, a decreased Th17 immune response biologically reduces the presentation of psoriasis symptoms.

HLA-Cw6 Allele

The HLA-Cw6 allele has been identified by geneticists in increasing the susceptibility and severity of psoriasis. Specifically, the allele is associated with type 1 early-onset psoriasis, and it works by mediating T helper cells.²⁰ Having a single HLA-Cw6 allele increases patient risk of psoriasis by 10x, while being a homozygous carrier increases the risk by 20x. The allele occurs most often in people who identify as Caucasian or White, which is concurrent with psoriasis prevalence statistics.^{3,20} Homozygote carriers have also been found to score higher on the PASI scale, indicating a higher level of psoriasis severity. Carriers have been seen to have more plaques on the arms, legs, and trunk, as well as being more susceptible to the Koebner phenomenon (lesion presentation after trauma). The allele is also associated with stress, obesity, and higher rates of strep infection.²⁰

Carriers of the HLA-Cw6 allele have reported more relief from psoriasis during pregnancy than their non-allele-carrying counterparts.⁹ They also experience more frequent remissions during pregnancy.²⁰ Unfortunately, this means that women who are not HLA-Cw6 positive are more likely to experience unchanged or worsened symptoms of psoriasis during pregnancy. This furthers the interest for genetic testing following a psoriasis diagnosis to understand the patient's HLA-Cw6 status and better inform prognosis and treatment options.

Pregnancy

Depending on her genotype, a woman's psoriasis is usually stable or improves during pregnancy.^{3,4,8,9,16} Many biologic treatments are considered teratogenic, and so are the acceptable treatments for psoriasis during pregnancy—common treatments are topical corticosteroids to help fight the outbreaks.³ The most improvement in presentation occurs early in pregnancy, between 10 and 20 weeks of gestation (vena). The maternal immune system adapts in order to accept the fetal allograft, improving many autoimmune disorders in addition to psoriasis.⁷ Danesh et al. reported that the psoriatic lesions studied decreased by 83.8% during the course of pregnancy.⁸ This relationship between psoriasis and pregnancy is supported by the evidence postpartum; up to 70% of women experience postpartum flareups for psoriasis.⁸ In most cases, BSA (Body Surface Area) affected also increases significantly by 6 weeks post-delivery.^{3,4,8} This data supports the hormonal and immunological pathogenesis behind psoriasis, while providing insight on new ways we can educate and treat psoriasis-affected women who are pregnant.

Discussion

This systematic literature review elucidates the individual nature of psoriasis. There are several factors affecting the presentation of psoriasis during pregnancy, ranging from genetic to hormonal. Overall, a woman with psoriasis who is pregnant should expect some improvement during early pregnancy, maintaining that improvement throughout the course, and then worsening symptoms postpartum.^{3,4,8,9,16} Current biologic medications available for psoriasis have limited data in showing safety of use during pregnancy, therefore, it may be of interest to explore the use of natural sex hormones as a possible route of safe treatment.⁷ Based on this literature review, progesterone seems like a strong candidate for possible non-teratogenic psoriasis treatment. Its use is already being tested in mouse models and is so far successful, and elevation of progesterone levels is already required for pregnancy maintenance in women.¹⁶ A low dose supplement could be a more efficacious treatment for pregnant women who are suffering from moderate to severe psoriasis and don't want to go back to non-preventative topical treatments. Topical treatments can be very effective for mild psoriasis, however, in more severe cases, interventional treatment is recommended in order to help prevent plaque formation—topical treatments are used only after the lesion is already formed and painful. Finding a biological treatment that is safe for pregnancy would alleviate the symptoms of millions of women worldwide.

The effectiveness of a sex hormone treatment route may be determined via genetic testing, which the researcher recommends following a psoriasis diagnosis. Genetic testing will allow physicians to understand what treatments the body will respond to best, as well as advise on expectations of psoriasis presentation throughout life and pregnancy. It will help map receptor distribution to identify candidacy for specific drugs, as

well as inform on patient HLA-Cw6 status to manage disease expectations. Future research may focus on other periods of life where one may experience hormonal changes in relation to psoriasis—for example, puberty. Furthermore, elucidating the differences in psoriasis presentation between men and women will allow physician scientists to better understand the pathogenesis behind psoriasis to develop more effective treatments against the disease.

The findings of this review provide the foundation for an investigation that the researcher will conduct following this literature review. The researcher aims to complete a clinical study that investigates the amount of change in BSA affected by psoriasis during pregnancy. This will allow for the creation of patient education materials that can be distributed to women of reproductive age upon a psoriasis diagnosis. Ultimately, the findings from this review help close the gap in the literature on the topic of psoriasis during pregnancy and provide a foundation for further study on the progression of psoriasis during pregnancy, which may lead to possible new treatments and enhanced patient education on this topic.

Summary – Accelerating Translation

The purpose of this systematic literature review was to thoroughly examine the relationship between psoriasis and pregnancy to elucidate possible new routes of treatment. Findings from this review help close the gap in the literature on the topic as well as educate physicians and women with psoriasis who are pregnant on how psoriasis may present along the course of pregnancy and thereafter. Searches were primarily conducted in three databases: PubMed, Scopus, and Embase. Articles considered for inclusion in this literature review focused on the presentation of psoriasis during pregnancy. The literature sample obtained consisted of 14 peer-reviewed articles published from 2012-2022. Data coding followed Saldaña's (2016) methods of first cycle and second cycle coding. All data sources (i.e., articles; N = 14) were entered into the Excel data collection matrix. First cycle coding began with the researcher hand coding all articles using an a priori code list adopted from Boote and Beile's (2005) Literature Review Scoring Rubric.¹⁰ As codes were identified, a master code list was developed. Second cycle coding involved categorizing of the data allowing for codes to combine and emerge as themes. Five themes were identified through categorical analysis: immunology, general sex hormones, estrogen, progesterone, and the HLA-Cw6 allele. Collectively, these findings elucidate the individual nature of psoriasis and identify progesterone as a possible non-teratogenic therapy. Primarily, the presence of the HLA-Cw6 allele in a woman's genome along with the individual variation of estrogen receptors reinforces the researcher's recommendation for genetic testing following a psoriasis diagnosis. This genetic testing may allow patients and physicians to best understand what to expect of psoriasis during pregnancy as well as help determine the most efficacious treatment course to follow. The findings of this review provide the foundation for an investigation that the researcher will conduct following this literature review. The researcher aims to complete a clinical study that investigates the amount of change in BSA affected by psoriasis during pregnancy. This will allow for the creation of patient education materials that can be distributed to women of reproductive age upon a psoriasis diagnosis. Ultimately, the findings from this review help close the gap in the literature on the topic of psoriasis during pregnancy and provide a foundation for further study on the progression of psoriasis during pregnancy, which may lead to possible new treatments and enhanced patient education on this topic.

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Guillain-Barre Syndrome Mimicked by Spinal Stenosis in A Case of Chronic Prolapsed Intervertebral Disc: A Case Report

Yi Xuan Lee,¹ 

Abstract

Background: Guillain-Barre Syndrome (GBS) is a rare acute autoimmune polyneuropathy, usually preceded by infections. It can be difficult to diagnose, especially in patients with underlying neurological comorbidities. **Case:** A 54-year-old male, with a long history of a prolapsed intervertebral disc, presented with progressive and asymmetrical onset tetraparesis for 4 weeks, which was associated with progressive paraparesis for 2 weeks. The diagnosis of GBS was initially missed due to a lack of relevant history of prior infection, atypical presentation (asymmetrical limb weakness), and radiological evidence of spinal stenosis. Nerve conduction study, cerebrospinal fluid analysis, and antiganglioside antibodies later confirmed the diagnosis of GBS. The patient was started on intravenous immunoglobulin and achieved significant improvement. He was discharged a week later and transferred to a rehabilitation hospital. **Conclusion:** GBS should not be excluded prior to diagnostic tests and lab work in neurological patients. Physicians should avoid over-reliance on radiological findings to conclude a diagnosis. Comprehensive history and examinations to understand the development of patients' presentations should be prioritized when establishing a diagnosis.

Key Words: Guillain-Barre Syndrome; Polyradiculoneuropathy; Intervertebral Disc Displacement; Spinal Stenosis (Source: MeSH-NLM).

Introduction

Guillain-Barre Syndrome (GBS) is a rare acute autoimmune polyneuropathy, with a global prevalence of only 0.0019% based on the Global Burden of Disease Study 2019.¹ However, around 20-30% of cases develop life-threatening respiratory failure due to severe generalized paralysis.² GBS-related years lost due to disability peak among children aged 5-9 years and elderly aged 60-64 years. Across all age groups, males are more likely to develop GBS than females.³ GBS is usually precipitated by gastrointestinal or respiratory infections and, rarely, systemic illnesses, post-surgery, trauma, and pregnancy.⁴ Several systemic diseases, such as Hodgkin's disease, lung cancer, thyroid disease, and systemic lupus erythematosus, were also reported to be related to GBS.⁴ Common presentations of GBS include progressive limb weakness with reduced tendon reflexes, muscle or radicular pain, ataxia, sensory symptoms, and autonomic dysfunctions.²

In contrast, spinal stenosis is the narrowing of the spinal canal (central canal or neural foramina), that causes central cord or nerve roots compression. The most common etiology of spinal stenosis is degenerative spine diseases, including disc herniation, facet joint hypertrophy, ligamentum flavum hypertrophy, osteophyte formation, and spondylolisthesis.⁵ Lumbar spinal

Highlights:

- Guillain-Barre Syndrome (GBS) is a rare acute autoimmune polyneuropathy that can cause severe complications.
- Broad differentials of neurological signs and symptoms increase the difficulty of diagnosing GBS.
- Comprehensive investigations should be established to rule out GBS, especially in patients with coexisting neurological comorbidities.

stenosis is classically presented as lower back and leg pain, lower limb weakness, paresthesia, and loss of balance. In severe cases like cauda equina syndrome, bowel or bladder incontinence can occur due to lumbar-sacral nerve root compression.^{5,6}

Although acute ascending sensorimotor polyneuropathy is a distinctive feature of GBS, it can be sometimes challenging for physicians to diagnose GBS when there are atypical presentations, rare variants, and heterogeneous manifestations. Broad differentials, lacking high sensitivity and specificity diagnostic tools, further complicate the diagnosis of GBS.⁷ This report describes a case of GBS initially misdiagnosed as spinal stenosis in a patient with a long history of a prolapsed intervertebral disc.

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The Case

A 54-year-old gentleman with a long history of a prolapsed intervertebral disc presented to a tertiary hospital in Kuala Lumpur, Malaysia in June 2022, complaining of progressively worsening bilateral upper and lower limb numbness for the past 5 weeks, associated with bilateral lower limb weakness in the last 3 weeks. He was diagnosed with a slipped disc at the L4-L5 vertebral level 21 years ago. No surgical intervention was done at the time, and he had been asymptomatic since, only requiring physiotherapy.

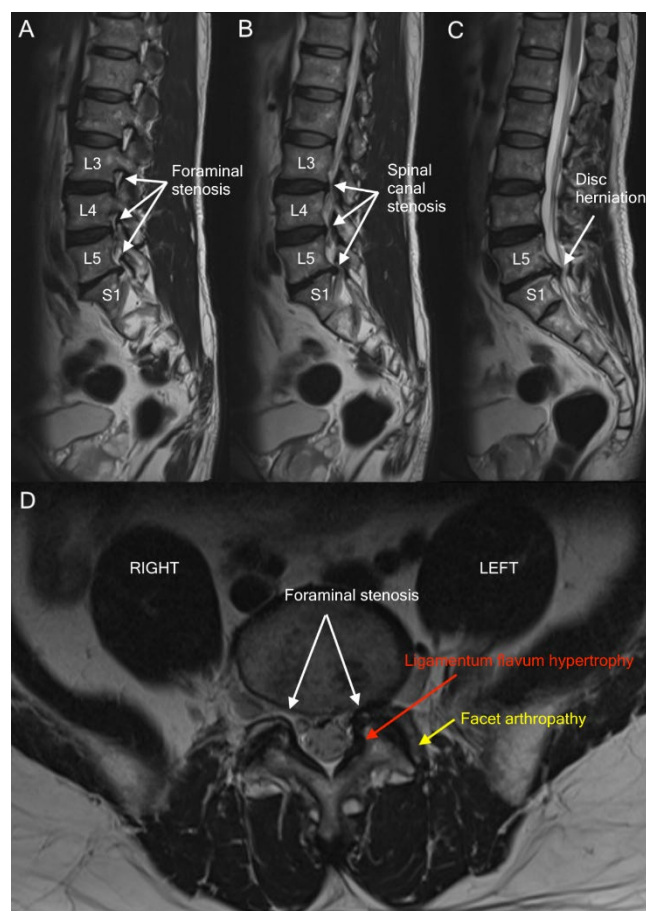
5 weeks before admission, the patient had a gradual onset of numbness in his right foot, which progressed proximally from his lower limbs to the waist bilaterally, and was associated with bilateral hand numbness up to the elbow. 3 weeks prior to admission, he began to experience bilateral lower limb weakness that worsened rapidly over a span of 2 weeks, until he was wheelchair-bound. At this point, he was also unable to hold a spoon firmly nor button up his shirt. He went to a private hospital and a Magnetic Resonance Imaging (MRI) thoracolumbar spine was done, revealing varying degrees of foramen stenosis due to multiple degenerative changes at L3 to S1 discs ([Figure 1](#)). Therefore, he was diagnosed with spinal stenosis and surgical intervention was proposed. However, the patient did not consent for the surgery and opted for medical treatment. He was then given Pregabalin capsules 75mg twice daily, Eperisone tablet 50mg once daily, and Vitamin B-complex tablet once daily.

Despite the medications, the patient's symptoms persisted. One week after the initiation of medical therapy, he visited our center for a second opinion. Upon thorough questioning, the patient recalled having 3 days of mild cough 2 weeks prior to the onset of his symptoms. Otherwise, he had no history of trauma, back pain, radiating pain, and bowel or urinary incontinence. He also had no diplopia, slurred speech, dysphagia, or dyspnea. On upper limb examination, the tonus was normal and sensation was intact. The power of his upper limb was reduced (Medical Research Council scale 4/5) with absent deep tendon reflexes. Upper limb proprioception and finger-to-nose test were unremarkable, with no dysdiadochokinesia. The grip-and-release test was negative, but the finger escape test was positive. On lower limb examination, sensation was intact. Hypotonia was present in the lower limbs and power was reduced at 4/5 over the hip and knee, 1/5 for dorsiflexion, and 2/5 for plantar flexion. Babinski's sign was equivocal with no clonus response. Lower limb proprioception was impaired, and the patient was unable to perform the heel to shin test. All upper and lower limbs findings were bilaterally symmetrical.

MRI of the cervical and thoracic spine was done, revealing no obvious spinal cord stenosis or lesions at the cervical and thoracic level. Nerve conduction studies (NCS) showed electrophysiological evidence of bilateral sural sparing, generalized, predominantly demyelinating polyneuropathy, suggestive of Guillain-Barre Syndrome, particularly the acute inflammatory demyelinating polyneuropathy (AIDP) subtype

([Table 1](#)). The diagnosis was further confirmed by cerebrospinal fluid analysis, which showed cytoalbuminologic dissociation: normal white cell count (0/mm³) and elevated total protein (1842mg/dL). Antiganglioside antibodies were also positive. The Modified Erasmus GBS Outcome Score (mEGOS) calculated for this patient was 3, representing a 41% probability of an inability to walk after 4 weeks and 18% after 3 months.

Figure 1. T2 Weighted MRI of the Lumbar Spine.



Legend: A) Sagittal Image Shows Foraminal Stenosis (white arrows) at L3-L4, L4-L5, and L5-S1 levels. (B) Sagittal Image Shows Lumbar Spinal Stenosis (White Arrows) at L3-L4, L4-L5, and L5-S1 Levels. (C) Sagittal Image Shows Disc Herniation (White Arrow) at L5-S1 Level. (D) Axial Image at L5-S1 Level Shows Bilateral Foraminal Stenosis (left>right, White Arrows), Ligamentum Flavum Hypertrophy (Red Arrow) and Facet Joint Arthropathy (Yellow Arrow).

The patient received intravenous immunoglobulin (IVIg) 0.4g/kg daily for 5 days and inpatient physiotherapy. His physiotherapy exercises focused on limb muscle strengthening. Upper limb proprioceptive neuromuscular facilitation was done on days 1 and 2 of admission, while other exercises were performed 3 times a day until discharge. These exercises included bilateral leg bridging with a 10-second hold, straight leg raise of 45 degrees with a 5-second hold, hip abduction and adduction with isometric exercises, and triceps strengthening exercises with 250g weights. All exercises were repeated 10 times in each training session.

Discussion

The clinical course and severity of GBS vary due to the condition's different pathophysiological processes. In general, the disease progresses through several phases.² About two-thirds of patients report respiratory or gastrointestinal symptoms within a period of 4 weeks prior to the onset of GBS symptoms. This is followed by progressive worsening of symptoms (progressive phase) that

peaks at 2-4 weeks. Subsequently, the symptoms plateau from 2 days to 6 months (with median of 7 days), before entering the recovery phase, where 80% of patients are able to walk independently within 6 months.⁸ In the case described, the patient presented to us 5 weeks after the onset of symptoms, which was during the plateau phase, following 2 weeks of tetraparesthesia and 2 weeks of progressive paraparesis.

Table 1. Nerve Conduction Studies (NCS) Results.

Motor					
Nerve/ Site	Latency (ms)	Amplitude (mV)	Conduction Velocity (m/s)	F wave (ms)	Interpretation
Median – Abductor Pollicis Brevis (Left/ Right)					
Wrist	5.65/10.35	3.5/3.9	-	38.31/37.78	DML: severely prolonged CMAP: reduced MCV: reduced F-wave: prolonged
Elbow	11.60/16.80	3.0/2.5	40.3/40.3		
Reference	<4.7	>4.2	>47	-	
Ulnar – Abductor Digiti Minimi (Left/ Right)					
Wrist	7.60/5.15	3.3/2.6	-		DML: severely prolonged CMAP: reduced MCV: reduced F-wave: prolonged
Elbow	12.20/12.00	2.1/1.7	45.7/32.1	45.08/40.50	
Ant. elbow	16.70/17.00	1.6/1.0	31.1/30.0		
Reference	<3.7	>7.9	>52	-	
Peroneal – Extensor Digitorum Brevis (Left/ Right)					
Ankle	8.30/8.40	1.2/0.8	-		DML: severely prolonged CMAP: reduced MCV: reduced F-wave: prolonged
Fib. head	NR/NR	NR/NR	0/0	NR	
Knee	NR/NR	NR/NR	0/0		
Reference	<6.5	>1.1	>42	-	
Tibial – Abductor Hallucis (Left/ Right)					
Ankle	7.75/8.20	1.6/1.0	-	68.5/68.83	DML: severely prolonged CMAP: reduced with conduction block MCV: reduced F-wave: prolonged
Knee	23.00/25.75	0.5/0.1	27.5/23.9		
Reference	<6.1	>5.3	>37	-	
Sensory					
Nerve/ Site	Rec. Site	Latency (ms)	Peak-Peak Amplitude. (µV)	Velocity (m/s)	Interpretation
Median – Digit II (Left/ Right)					
Digit II	Wrist	NR/NR	NR/NR	0/0	DSL: absent SNAP: absent
Reference		<3.3	>15	-	
Ulnar – Digit V (Left/ Right)					
Digit V	Wrist	NR/NR	NR/NR	0/0	DSL: absent SNAP: absent
Reference		<3.1	>13	-	
Sural – Lateral Malleolus (Left/ Right)					
Calf	Lat. malleolus	2.10/1.95	2.0/2.5	66.7/71.8	DSL: normal SNAP: reduced
Reference*		<3.6	>4	-	

Legend: DML, distal motor latency; CMAP, compound muscle action potential; MCV, motor conduction velocity; DSL, distal sensory latency; SNAP, sensory nerve action potential amplitude.

In 2011, the Brighton Collaboration GBS Working Group refined the original diagnostic criteria for GBS from the National Institute of Neurological Disorders and Stroke by providing the diagnostic level of different symptoms and ancillary examinations.⁹⁻¹¹ It is crucial to diagnose GBS timely due to its rapid progression and high mortality (3-10%), particularly once patients develop autonomic dysregulation, resulting in respiratory failure, arrhythmia, and blood pressure instability.⁷ In our patient's case, the cough was an important hint for GBS, but was missed during the first hospital visit, despite it being the most common presenting complaint in primary care.¹² Other common complaints from GBS include back pain, abdominal symptoms, pharyngitis, dermatitis, fever, headache, and fatigue. Even though the presenting complaint may initially seem irrelevant to the chief complaint, physicians should always conduct a review of the systems and screen for related symptoms.

AIDP was the first type of GBS discovered and is also the most common type. The two terms were used interchangeably until the axonal forms of GBS were discovered, namely acute motor axonal neuropathy and acute motor-sensory axonal neuropathy.⁴ Since then, more variants were classified under the spectrum of GBS, including paraparesis, pharyngeal-cervical brachial, bilateral facial palsy with paresthesia, pure sensory, Miller Fisher syndrome, and Bickerstaff brainstem.⁷ Although some variants share similar clinical presentations like flaccid weakness and areflexia, they can be differentiated by respective distinctive pathological characteristics. Diagnosis of GBS and its subtypes can be confirmed by electrodiagnostic studies, cerebrospinal fluid analysis, and serum antiganglioside antibodies analysis.^{4,7,8} NCS, in this case, revealed classic findings of AIDP: prolonged F-waves, reduced compound muscle action potential with motor conduction blocks, reduced motor conduction velocities, prolonged distal sensory latency, and reduced sensory nerve action potential. Another important finding in sensory NCS which differentiates demyelination from axonal polyneuropathy is the "sural-sparing pattern", where the sensory action potential of the sural nerve is normal or relatively preserved compared to a total absence of median and ulnar sensory nerve action potentials. This is the most specific sensory abnormality in AIDP.³

Management of GBS patients requires a multidisciplinary approach and patients often require intensive care unit admission due to respiratory failure, paralysis, bulbar and autonomic cardiovascular dysfunction.⁴ Common complications like

atelectasis, aspiration, nosocomial infections, deep venous thrombosis, and pulmonary embolism should be monitored closely to improve the overall outcome and prognosis.⁴ Immunomodulatory therapy is best started within 2 weeks of symptom onset to achieve maximum efficacy. IVIg, plasma exchange, or combination therapy are all proven equally effective in treating GBS; though IVIg is often chosen over plasma exchange due to easier administration, wide availability, and lesser adverse effects.^{2,7} Most patients show substantial recovery and resume walking ability within 6 months.^{2,4,7}

The mEGOS is a validated tool used to predict the prognosis of GBS patients.^{13,14} A lower score may prompt physicians to utilize more aggressive treatment approaches in the early phase of diagnosis, such as lower threshold ICU admission and a higher dose of IVIg treatment.^{4,13} However, a second IVIg course should not be given as it does not benefit patients and causes more severe adverse events instead, as suggested by the Netherlands SID-GBS RCT trial.¹⁵ The I-SID-GBS study, a global counterpart of the Netherlands study, is currently ongoing as part of the International Guillain-Barré Syndrome Outcome Study and is expected to complete in September 2024, elucidating further guidance on adequate treatment.¹⁶

GBS can be difficult to diagnose, especially in patients with co-existing neurological comorbidities. Established diagnostic criteria of GBS should be assessed when patients with limb weakness have symptoms atypical for their current diagnosis. In this case, leg pain is absent, despite the fact that it is the most common symptom of spinal stenosis.^{4,5} Also, physicians should refrain from over-relying on radiological findings to conclude a diagnosis. Comprehensive history and examination to discover reasons behind patients' presentations should be the mainstay when making a diagnosis.

Summary – Accelerating Translation

Guillain-Barre Syndrome (GBS) is a rare neurological disease. Its complications can range from limb weakness, muscle pain, loss of balance, and abnormal sensations, to life-threatening ones in more severe cases, such as autonomic dysfunctions. Diagnosing GBS in patients with existing neurological conditions can be challenging due to overlapping symptoms and signs. When developing a diagnosis, comprehensive history and examination to discover reasons behind patients' presentations should be prioritized. Also, GBS should not be excluded before diagnostic tests and laboratory investigations are completed. Careful evaluation and management of GBS patients using multidisciplinary care should be prioritized to ensure optimal patient recovery.

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Peroneal Nerve Injury due to Hip Surgery Located at the Knee Level: A Case Report

Aleksa Mičić,¹ Stefan Radojević,¹ Lukas Rasulić.²

Abstract

Background: A common peroneal nerve (CPN) injury located at the knee level, occurring as a consequence of hip surgery is described in the literature. However, there are only a few papers focusing on their surgical management, while there are no thoroughly analyzed cases following open reduction and internal fixation (ORIF) of the acetabular fracture. This paper aimed to describe such a case and discuss current trends in the surgical management of these patients. **Case:** A 32-year-old woman was admitted to our department due to left-sided CPN palsy. The patient was injured in a traffic accident eight months earlier, followed by left hip dislocation and acetabular fracture. Following the acetabular fracture ORIF, a CPN palsy developed. The electromyoneurography (EMNG) and ultrasound (US) indicated a nerve lesion at the knee level. The surgical treatment included external neurolysis, decompression, and complete nerve deliberation, with the preservation of all nerve branches. The patient reported immediate relief and completely recovered 8 months following the surgery (Medical Research Council (MRC) grade = 5, Visual Analogous Scale (VAS) = 0). **Conclusion:** The cause of CPN palsy following hip surgery may not always be located in the hip region. A detailed anamnesis, physical examination, and diagnostic evaluation are necessary for the proper surgical management of these patients. In addition to the EMNG, the US should be essential in preoperative planning and choosing the most effective surgical strategy.

Key Words: Orthopedic Procedures; Common Peroneal Nerve Entrapment; Neurosurgery; Hip fractures (Source: MeSH-NLM).

Introduction

Peroneal nerve dysfunction often referred to as common peroneal nerve (CPN) palsy presents a functional deficit, characterized by an inability to dorsiflex the foot (foot drop) with consequential disability and a significant decrease in patients' quality of life.¹⁻³ The cause of dysfunction may lie in central nerve structures, spinal nerve roots, sacral plexus, sciatic nerve (SN), the CPN, or its deep branch.⁴

The incidence of CPN palsy following the most common procedure in hip surgery: the total hip arthroplasty (THA), ranged up to 8%, depending on the inclusion and exclusion criteria of the reviewed studies.⁵⁻⁷ In most cases, the cause of the palsy involves SN injury at the hip region and may be a result of various etiologies, such as direct nerve injury, excessive nerve stretch, postoperative hematoma, or infection.⁷ Rarely, the palsy may develop as a consequence of CPN injury at the knee level, and there are only a few papers concerning their surgical management,^{8,9} with a recently reported incidence of 0.48%.¹⁰

The open reduction and internal fixation (ORIF) of the acetabular fracture is performed less often than the THA, thus the associated CPN injuries at the knee level are extremely rare.^{11,12} To the best

Highlights:

- Peroneal nerve palsy is a rare complication of hip surgery.
- In a small number of cases, peroneal nerve palsy is a consequence of nerve injury at the knee level.
- There are only a few papers focusing on the surgical management of these patients after the total hip arthroplasty (THA), while there are no thoroughly analyzed cases following open reduction and internal fixation (ORIF) of the acetabular fracture.
- This article presents a case of a surgically managed peroneal nerve injury located at the knee level consequential to the acetabular fracture ORIF.

of our knowledge, a thoroughly analyzed case of surgical treatment of such injury is not reported in the English medical literature. This paper aimed to describe a such case and discuss current trends in the surgical management of these patients.

The Case

A 32-year-old woman was admitted to our department due to left-sided CPN palsy. The patient was injured in a traffic accident eight months earlier, followed by left hip dislocation and acetabular fracture. After admission to the emergency care unit,

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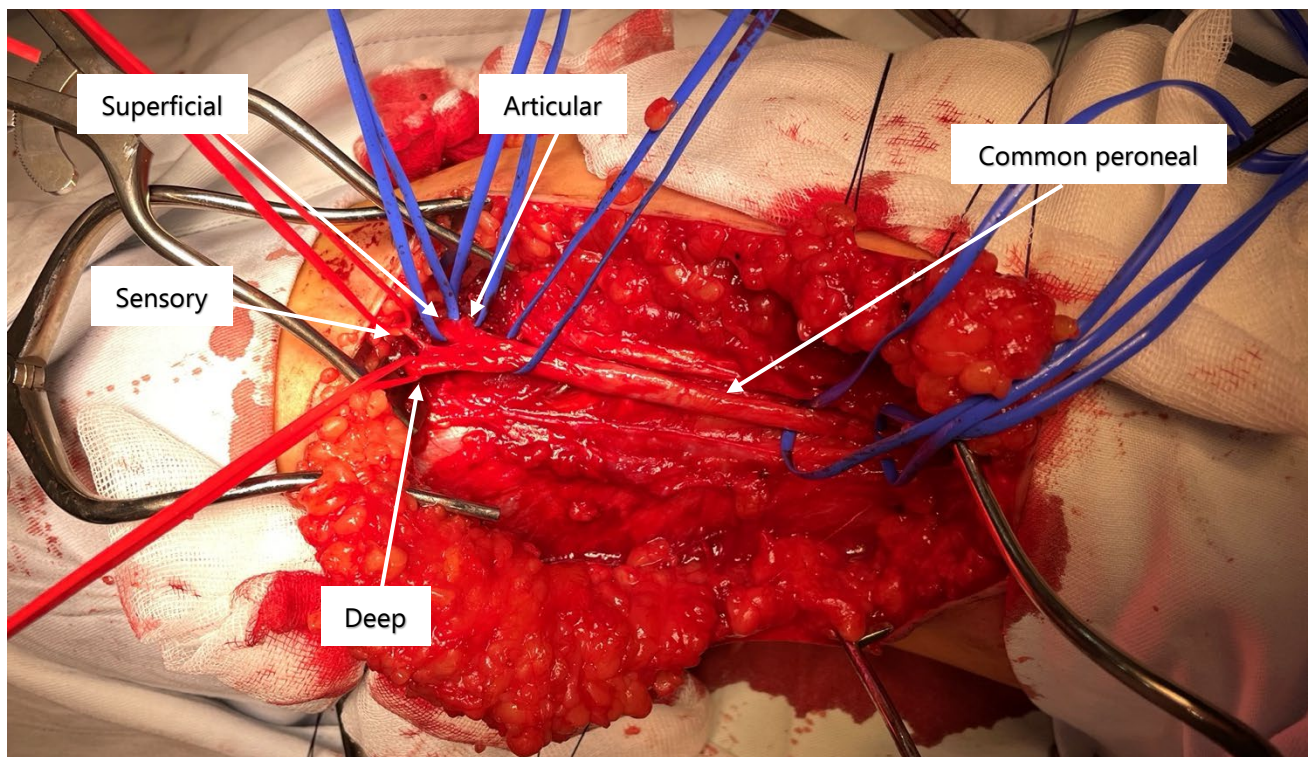
the hip dislocation was repositioned. Two weeks later, ORIF of the acetabular fracture was performed, resulting in ipsilateral CPN palsy.

Upon admission to our department, clinical findings included left-sided incomplete CPN palsy (Medical Research Council (MRC) grade 2), pain in the lateral lower leg (Visual Analogue Scale (VAS) score 3), and gait disturbances. Using electromyoneurography (EMNG), the peroneal nerve lesion was located at the knee level. Reduced nerve conduction was noted in the tibialis anterior (TA) and extensor digitorum brevis (EDB) muscles, while there were no changes in the short head of the biceps femoris (shBF) and muscles innervated by the tibial nerve. The ultrasound (US) findings indicated a suspectable CPN compression due to visible nerve thickening proximal to the fibular tunnel. The PNSQoL and SF-36 scores indicated a significant decline in the patient's quality of life.

Following GETA, the external neurolysis, decompression, and complete nerve deliberation were performed through the popliteal approach, with the preservation of all nerve branches ([Figure 1](#)). The nerve was thinned at the site of the previous compression. There were no signs of nerve bruising.

The patient reported immediate relief following the surgery. 2 months after the surgery, there were signs of motor recovery, with the improvement of foot dorsiflexion and gait performance. 3 months after the surgery, a significant motor recovery was noted with insignificant gait disturbances mostly due to pain. A complete motor and sensory recovery was achieved 8 months following the surgery (MRC = 5, VAS = 0). In order to assess the patient's postoperative quality of life, a prolonged follow-up is needed.

Figure 1. Intraoperative Picture of the Common Peroneal Nerve (CPN) with its Terminal and Side Branches after External Neurolysis, Decompression, and Complete Nerve Deliberation.



Discussion

The etiology of nerve injury in patients with CPN palsy is various. Regarding the CPN lesions at the knee level, the traumatic causes may include direct nerve damage, or indirect during orthopedic trauma such as hip or knee dislocation, or fibula fracture.^{13, 14} The iatrogenic causes may include surgical interventions in the lower extremity, improper positioning during general anesthesia, or application of the splints, casts, wrappings, and bandages.^{14, 15} The idiopathic causes may include increased anatomic risk factors and consequential CPN entrapment at the fibular tunnel,¹⁶ or

formation of an intraneural ganglion cyst,^{17, 18} while neoplastic etiology mostly include nerve schwannomas.¹⁹

Surgical treatment of the CPN palsy following trauma and associated orthopedic interventions must be planned well, due to the various mechanisms of injury and different locations at which the nerve may be damaged. Contrary to compression injuries that are easily managed by a simple surgical decompression, injuries due to traction or contusion may require more complex procedures such as tendon transfer or nerve repair.^{3, 20, 21}

Knowing the exact time of the nerve injury is important in determining the most effective surgical strategy, in terms of choosing the most appropriate procedure and setting the timing for surgery.^{3, 22, 23} While surgical decompression is indicated after 3 months of conservative management without the signs of motor recovery, the nerve repair should not be performed later than 12 months post-injury.²⁴ On the other hand, tendon transfers are reserved for cases with poor recovery capacity due to extensive nerve injury or due to exceeding the timing for nerve repair.³

Based on our experience,^{3, 22, 23} in some cases it is difficult to determine if the injury is acquired during the trauma or during the orthopedic intervention because the patient is immobilized and unaware of the present deficit. Regarding the patient described in this paper, the hip dislocation and its repositioning could have been a cause of the palsy due to the traction and contusion of the SN.²⁵ However, this was not the case. During the period between the trauma and the performed ORIF, both the patient and the medical staff were aware of the preserved CPN function and reported the palsy immediately following the intervention.

We could not provide the surgery for the patient when it was indicated because she had been recovering for a long time after the trauma and came to our clinic for evaluation 7 months later. Although, it seems that the timing was not a factor that affected the outcome of our patient, which is in accordance with a similar case that occurred following the THA.⁸ In their paper, the authors performed CPN decompression 8 months following the injury and achieved almost complete motor recovery. A poorer recovery in their patient compared to ours could be a consequence of a more serious CPN damage or a different decompression procedure that was used.

Similar to the study by Wilson et al,⁹ we used the EMNG to detect a reduced CPN conduction and locate the nerve lesion at the knee level. However, in their study, 22% of the patients had no motor unit potentials (MUPs) in the short head of the biceps femoris muscle (BFsh), indicating that the lesion may have extended proximally in relation to the fibular tunnel.²⁶ Even though there was a tendency for better outcomes in those who had the BFsh MUPs, the CPN decompression had positive effects on motor recovery in some of the cases with reduced BFsh MUPs.⁹ Regarding our patient, there was no reduction in the BFsh MUPs, and complete motor recovery was achieved. Therefore, a simultaneous CPN and SN injury should be considered in cases that fail to recover.²⁷

Compared to EMNG, the US is more precise in determining the exact location of the nerve injury, while in comparison to magnetic resonance imaging (MRI), it has a higher sensitivity in detecting peripheral nerve pathology and understanding the mechanism of injury.²⁷ Thus, the US plays a very important role in diagnosing and managing the patients with peripheral nerve

injuries. It was already discussed in the literature that a CPN palsy following the acetabular fracture ORIF,¹¹ usually performed in the Cocker-Lagenback position (*Figure 2*), may be a consequence of SN traction by the retractors and consequential CPN compression due to its reduced mobility at the fibular tunnel. This mechanism may be applied to our patient, considering the US finding that revealed nerve thickening proximal to the fibular tunnel and intraoperative finding of the nerve (*Figure 1*) which was thinned at the site of the previous compression.

Figure 2. Drawing to Present the Proximity of the Sciatic nerve to the Retractors during the Acetabular Fracture ORIF Performed in the Cocker-Lagenback Position, with Courtesy of Strahinja Gligorijević, BA (Faculty of Biology, University of Belgrade). Flexion of the Knee is a Measure for preventing the associated CPN injury.

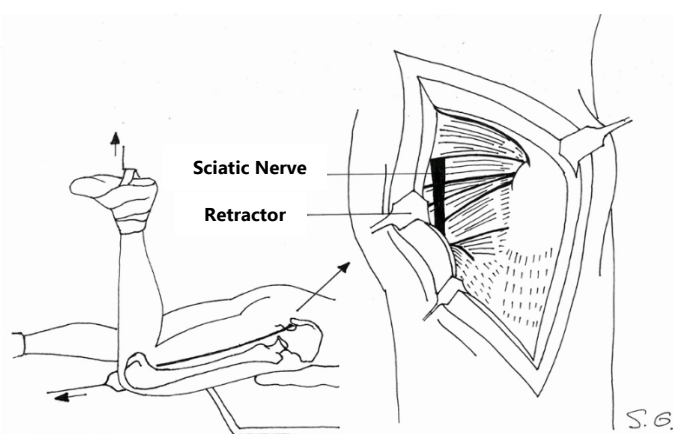
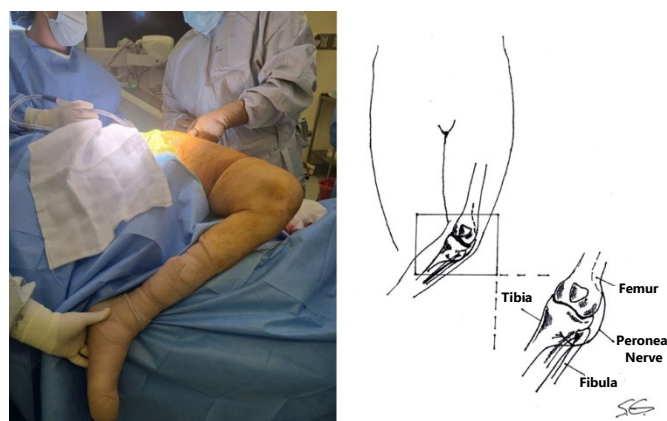


Figure 3. Leg Manipulation during the Antero-Lateral Approaches for Total Hip Arthroplasty (THA): (A) Intraoperative picture, with courtesy of dr Norma Izchel Orozco Aponte (Clinica de Nervio Periférico en Puebla, Mexico); (B) Drawing with Courtesy of Strahinja Gligorijević, BA (Faculty of Biology, University of Belgrade, Serbia).



Compared to the aforementioned mechanism of CPN injury following the acetabular fracture ORIF, there are some differences in cases that occur following THA. In the posterior approach for THA,²⁸ the SN is often visualized, and its traction may result in CPN compression at the fibular tunnel. However, in THA procedures in which the SN is not visualized,²⁹ such as the Smith

Petersen and Watson Jones approach, the cause of the CPN injury is probably SN stretching due to leg manipulation (*Figure 3*). Compared to the SN stretching by the retractors, in cases with leg manipulation, the length of the nerve stretch may be longer, resulting in more serious CPN entrapment or even a traction injury. In their study,⁹ Wilson et al. did not use the US to confirm isolated CPN entrapment and to differentiate cases with traction injury. This may be the factor influencing poorer postoperative recovery in some of their patients and indicates the importance of US usage in the preoperative evaluation of such cases.

Summary – Accelerating Translation

Slabost peronealnog živca manifestuje se padom stopala, funkcionalnim deficitom koji značajno remeti kvalitet života pacijenta. Lokalizacija nervnog oštećenja, koje uzrokuje pad stopala, može biti na relaciji od mozga, preko kičmene moždine do nerava. Povreda peronealnog živca na nivou kolena, kao posledica operacije kuka je već opisana u literature. Međutim, objavljeno je samo nekolicina radova koji se bave hirurškim

lečenjem ovakvih pacijenata, dok nema detaljno analiziranih slučajeva nakon otvorene redukcije i unutrašnje fiksacije karličnog preloma. Cilj ovog rada bio je da se opiše jedan takav slučaj, kao i da se prodiskutuju savremeni pristupi u lečenju ovih pacijenata.

Tridesetdvogodišnja žena je upućena na Kliniku za neurohirurgiju Univerzitetskog kliničkog centra Srbije, zbog levostranog pada stopala i bola u potkolnici. Povređena je u saobraćajnoj nesreći 8 meseci ranije, kada je zadobila dislokaciju kuka i frakturu acetabulum-a na levoj strani. Pad stopala nastupio je nakon otvorene redukcije i interne fiksacije preloma. Pomoću ultrazvuka i elektromioneurografije, povreda nerva locirana je na nivou kolena. Načinjena je dekompresija, deliberacija i spoljašnja neoliza n. peroneus – a, kroz poplitealni pristup. Olakšanje u vidu smanjenja bola je prijavljeno odmah nakon operacije, a kompletni oporavak je postignut 8 meseci kasnije.

Uzrok pada stopala nakon operacije kuka ne mora uvek biti na nivou kolena. Detaljna anamneza, fizikalni pregled i dijagnostička evaluacija su neophodni za pravilno lečenje ovih pacijenata. Uz elektromioneurografiju, ultrazvuk bi trebalo da bude esencijalan u preoperativnom planiranju i odabiru najefektivnije hirurške strategije.

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IFMSA Research Exchange: A Life-Changing Experience

Maria Konstantina Tzioti,¹ 

Introduction

As a Greek medical student with a particular research interest, my experience in higher education so far has failed to provide me with substantial knowledge about the research implications of the field. Given the COVID-19 pandemic, I had to spend my first year with online courses, while the possibilities to get involved in university projects as a sophomore were limited, mainly due to the restrictive measures taken to control viral transmission in my country. International Federation of Medical Students Associations' (IFMSA) research exchange program, organized by the Standing Committee on Research Exchange (SCORE), was an opportunity for me to participate in medical studies through bilateral agreements among institutions globally, combining education with interculturality.¹ Hence, I decided to take part in the exams to claim one of the available contracts offered to medical students of the National and Kapodistrian University of Athens, initially hoping for an exchange in a European country, as undertaking such a long journey posed a huge challenge for me. On these grounds, I accepted the contract for Argentina with great trepidation, hoping that a life-changing experience would be worth the risk. Admittedly, having spent a month in this beautiful country, I can now confidently say that it was the best decision I ever made.

Experience Report

Education

The research exchange took place at the Medical Faculty of the National University of Tucuman, in San Miguel de Tucuman, Argentina. I worked in the biomedical physiology department as a member of the research team, investigating the possible effect of vitamin D and antioxidants on vascular function in experimental models with hypertension.² Notably, I used the official language of Argentina, Spanish, to facilitate our communication in all the activities I was involved in.

From the first day in the laboratory, I managed to familiarize myself with the experimental animals and taking care of their nutrition and hygiene, always under the supervision of experienced researchers and their undergraduate assistants (*Figure 1*). I was also taught the proper way to handle the mice to perform various procedures, such as injecting an anesthetic,

transferring them to another cage, weighing them in order to calculate the appropriate dose of medication or distinguishing them according to their sex (*Figure 2*). Moreover, I was fortunate enough to observe a femoral arterial and venous catheterization for conscious blood pressure as well as heart rate measurements in a mouse and further understand the bioethical issues that researchers face, and learn about the protocol used for euthanasia and organ extraction. I became acquainted with the term 'reactive hyperemia' by performing a test to calculate the blood pressure differentiation in humans induced by a 5-minute forearm cuff occlusion.³

My educational experience in Tucuman was not confined to the laboratory, as I was able to visit the multi-purpose hospital "Angel Cruz Padilla" and learn of its specialties, under the guidance of the hospital doctors. Furthermore, I had the opportunity to attend a theoretical and practical course on the physiology of the electrocardiogram and interact with my fellow students. I learned about the medical curriculum in Argentina and made constructive comparisons with the corresponding curriculum in Greek universities regarding the duration of the studies and the evaluation system.⁴

Culture

Apart from the scientific training and the introduction to the basic principles of medical research, another vital aim of the program was to provide a complete and authentic cultural experience through the daily interaction with medical students-volunteers, along with participation in events and social activities organized by the local committee. Interestingly, the fact that I was the only incoming student that month did not impede me from experiencing the Argentinian customs and culture, all thanks to the excellent hospitality and amiability of the host family and the people I met at the university. As a result, I actively participated in family gatherings and celebrations, having the chance to delve into the Argentinian life and try local delicacies while enjoying folklore music and dances.

Concurrently, I seized any opportunity to explore places outside Tucuman; I travelled to the north, where I visited traditional villages such as Tilcara, Purmamarca and Jujuy, the famous wineries of Cafayate and the wonderful Salta. Overall, this trip

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enabled me to see landscapes of incredible natural beauty - the most overwhelming feeling I had ever experienced was when I saw the Iguazu Falls.

Figure 1. Taking Care of the Mice at the University Laboratory.



Self-development

Personal growth is utterly the most substantial benefit I derived from my exchange experience. Travelling on my own, meeting unique people along the way, and coming into contact with different values and ideals endowed me with a more open-minded perspective. Spending four weeks in Argentina boosted my self-confidence and extroversion, thus empowering me to free myself from stereotypes and fostering my trust in people.

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Undoubtedly, I consider this amazing educational training an invaluable self-discovery journey that added to my personal development.

Figure 2. Anesthetic injection.



Discussion

Personally, I feel grateful that I took advantage of the opportunity provided by IFMSA to prospective physicians to experience research and diversity in distant countries universally. Having promoted student mobility since 1991, the organization intends to lay the foundation for shaping the future world of medicine. During the project, I explored different scientific approaches and methodologies, adopting a broad understanding and holistic approach to the ethical concerns and practical issues that arise when planning and conducting a scientific study. The impression that the University of Tucuman left on me is definitely positive. Despite the lack of equipment and technical difficulties, the professors did their best to impart their knowledge, always treating me with the respect that is due among colleagues. Understandably, the possible obstacles that students may face during their exchange, such as the language barrier or cultural differences, cannot be overlooked. Nevertheless, I firmly believe that it is worth venturing out and testing these strengths beyond the comfort zone of the home institute; in all likelihood, they will be pleasantly surprised.

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Tackling the Learning Curve of Medical Terminology: Experience of a Medical Student with a Background in Classical Languages

Jigish Khamar.¹ 

The Experience

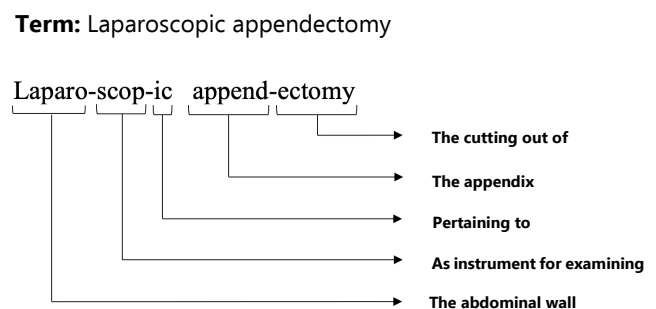
In Canada, medical schools accept students with a wide variety of past experiences. In my class alone, I have peers with diverse backgrounds such as nanotechnology engineering, forensic psychology, and English literature. Their unique perspectives help enrich my learning experience by expanding my perceptions. Likewise, my undergraduate experience was unique. Though my core degree was a Bachelor of Health Sciences at McMaster University, a typical program for many pre-med students, I also completed a Concurrent Certificate in the Language of Medicine and Health.

This concurrent certificate focused on allowing students to explore the origins of medical terminology through courses centered on Latin, Greek, and linguistics. The logic behind this certificate was that medical terminology has stemmed from the roots of classical languages and therefore, students with a basic understanding of these languages will be better equipped to understand medical terms. The professors used a formulaic approach to medical terminology by essentially fragmenting the medical terms into various Greek and Latin roots.¹ Therefore, students could learn a small number of classical roots and comprehend most medical terms. [Figure 1](#) demonstrates an example of the formulaic approach used in the Ancient Roots of Medical Terminology courses.¹ In the following paragraphs, I will describe my experience with learning the classical approach to medical terminology and its applications in medical education.

One of the most daunting aspects of medical school is the sheer volume of content that students must study. My program is an accelerated three-year medical program and so, every three months in my first year, I had to learn a new organ system. This involved a new set of medical terms in several domains (e.g., histology, anatomy, and pathophysiology). My background in medical terminology has proved to be useful in adjusting to this new learning curve posed every semester. When I see a new term, I use the Latin and Greek roots that I learned to get a general

sense of the word before I even learn what it means. For example, when we were reading a case about a pituitary tumour, we came across a procedure named transsphenoidal hypophysectomy. Most students in my class were overwhelmed by this seemingly complex term; however, I was able to use the formulaic approach to create a quick definition for myself - "the cutting out of the pituitary gland through the sphenoid bone." This is a reasonable deduction, especially for a student with no formal teaching on this topic. The lectures from the medical school help me refine my preliminary definitions, which makes memorization and understanding much easier and less intimidating since I already have a basic framework for each new term I encounter.

Figure 1. Formulaic Approach Applied to a Common Medical Term.



During the gastrointestinal unit, we encountered a series of confusing terms when discussing pathologies of the biliary tract. Terms such as cholangitis, cholelithiasis, choledocholithiasis, cholecystitis, and cholecystectomy were difficult to differentiate as they look and sound similar. I created a handout for my class as shown in [Figure 2](#) which displayed the formulaic approach to these terms and the response was amazing! By learning the individual roots, my classmates were able to better differentiate these terms, thereby reducing the time required for memorization.

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Discussion

Over the past few decades, there has been a reduction in hours spent on teaching anatomy in medical school.^{2,3} In my experience, the decreased hours of formal teaching makes anatomy an especially daunting topic for students which may even turn them away from pursuing careers in surgery, an anatomy-heavy discipline. On this point, Smith et al. integrated medical etymologies into their gross anatomy course and found that students reported an enhanced learning experience.⁴ Furthermore, a study by Stephens et al. found that medical students with a background in Greek and Latin performed better in anatomy examinations.⁵ Although Latin and Greek are not used as formal languages of communication anymore, my experiences and these studies both demonstrate that the study of medical terminology can be a worthwhile endeavor for those seeking a career in healthcare.

The formulaic approach to medical terminology only provides a basic template of the medical term, and cannot be expected to provide clinical context. For example, plasmapheresis can be translated using the roots, as “the removal of blood plasma.” However, this definition leaves out the fact that in the procedure the plasma is replaced by another solution or treated and then returned to the body. Thus, it is crucial to use classical roots only as a starting point rather than as a guide for clinical decision-making. Also worth noting is that eponyms such as Wilson’s disease that are based on a person, place, or thing, cannot be defined using roots.⁶ Lastly, not every part of medicine is derived from classical languages. One of the biggest pillars of medicine is pharmacology and many of the drug names originate from their chemical composition or colloquial language. Therefore, it could be that the formulaic approach is beneficial in the first few years of medical school when the content is taught in a classroom setting, but becomes less versatile as we progress into the clinical environment.⁷

Figure 2. Biliary Tree Pathologies Handout.

Roots

Cholecyst-	Gallbladder
Cholangi-	Bile duct
Choledoch-	Common bile duct
-lith	A calculus in(volving)
-iasis	The abnormal presence of
-ectomy	The cutting out of
-itis	The inflammation of

Definitions

Cholangitis	The inflammation of the bile duct
Cholelithiasis	The abnormal presence of a calculus involving bile
Choledocholithiasis	The abnormal presence of a calculus in the common bile duct
Cholecystitis	The inflammation of the gallbladder
Cholecystectomy	The cutting out of the gallbladder

In my experience, learning classical roots has allowed me a smooth transition into medical school. Since my classmates showed a great interest in the formulaic approach, I have partnered with the Classics Department at McMaster University to run a 6-week medical terminology course for McMaster medical students. I encourage other medical students to find ways to receive formal teaching in medical terminology before or during their early years of medical school as it can provide a strong basis for the following years. If you are unable to find a formal course, all is not lost. Be attentive, and find patterns in the terminology; just as you know by now that x-itis is “the inflammation of x” and x-ectomy is “the cutting out of x”, so too there are many more patterns out there for you to discover!

Summary – Accelerating Translation

Title: Tackling the Learning Curve of Medical Terminology: Experience of a Medical Student with a Background in Classical Languages

Before medical school, I completed a Concurrent Certificate in the Language of Medicine and Health which entailed completing courses in Latin, Greek, and linguistics. This certificate introduced me to the roots that make up the various medical terms in our vocabulary. Therefore, students who pursue this certificate can break down complex medical terms into their respective Latin or Greek roots and create logical definitions of most medical terms without prior formal teaching.

The transition into medical school can be difficult for many students and one of the most intimidating aspects tends to be learning the new terminology that healthcare professionals use daily. The primary benefit is that the skills I gained from having a background in Latin and Greek have helped reduce the amount of memorization that I need to do in medical school. Since I can create preliminary definitions of most medical terms using the roots, the lectures serve the purpose of filling in the gaps rather than teaching the topic from the beginning. Past studies have shown that medical students have responded positively to anatomy classes that integrate teachings of medical etymologies. The medical students with a background in classical languages performed better on evaluations compared to their classmates who did not learn the Latin and Greek roots.

Some considerations need to be taken into account with using classical roots to define medical terms. They only provide a basic anatomical or physiological definition which is not sufficient enough to be used in a clinical setting. Further research and teachings are required to transform the preliminary definitions into usable knowledge to guide clinical decision-making. Additionally, medical terms named after a person, place, or thing, cannot be defined with this approach as they do not originate from Latin or Greek roots. Lastly, this strategy is limited to many of the medical terms in pharmacology as these terms have generic names and brand names that are based on the chemical composition and company label.

In conclusion, I believe that learning the Latin and Greek roots is beneficial for many medical students, especially during the early years when they are overwhelmed by the sheer number of medical terms. Students will have an easier time navigating the lectures and will be able to focus on the clinical aspects more if they are not worried as much about memorization. This strategy is not a replacement for clinical experience, but rather a tool that students can use when facing unknown medical terms.

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Inviting Environmental Awareness Through Small, Sustainable Acts: Medical Students Impacting the Community

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The Experience

Impacting the community does not always mean creating exponential growth, it can also mean bringing small and sustainable changes to improve people's quality of life. Living in a developing country, we had a first-hand experience of seeing life in underprivileged communities. This experience expanded our desire to serve communities around us. However, due to the emergence of COVID-19 in Indonesia, most of the plans to contribute to our community were halted. Strict outbreak control measures, which restricted people's mobility, prohibited visits to these underprivileged communities.

The situation within Indonesia went awry during the within the first two years of the pandemic. However there were improvements in 2022. As a group of medical students, we were given a chance to organize a community service in collaboration with faculty members and hospital authorities in September 2022. As a part of the service, we were trusted to provide community counseling regarding the impact of the COVID-19 pandemic and how to dispose of used medical masks safely ([Figure 1](#)).

We were inspired to educate on this topic after observing heaps of used masks piling up at the side of beaches we visited. Disposable surgical masks are commonly made of polypropylene arranged into three layers. Each layer serves a different function, restricting the transmission of small particles and pathogens from both directions.¹ Increasing numbers of medical masks at the household level observed during recent years meant a global increase in the production of plastic waste. While wearing a mask

is very crucial for health protection, these masks may pollute the environment physically and biologically, thus minimizing the effects of health protection plans. These masks could contain sufficient pathogens capable of infecting susceptible hosts. If this waste is not discarded appropriately, cross-contamination to scavengers (both humans and animals) in landfills may occur,² perpetuating a never-ending chain of infection in the environment. Post-landfill, leachate may flow to nearby or even further areas, spreading COVID-19 through fomites while also being a threat to marine environment.^{3,4} Apart from the risks of infection, the polypropylene in face masks will eventually disintegrate into smaller micro- and nanoplastics which are genotoxic and cytotoxic to terrestrial and aquatic species.⁵ The microfibers that are broken down from face masks may enter soil and water as leachable compounds, thus polluting human food chain in the ecosystem. Furthermore, it was found that direct disposal of masks into aquatic environment would release more microfibers, which might aggravate threats to the aquatic ecosystem.^{5,6}

In addition to microfibers, certain types of masks which contain a nose wire made from metals were also found to produce heavy metal substances, such as lead (Pb), cadmium (Cd), and chromium (Cr). These substances could cause toxicological effects to the environment and especially to human health, such as carcinogenic effects, kidney and neurological damage, asthma, or even death. Even if the masks were to be incinerated instead of direct disposal, the volatile organic compounds (VOCs) that are produced should be considered since some of them are hazardous in nature.⁵

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Figure 1. Community Counseling about the Proper Ways of Disposing of Medical Masks.



The management of medical mask waste can be divided into upstream and downstream management. The focuses of upstream management include mass education and strict community monitoring to maximize household-based waste management. This process includes sorting out infectious waste from other organic and inorganic waste and decontamination via heating or disinfectant baths. Keeping this infectious waste dry is crucial to prevent leachate.⁷ Proper labeling and categorization will help garbage collectors identify which waste must be treated separately.⁷ Downstream management focuses on the formulation of a novel system and readjustments of existing operational protocols regarding these kinds of infectious waste to countermeasure rapid fomite spreading of the pathogen. These include specific scheduled pickup times, specialized waste management areas, chemical valorization, and physical valorization.^{7,8}

Figure 2. Symbolic Handover of Labeled Trash Cans by Faculty Members and Hospital Authorities to Local Representatives.



Specialized areas for the management of personal protective equipment (PPE) waste should be assigned, where every waste

being disposed of must first be disinfected to avoid the possibility of cross contamination towards workers within the area.⁷ Temporary and proper storage of the disposed masks could act as a conventional method of disinfection since studies have reported that viruses can only survive up to 9 days depending on several factors. The installations of developed mobile and on-site disinfection units to further reinforce the disinfection process should also be considered by the government. Regarding chemical valorization, the method of incinerating masks is not recommended due to the toxic compounds it produces in the process. Several alternatives have been discovered and should be considered by developing countries. These alternatives include pyrolysis, which is an environment-friendly process of converting solid plastic waste into liquid fuel, and carbonization, which is an energy-saving process of converting polymer waste into different valuable carbon materials.⁸ As for physical valorization, developing countries could benefit from integrating plastic fibers of masks waste into building materials. Several researchers have shown that the addition of mask fibers could improve the strength and endurance of asphalt, pavement, and even concrete.^{8,9}

As an alternative, sterilizing face masks for reuse through heating is proven to be effective in killing pathogens and results in minimal reduction in particle filtration efficiency (PFE).^{10,11} However, even though this solution is environment-friendly, standardization and ethical concerns may be an issue. Moreover, this solution would drive up the costs of masks as special and calibrated equipment is required. This may exacerbate the health inequity gap in underprivileged or overcrowded communities. As for the ethical issues, this may include the possibility of mask reuse by different people. Therefore, governments usually opt to appeal to the public to disfigure medical masks before disposal to prevent misuse by unwanted parties.

All things considered, we were required to think holistically and to act based on public health by educating the community about the potential harm of improper handling of medical waste. Putting our theoretical knowledge into action, we learned to apply a lot of skills and 'practical' knowledge we obtained from our lectures and textbooks. We learned to act based on our scope and capacity, educating the upstream while trying to gain attention from authorities regulating the downstream processes.

The activity by itself was heartwarming. We had the opportunity to converse with people who were part of the local Family Welfare Movement. They raised their concern, later urging us to speak with local trash regulators out of concern that the trash-collecting regulations from the authorities might not have supported this movement. Faculties and hospital authorities also sponsored our activity, which was shown by the handover of labeled trash cans (*Figure 2*). Afterwards, news of our action was spread through social media. We were then invited to speak at a local radio station to provide the same presentation and moral message as we had previously given, but this time in front of a larger audience

([Figure 3](#)). We also uploaded an original animated video to YouTube, which is watchable at <https://www.youtube.com/watch?v=boV28Pf8tz0>, to help the younger portion of our community understand the steps to dispose of medical waste safely. Again, through small and sustainable changes, we can also bring about an impact in the community and improve the people's quality of life.

Figure 3. Invitation to Speak at a Local Radio Station about Proper Disposal of Medical Masks.



This was a wonderful experience for the community and us. Not only did we spread awareness about the physical harm that

improper handling of medical waste may have brought, but we also helped our community and children strive for a greener future. These small actions bring sustainable impact in our community. Now is not the time for medical students to be impractical intellectuals, but it is time for them to understand theoretical knowledge holistically, to process real-life issues critically, and to act upon it decisively for the betterment of our community and our future.

Summary – Accelerating Translation

In this article, as a group of medical students, we organized a community service in collaboration with faculty members and hospital authorities. During the service, we provided community counseling regarding the impact of the COVID-19 pandemic and the proper way to dispose of used medical masks. This topic was brought up out of concern regarding the harm towards the environment and human health that could be caused by infectious waste. There are many methods, whether upstream or downstream, that should be considered to countermeasure the adverse effects of infectious waste. From this real-life situation, we were required to think holistically and to act based on public health principles through community education. We had a heartwarming experience as we were able to converse with and to receive the point of views of the local people. The news of our action was spread through social media and we were then invited to convey our moral messages at a local radio station. We also uploaded an original animated video to YouTube, which may help with the understanding of the younger portion of our community. Lastly, medical students are not meant to be impractical intellectuals, but they should be able to understand theoretical knowledge holistically, to process real-life issues critically, and to act upon it decisively for the betterment of our community and our future!

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Developing A Clinical Evidence Retrieval Service in Response to the COVID-19 Pandemic

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The Experience

During the initial stages of the COVID-19 pandemic, policies and treatment guidelines underwent rapid and frequent revisions based on varying levels of evidence. The COVID-19 Evidence Retrieval Service (CERS) was founded to uphold patient care with the conscientious use of EBM amidst the emergent nature of the pandemic to ensure that local clinicians were well-updated on the latest evidence on COVID-19 according to local needs.

As the first medical student and a coordinator in CERS, I was involved in designing, implementing, and running of CERS. My role as a coordinator often involved identifying and resolving issues ahead of time. This meant that my responsibilities ranged from managerial to administrative to service provision. This allowed me to always retain a macroscopic perspective of the service. This article further analyses my experience and further applications from setting up this service.

Components and Implementation of Cers

CERS was initiated and supported by a multidisciplinary team of qualified EBM practitioners (professors from various specialties like primary care, rehabilitation, and family medicine), medical officers, senior medical students, and academic librarians across different educational institutions. This service built upon the team member's initial study, 1 and incorporated the experience of Grandage et. Al, 2 who highlighted the efficacy of academic librarians and the American Gastroenterology Association, 3 who condensed their recommendations while keeping clinicians aware of the shortcomings of the guiding research.

Three main teams were involved in the service's process: the support, evidence retrieval, and expert panel. The support team oversaw retrieving and segmenting clinical queries into the Population, Intervention, Control, and Outcome (PICO) 4 format and sending pre-appraisal forms containing the relevant literature to the experts. They would then receive completed appraisals from the experts and send a summary via WhatsApp to the clinician asking the question. The evidence retrieval team would conduct a thorough search for literature and upload the completed appraisal forms to the website. The expert panel identified the best evidence provided by the evidence retrieval team, appraised it, and would conduct their search for relevant papers if they believed that the literature provided was unsuitable.

Working in a multidisciplinary team allowed me to hone my communication skills by presenting information concisely and appropriately to team members of various hierarchies. To ensure that morale was high, weekly virtual team meetings were organized to ensure that the team members were aware of the service's efficacy and could see their impact.

The service was piloted across public hospitals in Malaysia on the 21st of March 2020, with support provided by the Faculty of Medicine, University of Malaya. Weekly publication of the service occurred via the team members' communication networks to clinicians based in Malaysia to raise awareness of this service. Dissemination was carried out through existing WhatsApp group chats, research mailing lists, and posters being displayed physically around various hospitals. Clinicians interested in the

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About the Author: Wei Zhuen Chew is a junior doctor with a strong interest in incorporating evidence-based medicine for patient care. As part of the founding team of this multidisciplinary team service, which has received acknowledgement from the International Federation of Library Associations and Institutions, he was a finalist in the free communication session at the Asia Pacific Medical Education Conference (APMEC) 2022 and has had the opportunity to present this piece of work in APMEC 2022.

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service would contact the service and fill in their questions via Google Forms. These questions would then be categorized into critical or non-critical questions and background or foreground questions. The distinction between critical and non-critical questions was made because critical questions would alter the clinician’s healthcare practice. Background questions were defined as questions with established answers, and foreground questions were defined as questions requiring an appraisal of the available evidence.

Figure 1. Flowchart of CERS Operational Structure

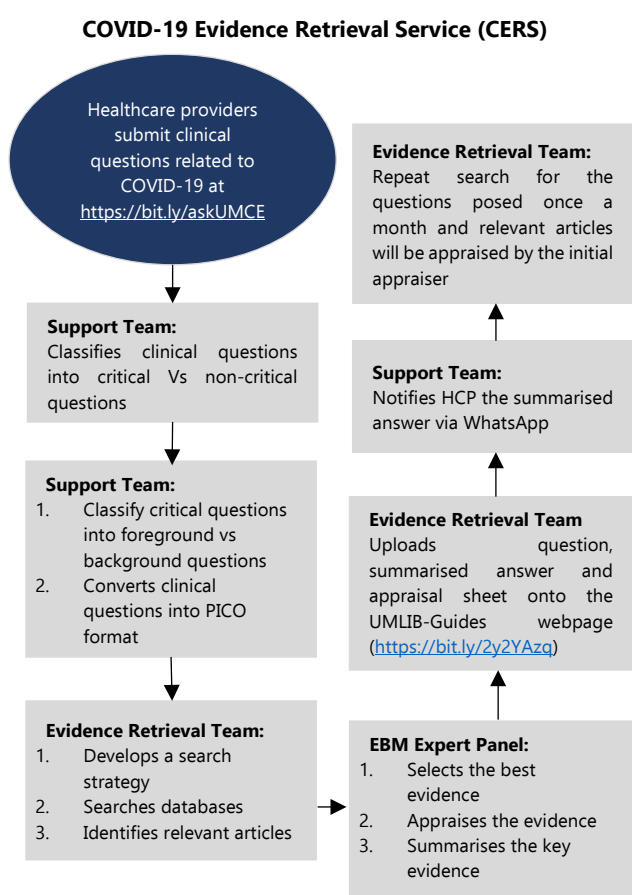


Figure 1 provides a visual representation of the service. The search strategy was conducted by identifying and searching for key concepts alongside the terms in Table 1. The databases searched are listed as follows: MEDLINE, Cochrane Library, COVID-19, TRIP Database, Wiley, UpToDate, WHO database, CINAHL, Ovid database- COVID-19 special collection, Clinical Trials (clinicaltrials.gov), Web of Science, Science Direct, Google Scholar, Google, CEBM ERS and the Ministry of Health, Singapore, also had their databases searched. These search strings would then be saved on the respective clinical search structure to allow the search to be rerun after 4-6 weeks. Given the nature of rapidly evolving evidence, this repeated search run was necessary to incorporate any new evidence into the appraisal. Any further evidence would undergo the same process of appraisal and dissemination.

Table 1. Search Strings Used.

(wuhan, OR buaian)	"coronavirus"[MeSH Terms]
2019 novel cox	Coronavirus infection*
2019nCoV	2019 novel coronavirus*
2019-nCoV	novel coronavirus
2019-novel corona virus (2019-nCoV)"	novel coronavirus pneumonia (NCP)
oronavir*	betacoronavir*
coronavirus	DEOX
coronavirus infections"[McSH, Terms]	sarcov2
COV2	. COVID-19
COVID 19	Cav
COVID19	COVID
NCP	SARS-CoV-2
new coronavirus	sari
SARS	severe acute respiratory syndrome corona virus-2
severe acute respiratory infection (sari)	(SARS-CoV-2)
Wuhan pneumonia	corona virus

Service Analysis

Our experience proved that many opportunities arise from a virtual work environment. The virtual environment contributed to CERS’ sustainability as it allowed team members to work at their convenience and collaborate with members from different institutions and disciplines. The inclusionary nature of this service should have far-reaching effects in the future because of the expansion of local networks of researchers with a similar.

Table 2. Composition of Meeting Attendees.

Date	Number of attendees at the meeting	Profile of attendees	Meeting duration (hours)
26/03	4	Professor Medical officer (X2)	1
28/03	3	Medical student Professor (X2) Medical student	1.5
3/04	9	Professor (X5) Medical officer (X2) Medical librarian Medical student	1.5
10/04	10	Professor (X6) Medical officer (X2) Medical librarian Medical student	1.5
24/04	10	Professor (X6) Medical officer (X2) Medical librarian Medical student	1.5
07/05	9	Professor (X6) Medical officer (X2) Medical librarian Medical student	1

CERS fulfills a niche in catering to the needs of the local population in Malaysia. Having a local service reduces the barriers for a clinician to ask questions because the service members recognize cultural nuances while providing a platform for local medical student participation and education.

Figure 2. Unique Questions Received by CERS.

'Is there literature present regarding boiling pharyngeal swab samples to 98 degrees celsius for five minutes instead of using chemical kit reagents?'
'In view of face mask shortage, what is the best way to sterilize and reuse a face mask safely?'
'Can we wear 2 pieces of 3ply Surgical Mask to replace N95?'
'Do we really need a full PPE suit if the SARS-CoV2 virus is transmitted via the respiratory tract? Should review PPE usage, and avoid unnecessary practice/waste.'
'What is the best method to sanitize N95 masks for reuse in Primary Care Setting?'

Formal feedback was sought from users who engaged with the service. 11 out of 12 users reported feeling satisfied or very satisfied with the service and rating the quality of answers as high or very high. A further 75% (8/12) of respondents reported that using this service significantly changed their clinical practice. The mean time it took for questions to be answered from the time it was received for our sample size was 10.5 days (range 1-19 days, median = 10 days).

Takeaways

Our experience has reinforced that an integrated, evidence-based retrieval service is feasible and useful for two reasons. Firstly, it supports healthcare workers – both future and current - and

policymakers in making informed decisions. Secondly, undertaking systematic appraisals efficiently trains the next generation of practitioners to prioritize an evidence-based approach.

The cohort of medical students, including myself, involved in CERS has used the skills learned – literature searching and critical appraisal skills - to complete and publish their research across various specialties in different peer-reviewed journals. The leadership skills developed through this evidence retrieval service have also enabled them to make substantial contributions during their clinical placements by presenting cases in multi-disciplinary team meetings.

Summary – Accelerating Translation

Title: Developing A Clinical Evidence Retrieval Service In Response To The COVID-19 Pandemic

Main Problem to solve: Addressing a local population's health needs through equipping front line workers who needed to concentrate their efforts on addressing patient's acute needs. Further, identifying opportunities for medical students to further their development as medical education took a break during the pandemic.

Aim of the experience: Sharing lessons learnt and offering a consultancy service for aspiring medical students/clinicians wanting to start their own local evidence retrieval service.

Methodology, Results and Conclusion: Each population has unique circumstances. A local evidence retrieval service addresses these needs while training the next generation of doctors in evidence-based medicine. The lessons learnt from our experience can help to accelerate the composition and starting of similar services which have long lasting impacts for clinicians served and medical students educated.

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