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

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IJMS INTERNATIONAL JOURNAL *of* MEDICAL STUDENTS

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

The *IJMS* receives submissions where there is at least one author enrolled as a medical student in any medical school in the world or a recently graduated physician worldwide. For research articles, early-career scientists must be accompanied by a senior researcher that must be also responsible for the research, guaranteeing the quality of the work. We publish Original Articles, Short Communications, Reviews, Case Reports, Interviews, Experiences, and Letters, which follow an innovative and unique two-step, double-masked peer-review process, in brief:

> *The first step of revisions is carried out by two Student Editors (medical students with publications indexed in the US National Library of Medicine (NLM) with the supervision of an Associate Editor. The aim of this step is to improve the quality of articles and identify those that can proceed to external peer-reviews. The second step of revisions is carried out by external peer-reviewers who are researchers with publications indexed in the NLM related to the topic of the submission.*

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The *IJMS* acceptance rate in 2023 was 29% of the 464 submissions. Published articles in 2023 came from around 40 different countries. The average time to a first decision is 5 days, 139 for acceptance, and 46 days to decline a submission. The time between submission and final publication in most cases has been three to four months depending on the diligence of Peer-Reviewers and Authors.

The journal's website got over 269 thousand visits only in 2022. The *IJMS*'s reach includes a growing social media presence (more than 20,000 followers on X, Facebook, Instagram, YouTube, and LinkedIn). Only in the last year, the Journal has been visited from nearly every place in the world (+190 countries). You can find more of the *IJMS* statistics here.

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There are no article processing charges, submissions fees, or any other costs required of authors to submit, review or publish articles in the IJMS.

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All papers submitted to the International Journal of Medical Students will undergo a two steps peer-reviewers process. The first step of revisions is carried by two anonymous Student Editors who will work together with one Associate Editor. In the second step, the manuscript will be reviewed by two anonymous reviewers (Editorial Board members, Associate Editors and/or invited reviewers with expertise in the subject matter). Authors will remain anonymous to all the referees.

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The *IJMS* also strive towards the training of a new generation of Editors and Peer-reviewers promoting different training strategies among our Editorial Team that includes the Web of Science Academy courses and the Committee on Publication Ethics (COPE) courses available to its members (*IJMS* is a member of COPE).

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Year 2024 • Months Apr-Jun • Volume 12 • Issue 2

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Table of Contents

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Year 2024 • Months Apr-Jun • Volume 12 • Issue 2

Int J Med Stud. 2024 Apr-Jun; 12(1)

IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Editorial

Transforming Toxic Research Cultures: Protecting the Future of Medical Students and Early Career Researchers – Part I

Hamrish Kumar Rajakumar,[1] Mihnea-Alexandru Găman,[2] Juan C. Puyana,[3] Francisco J. Bonilla-Escobar.[4]

The Hidden Crisis in Academic Research

The Royal Society defines research culture as the behaviors, values, expectations, attitudes, and norms of our research communities. It influences researchers' career paths and determines the way that research is conducted and communicated.[1] Medical research suffers from a hidden problem: a toxic culture that threatens the well-being and development of its participants. While it is known for contributing to scientific medical advances, the reality for many medical students and early career researchers is very different.

Have you ever worked tirelessly on research, only to have your supervisor demand being listed as the primary author, leaving you demoted to a secondary position or not acknowledged at all? Or perhaps you have faced a situation where permission to conduct research was denied because you did not include someone as a co-author, despite their lack of involvement in the actual work. Or have you experienced constant criticism and belittlement from your supervisor, causing you to doubt your abilities and reconsider your research career? If you have experienced any of these situations, you have been a victim of a toxic research culture. These are some examples but not all the potential situations that summarize this issue.

This culture undermines research integrity and threatens the health and career prospects of young researchers eager to advance medicine. It remains covered in a culture of silence and acceptance, despite its prevalence. Addressing this is essential to protecting researchers' interests, maintaining the integrity of medical research, and advancing scientific progress.

Historical Context: Evolution of Research Culture in Medicine

Medical research culture has evolved through various historical milestones being shaped by social norms, scientific advances, and economic pressures. From the systematic observations of Hippocrates[2] to the competitive grant-driven research environment post-World War II.[3] The emphasis on quantitative outputs over qualitative contributions, driven by technological innovations in the 20th century, has significantly shaped today's research culture leading to a publish-or-perish mentality[4].

Defining Toxic Research Culture

The term "toxic research culture" refers to the spectrum of harmful practices in academic and research institutions that undermine the well-being and professional development of researchers.

Hugh P. McKenna defines it a range of harmful practices,[5] including:

1. Bullying and harassment
2. Poor employment terms and conditions
3. Inadequate practices in equality, diversity, inclusion, and belonging
4. Breaches of research integrity
5. Pathological pursuit of higher league table positions, H-indices, and impact factors
6. 'Ghost authoring' where senior researchers take undue credit for work primarily done by junior staff

Factors cultivating this culture include short-term contracts, inadequate salaries (especially for early-career researchers), competitive work environments, and the relentless pressure to publish.[6]

Shahnawaz MG and Siddiqi N. describe toxic research supervisors as individuals who tear apart your work without mercy, publicly humiliate you, offer no support whatsoever, abandon you to fend for yourself, and actively work to erode your confidence and progress.[7]

The pathognomonic feature of these toxic environments is a hierarchical structure that grants substantial power to a select group of senior researchers. This power mismatch creates a cycle in which junior researchers are compelled to tolerate harsh conditions to advance their careers.[8,9]

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Manifestations of a Toxic Research Culture

Toxic research culture manifests in various detrimental ways, including:

1. Higher risk of depression and anxiety compared to the general population.[10]
2. Bullying and harassment reported by 43% of researchers, with 61% witnessing such behavior (Wellcome, 2020).[11]
3. Post-traumatic stress disorder, and suicide in severe cases.[12]
4. The COVID-19 pandemic exacerbated these issues by shifting from traditional face-to-face bullying to new forms such as abusive emails.[13]
5. Authorship abuses, such as coercion, guest authorship, gift authorship, mutual support authorship, duplication, ghost authorship, and denial of authorship, which are rampant in hierarchical research structures.[14,15]

Over the last decade, researchers identified several significant issues in research settings such as poor management of personnel, work-life imbalance, bullying and harassment, a culture of publishing that suppresses creativity, high levels of stress, and a lack of diversity.[16]

Breaches of Research Integrity

Researchers who felt underappreciated or denied proper credit are more likely to engage in misconduct and unethical behavior.[17] According to Smith R, the primary reason researchers resort to research misconduct is pressure to publish.[18] In toxic environments, the emphasis on productivity metrics often overshadows ethical research practices.[19] For instance, a meta-analysis of survey data revealed that 1.97% of researchers admitted to manipulating data and 33.7% admitted to questionable research practices to meet publication pressures.[20] This highlights the ethical compromises researchers might make under intense productivity pressures. Junior researchers are especially vulnerable to the negative impacts of such breaches, which can have long-lasting effects on their professional careers. Eric Poehlman, a University of Vermont researcher who spent 12 months in federal prison for falsifying data, attributed his actions partly to a toxic research culture "I was on a treadmill, and I could not get off".[21]

The Vulnerability of Medical Students and Early Career Researchers

The inexperience of medical students and early career researchers navigating the complexities of research ethics and professional conduct makes them vulnerable. The intense competition for funding and positions in academic medicine may create a culture of secrecy and self-protection rather than openness and collaboration.[22] This further isolates junior researchers who are still establishing their professional identities.

A study by Casadevall and Fang indicates that early career researchers are particularly vulnerable to ethical lapses due to the intense pressure to publish. This pressure is intense for medical students navigating their first research projects because of academic and professional stakes.[23] This underscores the need for comprehensive support systems for junior researchers.

Junior researchers often face situations where supervisors or senior authors impose honorary authorship due to hierarchical power.[24] The promised authorship or order can suddenly change without their consent. Furthermore, a junior researcher may become a ghost author if they leave their lab before the research is published as their contributions are not properly recognized as co-authorship.

Current Policies

Table 1 outlines key policies and charters aimed at improving research culture.[25-31] For instance, the Wellcome Trust's Bullying and Harassment Policy (2021) and BEIS's People and Culture Strategy (2021), aim to foster positive research environments by addressing workplace conduct and promoting diversity and ethical practices. Initiatives like DORA (2023) advocate for reforming research assessment to prioritize quality over quantity, while CoARA (2022) works to standardize evaluation practices within the EU. The Research Development Concordat (2023) supports researchers' career development and well-being, and the Race Equality Charter (2023) focuses on improving ethnic representation in academia.

Strategies for Change

1. In a survey of 13,000 researchers from over 160 countries, with strong representation from the top 10 research-producing countries and diverse minority groups, 49% stated they were afraid of getting in trouble if they asked for assistance.[32] It is therefore essential to create an environment where whistleblowing is not seen as a threat to one's own career. This is important for medical students and early career researchers who worry that senior researchers may affect their professional profiles and limit future opportunities.

2. The current system concentrates power in the hands of a few people. Principal investigators are usually given sole responsibility for grants instead of sharing them more evenly among team members. Because of this hierarchical structure, a single principal investigator oversees a large number of junior researchers. Similarly, heads of departments are led by a single person. A fairer environment can be achieved by encouraging leadership diversity and equitable responsibility distribution among team members.

3. According to Rice et al.'s[33] review of 92 faculties worldwide, 95% of promotion and tenure guidelines are influenced by peer-reviewed publications, authorship order, journal impact factors, grant funding, and reputation. It is necessary to update these traditional criteria to reflect modern research practices that encourage diverse contributions.

4. Structured educational interventions could be used to immunize academic environments against toxicity.[34] A Course

on Research Ethics and Integrity could function as a metaphorical vaccination. These would provide researchers with ethical frameworks and resilience against unethical practices and hostile work environments.

5. Initiatives to reduce the over-dependence on quantitative metrics and research output in evaluating promotions and grant applications. A more holistic view of researchers' contributions could be achieved by Introducing narrative CVs and concordat for career development.[16]

The Swiss National Science Foundation successfully introduced the SciCV narrative CV format, which broadens evaluation criteria providing insights into academic backgrounds.[35] Harvard University's introduction of narrative CVs in 2022 has shown promising results in reducing the emphasis on quantitative metrics and encouraging a more holistic evaluation of researchers' contributions.

Table 1. **Key Policies and Charters Influencing Research Environment.**[25-31]

Policy / Charter	Description
Wellcome Trust's Bullying and Harassment Policy (2021)	Policy aimed at addressing and preventing bullying and harassment within the research community supported by the Wellcome Trust.
People and Culture Strategy (BEIS, 2021)	The strategy focuses on creating a positive research culture by addressing aspects of workplace culture and professional conduct.
Vitae Reports (Parr, 2021)	An organization dedicated to supporting the professional development of researchers. It provides an understanding of current issues and practices.
San Francisco Declaration on Research Assessment (DORA, 2023)	Declaration advocating for the reform of research evaluation practices. It emphasizes the need to assess research based on its merit rather than journal metrics.
Coalition for Advancing Research Assessment (CoARA, 2022)	Agreement within the European Union to standardize and improve research assessment practices.
Research Development Concordat (2023)	An agreement between universities, research institutes, and funders to support the career development of researchers in the UK
Race Equality Charter (2023)	It focuses on improving the representation of ethnic staff within universities with the aim of equity and diversity in academic environments.

Conclusion: A Call to Action

In conclusion, addressing toxic research cultures is imperative for the future of medical research. By prioritizing mentorship, mental health, ethical behavior, collaboration, and inclusivity, we can create a supportive environment for medical students and early career researchers. Institutions must take decisive action to safeguard the welfare of junior researchers and uphold the integrity of scientific research.

Another important action is to avoid fake mentors. A mentor should be transparent, serve as a role model, and provide experience, support, and knowledge.[36] A real mentor will help mentees develop their skills, navigate challenges, and achieve their career goals.[37-38] Tackling toxic research culture includes steering clear of individuals with a poor record of successful mentees, those who are unavailable, unwilling to invest time in your growth, and those with a poor reputation. Genuine mentors will foster a positive and constructive learning environment, unlike fake mentors who may exploit their position for personal gain or fail to provide meaningful support.

Moving forward, abolishing toxic research culture requires implementing policies such as the Wellcome Trust's Bullying and Harassment Policy and advocating for reforms like those in DORA and CoARA. This includes revising evaluation criteria to prioritize quality over quantity, promoting diversity and equitable distribution of responsibilities, and enhancing educational interventions in research ethics.

Role of the International Journal of Medical Students

The International Journal of Medical Students (IJMS) can play a pivotal role in addressing and mitigating the toxic research culture by promoting ethical research practices and supporting early career researchers. IJMS is dedicated to fostering positive change by prioritizing publications that involve mentorship, emphasizing articles that highlight successful mentorship models and strategies for creating inclusive and supportive research environments. By partnering with organizations that advocate for research quality, IJMS ensures that its standards align with the best practices in the field. The journal is committed to accessible research, offering free open access to its publications to ensure widespread dissemination of knowledge. Additionally, IJMS promotes ethical and sustainable research practices, providing a platform for early career researchers to share their experiences and challenges. Through webinars, workshops, and discussion forums on topics like research ethics, mental health, and professional development, IJMS can and will offer valuable resources and support. By advocating for fairer and more holistic evaluation criteria within academic institutions and funding bodies, IJMS aims to transform the research culture into one that is nurturing, ethical, and conducive to scientific advancement.

In this Issue

In the upcoming issue of the International Journal of Medical Students, we feature a diverse array of articles addressing crucial health issues and educational insights. One highlight includes a study on antibiotic use awareness among the Indian community during the later stages of the COVID-19 pandemic, revealing significant gaps in knowledge and proper usage.[39] Another study

explores the disparities in blindness prevalence among different racial and ethnic groups in Texas, uncovering higher rates among Black individuals, which underscores ongoing healthcare inequalities.[40]

Additionally, we present an evaluation of tuberculosis-related information on Instagram, noting that posts by medical professionals tend to be more accurate.[41] Further, we describe menopausal symptoms in post-menopausal women in Eluru, Andhra Pradesh,[42] and examine the quality of intimate area examination training among Pakistani medical students.[43] The issue also delves into innovative educational methods, such as leveraging podcasts for nutrition education and the impact of skipping breakfast on sleep duration among medical students.[44,45]

Moreover, the impact of COVID-19 on the U.S. healthcare system is analyzed,[46] alongside a systematic review of stress factors affecting medical students' academic outcomes.[47] Other notable articles include three case reports, one about Bardet Biedl syndrome,[48] another about disseminated tuberculosis and how challenging this diagnostic can be,[49] and a discussion on the potential for continuous rifampicin therapy to induce acute kidney injury in tuberculosis patients.[50] Personal reflections from medical students on their experiences with research and patient loss,[51,52] and an acting internship in colorectal surgery,[53] round out this comprehensive issue. These articles aim to enrich the ongoing dialogue on improving healthcare education and addressing health disparities.

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Original Article

Antibiotic Use Awareness and Practices in the Indian Community During Later Stages of COVID-19 Pandemic: A Cross-Sectional Survey

Hiyanoor Ghosh,[1] Kanchan Gupta.[2]

Abstract

Background: An increased overuse of antibiotics coupled with dearth of newer alternatives has worsened antibiotic resistance in LMIC's like India. The prescription of antibiotics for symptoms similar to COVID-19 infection has aggravated the problem of antibiotic overuse, further worsening antibiotic resistance. This study aims at understanding not only the extent of overuse, but also the social patterns and causes of over-prescription or self medication of antibiotics in India. **Methods:** A cross-sectional survey of the knowledge, attitude and practices on antibiotic use was conducted from September to October, 2022, using a Google form questionnaire. A virtual snowball technique was used to recruit respondents. **Results:** A total of 309 responses were received (56% female and 44% male). 59.5% of the respondents were between 15 to 30 years. Surprisingly, in spite of a majority of respondents (around 70%) having a health sciences background, 67.8% of respondents falsely believe that antibiotics speed up recovery from most coughs and colds. 94.8% of respondents had used antibiotics in the last one year. 17.2% of respondents had taken antibiotics without the prescription of a doctor. The most common antibiotic used on prescription and self-medication was Azithromycin. Only 20.7% of respondents took antibiotics on suspicion of having COVID-19, with the most common one being Azithromycin. **Conclusion:** The study highlights that a greater knowledge on antibiotic use does not necessitate better attitude towards their cautious and rational use. The use of antibiotics for self-limiting indications like cough, cold and sore throat needs to be restricted through stricter regulations.

Introduction

Antibiotics have changed the course of medicine. Morbidity and mortality due to previously fatal diseases like pneumonia, tuberculosis and typhoid has been drastically reduced with antibiotic use. It has permitted life-saving invasive procedures with minimal risk of infection. The biggest beneficiaries of antibiotic therapy have been countries with the greatest load of infection, which correspondingly are mostly lower- and middle-income countries (LMIC) like India.[1] With the medical breakthroughs that antibiotics accomplished came the concomitant problem of antibiotic resistance (AMR), which has been expedited by the indiscriminate use of antibiotics. This increased usage of antibiotics coupled with the dearth of newer alternatives has worsened antibiotic resistance.[2-4] High rate of drug resistance was seen in some of the commonest healthcare associated (HAI) and community acquired infections e.g., UTI and pneumonia.[5] Contracting drug resistant bacteria prolongs hospital stays and causes preventable damage: 1.27 million deaths globally were directly attributed to antibiotic resistant infections in 2019.[6]

India has one of the greatest infectious disease burdens in the world as a part of BRICS (Brazil, Russia, India, China and South Africa).[7] India has the highest drug resistance index (DRI) amongst all HIC and LMIC's.[8] Overuse of and hence resistance against first line antibiotics coupled with limited accessibility of costlier second line antibiotics effective against drug resistant microbes is a two-pronged problem for an LMIC like India. An unregulated private sector accounts for 90% of antibiotic sales,[9] leading to the unauthorized sale of antibiotics as over the counter (OTC) drugs in India, despite them being prescription drugs. Certain studies conducting pharmacist interviews reveal commercial interests, poor access to public healthcare, economic and time constraints among consumers, lack of stringent regulations, and scanty inspections as a cause for OTC antibiotic dispensing.[10] The Indian government, taking into account the alarming rise in AMR related mortality and morbidity, launched an Antibiotic Stewardship Program to promote rational antibiotic use.[11] The greatest challenge lies in regulated restrictions on sale of effective antibiotics along with ensuring antibiotic availability for genuine use.

Another factor further worsening overuse in the current era is the prescription of antibiotics for symptoms similar to a COVID-19 infection or even after the diagnosis of COVID-19. Despite instructions from the Indian Council for Medical Research (ICMR) and the World Health Organization (WHO) for use of antibiotics only in cases of secondary bacterial infections in COVID-19 patients,[12] there is evidence to suggest that most patients were

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prophylactically prescribed antibiotics. Even though antibiotic sales in many HIC's during COVID-19 decreased, adult antibiotic doses in India increased.[9] Researchers estimated that COVID-19 likely contributed to 216.4 million excess doses of antibiotics for adults and 38 million excess doses of Azithromycin for adults during a period of peak COVID-19 activity in India.[9]

With greater emphasis on hospital setups in stewardship programs, the contribution of community patterns in antibiotic overuse specifically in India is understudied. The study takes into account the recent Omicron wave in India which may have aggravated overuse due to primarily flu-like symptoms of the infection. Along with irrational prescription of antibiotics during COVID-19, self-medication with antibiotics was also very frequently observed. Hence, it is imperative to study the practices and awareness about antibiotic usage in the Indian community. This study aims at understanding not only the extent of overuse, but also the social patterns and causes of over prescription or self-medication of antibiotics in an LMIC which is the largest consumer of antibiotics, yet, has minimal discourse and data on the same.[13] This study would help inform policy makers regarding factors responsible for antibiotic overuse. It would also help to target relevant social behaviors in awareness programs to curb antibiotic overuse.

Methods

Study Settings and Participants

It is a cross sectional, single center, observational study to assess the pattern of antibiotic use in India, through a self-administered Google form questionnaire. A literature review of research on similar topics which also assessed the awareness and practices on antibiotic use in the community using a questionnaire was done.[14-22] We did not come across any such study that assessed antibiotic use awareness and practices in the community during later stages of the pandemic. Hence, a new questionnaire, influenced by previous similar studies, was created to address the given problem in the Indian scenario. The questionnaire included multiple choice questions, forced choice questions and open-ended questions regarding antibiotic name and dosage. All questions were compulsory. The inclusion criteria for respondents were being citizens of India, of any gender, of age more than or equal to 15 years, literate in the English language and having access to online messaging applications. Respondents who were not citizens of India or were below 15 years of age were excluded from the study. Also, the respondents who were not well versed in the English language and did not have access to online messaging applications were excluded from the study.

Ethical Consideration

Ethical approval (IEC No.: 2022-790) was granted by the Institutional Review Board of the Medical College where the Principal Investigator is studying. The questionnaire began with brief information about the study followed by a consent clause. The respondents were assured that the information provided by them will be kept confidential and will be used for research and academic purposes only. The respondents were directed to the questionnaire only after they provided their consent for participation in the study.

Instrument

The questionnaire was pilot tested on ten medical students as well as ten non health care professionals. To avoid duplication, the questionnaire settings were such that multiple responses from the same email ID could not be submitted. The questionnaire was divided into four sections relating to demographic information and knowledge, practice and attitude of respondents on antibiotic use. The first section consisted of questions on demographic details of participants (name, gender, age, level of education, profession etc.). A question was also included to enquire if the respondents' close family member was a healthcare professional. The second section contained four questions about the respondents' knowledge on the use of antibiotics for conditions like cold and cough where they are commonly used, but not indicated. It also assessed people's awareness on the side effects of antibiotics and antibiotic resistance.

This was followed by a third section pertaining to the practices being followed regarding antibiotic use. Further, subsections were created based on whether the antibiotics used were prescribed by a doctor or self-medication was done. The name and dosage of antibiotic taken was asked. In the sub-section for prescribed antibiotics, a question was included to assess whether culture sensitivity for antibiotic prescription was done. Additionally, the source of information for antibiotics taken through self-medication was asked.

The last section assessed the respondents' attitude towards antibiotic course completion and regulations on the procurement of antibiotics. It also included questions regarding antibiotic use as prophylaxis for suspected COVID-19 cases. Another question assessed whether doctors prescribed antibiotics for COVID-19 positive individuals.

Data Collection

Responses were collected over a period of one month from 20th September to 20th October 2022. Responses were collected by sending online links through WhatsApp messages with the general information about the aim of the study. Virtual snowball technique was used which is a non-probability type of sampling technique. A URL link for the Google form was circulated by participants to other potential respondents, creating a referral chain for recruitment of respondents.

Data Management and Analysis

Descriptive statistics were used to analyze the data. The mean, standard deviation, frequency and percentage were calculated to assess the trends in knowledge and awareness about antibiotic use. Percentage and frequency of demographic details of respondents like gender, age, level of education, profession etc. was calculated. The percentage of true and false responses for

questions under the knowledge section was calculated. The attitude and practices of respondents on antibiotic use were also assessed based on the percentage and frequency of given options selected by the respondents. The generic name of commonly used antibiotics used by the respondents was manually extracted from the responses and the respective frequency and percentage of the commonest antibiotics were calculated. A correlation between positive antibiotic use practices and attitudes with gender as a variable was made by calculating relative percentages. Similarly, correlation between antibiotic use behaviors and whether the respondent had a healthcare professional as a close family member or not as a variable was made.

Results

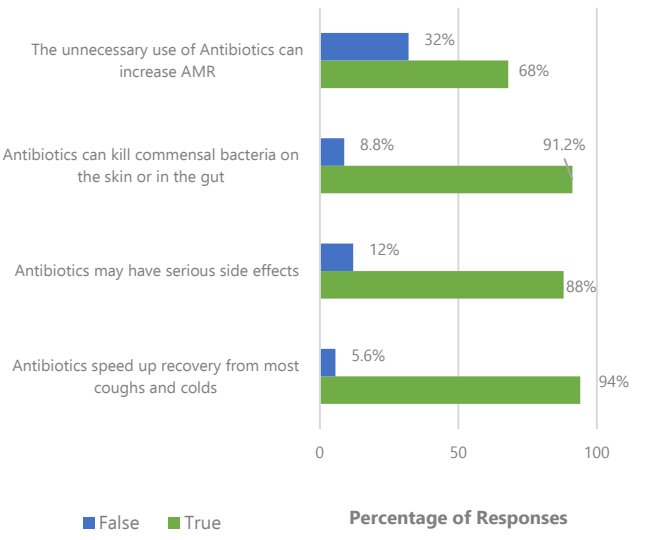
A total number of 309 responses were received. More than half respondents (59.5%, n=184) belonged to the age group of 15 to 30 years. The number of female respondents was 173 (56%) and 136 (44%) were male. The number of respondents having completed 12th grade was 117 (38%) and 113 (36.7%) had completed post-graduation. Two thirds of respondents (66.8%) had a close family member as a healthcare professional *Table 1*.

***Table 1*. Socio-Demographic Characteristics of Respondents.**

Attribute	Frequency (%)
Age (in years)	
15-30	184 (59.5)
31-45	25 (8.1)
46-60	95 (30.7)
>60	5 (1.6)
Gender	
Female	173 (56)
Male	136 (44)
Education level (completed)	
10th Grade	5 (1.6)
12th Grade	117 (38)
Undergraduate	73 (23.7)
Postgraduate	113 (36.7)
Professional field	
Homemaker	31 (10)
Healthcare professional	85 (27.5)
Student (Health Sciences)	132 (42.7)
Student (other than health sciences)	32 (10.4)
Businessperson	29 (9.4)
A close family member as a health professional	
Yes	206 (66.8)
No	103 (33.3)

Knowledge of the respondents was assessed through forced choice true and false statements. Most of respondents (94%, n=292) were aware that the unnecessary use of antibiotics can increase bacterial resistance to antibiotics. 91.2% (282) of respondents knew that antibiotics can kill the bacteria that normally live on the skin and gut and 88% (272) respondents were aware that antibiotics can have serious side effects. Almost a third of the respondents (68%, n=210) held the false notion that antibiotics speed up recovery from cough and cold. Data on the knowledge of respondents regarding antibiotic use is represented in *Figure 1*.

***Figure 1*. Socio-Demographic Characteristics of Respondents.**



Only 39.5% (122) of the respondents used antibiotics once in the last year. The number of respondents who selected fever as one of the reasons for antibiotic use was 134 (43.4%) while 42.1% (130) of respondents used antibiotics for sore throat and cough as well. A majority of respondents (82.8%) took antibiotics on prescription, out of which 68% (174) were prescribed an antibiotic course for 3 to 5 days and 92.6% (237) completed the antibiotic course prescribed. Only 17.2% (53) respondents took antibiotics without prescription, out of which 54.7% (29) took antibiotics from previous experience. The number of respondents who self-medicated with antibiotics for a duration of 3 to 5 days was 66% (35). *Table 2* contains data on the practices of respondents on antibiotic use.

The most commonly prescribed antibiotics by doctors were Azithromycin (31%, n=75), Amoxiclav (14%, n=33), Amoxicillin (12%, n=29) and Ofloxacin (9%, n=22), as shown in *Figure 2*. The most common antibiotics that the respondents self-medicated with were Azithromycin (26%, n=10), Amoxicillin (13%, n=5), Amoxiclav (13%, n=5) and Ofloxacin (10.5%, n=4), as shown in *Figure 3*. The most commonly taken antibiotic for COVID-19 were Azithromycin (64%), followed by Doxycycline (14%), Amoxiclav (4.5%) and Amoxicillin (4.5%), as shown in *Figure 4*.

Regarding completing the antibiotic course even after feeling better, 75.4% (233) respondents agree to this positive antibiotic use attitude. A large number of respondents (87.1%) feel that it is good to be able to procure antibiotics without seeing a doctor. 62.5% (193) respondents prefer taking antibiotics if they have a sore throat or cough for more than a week. More than a third of respondents (79.3%) did not take antibiotics on suspicion of COVID-19 while only 20.7% (64) respondents were prescribed antibiotics after testing positive for COVID-19. Information regarding attitude of respondents on antibiotic use is given in *Table 3*.

***Table 2*. Practices of Respondents Relating to Antibiotic Use.**

Attribute	Frequency (%)
Frequency of antibiotic use in the last year	
Once	122 (39.5)
Twice	98 (31.7)
Three or more times	89 (28.8)
Reason for using antibiotics (more than one option can be selected)	
Fever	134 (43.4)
Sore throat	130 (42.1)
Cough	130 (42.1)
Gastrointestinal infections	119 (38.5)
Cold	112 (36.2)
Runny nose	63 (20.4)
Skin infections	37 (12)
Urinary tract infections	32 (10.4)
Was the dose prescribed by a doctor?	
Yes	256 (82.8)
No	53 (17.2)
If the dose was prescribed by a doctor	
How many days was the antibiotic course prescribed for?	
Three days or less	56 (21.9)
Three to five days	174 (68)
More than five days	26 (10.2)
Did you complete the course prescribed?	
Yes	237 (92.6)
No	19 (7.4)
If self-medication was done	
Source of medication	
Previous experience	29 (54.7)
Consulting with a pharmacist	14 (26.4)
Consulting friends/family members who are not health professionals	08 (15.1)
From the internet	02 (3.8)
How many days did you take antibiotics for, if not prescribed by a doctor?	
1-2 days	17 (32.1)
3-5 days	35 (66)
More than 5 days	1 (1.9)

***Table 3*. Attitude of Respondents Regarding Antibiotic Use.**

Attribute	Frequency (%)
I always complete the course of treatment even if I feel better.	
Agree	233 (75.4)
Disagree	76 (24.6)
It is good to be able to get antibiotics from relatives or friends without having to see a doctor.	
Agree	269 (87.1)
Disagree	40 (12.9)
I prefer to use antibiotics when I have a sore throat/cough for more than a week.	
Agree	193 (62.5)
Disagree	116 (37.5)
Did you take antibiotics on suspicion of COVID-19?	
Yes	64 (20.7)
No	245 (79.3)
Were you prescribed antibiotics by your doctor after testing positive for COVID-19?	
Yes	64 (20.7)
No	93 (30.1)
N/A	152 (49.2)

Figure 2. **Most Commonly Prescribed Antibiotics by Physicians.**

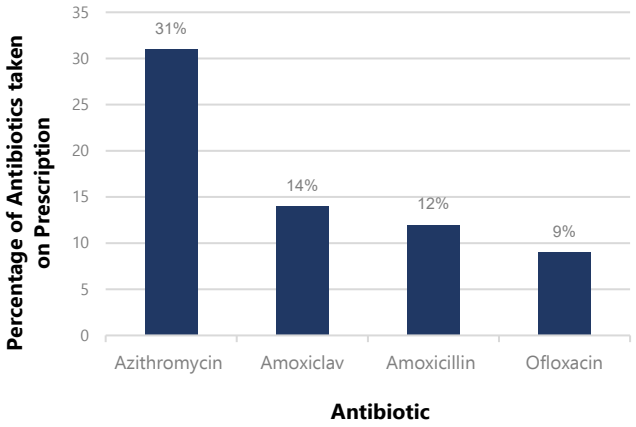


Figure 3. **Most Common Antibiotics Taken as Self Medication.**

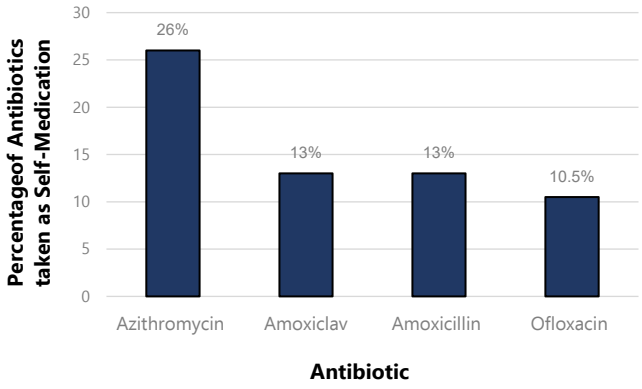
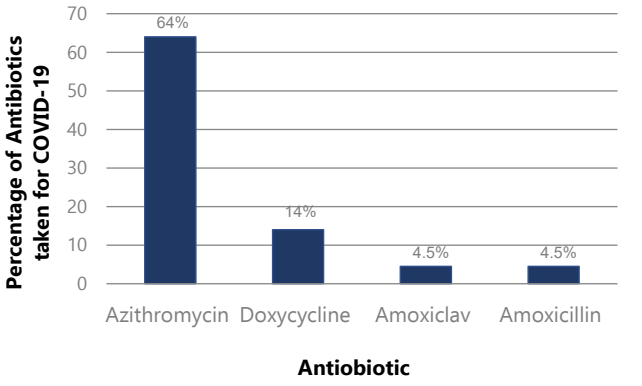


Figure 4. **Most Commonly Taken Antibiotics for COVID-19**



Discussion

The findings of our study reveal critical insights into the awareness and practices related to antibiotic use within the Indian community during the later stages of the COVID-19 pandemic. Despite a substantial proportion of respondents having a health sciences background, there remains a significant gap between knowledge and practice.

Knowledge

Majority of the respondents, being health science students, were aware about the side effects of antibiotics (87.2%) and that antibiotics can kill commensal skin and gut bacteria (90.7%). Awareness about the effect of antibiotics on commensal bacteria was higher than the findings in a similar study in Kuwait.[14] 95.2% of respondents knew about antibiotic resistance, which is higher than the findings in Kuwait,[14] Eritrea,[15] Karnataka,[16] Riyadh,[17] Bangladesh.[18] Various studies with which the comparison is being made were done before the pandemic. The better knowledge on antibiotics in our study can partly also be explained by the fact that during the pandemic, the population at large became more aware about the use of antibiotics due to more health reporting by news and social media platforms, also found by a study in Bangladesh.[18]

Surprisingly, in spite of a majority of respondents (around 70%) having a health sciences background, 67.8% of respondents believe that antibiotics speed up recovery from most coughs and colds, which is a false statement. The frequency of the false notion was even higher than in other similar studies conducted in the general population.[14-17, 19-20] A study in Korea found that physicians and pharmacists may possess more unfounded beliefs on antibiotic efficacy than people not from medical backgrounds.[25]

Comparing the results of our study to a similar one conducted in rural Manguluru[27], a much greater percentage of respondents in our study had knowledge on antibiotic resistance. This can be explained by the fact that most of the respondents from our study had an urban background.

Practice

A large percentage (94.8%) of respondents had used antibiotics in the last one year and more than half of the respondents (60.5%) took antibiotics more than once during the last year. Cough, cold, sore throat, fever and GIT infections were the most common causes for antibiotic use, similar to results in Karnataka,[16] Italy.[20] The highly contagious Omicron variant with primarily flu like symptoms might have contributed to the high antibiotic intake. Only 17.2% of respondents had taken antibiotics without the prescription of a doctor, which is much lower than Kuwait,[14] China,[21] Italy,[20] but similar to Riyadh and Eritrea.[17,15] This might be due to a larger proportion of respondents being health professionals, thus being aware of the positive behavior practice of taking antibiotics on prescription. A high compliance was seen with 92.6% people completing the prescribed antibiotic course, more than in previous studies in the general population in Karnataka,[16] Riyadh,[17] Eritrea[15] and another study on medical students from India.[22] The high compliance in our study may be explained by another study in China which found that students with a medical background had better antibiotic use behaviors.[21] A greater percentage of respondents completed the prescribed antibiotic dose in our study compared to the one conducted in rural Manguluru[27], but the number of respondents taking antibiotics on prescription was comparable.

Attitude

87.1% of respondents felt that it is good to be able to get antibiotics from relatives or friends without having to see a doctor, much greater than what was seen in Kuwait,[14] Karnataka,[16] Riyadh.[17] Majority of respondents prefer to use antibiotics when they have a sore throat/cough for more than a week, higher than in Kuwait,[14] Riyadh.[17] This might be a rational practice, given the higher infectious disease burden in India. In another study in Italy,[20] despite a higher percentage of respondents having correct knowledge about the use of antibiotics in cough and cold, a greater percentage of respondents did use antibiotics for fever, flu and sore throat.

The most commonly used antibiotic, both on prescription and self-medication, was Azithromycin. These results correspond with a recent study where Azithromycin was found to be the most consumed antibiotic in India.[12] Azithromycin has been linked to many side effects and is also included in the watch category of the AWaRe WHO classification of antibiotics.[23,26]

Only 20.7% of respondents took antibiotics on suspicion of having COVID-19, with the most common one being Azithromycin. Only one fifth of respondents reported that a doctor did prescribe antibiotics when they tested positive for COVID-19. This indicates a positive trend of rational antibiotic prescription by doctors during later stages of the pandemic, which could be due to greater awareness about antibiotic misuse during initial stages of COVID-19. Around 75% of COVID-19 positive patients were prescribed antibiotics in the initial stages of the pandemic.[24]

Gender differences were also observed for antibiotic use behaviors in our study. A higher percentage of female respondents (86%) used antibiotics on doctor's prescription than male respondents (77%), contrary to what was found in Karnataka,[16] but similar to Eritrea.[15] 80.3% of women completed the antibiotic course prescribed, compared to 71% of men. 80.3% percent of women completed the course even if they felt better compared to 68.4% of men. Our study found that being female was linked to better antibiotic use practices.

Compared to another study assessing knowledge and practices related to antibiotic use among Indonesian women[28], a greater percentage of female respondents in our study reportedly completed their antibiotic course (80.3%) and also practiced completing their antibiotic course even after they felt better (80.3%). This might also be due to a better level of education and a greater number of respondents overall having a healthcare background in our study.

The study also found that having a healthcare professional as a close family member has a positive influence on antibiotic use practices. 83% of people who had a close family member as a doctor completed their prescription. In comparison, only 64% of people having no close family member as a doctor completed their prescription. A similar study in Italy also found that people having a family member in the health care sector were more likely to correctly know the definition of an antibiotic.[20] On the contrary, a study in China found that university students whose parents had medical backgrounds were more likely to self-medicate with antibiotics.[21]

The findings of this study are limited by the fact that the information is self-reported, thus it may be affected by recall bias of the respondents. The use of a snowball sampling technique, combined with the principal investigator's status as a medical student, resulted in a sample skewed towards young health sciences students, with 66.8% of respondents having a close family member in the healthcare profession. The responses cannot be cross checked for accuracy. The sample population was urban, educated Indian citizens, which is not representative of the Indian population in entirety. As it was a self-administered questionnaire, the respondents could have reported socially desirable behaviors more than the socially undesirable ones India being one of the largest consumers of antibiotics in the world still has little discourse on the community patterns affecting antibiotic use. The novelty of the study lies in the fact that it aims at understanding the contribution of community patterns in antibiotic use behaviors coupled with the effect of the recent pandemic on antibiotic overuse.

Conclusion

The study brings to light trends in the awareness and usage of antibiotics which can have far reaching implications for various stakeholders, namely the patients, doctors and pharmaceutical industry. Public awareness drives to educate people regarding positive antibiotic use behaviors and the threat of antibiotic resistance can be organized under Antibiotic Stewardship Programs.

The study highlights that a greater knowledge on antibiotic use does not necessitate better attitude towards their cautious and rational use, nor does it guarantee a supportive attitude towards regulations on antibiotic dispensing. In spite of its significant cardiovascular adverse drug reactions, Azithromycin was found to be the most commonly used antibiotic in our study. Relatively lower rate of self-medication with antibiotics was seen in our study, which might be due to a greater percentage of respondents with a healthcare background, thus exhibiting positive behavior practices on antibiotic use.

Summary – Accelerating Translation

The biggest beneficiaries of antibiotic therapy have been countries with the greatest load of infection, which correspondingly are mostly lower- and middle-income countries (LMIC) like India. With the medical breakthroughs that antibiotics accomplished came the concomitant problem of antibiotic resistance (AMR), which has been expedited by the indiscriminate use of antibiotics. This increased usage of antibiotics coupled with the dearth of newer alternatives has worsened antibiotic resistance. With greater emphasis on hospital setups in stewardship programs, the contribution of community patterns in antibiotic overuse

specifically in India is understudied. The study takes into account the recent Omicron wave in India which may have aggravated overuse due to primarily flu-like symptoms of the infection. Along with irrational prescription of antibiotics during COVID-19, self-medication with antibiotics was also very frequently observed. Hence, it is imperative to study the practices and awareness about antibiotic usage in the Indian community. This study aims at understanding not only the extent of overuse, but also the social patterns and causes of over prescription or self-medication of antibiotics in an LMIC which is the largest consumer of antibiotics, yet, has minimal discourse and data on the same. This study would help inform policy makers regarding factors responsible for antibiotic overuse, to influence awareness programs so as to target relevant social behaviors to curb antibiotic overuse.

It is a cross sectional, single center, and observational study to assess the pattern of antibiotic use in India, through a self-administered Google form questionnaire. A literature review of research on similar topics was done and the questionnaire was created to fit the scope and aim of the study. Responses were collected over a period of one month from 20th September to 20th October, 2022. Responses were collected by sending online links through WhatsApp messages with the general information about the aim of the study. Virtual snowball technique for data collection was used where the URL link for the Google form was circulated by participants to other potential respondents.

A total of 309 responses were received (56% female and 44% male). 59.5% of the respondents were between 15 to 30 years. A large percentage (94.8%) of respondents had used antibiotics in the last one year and more than half of the respondents (60.5%) took antibiotics more than once during the last year. Cough, cold, sore throat, fever and GIT infections were the most common causes for antibiotic use. The highly contagious Omicron variant with primarily flu like symptoms might have contributed to the high antibiotic intake. Only 17.2% of respondents had taken antibiotics without the prescription of a doctor. This might be due to a larger proportion of respondents being health professionals, thus being aware of the positive behavior practice of taking antibiotics on prescription. A high compliance was seen with 92.6% people completing the prescribed antibiotic course, more than in previous studies in the general population. Surprisingly, in spite of a majority of respondents (around 70%) having a health sciences background, 67.8% of respondents falsely believe that antibiotics speed up recovery from most coughs and colds. The most common antibiotic used on prescription and self-medication was Azithromycin. Only one fifth of respondents took antibiotics on suspicion of having COVID-19, with the most common one being Azithromycin. This indicates a positive trend of rational antibiotic prescription by doctors during later stages of the pandemic, which could be due to greater awareness about antibiotic misuse during initial stages of COVID-19. Around 75% of COVID-19 positive patients were prescribed antibiotics in the initial stages of the pandemic. Gender differences were also observed for antibiotic use behaviors in our study. A higher percentage of female respondents (86%) used antibiotics on doctor's prescription than male respondents (77%). 80.3% of women completed the antibiotic course prescribed, compared to 71% of men. 80.3% percent of women completed the course even if they felt better compared to 68.4% of men. Our study found that being female was linked to better antibiotic use practices. The study also found that having a healthcare professional as a close family member has a positive influence on antibiotic use practices. 83% of people who had a close family member as a doctor completed their prescription compared to 64% of people who had no close family member as a doctor completed their prescription.

The study brings to light trends in the awareness and usage of antibiotics with greater emphasis on the Indian medical community. The findings of this study can be used to formulate a more effective Antibiotic Stewardship Programs to curb antibiotic overuse. The use of antibiotics for self-limiting indications like cough, cold and sore throat needs to be restricted through stricter regulations.

The study highlights that a greater knowledge on antibiotic use does not necessitate better attitude towards their cautious and rational use, nor does it guarantee a supportive attitude towards regulations on antibiotic dispensing. In spite of its significant Cardiovascular Adverse drug reactions, Azithromycin was found to be the most commonly used antibiotic in our study. Relatively lower rate of self-medication with antibiotics was seen in our study, which might be due to a greater percentage of respondents with a healthcare background, thus exhibiting positive behavior practices on antibiotic use.

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Author Contributions

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Original Article

Blindness Disparities Between Racial/Ethnic Groups in the State of Texas

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Abstract

Background: There are disparities in health outcomes between races. Blindness is associated with decreased quality of life and negative health outcomes. There is little published data investigating the difference in the prevalence of blindness between races/ethnicities nationally and in Texas. **Methods:** This retrospective observational study investigates the differences in crude prevalence of blindness between different race/ethnicities in Texas. Data was gathered from the Centers for Disease Control and Prevention (CDC) website Vision and Eye Health Surveillance System (VEHSS) using the most recently available Compositive Estimate data from the state of Texas. The variables compared were age groups and race/ethnicity categories of Black, non-Hispanic, Hispanic, any race and White, non-Hispanic, referred to as "Black," "Hispanic," and "White" respectively. The logs of the relative ratios and Z scores were used to compare each age group. **Results:** The Black group consistently had the highest crude prevalence of blindness across age groups; The White group had the lowest prevalence. The Hispanic group consistently had prevalence rates that were between the Black and White groups. No differences were found to be statistically significant. **Conclusion:** This data shows that, despite ongoing diversity and inclusion efforts, ongoing inequalities exist in healthcare outcomes. In the state of Texas, this is made apparent by the difference in blindness prevalence between Black, Hispanic, and White populations. These data can be used to bring about change that needs to be addressed at the state and institutional level.

Introduction

There are disparities that exist between races today in America. This is made evident by the racial wage gap, recent pushes for cultural awareness, and incorporation of diversity and inclusion into schools and work places.[1,2] In 2021, the American Association of Medical Colleges released a framework addressing structural racism in academic medicine following the nationwide movement for Black Lives.[3]

Healthcare disparities have been defined as "differences in health outcomes that are closely linked with social, economic and environmental disadvantage."[4] The impact of race, socioeconomic status, education and geographic location on healthcare has been reported by national and international organizations.[5,6] For example, Blacks and Hispanics are less likely to have health insurance than their Caucasian counterparts.[4] Further, even when controlling for income, insurance status,, age, and severity of incomes, there are persistent racial and ethnic disparities in health care access, utilization and outcomes.[7-11]

Vision loss is among the top ten most common disabilities among adults 18 and older.[12,13] Vision loss is associated with decreased productivity, decreased quality of life and negative health outcomes.[14-16] Data is lacking in associated outcomes in minorities and older age groups. Studies have been done globally examining causes of blindness in different age groups and populations, but few explore the rates of disparities between races and ethnicities.[17-19]

The purpose of this study is to investigate publicly available data to identify what disparities, if any, exist in the prevalence of blindness between different racial and ethnic groups in Texas. Specifically, this study will investigate the prevalence of blindness by detailed age groups within Black, non-Hispanic, Hispanic, any race and White, non-Hispanic groups. This is with the goal of awareness and calls for intervention.

Methods

This cross-sectional study was conducted using data gathered from the publicly available Centers for Disease Control and Prevention (CDC) website Vision and Eye Health Surveillance System (VEHSS).[20] The data used are estimates based on 2017 population, (released May 2021, revised July 2022) Compositive Estimate data from the state of Texas as of January 2023. Cases were chosen based on the presence of blindness, cases with vision loss were excluded in the study. Blindness is defined as "best corrected visual acuity in the better seeing eye ≤20/200." Under the category of composite estimates, the Crude Prevalence

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Estimates for blindness by detailed age groups was used. The variables compared were age groups (variable 1) by race/ethnicity (variable 2). Detailed age groups were broken down into 0-11 years, 12-17 years, 18-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years, 55-59 years, 60-64 years, 65-69 years, 70-74 years, 75-79 years, 80-84 years, and 85 years and older. Race/Ethnicity groups were "Black, non-Hispanic", "Hispanic, any race", "White, non-Hispanic" and "other." These groups will be referred to as "Black", "Hispanic", and "White" respectively. For the purposes of this study, the "other" group was not used due to inadequate comparative sample size. All genders were included.

The log of the relative ratio of "Hispanic vs White," "Black vs White" and "Black vs Hispanic" was used to compare between ethnicities within each age group. Standardized Z-scores were calculated for contrasts "Black Vs White," "Hispanic vs White" and "Black vs Hispanic." Analyses were conducted within and across age groups. Statistical testing was two-sided with significance level .05. Analysis was conducted in Rstudio.

Results

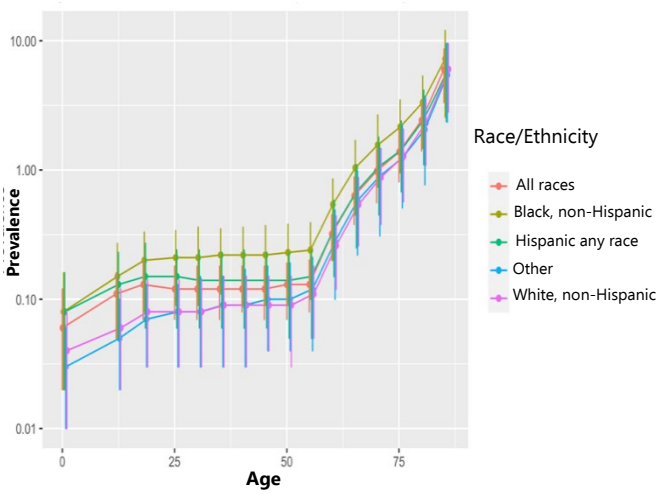
A total of 28,304,596 blind patients were identified in the state of Texas for this study. Of these, 3,336,453 were Black, non-Hispanic, 11,160,514 were Hispanic, any race and 11,856,625 were White, non-Hispanic. The prevalence for each Race/Ethnicity by detailed age group is seen in *Table 1*.

***Table 1*. Crude Prevalence of Blindness by Race/Ethnicity in Detailed Age Groups.**

Age	Black	Hispanic	White
0-11	0.08	0.08	0.04
12-17	0.15	0.13	0.06
18-24	0.20	0.15	0.08
25-29	0.21	0.15	0.08
30-34	0.21	0.14	0.08
35-39	0.22	0.14	0.09
40-44	0.22	0.14	0.09
45-49	0.22	0.14	0.09
50-54	0.23	0.14	0.09
55-59	0.24	0.15	0.11
60-64	0.54	0.35	0.26
65-69	1.04	0.68	0.54
70-74	1.56	1.06	0.88
75-79	2.15	1.43	1.28
80-84	3.33	2.45	2.32
85-89	7.24	5.61	6.02

The Black group consistently had the highest crude prevalence of blindness across all age groups. The White group had the lowest prevalence. Crude prevalence in the Hispanic group was between the black and white groups for all ages. As a general trend, prevalence of blindness was lowest under the age of 17 and increased with age in all race/ethnicities, especially after the age of 55. The logarithmic prevalence of each race/ethnicity for each age group was plotted on a scale in *figure 1*.

***Figure 1*. Logarithmic Prevalence of Blindness by Race/Ethnicity.**



Legend: Logarithmic Prevalence of Blindness by Race/Ethnicity. The prevalence of blindness is higher in Blacks than Hispanics and Whites. Whites having the lowest prevalence of the three groups. The logarithmic prevalence relationship seen in figure two reiterates the relationship in blindness prevalence seen between the Black, Hispanic, and white groups.

The largest differences in prevalences between the three groups are seen between adults ages 18-55. The largest difference in blindness prevalence across all age groups was seen between the Black and White groups. When looking at these two races, the crude prevalence of blindness was approximately twice as high in blacks as it was in Whites under the age of 70. Over this age, the Black group maintained a higher prevalence of blindness when compared to the White group. While these data were striking, none of these differences were found to be statistically significant. Z scores and P values are for each age group and ethnicity are found in *figure 2*.

Blindless crude prevalence in the Black group is the highest of the three groups. This trend is most prevalent in ages 18-55, where the crude prevalence is, on average, higher than the Hispanic group by 0.8 and higher than the White group by 0.13 (crude prevalence average for ages 18-50 in Black, Hispanic and White groups is 0.22, 0.14 and 0.09, respectively). Although most prevalent in the aforementioned age group, the trend is seen across all age groups when compared to Hispanic and White race/ethnicities.

Crude prevalence of blindness in the Hispanic group is consistently lower than the Black group and higher than the White group. The crude prevalence of blindness was very similar between Hispanics and Blacks up to age 17. From age groups 18 and up, the crude prevalence of blindness was higher in the black population than it was in the Hispanic population per age group. Blindness crude prevalence in the White group is the lowest overall under the age of 85. In the age group 85-89, the crude prevalence of blindness is 6.02 in the white group, which is greater than 5.61 in the Hispanic group.

Figure 2. **Z scores and P values for Black, Hispanic and White Groups by Detailed Age.**

Age	Z score: Black Vs White	Z score: Hispanic Vs White	Z score: Black Vs Hispanic	P value: Black Vs White	P value: Hispanic Vs White	P value: Black Vs Hispanic
0-11	1.0222025	1.0222025	0.0000000	0.3066851	0.3066851	1.0000000
12-17	1.4896906	1.3598002	0.2814390	0.1363056	0.1738932	0.7783737
18-24	1.7574049	1.1811087	0.6125639	0.0788488	0.2375595	0.5401647
25-29	1.9038553	1.3273273	0.7790730	0.0569290	0.1844004	0.4359367
30-34	1.7835853	1.1377091	0.8628670	0.0744911	0.2552420	0.3882106
35-39	1.9379256	0.9611387	1.0880326	0.0526323	0.3364825	0.2765807
40-44	1.7599334	0.9245003	0.9861337	0.0784191	0.3552259	0.3240675
45-49	1.7285385	0.9877296	0.9769000	0.0838917	0.3232851	0.3286187
50-54	1.7843084	0.9245003	1.0547257	0.0743736	0.3552259	0.2915508
55-59	1.6362236	0.6949956	1.0383655	0.1017928	0.4870581	0.2990999
60-64	1.5458941	0.6716371	0.9751607	0.1221301	0.5018147	0.3294805
65-69	1.4472629	0.5352545	0.9578526	0.1478233	0.5924739	0.3381371
70-74	1.2347320	0.4183502	0.8542018	0.2169303	0.6756911	0.3929932
75-79	1.1852240	0.2654218	0.9448516	0.2359289	0.7906846	0.3447347
80-84	0.8832288	0.1327563	0.7175709	0.3771127	0.8943861	0.4730219
85-89	0.4239414	-0.1690794	0.5536678	0.6716085	0.8657342	0.5798062

Discussion

This data review has revealed striking blindness disparities between races in Texas. These differences highlight how Race and Ethnicity affect patient outcomes. Disparities lead to decreased quality and efficiency in the healthcare system.[5] In fact, a 2009 study estimated excess direct medical care expenditures due to health inequalities to be $229.4 billion,[20] making this an opportunity for saving costs in society. Furthermore, a 2013 study estimated the economic burden of vision loss and disorders of the eye in people under the age of 40 to be $27.5 billion.[21] This data can contribute to discussions of inequities that are seen in minority patient populations. These inequalities can further contribute to some minorities' general mistrust of health care providers, thus leading to decreased medical adherence and poor patient outcomes. [22]

The largest disparities in crude prevalence of blindness are seen between the Black and White groups. Below the age of 75, crude prevalence of blindness is nearly double when all Black age groups are compared to their White counterparts. While this relationship is striking, it was not found to be statistically significant; The data closest to proving statistical significance are age groups 25-29 and 35-39 having p values that were .057 and .053, respectively. The "Hispanic, any race" group consistently showed prevalence data that was between that of the Black and White groups. As the largest minority in Texas, this data highlights the fact that underlying socioeconomic inequities influence access to vision healthcare services.[23-25] This further exacerbates the well-documented pattern that adults with blindness or visual impairment have self-reported lower access to and use of health care than those without.[13,26] This data is consistent with previous literature showing that there are racial/ethnic differences in the prevalence of major eye disease that are known to lead to blindness.[23,26-30]

Of note, the differences in blindness rates were largest in the ages 18-55, which was the majority of the population in 2017. Therefore the effect of these disparities was applicable to most adults. It is also important to consider the impact of vision loss on life expectancy. Vision loss poses many challenges to daily living, increasing stress past what a person with full vision might experience. Studies have shown a consistent association between blindness or visual impairment and mortality.[30-32]Therefore, it is probable that people with vision impairments aren't living to the higher ages included in the study. This effect of mortality due to visual impairments causes a sampling bias in the higher age groups. This can be considered as a reason for the converging of prevalences seen in all race/ethnicities within the higher age groups.

Although large strides have been made with respect to diversity and inclusion in healthcare, this data proves that there are still ongoing inequalities that thwart efforts being made. There are many social, personal, and economic factors that influence these outcomes. This data is showing that the state of Texas needs to address these disparities at the state and institutional level.

Limitations.

First, the blindness prevalence data was taken from one source, the publicly available CDC website VEHSS. This causes inherent sampling bias despite being a reputable reference. A future direction will be to use multiple sources to compare reporting and prevalence of blindness. Secondly, the CDC VEHSS reports prevalence estimates. These estimates were generated by statistical models from multiple data sources, not reported values. There were no comments about steps taken to avoid inherent biases that occur in this type of data reporting. Third, this data is from 2017 and was 5 years old at the time this study was conducted. Therefore, this data does not consider the impact of recent racial equality movements improving medical treatments, COVID-19 or political influences on blindness prevalence.

Summary – Accelerating Translation

There are disparities that exist between races today in America. Healthcare disparities have been defined as "differences in health outcomes that are closely linked with social, economic and environmental disadvantage." The impact of race, socioeconomic status, education and geographic location on healthcare has been reported by national and international organizations. Vision loss is associated with decreased productivity, decreased quality of life and negative health outcomes. Data is lacking in associated outcomes in minorities and older age groups. Studies have been done globally examining causes of blindness in different age groups and populations, but few explore the rates of disparities between races and ethnicities. The purpose of this study is to investigate publicly available data to identify what disparities, if any, exist in the prevalence of blindness between different racial and ethnic groups in Texas. Specifically, this study will investigate the prevalence of blindness by detailed age groups within Black, non-Hispanic, Hispanic, any race and White, non-Hispanic groups. This is with the goal of awareness and calls for intervention.

This cross-sectional study was conducted using data gathered from the publicly available Centers for Disease Control and Prevention (CDC) website Vision and Eye Health Surveillance System (VEHSS). The data used are estimates based on 2017 population, (released May 2021, revised July 2022) Compositive Estimate data from the state of Texas as of January 2023. Cases were chosen based on the presence of blindness, the Crude Prevalence Estimates for blindness by detailed age groups was used. The Log of the relative ratio of "Hispanic vs White," "Black vs White" and "Black vs Hispanic" was used to compare between ethnicities within each age group. Standardized Z-scores were calculated for contrasts "Black Vs White," "Hispanic vs White" and "Black vs Hispanic." Analyses were conducted within and across age groups.

As a general trend, the crude prevalence of blindness was highest in the Black group and lowest in the White. Hispanic group consistently had a prevalence that was in between the other two groups. This relationship was best seen between the ages of 18-55. The largest disparities in crude prevalence of blindness are seen between the Black and White groups. Below the age of 75, crude prevalence of blindness is nearly double when all Black age groups are compared to their White counterparts. While this relationship is striking, it was not found to be statistically significant; The data closest to proving statistical significance are age groups 25-29 and 35-39 having p values that were .057 and .053, respectively. The "Hispanic, any race" group consistently showed prevalence data that was between that of the Black and White groups.

Although large strides have been made with respect to diversity and inclusion in healthcare, this data proves that there are still ongoing inequalities that thwart efforts being made. There are many social, personal, and economic factors that influence these outcomes. This data is showing that the state of Texas needs to address these disparities at the state and institutional level.

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Original Article

A Cross-Sectional Survey of Instagram to Assess Quality and Reliability of Information Regarding Tuberculosis

Rohan Singhal,[1] Nagaspurthy Reddy Anugu.[2]

Abstract

Background: Tuberculosis is one of the oldest diseases known to affect humans and a major cause of death worldwide. The National Strategic Plan 2017-2025 aims to eliminate tuberculosis by 2025. Appraising knowledge and awareness of tuberculosis are essential for successful tuberculosis control, given the significance of social and psychological variables in determining health outcomes. **Methods:** A cross-sectional observational study was conducted wherein, the top six hashtags related to "Tuberculosis" on Instagram, identified by the maximum number of posts were taken. A questionnaire was made for assessment of these posts based on various pre-determined categories- type of post, type of information circulated and to assess if it is "true", "false" or "cannot be determined" using the WHO Factsheet on Tuberculosis & CDC. **Result:** A total of 370 posts were found to be relevant according to the inclusion criteria and had vast user interaction These posts created and uploaded by the health and wellness industry comprised of 27.02%, followed by doctors at 20.27% and news agencies at 5.96%. 50.54% of the posts analyzed contained a description of tuberculosis and 20% about prevalence and diagnosis The posts by doctors and health and wellness industry had a statistically significant higher number of posts that contained "true" information and scored statistically significantly higher on the mean of Global Quality Scores and Reliability Scores. **Conclusion:** Social media is a powerful medium for disseminating scientific facts on TB. The government and policymakers need to develop internet-based programs and interventions to improve knowledge, attitudes, and practices towards TB.

Introduction

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, which is mainly transmitted through droplet infection. It primarily affects the lungs causing pulmonary TB; however, it can also affect other organs of the body like the intestine, joints, meninges, bones, etc. causing extrapulmonary TB. In 2021, an estimated 10.6 million people contracted TB with the death toll reaching an estimated 1.6 million, according to the Global TB Report by the World Health Organization (WHO).[1] India was one of the eight nations that accounted for more than two-thirds (or 68.3%) of all TB patients, with 28% of cases. Its persistent morbidity and mortality burden thus, makes it one of the major public health challenges in India.[1]

With the recent internet explosion in India leading to ease of access and increased internet penetration, there are an estimated 470 million social media users as of 2022. Internet users are increasingly relying on social media to discover and share health information. Instagram has been investigated as a health promotion modality, with some researchers emphasizing Instagram's general utility as a source of education and motivation,[2-3] as well as users' experiences receiving social support via Instagram.

Additionally, health groups and professionals use this channel to share information about healthy lifestyle choices and medical knowledge for disease prevention, considering that it offers a chance to promote health awareness, self-efficacy, and treatment adherence among communities.[4] However, these public tools can create opportunities for social and health risks as recent studies have suggested that false or misleading information about health may spread over social media more quickly than accurate information.[5-6] As a result, it is critical to understand how health misinformation spreads and how it may influence choices and health habits.

Although there is widespread agreement among health professionals and policymakers regarding the importance of controlling health misinformation,[7] little is known about the effects that the dissemination of false or misleading health messages via social media may have in the near future on public health. To address this existing lacuna, we aim to assess the quality and reliability of information related to the disease "Tuberculosis" on the social media platform Instagram.

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This study aims to evaluate the type of information circulated about the disease "Tuberculosis" by categorizing them into symptoms, treatment, etc., to assess the authenticity of this information by verification with official resources like WHO, and to suggest measures for improving access to authentic information on Instagram by the population.

Methods

A cross-sectional type of observational study was conducted virtually over a period of ten days. Instagram – a widely used social media platform, was used to assess the information available about the disease "Tuberculosis". The top five hashtags were identified by the maximum number of posts - #tuberculosis, #tuberculosisawarenss, #tuberculosistreatment, #tuberculosiswarrior, and #tuberculosisdiagnosis. Each author was allotted one hashtag for further analysis. The authors analyzed the top ten posts under the allotted hashtags each day for ten days. Posts in language "English" or "Hindi" and containing information about the disease "Tuberculosis" were included in the study; while the rest were excluded. A questionnaire was made for assessment of these posts based on various pre-determined categories- Information about the post, information about the disease "Tuberculosis" and to assess if this information is "true," "false," or "cannot be determined." As per World Health Organization Factsheet on Tuberculosis & CDC guidelines, correct posts were deemed to be proving "true" information, otherwise labeled as "false."

Following training on analyzing the quality and reliability of the posts, each author independently assessed the posts assigned to their respective hashtags.

The reliability and the quality of the posts were determined by using the Reliability Score and Global Quality Score(GQS) respectively.[8] The GQS has five points: 1) Poor quality, poor flow of the site, most information missing, not at all useful for patients; 2) Generally poor quality and poor flow, some information listed but many important topics missing, of very limited use to patients; 3) Moderate quality, suboptimal flow, some important information is adequately discussed but others poorly discussed, somewhat useful for patients; 4) Good quality and generally good flow, most of the relevant information is listed, but some topics not covered, useful for patients; and 5) Excellent quality and excellent flow, very useful for patients. The calculation of the reliability score uses five questions – the answer to the question "yes" is scored as point one and "no" is scored as zero. The total score of five questions is calculated for each post. These five questions are (1) Are the aims clear and achieved? (2) Are reliable sources of information used? (3) Is the information presented balanced and biased? (4) Are additional sources of information listed for patient reference? (5) Does it refer to areas of uncertainty?

Data was entered in Excel and analyzed using the function tool. Statistical analysis was performed using SPSS software and the value of significance was calculated using T-test for mean and standard deviation and Z-test for percentages.

Results

A total of 370 posts were considered relevant and included in the study after applying the inclusion and exclusion criteria. *Table 1* shows the number of posts belonging to each hashtag that was included in the study. Maximum posts belonged to #tuberculosistreatment, followed by #tuberculosis.

Table 2 shows the characteristics of the posts analyzed based on the type of post (image or video) and their interaction with users (number of likes and comments). *Figure 1* depicts the owner of the posts (doctor, pharmaceutical industry, etc., who created and uploaded the post). The 370 posts had a wide reach evidenced by 66048 likes and 1823 comments by the users. However, only 20% of the posts were created and uploaded by doctors. *Table 3* shows the type of information about tuberculosis circulated by the posts. 50% of posts gave descriptive information about the disease and 20% of posts revealed information about prevalence and diagnosis.

***Figure 1*. Owner of the Posts (Created and Uploaded the Post).**

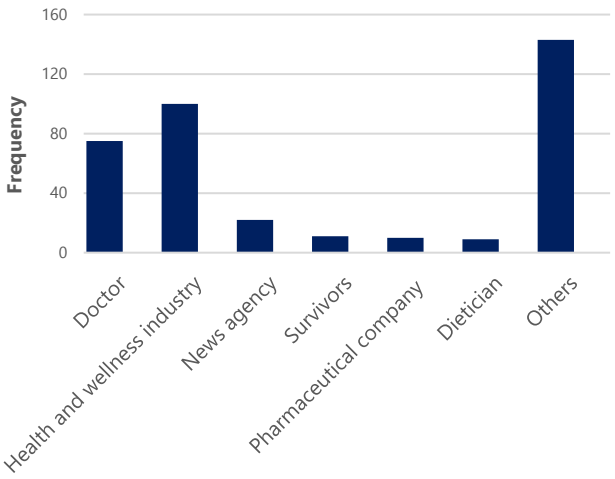

***Table 1*. Number of Relevant Posts Identified under each Hashtag.**

Hashtag Name	Number of Relevant Posts
#tuberculosis	80
#tuberculosisawareness	71
#tuberculosistreatment	102
#tuberculosiswarrior	38
#tuberculosisdiagnosis	79
Total	370

Table 2. **Characteristics of the Posts Analyzed.**

	N	Percentage
Type of post		
Image	333	90
Video	37	10
Engagement with users		
Total no. of likes	66048	
Total no. of comments	1823	

Table 3. **Type of Information about Tuberculosis Communicated by the Posts.**

Information Type	N	%
Description	187	50.54
Prevalence	75	20.27
Symptoms	62	16.76
Diagnosis	75	20.27
Screening	61	16.49
Prevention	56	15.14
Treatment	58	15.68
Mortality	14	3.78
Rehabilitation	5	1.35
Support Groups	11	2.97
Patient sharing their own experience	13	3.51
Parents sharing experience with family members	4	1.08

Out of all the posts analyzed, the information circulated in them was "true" in 287 posts (77.57%), "false" in 3 posts (0.81%) and it "could not be determined" in 80 posts (21.62%). 55 out of the 370 analyzed posts (14.86%) had promotional content whereas 315 posts (85.14%) had no promotional content.

The quality of posts was analyzed using Global Quality Score. The posts were rated from "Very Low" quality to "Very high" quality using pre-determined criteria. The reliability of the posts was analyzed using Reliability Score ***Table 4***. The majority of the posts (31.89%) in our study were classified as "medium" quality, while most (31.08%) were assessed as having "very low" reliability.

The total number of relevant posts was divided into two groups. The information posted by doctors and others in the healthcare industry involved in active patient care was grouped into group A and all others into group B. ***Tables 5*** ***and*** ***Table 6***. There was a significant difference in the number of "true" posts (p value<0.0001), Global Quality Score (p value=0.0018), and Reliability Score (p-value=0.0007) between the two groups

Discussion

In this study, 370 posts were found to be relevant using the inclusion criteria and had a vast interaction by users on Instagram with 66048 likes and 1823 comments. The health and wellness industry created and uploaded these posts comprising 27.02% of the total posts, followed by doctors at 20.27% and news agencies at 5.96%. However, it was interesting to note that 38.64% of the posts came from various miscellaneous sources with the majority from pages dedicated solely to the purpose of TB awareness and education. 14.86% of the posts had promotional content. Around 50.54% of the posts analyzed contained descriptions of tuberculosis and 20% had information about prevalence and diagnosis. Another study by Niknam et al.[9] about content analysis related to COVID-19 on Instagram had "diagnosis and prevention" as major themes in the reviewed posts.

Table 4. **Quality and Reliability of The Posts.**

		N	%
Global Quality Score			
1	Very low (Poor quality, poor flow of the site, most information missing, not at all useful for patients)	100	27.03
2	Low (Generally poor quality and poor flow, some information listed but many important topics missing, of very limited use to patients)	106	28.65
3	Medium (Moderate quality, suboptimal flow, some important Information is adequately discussed but others poorly discussed, somewhat useful for patients)	118	31.89
4	High (Good quality and generally good flow, most of the relevant information is listed, but some topics not covered, useful for patients)	39	10.54
5	Very High (Excellent quality and excellent flow, very useful for patients)	7	1.89
Reliability Score			
1	Very Low	115	31.08
2	Low	96	25.95
3	Medium	97	26.21
4	High	50	13.51
5	Very High	12	3.24

Table 5. **Comparison of the Posts Having "True" Information in the Group A and Group B.**

	Group A (n=205) (Posts created and uploaded by doctors and health & wellness industry)	Group B (n=165) (Posts created by those not included in Group A)
Posts having "true" information	174	113
Percentage	84.88%	64.48%

Legend: p-value= <0.0001 (Significant, p value <0.05)

Table 6. **Comparison of the Mean of Global Quality Score and Reliability Score of the Posts in the Group A and Group B.**

	Group A (Posts created and uploaded by doctors and health & wellness industry)	Group B (Posts created by those not included in Group A)
Global Quality Score		
Mean ± SD	2.47 ± 1.00	2.13 ± 1.07
P value = 0.0018 (Significant; p<0.05)		
Reliability Score		
Mean ± SD	2.50 ± 1.12	2.10 ± 1.13
P value = 0.0007 (Significant; p<0.05)		

Legend: SD, Standard deviation.

Most posts (77.57%) in our study had "true" information about tuberculosis. The posts created and uploaded by doctors and the health and wellness industry had a statistically significant higher number of posts that contained "true" information (p <0.05) and scored statistically significantly higher on the mean of Global Quality Scores and Reliability Scores.

Some studies similarly revealed that Internet users trust expertise-based information sources over experience-based information sources,[10] whereas others found no significant difference in the perceived credibility of the content generated by doctors and laymen.[11]

Healthcare practitioners and policymakers, in addition to social media owners, can help reduce the potential harm of misleading or incorrect information transmitted through social media by directing patients to reputable sources. However, as healthcare providers are unable to control the content that is posted or discussed, there is still a high risk of misinformation. A study by Mahmud et al. [12] revealed poor knowledge, attitude, and practices toward TB among social media users.

Therefore, we recommend that doctors and healthcare professionals work in collaboration with health influencers to develop and implement communication strategies aimed at busting myths and stigmas related to TB and improving patient awareness. This strategy has been examined by previous research into Instagram suggesting that influencers provide several techniques for disseminating information that may be less possible for organizations. [13-14] Moreover, indications from social media about significant health events or trends could provide policymakers with information to guide the development of targeted and timely interventions, thereby making social media analysis immensely valuable in government policy making. [15]

Given the substantial impact of tuberculosis (TB) on the population, government interventions are necessary. We recommend adopting a strategy to address online misinformation and fake news about TB, ensuring that only reliable and high-quality information from credible, approved sources is disseminated. This strategy can be integrated into the government's National Tuberculosis Elimination Program (NTEP) which has adopted various technological approaches to improve patient care in the recent past,[16] so ensuring quality TB content will only strengthen this approach. Fact-checking teams can be established to mitigate the spread of misinformation by efficiently identifying and verifying unreliable content. The social media and technology industries can also use artificial intelligence (AI) as a supplement to combat misinformation, like the detection of false news.[17] Since AI is easily trainable to identify examples of news that are factually accurate, and by leveraging AI's ability to detect anomalies or deviations from the norm, it is possible to develop a solution that can continuously monitor, compare, and report on the factual accuracy of posts.

This study had some limitations, including the possibility of posts being repeated if they contained multiple hashtags. Although our sample size was small, this was done on purpose because users typically only view the top few posts that catch their attention, rather than going through all the available posts. In addition, because Instagram lacks the feature to authenticate credentials, we were unable to verify the doctor's qualifications or those of the health and wellness industry. We are also aware that, despite receiving a large number of likes and comments, we were unable to estimate the precise number of users who viewed the posts. This estimate could have been significantly higher, but we lacked the resources necessary to ascertain it.

In conclusion, the posts created and uploaded by doctors and the health and wellness industry had a statistically significantly higher number of posts with "true information", a higher mean Global Quality Score, and Reliability score. To achieve the End-Tb Goal of 2030, the policymakers should join hands with doctors and the health-wellness industry to ensure that correct information is being circulated on social media like Instagram and the use of artificial intelligence software will promptly help to identify

incorrect information and thereby stop misinformation from being circulated.

Summary – Accelerating Translation

Title: Assessing the Quality and Reliability of Tuberculosis Information on Instagram

Summary: Tuberculosis (TB) is a centuries-old disease that continues to be a significant global health concern. In an effort to control and eliminate TB, it is crucial to understand people's knowledge and awareness of the disease. With the rise of social media as a platform for health information, this study examined the quality and reliability of TB-related information on Instagram.

Over a period of ten days, researchers conducted a virtual cross-sectional survey on Instagram to evaluate the information shared under the top six hashtags related to tuberculosis. The study focused on posts in English or Hindi that contained information about TB. A questionnaire was developed to assess various aspects of the posts, such as the type of information and its accuracy, using reliable sources like the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC).

A total of 370 relevant posts were analyzed, with a significant level of engagement from users, including 66,048 likes and 1,823 comments. The posts were primarily created by the health and wellness industry (27.02%), followed by doctors (20.27%) and news agencies (5.96%). Approximately half of the posts included descriptions of TB, while 20% discussed prevalence and diagnosis.

The study found that posts created by doctors and the health and wellness industry were more likely to contain accurate information compared to other sources. These posts also received higher scores for overall quality and reliability. This highlights the importance of reliable sources when seeking health information on social media platforms.

The findings suggest that social media can serve as a powerful tool for disseminating accurate scientific information about TB and other diseases. However, it is essential for governments and policymakers to develop internet-based programs and interventions to improve knowledge, attitudes, and practices related to TB.

This study underscores the need for individuals to critically evaluate the information they encounter on social media platforms. When searching for health-related information, it is advisable to rely on reputable sources such as government health agencies, medical professionals, and established health organizations. By being cautious about the sources of information and verifying its accuracy, individuals can make better-informed decisions regarding their health.

Additionally, healthcare professionals and organizations should consider utilizing social media platforms to educate the public about TB and promote reliable sources of information. By actively engaging with social media users, healthcare providers can help combat misinformation and provide accurate information about TB prevention, diagnosis, and treatment.

In conclusion, while social media platforms like Instagram can be valuable sources of health information, it is crucial to critically assess the reliability and accuracy of the content. Government initiatives, along with the active involvement of healthcare professionals, are needed to ensure that accurate and trustworthy information about TB is readily available to the public. With improved knowledge and awareness, we can work towards reducing the burden of TB and achieving the goal of its elimination by 2025.

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Original Article

Determining the Prevalence and Severity of Menopausal Symptoms in Post-Menopausal Women of Eluru, Andhra Pradesh, India, using the Menopause Rating Scale (MRS)

Anjali Mediboina,[1] Penumala Pratyusha,[1] G. Sravan Kumar.[2]

Abstract

Background: This study aimed to assess the prevalence and severity of menopausal symptoms among women in Eluru, Andhra Pradesh, India, to better comprehend the specific challenges faced by rural women during this transitional phase. **Methods**: Post-menopausal women who visited the Rural Health and Training Center in Eluru between September-November 2021 and had one year of amenorrhea were included. A face-to-face interview administered a questionnaire to collect socio-demographic details and the Menopause Rating Scale (MRS) which contained 11 questions using a 4-point Likert scale. Microsoft Excel and SPSS-20, with one-way ANOVA test were used for data and statistical analysis. **Results**: A total of 100 respondents were included, aged between 45-60 years. Majority of the respondents (37%) were aged 45-50 years and were unskilled workers (53%) with a monthly income falling under the upper middle-class category (53%). Additionally, 61% belonged to nuclear families. Using the MRS, joint and muscle pains were the most prevalent symptoms (82%), followed by sleep problems (64%) and anxiety (57%). Heat discomfort was reported least frequently (25%). Age groups and symptom severity were found to be significantly associated, indicating that women between 45-50 years were more likely to experience mild-severe symptoms. **Conclusion**: This study identified a notable prevalence of menopausal symptoms among women in Eluru; however, limitations included the limited sample size and geographic scope. Retrospective data collection might have introduced recall bias. The study highlights the need for increased awareness and education on menopause. Community-based programs and health centers should be established to address these needs.

Introduction

Menopause is a natural biological process that is generally defined as the time of cessation of ovarian function, resulting in permanent amenorrhea. At this stage, the menstrual cycle stops for longer than 12 months and is accompanied by a decrease in the levels of estrogen and progesterone. This period marks the end of a woman's reproductive life.[1]

Menopausal symptoms can manifest in various ways. These included vasomotor symptoms (hot flashes and night sweats), psychosocial symptoms (mood swings, anxiety, depression), physical symptoms (joint and muscle pain, sleep disturbances), and sexual symptoms (vaginal dryness and decreased libido). These symptoms often occur due to the hormonal and biological fluctuations that take place during menopause, and they can have a profound effect on a woman's daily life, relationships, and overall health.[2]

In the Indian context, the onset of menopause tends to occur at a relatively young age, with some women experiencing it as early as 30 to 35 years old.[3] Furthermore, the proportion of menopausal women in the general population has increased significantly in recent years due to rising life expectancy. By 2026, the number of women in India who are 45 years old or above is projected to reach 401 million, highlighting the substantial impact of menopause on a significant portion of the population.[4] Factors such as age at menarche, breastfeeding of multiple children, and age at first pregnancy have been found to be strongly correlated with menopausal age.[5] It is possible that the cultural practice of early marriage and subsequent early pregnancy in India may be contributing factors to the average age of menopause in the country.[6]

Despite advancements in developing nations, including India, the existing biomedical healthcare model primarily focuses on addressing the medical symptoms of menopause to minimize their impact on women's psychosocial transition during this phase. However, there is a considerable lack of awareness and understanding regarding the effects and challenges faced by women during menopause, particularly among rural communities.[7, 8]

Although India offers various programs for maternal and child health, family planning, and other health services, the attention given to women's health is mainly focused on sexual and

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reproductive health, with little to no consideration for post-menopausal or mid-life health.[9] For example, Reproductive, Maternal, Neonatal, Child, and Adolescent Health (RMNCH+A) is a program under the National Health Mission (NHM) aimed at promoting lifecycle interventions, but it does not extend to health concerns beyond the reproductive years.[10] Moreover, rural areas often face significant challenges in accessing health care services. Shortages of female doctors and health staff in rural settings exacerbate these challenges, as these areas are often considered remote or challenging posts by health care providers. Consequently, rural women may encounter barriers in seeking timely and appropriate healthcare, particularly for conditions related to menopause and mid-life health.[11] Existing research also primarily focuses on northern and central India, with limited attention given to the unique socio-cultural and environmental factors influencing menopausal experiences in the southern regions.

To bridge this knowledge gap, this study aimed to evaluate the prevalence and severity of menopausal symptoms among women in Eluru, Andhra Pradesh, in Southern India. By examining the common symptoms experienced by women who met the inclusion criteria, this study sought to shed light on the challenges faced during this transitional period, which could ultimately help in developing targeted interventions, improving healthcare services, and enhancing the overall well-being of women in rural India during their menopausal years.

Aims and Objectives

Hence, the primary objective of this study was to ascertain the prevalence and assess the severity of menopausal symptoms in postmenopausal women in Eluru. Furthermore, it aims to explore potential sociodemographic factors, including age, monthly per capita income, and type of family structure, associated with the severity of menopausal symptoms among these women.

Methods

Design and Setting

The present study was an analytical cross-sectional study that adhered to the STROBE guidelines. The study was conducted during September, October, and November 2021 at the Rural Health and Training Center (RHTC) in Eluru, which serves as a primary healthcare facility catering to the healthcare needs of the rural population in the region. This was a significant setting for this study, as it provided access to a diverse population of postmenopausal women. This article has been reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies (*Supplementary Material*).[12]

Inclusion and Exclusion Criteria

The present study used convenience sampling method, and all women visiting the Rural Health and Training Center (RHTC) in Eluru, India, who had experienced at least one year of amenorrhea and were willing to provide informed consent, were included in the study. We excluded individuals who were unwilling to participate, those with medically or surgically induced menopause (i.e., previous history of hysterectomy), or women using hormone replacement therapy (HRT) to eliminate the influence of exogenous hormonal interventions on menopausal symptom presentation. Women with a known history of tumors, tuberculosis, rheumatoid arthritis, or osteoarthritis were also excluded from the study to minimize the impact of specific medical conditions known to present symptoms that could mimic or exacerbate menopausal symptoms.

These criteria were applied to ensure that the study focused on naturally occurring menopausal symptoms among a homogeneous group of participants, and to minimize potential confounding factors associated with induced menopause or specific medical conditions.

Study Tools

A pre-designed and ethically approved questionnaire, consisting of three sections, was administered by the researchers via face-to-face structured interviews. The first section included an informed consent form provided in both the English and Telugu languages. The second section collected sociodemographic data, including information on age, occupation, type of family (nuclear or joint), and monthly income based on Per Capita Income. The third section employed the Menopause Rating Scale (MRS), which is a well-established health-related quality of life scale developed in the early 1990s, and has since been used by researchers such as Armo et al. and Sushmitha et al. in various regions across India to evaluate menopausal symptoms on women's quality of life.[13,14,15]

The scale comprises 11 items, with each item scored from 0 to 4, where 0 indicates no complaints and 4 represents very severe complaints. Scores for each item are then summed up, and the total scores were then classified into five grades, ranging from "none," "mild," "moderate" and "severe." The scale assesses the quality of life across three independent dimensions: somatic, psychological, and urogenital.[13]

Data Entry and Analysis

Microsoft Excel 2010 and Statistical Package for Social Sciences (SPSS) version 20 were used to analyze the data. Sociodemographic variables and the prevalence of menopausal symptoms were documented in terms of frequency and percentage. To explore associations between sociodemographic factors and the items on the MRS, one-way Analysis of Variance (ANOVA) with a 95% Confidence Interval (CI) was employed. Statistical significance was set at $p < 0.05$. ANOVA was considered as an appropriate statistical test to explore potential differences in these scores across different sociodemographic factors, allowing for a comprehensive assessment of the impact of these factors on the severity of menopausal symptoms.

Ethical Issues

The study was approved by the Institutional Ethics Committee (IEC) of the Alluri Sitarama Raju Academy of Medical Sciences,

with approval number IEC/ASR/APPROVAL/023/2021. The study adhered to ethical guidelines, ensuring voluntary participation of individuals without coercion. Confidentiality was maintained by anonymizing participant data through the use of study IDs instead of personal identifiers.

Results

A total of 109 responses were collected, of which seven were excluded due to incomplete collection of data, and two were excluded because they did not meet the stipulated inclusion criteria, particularly concerning the requirement of at least one year of amenorrhea or other specified criteria. Therefore, the responses of the 100 participants were included in the analysis.

Socio-demographic Characteristics

Table 1 shows the respondents' sociodemographic characteristics. The age of the participants ranged from 45 to 60 years, with the majority (37%) of participants belonging to the 45-50 age group, and most (53%) of the participants were unskilled workers.

Regarding monthly income, participants' responses were categorized based on their per capita income (PCI). The majority (53%) earned Rs. 3,766-7,532 per month (~45-90 USD), which, according to the revised modified BG Prasad's scale, falls under the upper middle-class category.[16] Additionally, information on the type of family revealed that most women (61%) belonged to nuclear families.

***Table 1.* Socio-demographic Characteristics of the Respondents.**

Characteristic	n (%)
Age Groups (years)	
45-50	37
50-60	30
>60	33
Occupation	
Homemaker	31
Unskilled Worker	55
Semi-Skilled Worker	10
Skilled Worker	2
Professional	2
Income per month (INR)*	
<1,129 (Lower class)	6
1,130-2,259 (lower middle class)	14
2,260-3,765 (middle class)	23
3,766-7,532 (upper middle class)	53
>7,533 (upper class)	4
Type of Family	
Joint	39
Nuclear	61

Legend: *Categories are according to the revised classification of BG Prasad's socioeconomic status for 2020.

***Figure 1.* Severity of Symptoms Reported by Participants in the Menopause Rating Scale.**

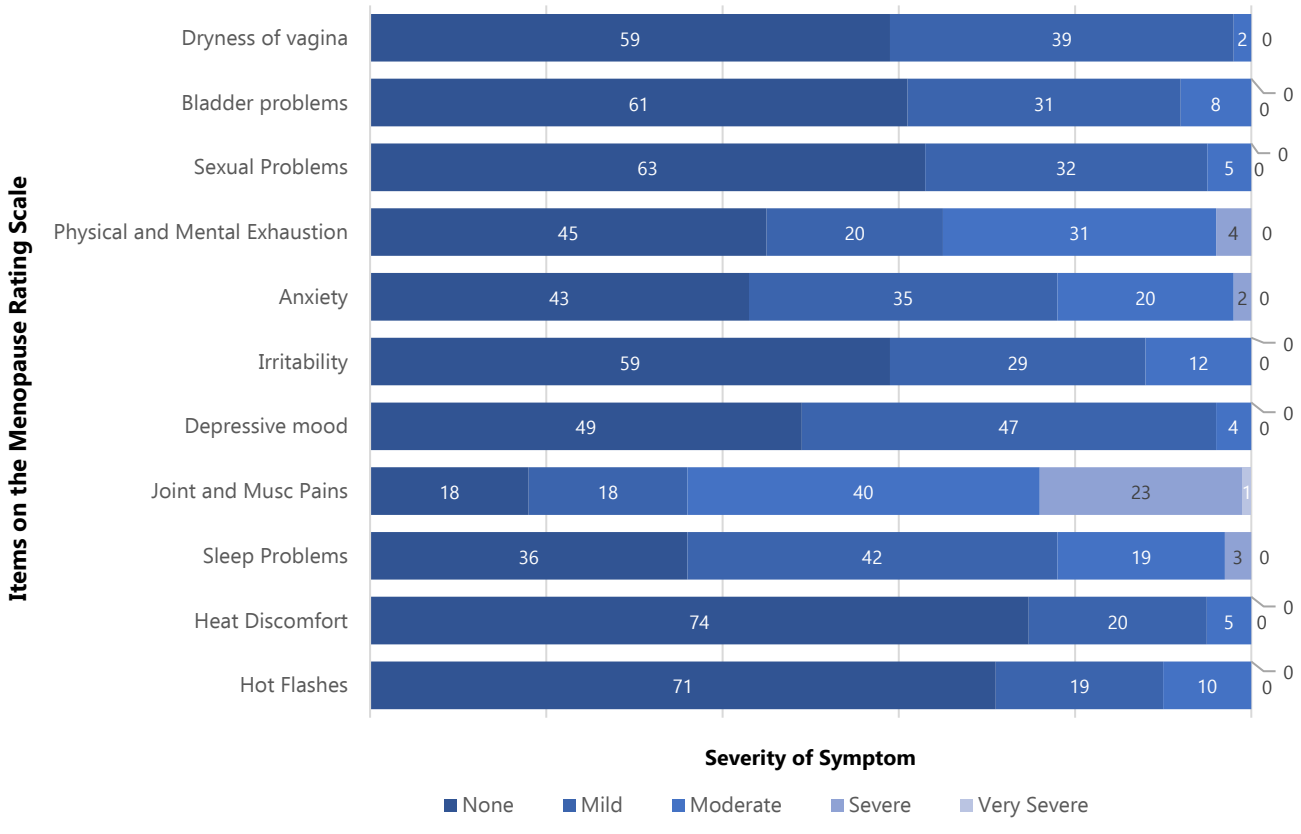

***Table 2*. Grading of Severity of Symptoms on the Menopause Rating Scale.**

Grading	n (%)
<5	31
5-10	37
11-15	28
>15	4

Menopause Rating Scale (MRS)

Participants scored the items on the Menopause Rating Scale (MRS) on a scale of 0–4. The severity of the symptoms, as reported by the participants, is shown in ***Figure 1***.

The grading of symptom severity and the total number of participants in each grade are shown in ***Table 2***. Four participants had a total score of > 15, indicating the need to manage their problems.

***Table 3*. Total Number of Respondents who Reported the Item as a Problem.**

Item	n (%)
Somatic (Mean=3.3, SD=1.9)	
Hot Flashes	29
Heat Discomfort	25
Sleep Problems	64
Joint and Muscle Pains	82
Psychological (Mean=2.8, SD=2.5)	
Depressive mood	51
Irritability	41
Anxiety	57
Physical and Mental Exhaustion	55
Urogenital (Mean=1.3, SD=1.6)	
Sexual Problems	37
Bladder problems	39
Dryness of vagina	41

Table 3 summarizes the number of participants who reported each item on the subscale as a problem (scoring 1-4). Among these symptoms, joint and muscle pain were the most frequently reported (82%), followed by sleep problems (64%). Anxiety was the most common psychological symptom (57%). Heat discomfort was the least frequently reported symptom (25%) in this study. The overall mean score for each subscale is also presented, with somatic symptoms being the most reported symptoms (Mean=3.3, SD=1.9), and urogenital items being the least reported symptoms overall, (Mean=1.3; SD=1.6).

***Table 4*. Association between Socio-Demographic Characteristics and Grades of Severity.**

Variables	Grades of Severity (n)			
Type of Family	None	Mild	Moderate	Severe
Joint	10	15	13	1
Nuclear	21	20	17	3
P Value*	0.08			
Per Capita Income	None	Mild	Moderate	Severe
<1,129	2	4	0	0
1,130 – 2,259	7	2	5	0
2,260 – 3,765	9	8	5	1
3,766 – 7,532	12	21	18	2
>7,533	1	0	2	1
P Value	0.3661			
Age Groups	None	Mild	Moderate	Severe
45-50	10	9	16	2
50-60	11	12	6	1
>60	10	14	8	1

Legend: *P value=0.0098 (<0.05) was considered significant.

Association Between Socio-Demographic Factors and Items on the MRS

A one-way ANOVA test was conducted to examine the associations between sociodemographic factors and grades of symptom severity, as shown in ***Table 4.***

There was no significant association between family type, per capita income, and symptom severity grades. However, age groups showed a significant association, with an F-statistic value of 7.64 and a p-value <0.05. Women in the 45-50 age group were thus observed to be more likely to experience mild to severe symptoms.

Discussion

The present study aimed to identify the prevalence and severity of menopausal symptoms in women in Eluru and explore the associations between sociodemographic factors and symptom severity. Our study has several noteworthy findings.

Among the 100 women considered, a majority (37%) belonged to the 45-50 age group, indicating a younger than average menopausal age group of approximately 50 years. This finding aligns with previous studies in India, which have reported a relatively early onset of menopause among Indian women compared to Western populations, such as the review by Pallikadavanth et al. and Prasad et al.[4,17] It is also important to note that this is different from the younger age of menopause as reported by the 1996 data from, and suggests that women in rural India also experience similar patterns of menopausal symptoms as reported elsewhere.

In India, the national classification of labor is as follows: unskilled workers (e.g., construction workers, peons), semi-skilled workers (e.g., bearers, assistant electricians), skilled workers (e.g., electricians, mechanics, tailors), and professionals (e.g., teachers, doctors).[18] We found that most of the participants in our study were unskilled workers (53%) and earned an income of Rs. 3,766-7,532 per month (53%), which according to B.G. Prasad's socioeconomic scale (2020), falls under the upper middle class category.[16] A nuclear family system is defined as 'a two generation family consisting of a father and mother and children or a single parent and his/her children', while a joint family is defined as 'three or more generations living together, having a single line of authority, either patrilineal or matrilineal.[19] An overall 61% of women in our study belonged to nuclear families.

The type of family (joint/nuclear) and socioeconomic status can potentially affect the severity of menopausal symptoms. Joint families may provide more familial support, which could mitigate the psychological impact of symptoms, and higher socioeconomic status may offer better access to healthcare resources, leading to more effective management of symptoms.[20] However, the extent of these influences may vary across different cultural and geographical contexts. The present study found no significant association between the type of family (joint/nuclear) and the severity of symptoms. This contrasts with studies by Vijayalakshmi et al., Thakur et al., and Sushmitha et al., who observed a significant association between socioeconomic status and symptom severity.[15, 21, 22] This could be due to the limited sample size of the various socioeconomic groups in our study. Furthermore, the present study found no significant association between per capita income and severity of symptoms, while Karmakar et al. noted a significant association between vasomotor symptoms and type of family.[1] These discrepancies highlight the need for more comprehensive research incorporating larger and diverse samples across different regions to better understand the relationship between socioeconomic factors, family type, and menopausal symptoms.

In terms of specific symptoms on the MRS, joint and muscle pain were the most frequently reported (82%), followed by sleep problems (64%). These findings align with studies conducted by Gyawali et al. in Nepal and Singh et al., in rural Delhi.[23, 24] However, it is worth noting that heat discomfort was the least common symptom (25%) in our study, which is in contrast to the findings of Pandey et al., who also noted that it is one of the more common findings in studies outside Nepal.[25] This may be attributed to cultural factors and the conservative nature of reporting sexual health-related symptoms among women in rural India.[25, 27]

Regarding psychological symptoms, anxiety was the most commonly reported (57%), which is similar to studies by Poomalar et al. and Ayranci et al., while the study conducted by Singh et al. in rural Delhi reported depression to be more common.[24, 28, 29] Furthermore, a study by Bernis and Reher in Spain noted that women in urban areas were found to be more affected by these psychological symptoms than rural women.[30] The lower frequency of urogenital symptoms compared to the other two subscales is another interesting observation, which was also noted by Armo et al. in Chhattisgarh.[14] This trend aligns with previous research by Joshi et al. and Anukriti et al., indicating the hesitancy among women in rural India to report such symptoms, possibly due to cultural conservatism surrounding sexual health matters.[31,32] Women in rural India also have different customs and beliefs regarding reproductive health, and these cultural, and religious, beliefs and values have a significant role in shaping women's experiences during the menopausal period.[33] Studies by Mackey et al., and Hunter et al., observed a positive effect of religion on the mental health of midlife South Asian women, and observed that their belief in a higher power allowed them to cope with stressors.[34, 35] Therefore, promoting religious and spiritual practices among religious women and reassessing cultural norms are crucial to support women during this transitional phase, and these findings underscore the importance of researchers approaching these sensitive topics with cultural sensitivity and discretion, and suggests a need for further investigation into the sociocultural factors influencing women's perceptions and experiences in discussing these issues openly.[27,30]

Our study found that women in the 45-50 age group were more likely to experience mild to severe menopausal symptoms than women in other age groups. This is consistent with previous studies, indicating that the perimenopausal period is characterized by more severe symptoms than the postmenopausal phase.[36] Thus, it is important for healthcare providers to recognize the increased symptom burden during this transitional phase and provide appropriate support and management strategies.

Limitations

Although our study provides valuable insights into menopausal symptoms among women in rural India, it has some limitations. The sample size was restricted to one area of Eluru, which may limit the generalizability of the findings. A larger and more diverse sample encompassing women from various rural areas would provide a more comprehensive understanding of menopausal symptoms in this population. The convenience sampling method employed in our study could also introduce a selection bias and impact the generalizability of the findings. The recruitment of participants from the Rural Health and Training Center in Eluru may not fully represent the entire spectrum of women experiencing menopausal symptoms in rural areas, potentially excluding those who did not seek healthcare or access a specific health center during the study period. The exclusion of such individuals might influence the representation and variation in menopausal symptom experiences within the broader rural community. Additionally, the retrospective nature and self-reporting of the data collected from older women may have introduced recall bias owing to the longer time span since their menopausal transition, highlighting the need for caution when interpreting the results.

These limitations emphasize the necessity of more inclusive sampling methods and prospective study designs to attain a more nuanced understanding of menopausal symptoms and their implications among women in rural India.

Conclusion

The prevalence of menopausal symptoms among women in Eluru highlights the critical need for targeted interventions and enhanced awareness programmes. Despite the limitations of our study, notably the restricted sample size, our findings emphasize the urgency to address menopause-related challenges in rural communities. A crucial finding of our study was the lack of awareness among the majority of women regarding menopause and the management of associated symptoms through interventions such as exercise and yoga.[37, 38] This presents a significant opportunity for healthcare initiatives focused on education and awareness-building among women and their families. By fostering a deeper understanding of menopausal transitions and their management, these initiatives could substantially improve the quality of life of women in rural areas. Furthermore, our study underscores the need to establish community-based programs and health centers dedicated to addressing menopausal health concerns. Collaborative efforts involving ASHA workers, MLHP professionals, Anganwadi centers, and female village volunteers can play a pivotal role in disseminating information, offering support, and providing accessible healthcare services to menopausal women.

The practical implications of our findings extend beyond the identification of prevalent symptoms; they call for a proactive approach to empower women with the knowledge and resources necessary to navigate the menopausal phase while acknowledging and incorporating their cultural and religious customs into menopausal care. Health policies should be introduced to specifically address the reproductive needs of elderly patients. By leveraging community-based support systems and healthcare infrastructure, we can bridge the information gap, destigmatize menopausal experiences, and facilitate improved health outcomes for women in rural regions, thereby improving their quality of life during this transitional phase.

Summary – Accelerating Translation

Title: Determining the Prevalence and Severity of Menopausal Symptoms in Post-Menopausal Women of Eluru, Andhra Pradesh using the Menopause Rating Scale (MRS)

Main Problem to Solve: Menopausal symptoms among rural women are often overlooked, leading to inadequate support and management strategies.

Aim of the Study: This study aimed to assess the prevalence and severity of menopausal symptoms among women in Eluru, Andhra Pradesh, to better understand the challenges they face during this transitional phase.

Methods: We interviewed post-menopausal women at the Rural Health and Training Center in Eluru between September and November 2021. We collected socio-demographic details and used the Menopause Rating Scale (MRS) to assess symptom severity.

Results: Among 100 women aged 45 to 60 years, joint and muscle pains were the most prevalent symptoms (82%), followed by sleep problems (64%) and anxiety (57%). Women aged 45-50 were more prone to experiencing mild to severe symptoms.

Conclusion: This study highlights the significant prevalence of menopausal symptoms among rural women in Eluru. Incorporation of religious and cultural sensitivity while interacting with these patients is essential. Increased awareness and education about menopause, for women and their families, are also crucial, along with the development of targeted health policies, community-based programs and health centers.

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Author Contributions

Conceptualization: P.P, G.S.K. Data Curation: A.M, P.P, G.S.K. Formal Analysis: A.M, P.P, G.S.K. Funding Acquisition: P.P Methodology: A.M, P.P, G.S.K. Project Administration: P.P, G.S.K. Resources: P.P, G.S.K. Supervision: P.P, G.S.K. Writing - Original Draft: A.M, P.P, G.S.K. Writing - Review Editing: A.M, P.P, G.S.K.

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Supplementary Material

STROBE Statement—Checklist of Items that Should be Included in Reports of Observational Studies.

Section	Item No.	Recommendation	Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8
Generalisability	21	Discuss the generalisability (external validity) of the study results	8-9
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Original Article

Learning of Intimate Area Examination Amongst Pakistani Medical Students: Knowledge, Attitudes, and Practices Study

Masooma Bakhtiari,[1] Rana Muhammad Umar Farooq,[1] Muhammad Tayyab Ijaz,[2] Amna Shahab,[3] Muhammad Imran Hameed Daula.[3]

Abstract

Background: Intimate area examination (IAE) is an integral part of clinical examination skills and must be mastered by medical students before they start their careers. This study explores the experiences of Pakistani medical students regarding learning of IAE, the associated barriers and their effects on students' learning. **Methods:** This cross-sectional study, based on a self-designed questionnaire, was conducted at two Pakistani medical colleges, which included final year students and postgraduate trainees. **Results:** During their undergraduate training, 74.9% of the respondents had not conducted a female pelvic examination, 51.9% had not examined a female groin, 79.7% had not examined a female rectum, and 72.7% had not examined a male rectum. From the 65 postgraduate doctors, 48.4% reported that they were not prepared to perform an IAE at the start of their clinical career. Regarding barriers to IAE learning, more than half of the respondents felt that the opposite gender of the patient (64.7%) and patient's refusal (63.1%) had a strong negative effect on IAE learning. A high percentage of respondents reports that they were not taught IAE during their undergraduate years. Among the currently used pedagogical techniques, 71.1% of the respondents opted for real patient-based learning, followed by clinical simulations (21.9%), and videos (7.0%). No one thought examination should be taught theoretically. A significant difference between male and female experience in IAE learning was also observed. **Conclusion:** Learning of IAE remains unsatisfactory and poses a major challenge for the Pakistani Medical Students in the institutes included in this study.

Introduction

Intimate area examination (IAE) refers to a physical examination of male and female genitalia, female breasts, and the rectum.[1] In Pakistan, the medical education system typically lasts for five years and encompasses compulsory subjects such as gynecology, surgery, pediatrics, and other related fields. Each academic year culminates in a rigorous annual examination that combines written assessments and Objective Structured Clinical Examinations (OSCEs). It is worth noting that these subjects often entail practical training that involves exposure to intimate areas to ensure comprehensive development of clinical skills. Clinical examination is integrated into the undergraduate MBBS and BDS curriculum as part of the syllabus, which includes clinical demonstrations, individual practice on inanimate simulators (mannequins), practice with simulated patients/trainers, or individual practice on patients in a clinical setting under supervision. This approach enables students to become familiar with clinical skills at an early stage in their academic journey. By the time they reach their final year, they are not only taught how to conduct examinations but are also required to practice procedures on real patients and formulate a plausible differential diagnosis regarding the patient's condition. Mastering the skills of IAE is essential for a medical graduate to be able to practice safe medicine. Unfortunately, this skill is found deficient in most graduates.[2] A curriculum centered on an overwhelming plethora of facts and figures without significant emphasis on clinical skills, fails to serve the community well.[3]

Previous studies addressing the issue of learning IAE suggested that not only have students failed to thoroughly conduct an IAE at an undergraduate level,[4] but as a consequence of the awkward and obviously discommoding nature of these examinations, opportunities to procure expertise in this specific area are also not adequately available in undergraduate medical programs.[5]

IAE, just like any other human interaction, is subject to a lot of complexity due to the two individuals behaving in accordance with their own set of beliefs, knowledge, sex, religion, ethical values, experiences, and cultural context. All this significantly impacts the acquisition of skills involved in IAE. Moreover, the patient as well as the examining student / doctor might have concerns and apprehensions. Failure to address these puts both of them at considerable risk.[1]

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According to a number of studies, general practitioners deficient in IAE skill set avoided taking sexual histories and IAE examination in clinical settings.[6] The unfortunate exiguity of clinical experience in this area is not only detrimental to the student's professional career, since we are talking about the under-development of a certain skill set, which is often not subjected to amelioration later on, but it also puts the life of the patient in considerable danger due to the negligence that is most definitely concomitant. A thorough IAE is a prerequisite for accurately detecting many medical disorders like sexually transmitted infections,[7] testicular cancers,[8] hernias,[9] varicocele,[9] hydrocele,[9] carcinomas and cervical neoplasia screening via pap smears,[10] and other gynecological and obstetric ailments.[11]

Female breast examination helps the examiner to distinguish between benign and malignant lesions of breast tissue. Research literature suggests that 1 out of every 9 Pakistani women have, during some stage of their life, been diagnosed with breast cancer.[12] Hence, it is critical for the medical doctor to be well-equipped with the essentials of examining such areas because a single timely diagnosis could decide between life and certain death. In a developing country like Pakistan, there are other numerable cultural and religious elements which contribute towards barriers to adequate learning of IAE.

We conducted this study to analyze the ability and experience of Pakistani medical students when it came to IAE and also to detect factors which the students felt as hurdles in their IAE learning experience. Furthermore, this study sought to shed some light on teaching methodologies that are used to teach Pakistani medical students about IAE and to what extent do they succeed in their purpose. To the best of our knowledge, literature on this issue is scarce. It can, therefore, help educational institutions develop effective policies and courses that not only improve the clinical skills of aspiring doctors but also enhance our current pedagogy.

Methods

An observational cross-sectional study was conducted simultaneously at Combined Military Hospital Lahore Medical College & Institute of Dentistry (CMH LMC &IOD) and King Edward Medical University (KEMU), Lahore, Pakistan. CMH LMC & IOD is a private sector institute whereas KEMU is a public sector university. The study was conducted over a period of 8 months.
The eligibility criteria included male and female final year MBBS students and postgraduate trainees within two years of their graduation. Two hundred and ten participants were selected using non-probability convenient sampling (105 from each medical college) over a period of 6 months. Students who did not consent to be included in the study and whose questionnaires were incomplete were excluded from the study. The response rate was 89%. The research investigates the interplay among public versus private university settings, gender differences (boys versus girls), and academic levels (undergraduate versus postgraduate) to examine their individual influence on their experience of having performed IAE.

Data from the subjects was obtained through a self-designed questionnaire after informed consent. Participants were provided with a written explanation of the survey, ensuring transparency, and a guarantee of confidentiality, securing their informed consent before engaging in the research. The questionnaire was developed based on a scientific literature review,[4,13,14] and developed using the general principles of good survey design.[15] Initially, it was pilot tested on 12 students and changes in the response format were done according to the feedback of the pilot sample (such as a separate section for postgraduate students to avoid confusion). The questionnaire was further reviewed, and the quality of the included questions was verified. Cronbach's alpha test was applied to check the validity and reliability of the questionnaire before being used for data collection, and it gave a value of 0.80 hence deeming it reliable.

With a confidence level of 95% on a population size of 300 and 5% margin of error, the sample size was calculated using the following formula (based on central limit theorem) $n = Z^2 1 - {}^{\alpha}/2\ p(1-p) / d^2$ to be 187.

All information collected was entered and analyzed through of IBM SPSS 23. Descriptive statistics was employed to measure the frequencies and Pearson Chi-squared test was used to evaluate the association between different variables. During the analysis, the statistical significance level was considered as $P<0.05$.

The study was approved by the Ethical Review Committee of CMH LMC & IOD and the approval code was 228/ERC/CMHLMC. Given population was approached by the researchers and were informed about the research details. Essential guidelines were provided. Informed consent was taken from the participants and were told that their confidentiality will be ensured, and the data will be used for research purpose only. All reasonable steps were taken to ensure that any potential risks to the participants were mitigated as much as possible, such as assigning a sequential code to every participant during data entry to ensure confidentiality was maintained during the data analysis process

Results

Out of two hundred and ten 187 questionnaires were properly filled, 83 were filled by KEMU (44%), and 104 were filled by CMH LMC & IOD (55.6%). 98 of the questionnaires were filled by males (52.4%) and 89 were filled by females (47.6%). 122 of the respondents were undergraduate, whilst 65 had graduated less than 2 years ago.

The results comparing the percentage of male vs female students, and of private vs government students who had performed intimate area examination during their undergraduate clinical training are shown in *Table 1.*

The details of most common barriers that affect the performance of intimate area examination have been given in *Table 2.*

Table 1. **Percentage of Students Who Performed Intimate-Area Examinations During Clinical Training, by Medical College and Sex (n=187).**

Clinical Exam	Performed, n (%)	Type of College		p-value	Sex		p-value
		Public (n=83)	Private (n=104)		Male (n=98)	Female (n=89)	
Female breast	Yes	66 (79.5)	79 (76.0)	0.563	63 (64.3)	82 (92.1)	<0.001
	No	17 (20.5)	17 (24.0)		35 (35.7)	7 (7.9)	
Female pelvis	Yes	22 (26.5)	25 (24.0)	0.699	10 (10.2)	37 (41.6)	<0.001
	No	61 (73.5)	79 (76.0)		88 (89.8)	52 (58.4)	
Female groin	Yes	30 (36.1)	60 (57.7)	0.003	37 (37.8)	53 (59.6)	0.003
	No	53 (63.9)	44 (42.3)		61 (62.2)	36 (40.4)	
Female rectum	Yes	11 (13.3)	27 (26.0)	0.032	13 (13.3)	25 (28.1)	0.012
	No	72 (86.7)	77 (74.0)		85 (86.7)	64 (71.9)	
Male groin	Yes	63 (75.9)	85 (81.7)	0.330	83 (84.7)	65 (73.0)	0.05
	No	20 (24.1)	19 (18.3)		15 (15.3)	24 (27.0)	
Male rectum	Yes	25 (30.1)	24 (23.1)	0.268	33 (33.7)	16 (18.0)	0.051
	No	58 (69.9)	78 (75.0)		64 (65.3)	72 (80.9)	

Legend: Public= King Edward Medical University. Private= CMH LMC & IOD.

Table 2. **Medical Student Ratings of the Effect of Different Barriers to Learning Skills for Intimate Area Examination, by Sex and College Type (n=187).**

Barrier	Sex	Effect [n (%)]			p-value	University	Effect [n (%)]			p-value
		None	Little	Strong			None	Little	Strong	
Patient's refusal	Male	5 (5.1)	42 (42.9)	51 (52.0)	<0.001	Public	2 (2.4)	25 (30.1)	56 (67.5)	0.17
	Female	6 (6.7)	16 (18.0)	67 (75.3)		Private	9 (8.7)	33 (31.7)	62 (59.6)	
Patient's opposite gender	Male	4 (4.1)	23 (23.5)	71 (72.4)	0.06	Public	4 (4.8)	17 (20.5)	62 (74.7)	0.036
	Female	7 (7.9)	32 (36.0)	50 (56.2)		Private	7 (6.7)	38 (36.5)	59 (56.7)	
Lack of student motivation	Male	20 (20.4)	45 (45.9)	33 (33.7)	<0.001	Public	16 (19.3)	34 (41.0)	33 (39.8)	0.155
	Female	6 (6.7)	34 (38.2)	49 (55.1)		Private	10 (9.6)	45 (43.3)	49 (47.1)	
Lack of supervision	Male	11 (11.2)	46 (46.9)	41 (41.8)	<0.001	Public	7 (8.4)	36 (43.4)	40 (48.2)	0.203
	Female	6 (6.7)	22 (24.7)	61 (68.5)		Private	10 (9.6)	32 (30.8)	62 (59.6)	
Lack of favorable environment	Male	17 (17.3)	45 (45.9)	36 (36.7)	0.02	Public	5 (6.0)	39 (47.0)	39 (47.0)	0.063
	Female	6 (6.7)	35 (39.3)	48 (53.9)		Private	18 (17.3)	41 (39.4)	45 (43.3)	
Sociocultural issues	Male	10 (10.2)	35 (35.7)	53 (54.1)	0.39	Public	2 (2.4)	19 (22.9)	62 (74.7)	<0.001
	Female	6 (6.8)	26 (29.5)	56 (63.6)		Private	14 (13.6)	42 (40.8)	47 (45.6)	

Legend: Public= King Edward Medical University. Private= CMH LMC & IOD.

According to our results, a high percentage of respondents reports that they were never even taught IAE during their undergraduate years. For example, 106 (56.7%) of respondents were never taught examination of female pelvis, 114 (61%) were never taught examination of female rectum, 67 (35.8%) were never taught examination of female groin and 92 (49.2%) were never taught examination of male rectum. Majority of them were taught examination of the female breast (167, 89.3%) and the male groin (159, 85%).

Various methods of teaching were reported by the students, i.e., real patients, clinical simulations, videos, theoretical or a mixture of these. The results are shown in ***Table 3***. When asked which method they think is best, 133 (71.1%) of the respondents said real patients, followed by clinical simulations with 41 respondents (21.9%), and videos with only 13 (7.0%). None of them thought examination should be taught theoretically.

From the 65 postgraduate doctors who filled out the questionnaire, 31(48.4%) reported that they were not prepared to perform an IAE at the start of their clinical career. Only half of the males (12 (54.5)) and females (21 (50.0%)) respondents felt prepared. From KEMU, 19 (57.6%) of the respondents felt prepared, whereas from CMH LMC & IOD only 14 (45.2%) of the respondents felt prepared. There was no statistical difference between the responses of males and females who felt prepared, as well as between the responses from CMH LMC & IOD and KEMU.

Table 3. **Percent of Students who Performed Intimate-Area Examinations During the Clinical Training by Sex and College Type (n=187).**

Clinical Exam	Method [n (%)]	Sex		p-value	College Type		p-value
		Male	Female		Public	Private	
Female breast	Real patients	62 (63.3)	74 (83.1)		71 (85.5)	65 (62.5)	
	Clinical Simulations	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
	Videos	3 (3.1)	2 (2.1)	0.009	3 (3.6)	2 (1.9)	0.017
	Theoretical	21 (21.4)	1 (1.1)		9 (10.8)	13 (12.5)	
	Two or more	13 (12.1)	12 (13.4)		0 (0.0)	23 (23.2)	
Female pelvis	Real patients	12 (12.2)	40 (44.9)		26 (31.3)	26 (25.0)	
	Clinical Simulations	5 (5.1)	3 (3.4)		5 (6.0)	3 (2.9)	
	Videos	8 (8.2)	3 (3.4)	<0.001	8 (9.6)	3 (2.9)	0.035
	Theoretical	65 (66.3)	37 (41.6)		44 (53.0)	58 (55.8)	
	Two or more	8 (8.1)	6 (6.7)		0 (0.0)	13 (13.5)	
Female groin	Real patients	33 (33.7)	55 (61.8)		39 (47.0)	49 (47.1)	
	Clinical Simulations	2 (2.0)	5 (5.6)		5 (6.0)	2 (1.9)	
	Videos	7 (7.1)	5 (5.6)	0.001	11 (13.3)	1 (1.0)	0.001
	Theoretical	46 (46.9)	14 (15.7)		28 (33.7)	32 (30.8)	
	Two or more	10 (10.1)	10 (11.2)		0.00%	20 (19.3)	
Female rectum	Real patients	15 (15.3)	28 (31.5)		19 (22.9)	24 (23.1)	
	Clinical Simulations	4 (4.1)	1 (1.1)		2 (2.4)	3 (2.9)	
	Videos	9 (9.2)	3 (3.4)	0.16	7 (8.4)	5 (4.8)	0.174
	Theoretical	62 (63.3)	50 (56.2)		55 (66.3)	57 (54.8)	
	Two or more	8 (8.1)	7 (7.7)		0.00%	15 (14.5)	
Male groin/scrotum	Real patients	69 (70.4)	57 (64.0)		61 (73.5)	65 (62.5)	
	Clinical Simulations	1 (1.0)	2 (2.2)		2 (2.4)	1 (1.0)	
	Videos	1 (1.0)	1 (1.1)	0.804	2 (2.4)	0.00%	0.007
	Theoretical	15 (15.3)	19 (21.3)		18 (21.7)	16 (15.4)	
	Two or more	10 (12.2)	10 (11.2)		0.00%	22 (21.1)	
Male rectum	Real patients	41 (41.8)	24 (27.0)		35 (42.2)	30 (28.8)	
	Clinical Simulations	2 (2.0)	5 (5.6)		3 (3.6)	4 (3.8)	
	Videos	5 (5.1)	2 (2.2)	0.069	1 (1.2)	6 (5.8)	0.069
	Theoretical	41 (41.8)	52 (58.4)		44 (53.0)	49 (47.1)	
	Two or more	9 (9.2)	6 (6.7)		0.00%	15 (14.5)	

Legend: Private= CMH LMC & IOD Public= King Edward University

Discussion

According to the results of our research, the majority of the students had never been taught how to perform IAE during their undergraduate years. As a result, the greater chunk graduated with a serious dearth of clinical experience when it comes to IAE. As mentioned before, this may prove to be a setback as far as their diagnostic skills as a clinician are concerned. Our results reveal significant differences between the experience of male and female students. Although the percentage of the males and the females who had examined male genitalia was about the same, the percentage of females who had examined female intimate areas was far greater than their male counterparts. This could be due to a female patient's preference of a female doctor, as a recent research conducted in Pakistan indicates that 95% of the female respondents preferred a female gynecologist as opposed to a male.[16] Another study conducted amongst women during their prenatal visits revealed that female patients tend to be more content with the emotional sensibility and responsiveness expressed by female obstetricians as opposed to male obstetricians.[17] However, as far as males are concerned, previous literature reveals that a male patient's satisfaction is not related to the gender of the physician. [18]Therefore, it is safe to hypothesize that female patients might experience discomfort during intimate examinations by male doctors, particularly medical students. Patients may perceive the presence of a student as unnecessary compared to a consultant, thereby contributing to the male students' lack of experience. On the other hand, male patients are less likely to be influenced by the gender of the physician treating them regarding IAE. As a result, IAE of a female patient is more likely to be done by a female, whereas most of the times, such a discrepancy would not occur where IAE of a male patient is concerned.

There was no statistically significant difference between the experience of students from CMH LMC & IOD vs the students of KEMU, except for the examination of the female groin and the female rectum. Despite the larger patient load of KEMU and its affiliated hospital (Mayo Hospital Lahore), the fact that there was not much difference between the experience of students reveal that this deficiency of clinical experience has less to do with the

lack of opportunity, and more to do with other factors which shall be discussed below.

The most important barriers for IAE were the opposite gender of the patient and refusal of the patient. Previous relevant medical literature suggests that a number of factors can influence whether or not the patient consents to an IAE, one of which is the gender of the doctor.[19] This is further backed by an Australian study carried to identify the barriers that existed in the procedures of Sexual History Taking (SHT) and Intimate Area Examination (IAE). The research pointed at factors such as patient embarrassment, fear of invasion of privacy and the disparity of gender between the patient and the doctor.[6] For male students, the most important factor was the opposite gender of the patient. In a deeply conservative country such as Pakistan, religious and cultural values are deeply rooted in Islamic principles, emphasizing modesty and maintaining appropriate interactions between opposite genders to uphold moral standards. The adherence to these principles is often seen as a way to uphold religious morality and societal cohesion, contributing to the conservative norms regarding interactions between men and women. Unfortunately, this specific stigma meanders its way into medical practices owing substantially to the fact that many patients are strictly against seclusion/physical contact with the doctor of the opposite gender.[18] For females, the lack of supervision was also an important factor. This could be due to the fact that female healthcare workers are far more likely to face sexual harassment at the hands of a patient [21,22] than a male worker, and hence they feel more comfortable treating a male patient in the presence of a chaperone or a colleague instead of treating him in seclusion. To resolve these issues, gender-sensitive training methods, such as role-playing and case discussions, should be employed to foster a more inclusive and culturally competent healthcare environment, promoting better patient-doctor communication.

When comparing CMH LMC & IOD with KEMU, the results indicate that the opposite gender of the patient and the sociocultural issues were more of a problem for KEMU than for CMH LMC & IOD. This could be owing to the fact that KEMU is located in a socially conservative area, where cultural norms and religious values often shape perceptions and expectations around gender interactions. Furthermore, KEMU attracts patients from all socioeconomic backgrounds since it's a government hospital. In contrast, CMH LMC & IOD is not only situated at the heart of an affluent residential area – it is also private, hence catering disproportionately more to the wealthier strata of society which, being more affluent, might be more accustomed to diverse healthcare interactions and possibly more liberal attitudes toward gender dynamics.

When it comes to teaching the clinical methods of IAE, it is evident that this area is in dire need of amelioration, as a large percentage of students were never even taught IAE. Male students suffered more from this than females, as not only were a lesser percentage of male students taught examination on a female patient, but there is a striking disparity in the methods used to teach each gender as well. For example, the percentage of male students who were taught IAE on actual patients is considerably less than females, and instead they were taught using videos, clinical simulations or worse yet, just theoretically. This is not only detrimental to the honing of their skills as future physicians, but it may also be counter conducive to their assessment of female patients in the future.[23] For example, a research conducted in Pakistan in 1999 revealed that around 340 million new cases pertaining to STIs that are either curable and/or preventable limited to Gonorrhea, Chlamydia, Syphilis and Trichomoniasis were uncovered.[24] Keeping in mind the fact that these STIs are treatable if diagnosed early on, it is absolutely crucial that the medical practitioner has well-honed skills in the field of IAE.[7]

There were also appreciable differences between the methods used in CMH LMC & IOD vs KEMU. In KEMU, more students had performed IAE on actual patients as compared to CMH LMC & IOD, with less reliance on other methods, such as videos or clinical simulations. There is also no evidence of the students from KEMU having used more than one method to learn IAE. One reason behind this could be that KEMU, being a government institute, receives far less funding, as a result of which methods such as videos or simulations are not provided. However, KEMU also has a much greater patient load, hence a greater availability of patients could contribute to the lack of reliance on other methods.

When asked about the best teaching method for IAE, majority of the students opted for real patients, as it has been cemented that exposure to patients help students develop better clinical skills.[25,26] However, in conservative societies like Pakistan, training for IAE necessitates culturally sensitive approaches, such as enhanced simulation techniques involving advanced mannequins mimicking realistic scenarios or mixed reality training, which integrates virtual and real-world elements, providing a controlled environment for practical training. Clinical simulations were the next most popular choice. According to previous research surveys, students find that the use of clinical simulations help the student prepare for real life patients[27], as it gives them the margin of making mistakes without fear of hurting the patient.[28] This provides them with much-needed psychological cushioning and allows them to practice their skills without fearing failure and/or embarrassment. Furthermore, it is less anxiety-inducing for the students to practice using simulators as compared to practicing on a real-life patient.[29] Unsurprisingly, nobody thought that it was a good idea to limit the teaching of clinical skills to a strictly theoretic domain. As recent research shows, students find it extremely hard to translate their vast theoretical knowledge into practice, once they enter professional clinical settings.[30]

The fact that only half of the postgraduate trainees we surveyed felt they were ready to perform an IAE at the start of their clinical years profoundly attests to this fact. It goes without saying that this deafening hesitation is proof of their questionable clinical training in this field. This means that almost half of the doctors that have recently graduated have never performed a breast, groin or rectal exam on either gender, rendering them incapable of performing procedures that are expected from them during

their House job (internship) such as urinary catheterization, per rectal examination and proctoscopy etc. This will not only put them under immense psychological pressure when the duty calls them to task, they will also be more liable to making mistakes. This will have a two-fold effect on these budding physicians: not only will their confidence be badly shaken when they will find themselves unable to perform basic clinical examinations, but they might even end up hurting or harming the patient owing to their crude and/or underdeveloped examination skills.

Limitations

The study has several limitations, which should be addressed in future research on this topic. This study uses a convenient sampling approach, which may introduce selection bias and restrict the findings' generalizability. Using a more rigorous and representative sampling method, such as stratified random sampling, would enhance the study's validity. Additionally, the study is based on self-reported data, which is susceptible to social desirability bias. Participants may give answers that they believe are socially acceptable rather than their true experiences. Incorporating objective measures or observations alongside self-reports could mitigate this bias, such as implementing OSCE stations that specifically evaluate students' performance in IAE, providing a standardized and structured assessment tool with direct observation by examiners. Furthermore, the study focuses on medical students from two specific Pakistani medical colleges, limiting the generalizability of its findings to a broader population. Including a more diverse range of institutions and students would increase the study's external validity.

Conclusion

This study and medical literature show that intimate area examination (IAE) remains a neglected area of undergraduate studies. Given its current state, IAE demands attention and improvement. Cultural biases must be addressed, and teachers themselves must take the initiative to ensure that students learn these vital examinations in real life.

Measures to improve the current system could include supervision at all times by a senior physician to alleviate any anxiety the student may feel, emphasis on an integrated system of learning (like combining clinical simulations with in real life examination) to ensure the student gets enough practice before attempting an examination on a real patient, and counseling sessions of patients to address the socioeconomic barriers and how to overcome them.

For future research in the field of Intimate Area Examination (IAE), it is imperative to explore the significant influence of cultural and religious factors on the learning process. Conducting studies that compare the experiences of medical students hailing from diverse cultural and religious backgrounds can provide invaluable insights. These studies should delve into how cultural beliefs, practices, and religious doctrines impact the acquisition of IAE skills. Understanding these influences can help educators tailor their teaching methods to be more inclusive and effective for a wider range of learners.

Summary – Accelerating Translation

Title: Learning of intimate area examination amongst Pakistani medical students: KAP study

Main Problem to Solve: Intimate Area Examination (IAE) skills remain inadequately taught during medical education. Students face challenges in learning how to perform thorough check-ups in sensitive areas of the body. Cultural biases, gender dynamics, and insufficient teaching contribute to this problem.

Aim of the Study: Our research aimed to explore how Pakistani medical students learn IAE. We focused on the challenges they encounter and compared learning methods between public and private medical colleges. Ultimately, we sought to enhance IAE training for future healthcare professionals.

Methodology: We conducted a cross-sectional study at two Lahore-based institutions: Combined Military Hospital Lahore Medical College & Institute of Dentistry (CMH LMC & IOD) and King Edward Medical University (KEMU). Participants included final-year MBBS students and postgraduate trainees. We used a self-designed questionnaire to collect data, considering factors like university type, gender, and academic level.

Results: Our study surveyed 187 participants from both public and private institutions. Among them, 83 were from KEMU (public), and 104 were from CMH LMC & IOD (private). Male participants constituted 52.4%, while females made up 47.6%. Here are the key findings:

1. **Teaching Gaps:**
   - Most respondents (56.7% to 61%) reported never being taught IAE during their undergraduate years.
   - Specific areas lacking instruction included examination of the female pelvis (56.7%), female rectum (61%), female groin (35.8%), and male rectum (49.2%).

2. **Preferred Learning Methods:**
   - Real patients were considered the best teaching method (71.1%).
   - Clinical simulations (21.9%) and videos (7.0%) were also used.
   - None of the respondents believed that IAE should be taught theoretically.

3. **Postgraduate Preparedness:**
   - Among the 65 postgraduate doctors who filled out the questionnaire, 48.4% reported not feeling prepared to perform IAE at the start of their clinical careers.
   - Gender and institutional differences did not significantly impact preparedness levels.

4. **Overall Inadequacy:**
   - IAE learning remains insufficient in both public and private institutes.
   - The study highlights the urgent need for improvement.

Conclusion:

In conclusion, our research sheds light on the neglected area of IAE in undergraduate medical education. To address this issue, we propose the following measures:

1. **Supervision:**
   - Continuous supervision by senior physicians can alleviate student anxiety during IAE practice.
   - Senior guidance ensures that students gain confidence and competence.

2. **Integrated Learning:**
    - Combining clinical simulations with real-life examination provides a comprehensive learning experience.
    - Students should have ample practice before attempting IAE on actual patients.

3. **Patient Counseling:**
    - Address socioeconomic barriers and patient concerns.
    - Educate patients about the importance of IAE and their role in the learning process.

4. **Future Research:**
    - Explore cultural and religious influences on IAE learning.
    - Compare experiences of medical students from diverse backgrounds.
    - Tailor teaching methods to be more inclusive and effective.

By implementing these recommendations, we can bridge the gap in IAE education and better prepare future healthcare professionals.

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Original Article

Leveraging a Podcast Series for Nutrition Education in Medical Curriculum

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Abstract

Background: Malnutrition is a worldwide problem. Despite the paradoxical global prevalence of both an obese and underfed population, physicians have historically fallen short in their efforts to combat this epidemic. Unfortunately, medical education has only recently prioritized nutrition curriculum, and its incorporation has been slow. The Culinary Medicine Interest Group (CMIG) at New York Medical College (NYMC) aims to expand access to nutrition education in medical school. **Methods:** The CMIG podcast was conceived as an adjunct to the preclinical curriculum. Podcasts were distributed via the NYMC learning-management system in parallel with pre-clinical curriculum and made widely available via Spotify, YouTube, and Google Podcasts. A pre-podcast survey was conducted to establish a baseline of nutrition knowledge in the NYMC student population, and a post-podcast survey was also distributed. **Results:** During 2022-2023, twelve episodes covering various nutrition-related subspecialty topics were released. We received 76 pre-podcast survey responses which made the need for nutrition curriculum clear: 37% reported no experience with nutrition, less than half took coursework that covered nutrition, 59% were uncomfortable discussing eating disorders, and only 21.5% reported feeling comfortable discussing diet in relation to menopause. Post-podcast survey responses could not be analyzed due to low participation. **Conclusion:** Limited survey responses hinder conclusions about the podcast's potential impact; we believe this is related to the lack of value conferred upon content beyond the scope of mandated material. Nevertheless, baseline data support the need for more nutrition curriculum; we present a novel approach to expanding access to nutrition curriculum in medical education.

Introduction

Malnutrition is a worldwide problem that presents in many forms. In the US, there has been a drastic increase in obesity over recent decades, with the percentage of adults considered to be obese rising above 40% nationwide in 2021.[1] Globally, obesity continues to rise; shockingly, the number of obese adults doubled between 2000 and 2010.[2,3] This dramatic rise in obesity is closely related to people consuming nutrient-poor, energy-dense foods that are often less expensive and more easily obtained than their nutritious counterparts.[4,5] As such, many people in the obese population worldwide are also deficient in a variety of micronutrients, further compounding their health risks. Alongside the growing number of people who are obese, in stark contrast, there remains a global problem of an underfed population, particularly in developing countries, who experience malnutrition at alarming rates.[2] Despite global malnutrition, physicians have historically lacked the education to address these issues.[6,7]

Some of the blame for physicians' failure to tackle this issue has been placed on physician burnout and the overwhelming pressure to combat the sequelae of poor nutrition. However, research has highlighted that nutrition education at the medical school level remains underdeveloped despite the Association of American Medical Colleges declaring the importance of nutrition in medical education.[6-8] In recent years, nutrition has been taught as a specific set of pathologies related to micronutrient deficiencies rather than a concept intimately related to general wellness.[7] Only 25% of medical schools in the US have a formal nutrition education built into their curriculum.[7] Furthermore, an analysis of physician education in nutrition in the US has shown that most of their nutrition training is acquired independently rather than as part of their formal education.[7] The Culinary Medicine Interest Group (CMIG) at New York Medical College (NYMC) was founded in 2020 by first-year medical students to expand nutrition education in medical school's preclinical and clinical years.

There has been a dramatic increase in the popularity of podcasts over the last several years.[9] While many are based on leisure, the interest in educational podcasts has also increased.[10,11] Notably, the distribution of these podcasts within the field of medicine has been inconsistent, often with variable topics covered depending on subspecialty.[10] Within medical podcasts, content surrounding nutrition and nutrition education is uncommon and often

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gleaned from individuals outside of the medical field.[7,10-12] Incorporating new material within the medical school curriculum is daunting, as curricular programs are well-established and have limited opportunities for expansion without sacrificing content elsewhere. As such, the CMIG sought to pursue its mission of increasing preclinical and clinical nutrition education at the medical school level by releasing a podcast series detailing the clinical experiences of various physicians and their use of nutrition and diet education, thereby creating a self-directed resource to bridge the gap in nutrition education for future and current physicians and clinicians. This study seeks to explore the utility of an adjunct nutrition curriculum provided as a voluntary podcast in enhancing student understanding of nutrition in medicine.

Methods

We initially conceived the CMIG podcast as an adjunct to the preclinical curriculum, modeling a systems-based approach. We chose to deliver our curriculum as a podcast series given the increasing popularity of podcasts among the public, ease of access through streaming applications, and most notably as a result of the virtual asynchronous learning model used during the COVID-19 pandemic when this project was created. Our initial plan was to record two episodes per system covered within a course; each episode was approximately 15 to 20 minutes. We recruited NYMC faculty to be interviewed via email including the CMIG's mission statement. We notified faculty via email or verbally that the podcast would be distributed virtually on public platforms with a target audience of students at NYMC. Upon their agreement to participate, we provided faculty participants with a list of questions that would be covered during the podcast recording. The CMIG executive board composed and tailored questions to each faculty member's expertise and/or desired discussion topics.

We recorded twelve podcast episodes during two academic years beginning in the fall of 2020 and ending in the spring of 2022. Podcast guests specialized in areas coinciding with the systems-based approach utilized in preclinical curriculum, including general medicine/primary care, pediatrics, neurology /neuroscience, nephrology, pulmonology, women's health, endocrinology, gastroenterology, and cardiology. Before recording, we briefed interviewees once again on the podcast and its distribution plan. Faculty were then asked questions per the pre-written document with subsequent follow-up questions as appropriate. The target conversation length was approximately 15 to 20 minutes. We recorded podcast episodes using the Zoom video conferencing platform. After recording, audio files from Zoom were edited with Final Cut Pro.

We initially distributed podcast episodes using the learning management system for NYMC as an adjunct to the first-year medical school physiology curriculum for the Class of 2025. Subsequently, we uploaded episodes to YouTube, Spotify, and Google Podcasts. Episodes were released on the 15th and 30th of every month, starting in September 2022 and concluding in March 2023 (excluding December 2022). We advertised episode releases via an email to the entire NYMC student body. Faculty interviewees were notified via email upon release of their respective episodes. We have not monetized episodes or used funds to create, market, or distribute the podcast.

A pre-podcast survey was emailed to NYMC students via Qualtrics on 8/30/2022. Students receiving the survey included those studying for an MD, PhD, Masters, and other health professional programs, including dental, physical therapy, and speech-language pathology students. The survey was made available to over 1900 students in various health-related fields, including more than 800 studying for a MD.

We derived our survey from the pre-module survey used in the Nutrition and Culinary Medicine Area of Concentration at NYMC and recorded responses to establish a broad baseline of nutrition knowledge within the target population.[13] The survey asked respondents to provide consent so we could incorporate their answers for academic research; it remained open until the release of the podcast's first episode on 9/16/2022. The original plans included reevaluation with a post-podcast survey, which included the same questions as the pre-podcast survey, plus a section about listenership. However, we received limited responses to the pre-podcast survey and very few responses to the post-podcast survey.

Survey responses were studied in aggregate to preserve confidentiality of individual responses. Student emails were the only identifying data recorded, which were used to contact students to request consent for use of their responses. This study was deemed exempt by the NYMC Institutional Review Board.

Results

We received 76 complete responses to the pre-podcast survey with permission to analyze data. We also received some partial additional responses. The respondents were predominantly female-identifying (68.4%), with the remainder identifying as male. The majority of respondents were in their third year of medical school at the time of their response (40.8%), followed by second year (30.3%), with first and fourth year garnering lower response rates (18.4% and 7.9%, respectively). Most respondents reported occasional podcast listenership in their free time, with 25.0% responding with 1-2 listens per month and 23.7% responding with listening to podcasts a few times per month. Complete demographic data can be found in *Table 1*.

We recorded baseline nutrition education in the target audience by querying their feelings about discussing nutrition in various clinical settings through our pre-podcast survey *Supplementary Material*. Complete data for these questions can be found in *Table 2*.

Table 1. **Select Demographic Data of Podcast Respondents in the Pre-Podcast Survey (N=76).**

Gender Identity		**Man**			**Woman**	
		31.6%			68.4%	
Previous Nutrition Experience	Some high school or college courses	Undergraduate minor or major		Other program	None	
	43.7%	3.5%		16.1%	36.8%	
Year in Medical School	**First**	**Second**		**Third**	**Fourth**	
	18.4%	30.3%		40.8%	7.9%	
Podcast Use	Never	Rarely (1-2 times a month or less)	Sometimes (more than 2 times a month but not weekly)	Often (1-2 times a week)	Very often (3-4 times a week)	All the time (nearly every day or daily)
	13.6%	25.0%	23.7%	17.1%	10.5%	10.5%

Table 2. **Summary of Comfort Levels in Discussing Nutritional Concepts and Diet Management with Patients (Pre-Podcast Survey Questions 2.2, 2.3, and 2.4).**

Level of comfort in discussing how to treat/manage the following conditions using diet? (N=85)	**Extremely uncomfortable**	**Somewhat uncomfortable**	**Neither comfortable nor uncomfortable**	**Somewhat comfortable**	**Extremely comfortable**
Type II Diabetes mellitus	9.41%	17.65%	20.00%	43.53%	9.41%
Hypercholesterolemia	9.41%	12.94%	31.76%	43.53%	2.35%
Cardiovascular disease	10.59%	9.41%	35.29%	37.65%	7.06%
Hypertension	9.41%	8.24%	23.53%	54.12%	4.71%
Epilepsy	27.06%	44.71%	21.18%	5.88%	1.18%
Osteoporosis	22.35%	28.24%	30.59%	18.82%	0.00%
Eating disorders	23.53%	35.29%	24.71%	16.47%	0.00%
Food allergy and sensitivity	12.94%	8.24%	23.53%	47.06%	8.24%
Asthma	23.53%	25.88%	30.59%	18.82%	1.18%
Vitamin and mineral deficiencies	10.59%	11.76%	25.88%	48.24%	3.53%
Inflammatory disorders of the gastrointestinal system (IBS, Crohn's disease, Celiac Disease)	14.12%	28.24%	27.06%	22.35%	8.24%
Reflux Disorders	8.24%	21.18%	22.35%	41.18%	7.06%
Level of comfort discussing how to treat/manage physiological changes using diet? (N=79)					
Glycemic Index	10.13%	26.58%	26.58%	30.38%	6.33%
Trauma and recovery	16.46%	29.11%	32.91%	20.25%	1.27%
Overweight/obesity	8.86%	10.13%	16.46%	53.16%	11.39%
Preconception nutrition	15.19%	25.32%	25.32%	29.11%	5.06%
Gestational nutrition	15.19%	22.78%	26.58%	34.18%	1.27%
Postnatal nutrition and breastfeeding	15.19%	26.58%	29.11%	25.32%	3.80%
Menopause	18.99%	30.38%	29.11%	21.52%	0.00%
Renal health	17.72%	31.65%	26.58%	21.52%	2.53%
Level of comfort discussing nutritional concepts and their impact on health? (N=76)					
Macronutrients (carbohydrates, proteins, fats)	5.26%	11.84%	17.11%	47.37%	18.42%
Fat profiles in specific foods and oils	7.89%	15.79%	21.05%	43.42%	11.84%
Cholesterol	7.89%	7.89%	15.79%	55.26%	13.16%
BMI	5.26%	15.79%	13.16%	51.32%	14.47%
Hip-to-waist ratio	5.26%	21.05%	23.68%	35.53%	14.47%
Alcohol	3.95%	11.84%	2.63%	60.53%	21.05%
Vitamins and minerals	6.58%	10.53%	18.42%	52.63%	11.84%
Antioxidants	7.89%	18.42%	26.32%	40.79%	6.58%
Hydration	3.95%	2.63%	9.21%	52.63%	31.58%
Plant-based diets	7.89%	17.11%	23.68%	42.11%	9.21%

Most students reported limited nutrition experience prior to taking the survey: 43.7% reported taking some high school or college nutrition courses, while 36.8% reported having no prior nutrition experiences whatsoever. We asked respondents to first rate their level of comfort in discussing the treatment of various disease states using diet with patients that they would hear throughout the podcast series. Respondents reported the greatest level of comfort in the discussion of hypertension, with 58.8% responding that they felt "somewhat comfortable" or " extremely comfortable." Respondents also reported high levels of comfort in discussing food allergies and vitamin deficiencies, with 55.2% and 51.8% responding as "somewhat comfortable" or " extremely comfortable" for each subject, respectively.

Students reported the greatest level of discomfort in relation to the discussion of eating disorders, with 58.9% responding that they felt " somewhat uncomfortable" or "extremely uncomfortable." When asked about comfort discussing specific physiological changes and their relation to diet, respondents reported an overall lower level of comfort. For the relationship between menopause and diet, only 21.5% of respondents reported feeling "somewhat comfortable" or "extremely comfortable" discussing with patients. We saw similarly low levels of comfort to questions about other physiological changes, including breastfeeding and trauma, with 21.5% and 29.1% of students responding "somewhat comfortable" or "extremely comfortable" for each topic, respectively. Respondents had the highest level of comfort discussing being overweight and obese with patients, with 64.5% feeling "somewhat comfortable" or "extremely comfortable." Students reported greater levels of comfort discussing common nutritional concepts with patients compared to the previous questions. Students reported high levels of comfort, particularly when discussing alcohol with patients, with 81.5% responding "somewhat comfortable" or "extremely comfortable." We also saw high comfort levels when discussing hydration status at 84.2% for the same categories. Notably, over 60% felt "somewhat comfortable" or "extremely comfortable" discussing macronutrients, cholesterol, body-mass index (BMI), and vitamins/minerals. Students were less confident in their ability to discuss hip-to-waist ratio, with only 50.0% feeling "somewhat comfortable" or "extremely comfortable."

We recorded listenership to each podcast episode individually and separately by streaming platform as of 11/27/2023 *Table 3*. The most popular episode of the podcast was "Plant-Based Diets and Reflux Disorders," with 140 plays on YouTube and 27 on Spotify. The second most popular was "Eosinophilic Esophagitis," with 16 plays on YouTube, seven on Spotify, and four on Google Podcasts. Listenership declined following the release of these two episodes, the first two in the series. YouTube garnered the highest overall views across all episodes, followed by Spotify and Google Podcasts. A list of titles and links to the twelve podcast episodes can be found in *Table 4*.

***Table 3*. Podcast Aggregate Viewership Data from Release to November 27th, 2023.**

Episode	YouTube	Spotify	Google Podcasts
Plant-Based Diet and Reflux Disorders	140	27	0
Eosinophilic Esophagitis	16	7	4
Adolescents, Allergies, and Eating Disorders	14	1	7
Pediatric Obesity	4	2	10
Fad Diets and Cardiovascular Disease	5	6	7
Hypertension	4	5	2
Allergy and Pulmonology	8	2	3
Renal Health	2	2	2
Obesity and Endocrine	5	3	0
Menopause	2	1	2
Breastfeeding	17	2	2
Neurodegeneration	7	5	2

***Table 4*. Podcast Aggregate Viewership Data from Release to November 27th, 2023.**

Episode	Link - YouTube
Plant-Based Diet and Reflux Disorders	https://youtu.be/WnZpQsUnPTQ
Eosinophilic Esophagitis	https://youtu.be/JIFl97Lj-cs
Adolescents, Allergies, and Eating Disorders	https://youtu.be/LPfwIYbBJ-8
Pediatric Obesity	https://youtu.be/_2b4gceW_bQ
Fad Diets and Cardiovascular Disease	https://youtu.be/57opolHs6fs
Hypertension	https://youtu.be/PXYBtyDpyD8
Allergy and Pulmonology	https://youtu.be/GPQrcyvFyaQ
Renal Health	https://youtu.be/N3ZTqzUY7B8
Obesity and Endocrine	https://youtu.be/YJpoySj2KBQ
Menopause	https://youtu.be/1Z7zs046dkE
Breastfeeding	https://youtu.be/ftCuhlqpDnU
Neurodegeneration	https://youtu.be/EXxG4_rWhrg

Our post-podcast survey was distributed in a manner similar to the pre-podcast survey over a period of several weeks. We received 7 complete responses to the post-podcast survey, and unfortunately could not perform any meaningful analysis given this low response rate.

Discussion

To our knowledge, this work details the first use of a podcast series to enhance nutrition education in a medical school

curriculum. The literature has shown that physicians have historically fallen short in their efforts to understand nutrition. Additionally, medical education tends to view nutrition as a myriad of specific deficiencies rather than as a fundamental component of overall well-being.[6,7,8] Respondents from the NYMC medical school class had minimal experience in nutrition prior to medical education, with nearly half reporting having only taken a few classes, and almost 40% reporting no previous exposure to nutrition education. Given the low response rates, we must interpret these data with some caution while also admitting that they likely represent overestimates, as students with an interest in nutrition were more likely to answer our survey.

Data collected from the pre-survey clearly depict a need for expanded nutrition education. Students reported less comfort and even discomfort when asked about discussing pathologies and treatment plans involving diet. This was particularly evident in our results surrounding eating disorders, where nearly 60% of respondents were uncomfortable, as well as menopause, where only 21.5% were comfortable. This underscores the need for our work to continue, considering that eating disorders have become increasingly pervasive worldwide alongside the expansion of social media and menopause is a physiologic change impacting half of patients across all subspecialties. Regardless of specialization, all physicians need to be ready to talk about diet and nutrition, and our data show that the current generation of new physicians does not feel prepared. Our students reported the greatest degree of comfort in discussing macronutrients, micronutrients, and hydration, which may be in large part due to the presence of this material on board examinations. Unfortunately, extremely limited responses to the post-podcast survey precluded any analysis of the impact of our podcast on students' knowledge and attitudes.

Listenership to the podcast series was inconsistent. Initial results were promising, with high levels of play recorded for the first episode. However, listenership quickly dropped off and stabilized to around 10 listens per episode across streaming platforms, bringing into question the strength of the series' retention with its audience. Although our podcast introduced valuable content to the medical school community, we believe its efficacy was limited by the strained schedule associated with medical education. This may have led to a hesitancy among listeners to spend time on "extra" content exams don't cover. [6,7,8] Research has shown that medical education has historically failed to incorporate meaningful nutrition education into the curriculum despite the importance placed on it by the AAMC. [6,7,8] We hypothesize that listenership would increase if medical school exams and licensing exams confer more value on nutritional content by mandating its inclusion and testing students on it. Additionally, inclusion of the podcast series, or at least its contents, into the standard curriculum would likely have led to greater listenership. As a wholly separate resource, listenership was most likely driven by pre-existing interest in nutrition.

Unfortunately, our survey analysis was limited due to the low response rate. Of the over 1900 health science students, including over 800 medical students, given access to the surveys, only 76 fully completed the pre-podcast survey with consent to participate in research, a response rate of less than 5%. One of the reasons for this may have been the length of the survey. Additionally, we had minimal participation in the post-podcast survey, with less than 10 complete responses. As such, we cannot currently ascertain the impact of our podcast on NYMC nutrition education, although we believe this is due to our resource being provided outside of the normal curriculum as a voluntary learning tool. However, we are hopeful that we can continue to expand access to important nutritional education through continued expansion of listenership amongst other medical school populations so we may analyze survey data as the podcast series expands. We also hope to see the incorporation of nutritional education content into the mandated preclinical curriculum, which would confer value upon it as "testable" rather than as a wholly separate, optional, and implicitly less critical body of knowledge. We recommend that those who wish to replicate our work incorporate all components, including survey distribution, directly into the existing curriculum at their institution. The incorporation into mandated curriculum would confer value upon these concepts. Furthermore, students would be more likely to both listen to the material as well as complete pre- and post-surveys to better understand the benefit of these resources.

Despite the limited data available, we believe this work models an innovation in nutritional medical education. The aims of our work were twofold: to present an alternative method of delivery of medical education content through asynchronous podcast episodes and to highlight nutrition as an essential and underdeveloped area of healthcare education. The production of this podcast series has made subspecialty-specific content available to future clinicians and emphasized the role of nutrition across various aspects of medicine. As we continue to distribute this podcast, we hope this work may spark conversations about the need to continue to prioritize, enhance, innovate, and mandate nutrition education in medical school.

Summary – Accelerating Translation

Leveraging a Podcast Series for Nutrition Education in Medical Curriculum

This work seeks to address the gap in medical education regarding nutrition. By creating a podcast series involving physicians and their use of nutrition in the day-to-day of their subspecialty, we exposed students to the value of understanding nutrition regardless of what type of doctor they aspire to become. Our survey data also demonstrate that the average medical student does not feel prepared to discuss nutrition with their patients across a spectrum of common topics that come up in treatment and preventative care. However, we are currently unable to determine its efficacy in preparing students for this role, as post-podcast survey responses were extremely limited. Given this result, we can reasonably conclude that the delivery of this material as a voluntary resource was not conducive to student learning. As such, we believe that this work demonstrates the need for expansion of nutrition education in medical school as well as the need to examine further methods for bridging that gap.

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Author Contributions

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Supplementary Material

Pre-Podcast Survey

Section 1 – Opening Questions

1. The following survey will address questions regarding diet, food practices, medical conditions, and the interplay between them. You will be asked both about your own diet and your role as a physician in influencing the food practices of others. The survey will take you approximately 5-10 minutes to complete. If you are comfortable having your anonymized responses used in the future for academic research, please select "I agree" as your response to this question.
    a. I agree
    b. I disagree
2. If you answered yes to the previous question, please provide your email address for future contact regarding this research.

Section 2 – Diet and Nutrition

1. What is your level of satisfaction with your current diet?
    a. Extremely dissatisfied
    b. Somewhat dissatisfied
    c. Neither satisfied nor dissatisfied
    d. Somewhat satisfied
    e. Extremely satisfied
2. What is your level of comfort in discussing how to treat/manage following conditions using diet with patients?
    a. Type II Diabetes mellitus
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    b. Hypercholesterolemia
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    c. Cardiovascular disease
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    d. Hypertension
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    e. Epilepsy
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    f. Osteoporosis
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    g. Eating Disorders
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    h. Food allergy and sensitivity
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    i. Asthma
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    j. Vitamin and mineral deficiencies
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    k. Inflammatory disorders of the gastrointestinal system (IBS, Crohn's disease, Celiac Disease)
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    l. Reflux disorders
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable

3. What is your level of comfort in discussing how to treat/manage following physiological changes using diet with patients?
    a. Glycemic index
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    b. Trauma and recovery
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    c. Overweight/obesity
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    d. Preconception nutrition
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    e. Gestational nutrition
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    f. Postnatal nutrition and breastfeeding
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    g. Menopause
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    h. Renal health
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
4. What is your level of comfort in discussing the following nutritional concepts and their impact on health with your patients?
    a. Macronutrients (carbohydrates, proteins, fats)
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    b. Fat profiles in specific food and oils
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    c. Cholesterol
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    d. BMI
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    e. Hip-to-waist ratio
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    f. Alcohol
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    g. Vitamins and minerals
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    h. Antioxidants
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    i. Hydration
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable
    j. Plant-based diets
        i. Extremely uncomfortable
        ii. Somewhat uncomfortable
        iii. Neither uncomfortable nor uncomfortable
        iv. Somewhat comfortable
        v. Extremely comfortable

Section 3 - Demographics

1. What is your current age range?
    a. <18
    b. 18-20
    c. 21-25
    d. 26-30
    e. 31-15
    f. 36-40
    g. 41-45
    h. 46-50
    i. 51-55
    j. 56-60
    k. 61-65
    l. >65
2. With what gender do you primarily identify? Please select all that apply
    a. Man
    b. Woman
    c. Transgender
    d. Non-binary
    e. Prefer not to say
    f. Fill in – answer not listed
3. With what race do you primarily identify? (Please select all that apply)
    a. White
    b. Black or African American
    c. American Indian or Alaska Native
    d. Asian
    e. Native Hawaiian or Pacific Islander
    f. Fill in – answer not listed
    g. Prefer not to say
4. With what ethnicity do you primarily identify? (Please select all that apply)
    a. Not Hispanic or latinX
    b. Hispanic or latinX
    c. Fill in – answer not listed
    d. Prefer not to say
5. What is the highest level of education you have completed to date? (Please do not select degree program in progress)
    a. High school
    b. Associate degree
    c. Bachelor's Degree
    d. Master's Degree
    e. PhD
    f. MD/DO
    g. Fill in – answer not listed
6. What, if any, previous nutrition experience have you had? (Please select all that apply)
    a. Some high school courses
    b. Some college courses
    c. Undergraduate minor
    d. Undergraduate major
    e. Master's degree
    f. PhD program
    g. Certification
    h. Culinary program
    i. Area of Concentration
    j. None
    k. Fill in – answer not listed
7. What is your current year in medical school?
    a. First
    b. Second
    c. Third
    d. Fourth
    e. Gap/research year
    f. Completed medical school
    g. Not enrolled in an MD/DO program
8. What is your most likely specialty or current specialty of practice?
    a. Anesthesiology
    b. Dermatology
    c. Emergency Medicine
    d. Family Medicine
    e. General Surgery
    f. Internal Medicine
    g. Neurology
    h. Neurological Surgery
    i. Obstetrics and Gynecology
    j. Orthopedic Surgery
    k. Otolaryngology
    l. Pathology
    m. Physical Medicine and Rehabilitation
    n. Psychiatry
    o. Radiology
    p. Urology
    q. Undecided
    r. Fill in – answer not listed
9. How often do you listen to podcasts (of any subject) in your free time?
    a. Never
    b. Rarely (1-2 times a month or less)
    c. Sometimes (more than 2 times a month but not weekly)
    d. Often (1-2 times a week)
    e. Very often (3-4 times a week)
    f. All the time (nearly every day or daily)

We thank you for taking the time to complete our survey! Your responses are incredibly valuable for developing our podcast series and helping us create a resource that enhances student learning.

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Original Article

Skipping Breakfast is Associated with Shorter Sleep Duration in Medical Students

Harsh Bhoopatkar,[1] Shivani Sharma,[2] Fiona Moir,[3] Miriam Nakatsuji,[4] Andy Wearn,[5] Karen Falloon.[6]

Abstract

Background: Breakfast skipping is common in young adults, including medical students. Poor sleep quality is also common in medical students. Sleep quality and duration are important determinants of health and wellbeing. The aim of the study is to explore the novel association between medical students' frequency of breakfast consumption with sleep quality and duration. **Methods**: Year 3 medical students completed a survey at the end of 2018. Data collection included demographic information, the Pittsburgh Sleep Quality Index (PSQI) and breakfast consumption in the month before their end-of-year clinical assessment. **Results**: The response rate for the survey was 76.6% (216/282). Forty-five percent of medical students skipped breakfast at least once in an average week and 56.9% of students had poor sleep quality (as defined by PSQI scores > 5). There was a statistically significant association between a higher frequency of breakfast skipping and shorter sleep duration (Kendall's tau-b, P = 0.012). Regression analysis also showed that breakfast frequency had a statistically significant impact on sleep duration (P = 0.048). **Conclusion**: Breakfast skipping is common in medical students. Furthermore, breakfast skipping is significantly associated with a shorter sleep duration. This knowledge could empower medical students to optimize their routines for better sleep and general health.

Introduction

Breakfast is commonly believed to be "the most important meal of the day";[1] however, in the United States, 24-hour recall data from the National Health and Nutrition Examination Survey (NHANES) showed that 23.8% of young adults (20-39 years of age) consumed no foods/beverages, excluding water, at breakfast.[2] Moreover, rates of skipping breakfast among medical students are reported to be even higher: 26.7% in Japan,[3] 41.7% and 23.5% for males and females, respectively, in China,[4] 60% in Saudi Arabia,[5] and 72% in Ghana.[6]

Good sleep quality and adequate sleep duration are important for the health of medical students as they impact memory,[7, 8] problem-solving,[9] motor skills,[10] emotional regulation,[11] psychological wellbeing,[12, 13] and decrease the risk of adverse outcomes such as accidents.[14] Poor sleep quality is more common in medical students as compared with other university students, and the general population.[15-18] It has been proposed that this may be related to poor mental health, heavy workload, time-demands of the programme, and financial pressures.[19] However, less is known about the impact of eating patterns and meal frequency (which is modifiable) on sleep in medical students.

Epidemiological,[20, 21] interventional,[3] chronobiological,[22, 23] and endocrine evidence[3] supports an association between breakfast skipping and short sleep duration. Firstly, large epidemiological studies have shown that skipping breakfast is associated with shorter sleep duration.[20, 21] Secondly, an interventional study (randomised crossover-design) has shown that skipping breakfast is negatively associated with sleep duration.[3] Thirdly, from a chronobiological perspective, it is known that our circadian clock has a role in activity, sleep, and food intake.[22] In addition to our central clock (located in the suprachiasmatic nucleus), there are also peripheral clocks located in many parts of the body including the gastrointestinal system.[23] Since peripheral clocks follow food cues, irregular eating patterns (such as skipping breakfast) can result in the desynchronisation of the peripheral clocks from the central clock which disrupt sleep-wake cycles.[23] Finally, from an endocrine perspective, skipping breakfast (characterised as 'nocturnal' lifestyle) is associated with a decrease in the peak of melatonin (which induces and maintains sleep) and leptin (which helps to maintain sleep) at night as compared to taking breakfast (characterised as 'diurnal' lifestyle).[3]

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There is limited consensus as to the definition of breakfast; however, it is proposed that for the basis of research, breakfast is defined as "…the first meal of the day that breaks the fast after the longest period of sleep and is consumed within 2 to 3 hours of waking…".[1] There is also no consensus as to the definition of breakfast skipping[1]; however, for the purposes of this paper, we define it as skipping breakfast at least one time per week." We sought to explore the association between medical students' frequency of breakfast consumption and sleep quality/duration.

Methods

Participants

Participants were Year 3 undergraduate medical students from the University of Auckland, New Zealand, at the end of 2018. The students (n=282) were invited to complete a questionnaire directly after their end-of-year clinical assessment. Auckland has a six-year Medical Programme; Year 1 being a common health science year and Year 2 being the start of the formal MBChB. Year 3 involves mostly campus-based teaching and learning, including clinical skills in a simulated environment such as a dedicated Clinical Skills Centre.

Study Design

Immediately after completion of an end-of-of year clinical assessment, a consent form and structured self-complete questionnaire were administered by a research assistant. Approval was obtained from the University of Auckland Human Participants Ethics Committee (UAHPEC; Reference Number 022024).

Measures

The questionnaire comprised of demographic information (age, gender, ethnicity), sleep measures, and questions related to breakfast consumption. We asked: "In the past month, how many days in an average week did you usually have something for breakfast (food or nutritional drink/food replacement such as a smoothie)?". We used the Pittsburgh Sleep Quality Index (PSQI), a validated sleep measure commonly used to measure sleep quality in medical students.[12] The PSQI comprises of seven component scores for sleep quality, sleep onset latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. These component scores are added to give an overall score (range 0-21) where higher scores indicate poorer sleep quality. The overall PSQI score is categorised into good sleep quality (0-5) and poor sleep quality (6-21).[12] Sleep duration was categorised into $\leq$ 6 hours (short sleep duration) and > 6 hours (based on thresholds for neurobehavioral dysfunction).[10]

Statistical Analyses

Descriptive statistics were used to report the frequency of breakfast consumption, sleep quality, and sleep duration. Frequency of breakfast consumption in an average week was categorised into 'Breakfast Skippers' (skipped breakfast at least once a week) and 'Breakfast Eaters' (ate breakfast every day). We also investigated the impact of the regularity of breakfast consumption; categorising students into a 'Regular Breakfast Pattern' (those who *never* ate breakfast or *always* ate breakfast) and 'Irregular Breakfast Pattern' (those who ate breakfast 1-6 times a week).

The measure of association used to study variables that were both discrete (for example, breakfast skippers/eaters and good/poor sleep quality) was Fisher's Exact Test. The measure of association used to study the association between a discrete variable (for example, frequency of breakfast consumption) and a continuous variable (for example, sleep duration) was Kendall's tau-b. Ordinal regression was also undertaken to better understand the relationship between the dependent ordinal variable (frequency of breakfast consumption) and key independent ordinal variables (sleep duration [short/normal] and sleep quality [good/poor]). Goodness-of-fit statistics (Pearson Chi Square) was used to determine whether the model adequately describes the data. Data were analysed using IBM SPSS Statistics; Version 28.

Results

The response rate was 76.6% (216/282). The study population was predominantly made of individuals aged 20-24 years (84.3%), with smaller proportions in other age groups. Females make up 56.5% of the sample. Ethnically, the majority are New Zealand European (53.7%), followed by Chinese (17.6%), Māori (14.8%), with other ethnicities making up the remainder. Detailed demographic data are shown in *Table 1*.

Breakfast Consumption

Forty five percent of students skipped breakfast at least once a week *Table 2*. Eight percent of students never ate breakfast on any day of the week. There was no significant association between breakfast skipping and gender (Fisher's Exact Test, P = 0.273 [2-sided]).

***Table 1*. Age, Gender, and Ethnicity of Medical Students.**

Characteristic	n (%)
Age (years)	
15-19	5 (2.3)
20-24	182 (84.3)
25-29	24 (11.1)
30-34	4 (1.9)
35-39	1 (0.4)
Gender	
Male	94 (43.5)
Female	122 (56.5)
Gender Diverse	0 (0.0)
Ethnicity[a]	
New Zealand European	116 (53.7)
Māori	32 (14.8)
Pacific peoples[b]	15 (6.9)
Chinese	38 (17.6)
Indian	18 (8.3)
Other	53 (24.5)

Legend: [a] Some participants identified as more than one ethnic group; [b] Samoan, Cook Island Māori, Tongan.

Table 2. **Frequency of Breakfast Consumption in an Average Week.**

Breakfast consumption (per week)	Frequency (n)	Percentage (%)
No days	17	7.9
1-2 days	19	8.8
3-4 days	31	14.4
5-6 days	29	13.5
Everyday	119	55.3
Total	215[a]	100.0

Legend: [a] Data for breakfast consumption was missing for one student out of the 216 respondents.

Sleep Duration

In the month before the survey, 22.7% (49/216) of students slept ≤ 6 hours per night, and the average sleep duration was 7.1 hours per night (median 7 hours per night, standard deviation 1.1 hours per night, range 7 hours per night [3 to 10 hours per night]). There was a statistically significant association between lower frequency of breakfast consumption and shorter sleep duration (Kendall's tau-b, P = 0.012).

When looking at regularity, there was no statistically significant association between the Irregular Breakfast Pattern (ate breakfast 1-6 times per week) as compared with Regular Breakfast Pattern (*always* ate or *never* ate breakfast) and short sleep duration (Kendall's tau-b, P = 0.619).

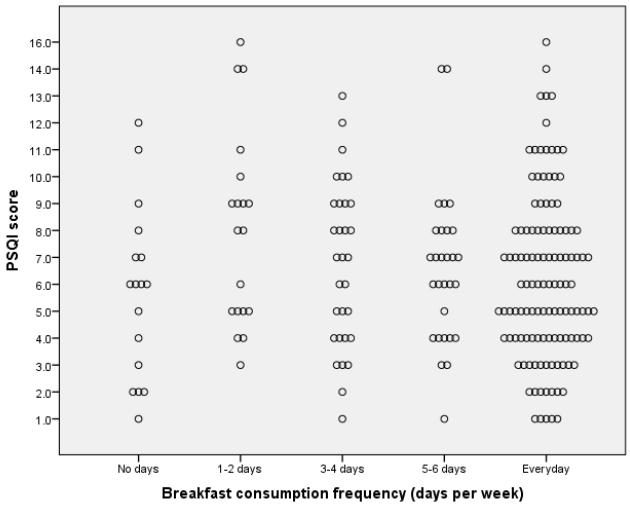
Ordinal regression showed that for the frequency of breakfast consumption (dependent variable), there was a statistically significant result for sleep duration (P = 0.048). The value of the sleep duration coefficient was negative (-0.929), which suggests that if you are in the category "short sleep duration" (≤ 6.0 hours), you are more likely to have a lower frequency of breakfast consumption. Goodness-of-fit statistics confirmed that the regression model adequately describes the data (Pearson Chi-Square, P = 0.949).

Sleep Quality

On average, in the month before their clinical assessment, 123 out of 216 (56.9%) students reported poor sleep quality (PSQI > 5). The PSQ1 range was 15 (1-16), mean 6.4, median 6. ***Figure 1*** is a scatter plot of PSQI and frequency of breakfast consumption. A higher proportion of Breakfast Skippers had poor quality of sleep (61/96 = 63.5%) as compared with Breakfast Eaters (62/119 = 52.1%); however, there was no statistically significant association between Breakfast Skippers and poor sleep quality (Fisher's Exact Test, P = 0.098 [2-sided]).

When looking at regularity, there was no statistically significant association between the Irregular Breakfast Pattern (ate breakfast 1-6 times per week) as compared with Regular Breakfast Pattern (always ate or never ate breakfast) and poor sleep quality (Fisher's Exact Test, P = 0.116 [2-sided]).

Figure 1. **Scatter Plot of Sleep Quality and Frequency of Breakfast Consumption.**



Ordinal regression showed that for the frequency of breakfast consumption (dependent variable), the value of the sleep quality coefficient was positive (0.420), which suggests that if you are in the category "poor sleep quality" (PSQI > 5), you are more likely to have a lower frequency of breakfast consumption; however, this was not a statistically significant result (P = 0.331). Goodness-of-fit statistics confirmed that the regression model adequately describes the data (Pearson Chi-Square, P = 0.949).

Discussion

To our knowledge, this is the first study that found a significant association between reduced frequency of breakfast consumption and shorter sleep duration in medical students. Given that the impact of sleep duration on health and wellbeing is documented in the literature, this finding has practical implications. Most importantly, the frequency of breakfast consumption is a modifiable habit. It is also important since the circadian rhythms can be entrained by the regularity of meals.[23] Furthermore, it has been shown that students' own habits correlate with the frequency with which they promoted those habits to patients.[24] Thus, setting up good habits of eating and sleep may lead to improving student health as well as promoting awareness of sleep habits and meal regularity to patients in the future.

We found that approximately half of the participants reported skipping breakfast at least once a week. This is similar to what is reported in Saudi Arabia (60%)[5] and falls somewhere in between the two extremes reported in the literature (26.7% in Japan[3] and 72% in Ghana).[6] We also found that a higher proportion of Breakfast Skippers had poor quality of sleep as compared with Breakfast Eaters; however, this was not statistically significant. This finding is similar to an interventional study in young adults which showed that breakfast consumption tended to improve

perceived sleep quality (as compared with skipping breakfast), but this was also not statistically significant.[25]

The key finding, based on correlation analysis, is that a lower frequency of breakfast consumption is significantly associated with a shorter sleep duration. Furthermore, regression analysis statistically confirmed that the frequency of breakfast consumption affects sleep duration, implying a functional relationship. There are large epidemiological studies,[20, 21] interventional studies,[3] chronobiological evidence,[23] and mechanistic endocrine evidence[3] that support these findings.

There are several proposed mechanisms that could explain why breakfast skipping impacts sleep duration in medical students. Firstly, skipping breakfast is associated with a 'later' chronotype (preference for later bed and wake times or "night owls").[26] Since wake times are constrained by academic and social commitments, later bedtimes probably lead to shorter sleep duration and may also lead to a later timing of evening meal/food, which could impact bed/sleeping time. Secondly, irregular eating times may produce chronodisruption (when the peripheral clocks desynchronise from the central clock) which can induce a disruption in the circadian system and affect sleep duration.[23] Chronodisruption is part of a vicious cycle impacting adipose tissue, organs of digestion, food components, genetic background, energy input and output, adaptive hyperlipogenesis, food intake control (leptin and ghrelin), and changes in hormones (insulin, corticoids).[23] Furthermore, there is emerging research on the relationship between circadian rhythm and brain cognitive functions showing that chronodisruption affects attention, working memory, cognitive inhibition, and task switching.[27] Thirdly, breakfast skipping is associated with increased snacking of high-fat, high-sugar foods in the evening which also impacts sleep duration.[25] Fourthly, there is growing evidence that breakfast may affect sleep through the brain-gut-microbiome axis (BGMA).[28] Bacteria have shown to affect immune, hormonal, and neural responses, as well as the permeability of both the gut barrier and blood-brain barrier.[28] One study found that total microbiome diversity was positively correlated with increased sleep efficiency and total sleep time and was negatively correlated with wake after sleep onset.[28] Additionally, the macronutrient composition of the breakfast may also affect sleep given that there is a strong link between food, the gut microbiome, and health, as shown in the landmark PREDICT 1 study.[29]

Skipping breakfast has been shown to have an impact on health. A recent meta-analysis showed that skipping breakfast is associated with increased risk of heart disease and cardiometabolic risks such as obesity, hypertension, and diabetes, dyslipidaemia, and insulin resistance.[30] Furthermore, a large prospective cohort study showed that breakfast skipping is associated with an increase in cardiovascular and all-cause mortality.[31] There are several postulated mechanisms that may explain the increase in cardiovascular morbidity and mortality. Firstly, breakfast skipping is associated with a worse glycaemic control.[26] Secondly, breakfast skipping is associated with disrupted cortisol rhythm due to a longer period of fasting which results in an increase in blood pressure.[32] In contrast, taking breakfast has been shown to help lower blood pressure which may result in the prevention of the clogging of blood vessels, haemorrhage, and cardiovascular events.[31] Thirdly, breakfast skipping in adolescents is associated with an unhealthy lifestyle such as consuming snacks, foods high in sugar, and fast foods as compared to those who regularly eat breakfast.[33] Frequently eating fast foods is associated with endothelial dysfunction, inflammation, and cardiovascular disease.[33]

Another argument against skipping breakfast is that a long overnight fasting period is associated with an increased risk of gallstones.[34] A prospective study showed that a long overnight fast is one of the most important independent dietary risk factors for hospitalisation with gallstone disease.[34] The mechanism for the increased risk of gallstones with long period of fasting is through reduced gallbladder motility and/or changes in bile composition.[34]

The counter argument for the negative impact of breakfast skipping is the concept of intermittent fasting. The three most widely studied are daily time-restricted feeding (eating within a specified window), 5:2 intermittent fasting (fasting two days each week), and alternate day fasting.[35] Preclinical studies and clinical trials have shown that intermittent fasting is associated with a broad range of benefits related to obesity, diabetes, cardiovascular disease, neurological disorders, and cancer; however, these studies have focused on overweight participants, so the generalisability, safety, and benefit to the general population are in question.[35]

Time-restricted eating (TRE) is a specific protocol of intermittent fasting that is relevant to breakfast skipping because people find it culturally easier to skip breakfast than dinner.[36] The TREAT randomised study showed no significant difference in self-reported sleep measures with TRE (skipping breakfast [only eating from 12:00 PM until 8:00 PM]) as compared with eating three structured meals a day (eating breakfast [between 7:00 AM and 11:00 AM].[36] As an attempt to investigate a potential pattern in those who practiced intermittent fasting, we also looked at the regularity of breakfast consumption. We found no significant association with either sleep duration or quality when we looked at the regularity of the breakfast eating pattern.

Even though our study has a high response rate for this type of survey, there are several limitations. Firstly, our data were retrospective and are based on students' recall over a period of one month. This may have resulted in self-reporting bias, more specifically, recall bias (where students responses depend on their ability to remember their eating and sleeping habits over the last month). Objective measures of sleep (for example actigraphy or polysomnography) were not undertaken. Secondly, the sleep

patterns in the month before the clinical assessment were reflective of an end-of-year assessment period. The stress associated with upcoming assessment could impact eating habits. Future research is required to investigate sleep patterns in a non-assessment period which would give a picture of breakfast and sleep patterns throughout the year. Thirdly, due to the quantitative nature of the data, we were not able to ascertain why some students chose not to eat breakfast at all (for example, lack of time, intentional intermittent fasting, food scarcity, nocturnal eating reducing morning hunger), eating less due to other health conditions (for example, depression), and other practicalities such as not having any food at home, lack of money, or poor organisation. Further studies with qualitative data are required to explore breakfast consumption (when and what is eaten) as it is a potentially modifiable factor which could improve sleep health. Additionally, we have not investigated and ruled out other explanations for the associations we found. Finally, given that the data were obtained from a single institution in New Zealand, wider extrapolation may not be possible.

Future research ideas include (i) using objective measures of sleep quality, such as actigraphy or polysomnography to add to self-reported data, (ii) collaborating with other institutions across different regions to improve the generalisability of results, (iii) conducting a controlled prospective study to add weight to the causality of the relationship between nutrition and sleep, (iv) determining the impact of social determinants such as family and children, (v) exploring the nuances of napping, and (vi) collecting data on other confounding factors that are relevant to medical students such as stress levels and workload.

Going forward, it is also important to explore real-world practical and policy implications. Specific strategies include (i) educating students on the importance of breakfast on sleep and health; (ii) involving students in creative ways such as instituting a breakfast club; (iii) bringing breakfast to the students (if institutional funding is available); (iv) giving breakfast a second chance within their timetable (similar to how lunchtime is scheduled) given that many medical students do not have time in the morning, (v) inviting institutional staff to promote and model healthy behaviours.

In conclusion, we found that approximately half of medical students skip breakfast at least once in an average week during an end-of-year assessment period. Importantly, we found a statistically significant functional association between a lower frequency of breakfast consumption and shorter sleep duration. Given the importance of sufficient sleep duration for wellbeing and performance, this knowledge could empower medical students to optimize their routines for better sleep and general health.

Summary – Accelerating Translation

Title: Skipping Breakfast is Associated with Shorter Sleep Duration in Medical Students

Main problem to solve: Breakfast is commonly believed to be "the most important meal of the day"; however, it is common for medical students to skip breakfast. Skipping breakfast is associated with poor sleep. Good sleep quality and adequate sleep duration are important for the health of medical students; however, poor sleep quality is more common in medical students as compared with other university students and the general population.

Aim of study: To explore the association between how often medical students eat breakfast and how well they sleep.

Methodology: Year 3 medical students at the University of Auckland, New Zealand, completed a survey at the end of 2018. Data collection included information about students' age, gender, ethnicity, the quality and duration of sleep, and breakfast consumption in the month before their end-of-year examinations.

Results: Seventy-seven percent of the Year 3 students completed the survey. Forty-five percent of those medical students skipped breakfast at least once in an average week and 57% of students had poor sleep quality. There was a clear association between how often students ate breakfast and how long they slept.

Conclusion: Approximately half of medical students skipped breakfast at least once in an average week. The more often medical students skipped breakfast, the fewer hours they slept. Given the importance of getting enough sleep for wellbeing and performance, this knowledge could help medical students to optimize their lifestyle for better sleep and general health.

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Review

Exploring the Impact of COVID-19 on the Healthcare System and Vulnerable Populations in the United States

Rachel Williams,[1] Alagarsamy Srinivasan,[2] Muthu Periasamy.[3]

Abstract

Beginning in early 2020, SARS-CoV-2, the virus responsible for COVID-19, spread across the world, giving rise to a global pandemic that impacted billions of people. Surprisingly, the United States was among one of the worst affected countries with over a million deaths. The purpose of this review is to discuss the impact of COVID-19 in the United States from the perspectives of government policies and the U.S. healthcare system. The emergence of multiple viral variants was at the center of sequential waves of infection in the U.S., resulting in increased number of cases, hospitalizations, and deaths along with associated mental health sequelae in the population. Lack of uniform policies at the local, state, and federal levels exacerbated the situation. These factors contributed to significant healthcare worker burnout. Furthermore, the disease caused higher morbidity and mortality rates in specific groups such as lower average socioeconomic status, rural and underserved communities, Native Americans and African Americans, and older age groups (65+ years). The lessons learned from this broad analysis highlight many inadequacies and challenges experienced in the U.S. during the pandemic. Here we propose several suggestions for healthcare and government responses in the event of future unanticipated healthcare crises.

Introduction

COVID-19 (Coronavirus Disease 2019) is caused by the virus SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) and presents with common symptoms of fever, persistent cough, congestion, fatigue, and notable anosmia (loss of smell) and ageusia (loss of taste).[1] The virus first appeared in the Hubei Province of Wuhan, China on December 12, 2019.[2, 3] On January 20, 2020, the first laboratory-confirmed case was identified in the United States in Snohomish County, Washington state from an individual who had recently traveled to Wuhan. Throughout the first month of 2020, cases were identified in Arizona, California, and Illinois.[3]

The rapid spread and growing number of cases and deaths led the WHO to declare COVID-19 a global pandemic on March 11. The emergence of multiple variant viruses with enhanced infectivity in the subsequent months and years led to a total of 775,431,269 cases and 7,047,741 deaths globally as of May 5, 2024.[4] By September 28, 2020, COVID-19 deaths reached 1 million globally.[3] To date, there have been approximately 652 million cases and 6.6 million deaths globally from COVID-19.[5] The United States has recorded over 10 million cases and over 1 million deaths, and it is estimated that costs from COVID-19 have exceeded $16 trillion in U.S. dollars.[6]

COVID-19 created an unprecedented crisis both globally and in the U.S. Although there have been several reviews discussing the impact of COVID-19 on a global, as well as local, scale, none have yet discussed how COVID-19 challenged the U.S. government, healthcare system, and ability to care for socially disadvantaged populations. Therefore, in this review, we explore how COVID-19 impacted not only government and health care policies, but also how this may have exaggerated the disease's impact on historically socially disadvantaged populations including ethnic minorities, low socioeconomic regions, and underserved areas. Specifically, we strive to highlight key aspects of COVID-19 challenges, outcomes, and takeaways to further increase awareness among healthcare and public health professionals for more efficient, effective, and equitable healthcare system preparedness and public health responses to deal with future unanticipated epidemics.

Methods

Data for this literature review was obtained through searching the database PubMed for articles addressing COVID-19 in the United States. A general search engine query was performed for current, up-to-date case, hospitalization, and death rate statistics. The following keywords, or combinations of keywords, were used: "COVID-19," "SARS CoV-2," "United States," "U.S.," "government policies," "healthcare," "vulnerable populations," and "disparities." Articles selected for inclusion ranged from 2020 – 2023 and were written in English. A total of 45 articles were selected for this analysis.

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Results

The Impact of COVID-19 on Government Policies and Strategies

In the U.S., COVID-19 was met with considerable confusion, controversy, and chaos in its initial stages. Implementation of COVID-19 measures varied widely across states, schools, and workplaces; in many cases, policies at one level contradicted policies at another level. Compared to developed countries like Australia that exhibited relatively lower death rates, the U.S. lacked inter-government collaboration and a centralized, unified plan, which further worsened confusion and conflict regarding the status, spread, and response to the virus. Prevention strategies such as mask-wearing and social distancing were implemented at different levels and to different degrees, with variation in policies exhibited at the federal, state, and local levels.

Discoordination Between the Federal and State Level

In total, 39 out of 50 states issued statewide mask mandates. The first state to issue a mask mandate was New Jersey on April 10, 2020; the first state to end mask orders was Iowa on February 7, 2021. Moreover, the length of mask mandate periods varied greatly from state to state: the state with the shortest period of mask mandates was Mississippi (56 days) while the state with the longest mask mandate was Hawaii (704 days).[11]

As the pandemic gained momentum, statewide lockdowns—which discouraged travel outside the home and restricted nonessential movement—were enforced starting in March 2020 and continued into May 2020. In April, 42 U.S. states were under mandatory lockdown; however, by May 2020 most states had begun lifting lockdown protocols and relaxing masking and social distancing guidelines.[12]

Discoordination at the Local Level

Across schools nationwide, COVID-19 mitigation efforts varied according to region, state, county, and school district. Masking in school was required by 18 states while 8 states prohibited mandatory school masking. Out of 50 states, 11 states required vaccination for school employees; California was the only state to require vaccination for both students and school employees.[13] Hybrid learning (containing both virtual and in-person components) was implemented to different degrees in different regions.

The Impact of COVID-19 on the Healthcare System

The initial 2020 surge in COVID-19 cases placed significant demands on the healthcare system. Following the initial surge, hospitalizations in the U.S. reached a 7-day average of 58,261 nationwide on April 30. Hospitalization surges for the second, third, fourth, and fifth waves were as follows: 73,069 in July 2020, 137,335 in January 2021, 102,778 in September 2021, and 159,401 in January 2022—the highest surge thus far *Figure 1*.[14] In states with highly populated areas such as New York, the number of newly hospitalized patients reached its highest, peak 7-day average of 13,623 in April 2020 (following the pandemic's initial surge) and experienced its second largest spike in hospitalizations in January 2022 with a 7-day average of 13,183 admissions.[14]

In March 2020, healthcare systems began discussing guidelines for prioritizing critical care in the event that ventilator supplies could not meet demand.

Shortage of Healthcare Workers

With increasing patient numbers, many hospitals, especially those in busy cities, experienced understaffing. In a study encompassing 6,194 hospitals enrolled in the National Healthcare Safety Network (NHSN) from March to July 2020, approximately one-third reported shortage of healthcare workers (including physicians, nurses, respiratory therapists, environmental service staff, pharmacists, and temporary workers), with approximately 16% reporting a shortage of nurses.[15] Of those staff serving at the frontlines, many had to work overtime with dwindling supplies to meet increased hospitalization demands.

Between June 2020 and January 2021, increased temporary absences and terminating departures from nursing homes following severe COVID-19 outbreaks created even greater staffing gaps. Increased absences and departures were driven by increased job demands (working overtime, assuming more roles, etc.), increased high-risk exposure, and insufficient pay.[16]

Even before the pandemic, nurses working at hospitals in New York and Illinois experienced increased patient volumes and lack of adequate supplies. This ongoing, preexisting situation was exacerbated by the initial and subsequent surges in COVID-19 cases and admissions, which created greater demands on working staff along with inadequate supplies, insufficient time to complete tasks, and greater feelings of overwork, job dissatisfaction, and burnout.[17]

Furthermore, 17% of the estimated 3,500 healthcare workers who died during the pandemic consisted of physicians, representing a tragic loss to an already understaffed healthcare system. Increased demands on and for physicians during the pandemic further highlights an ongoing, nationwide shortage of physicians with concurrent increase in physician burnout.[18]

Shortages in PPE and Healthcare Equipment

As hospitalizations increased acutely, many hospitals did not have adequate supplies or equipment to meet increasing hospitalizations. In a study encompassing 6,194 hospitals enrolled in the National Healthcare Safety Network (NHSN) from March to July 2020, 11% reported PPE or ventilator supply shortages.[15]

In April 2020, supply shortages drove healthcare providers to improvise—as in the extreme case of frontline healthcare workers using trash bags to compensate for gown shortages—which compromised quality and safety of patient care.[19] Other

workarounds in response to PPE shortages included reusing PPE and using less-safe alternatives, such as bandanas for masks.[20]

In the wake of the pandemic, it was estimated the U.S. needed approximately 300 million N95 respirators, which left substantial deficits considering roughly 35 million N95 respirators were produced and supplied by a single, primary manufacturer.[21] The estimated need for ventilators in the U.S. in April 2020 ranged from 60,000 to 160,000, depending on ventilator functionality.[20] In one national study, ventilator use peaked in April; during this time, 25% of surveyed hospitals had over 76% ventilators dedicated to patients with COVID-19. Meanwhile, orders for drugs used to treat symptoms of COVID (midazolam, fentanyl, and albuterol) increased by 53-100%, and 533-4100% in especially hard-hit areas such as NYC.[21]

Prior to the pandemic, approximately half of the global face mask supply was produced by China. Following the initial infection surge in China, supplies were diverted to internal use and much-needed exports were decreased, while those available for export increased in price.[20]

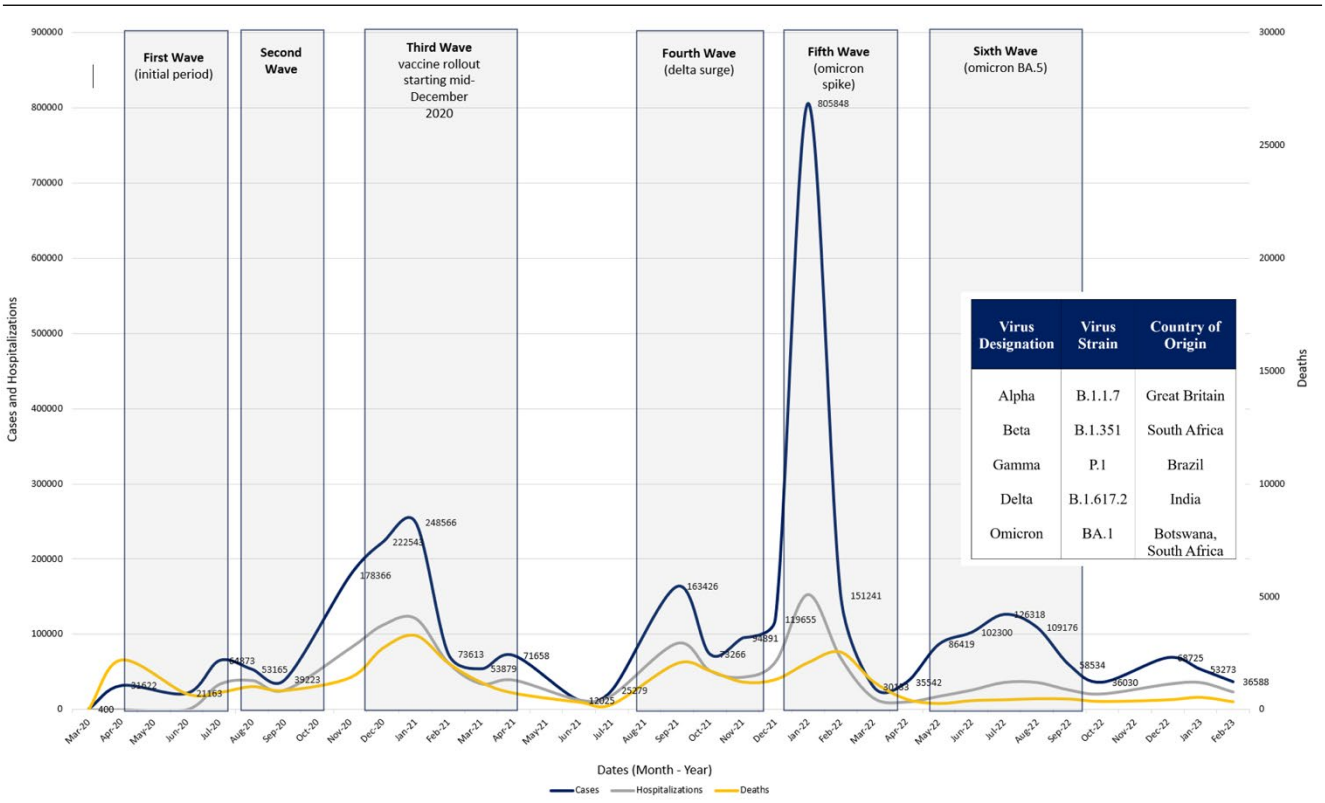
Effects on Other Healthcare Areas

COVID-19 infections were shown to negatively impact healthcare-associated infections (HAIs) such as methicillin-resistant *S. aureus* (MRSA). Increased rates of bacterial bloodstream infections and antibiotic resistant pathogens paralleled surges in COVID-19 cases.[22, 23]

In contrast to increases in infectious disease cases, non-COVID, inpatient, emergency, and same-day surgery hospital admissions declined starting in March 2020 and into the end of the year, with the greatest declines in groups 17-years and younger and 65-years and older. Furthermore, surges in COVID cases were paralleled by decreases in acute care admissions, most likely due to aversion to catching COVID.[24] COPD/asthma, non-COVID pneumonia, and transient ischemic attack were among the top conditions associated with the largest admission declines. Hospitalization for pancreatitis, alcohol-related disorders, and diabetes returned to pre-pandemic levels; however, reduced admissions for conditions such as UTI, sepsis, COPD/asthma, and pneumonia persisted into June and July of 2020. Urgent conditions requiring immediate medical care, most notably, acute STEMI and cerebral infarction, demonstrated concerning declines.[25]

During the early months of 2020, declines in routine cancer screenings (as a result of clinic closures and increased patient caution), such as those for the breast, colon, and cervix, decreased by 86-94%.[26] As prognosis and treatment outcomes for cancer greatly benefit from early detection, undetected and undiagnosed cancer could impact disease progression, treatment options, survival rates, and outcomes.[27]

Figure 1. **Number of Daily COVID-19 Cases, Hospitalizations, and Deaths from March 2020 – February 2023. Data sourced from Our World in Data "United States: Coronavirus Pandemic Country Profile" by Edouard Mathieu et al.[51]**



Impact on Healthcare Workers

Physical, occupational, and psychological strain from the pandemic led to significant rates of burnout. In line with the Great Resignation—a period starting in early 2021 involving mass waves of workers leaving their jobs due to job dissatisfaction and burnout, among several things—many healthcare workers resigned, including an estimated 30% of nurses and nearly 1.7 million healthcare workers from January to May 2022.[28] An October 2021 study estimated 1 in 5 healthcare workers had quit their jobs. Subsequent employment varied, with workers reporting relocating to new healthcare employment locations, switching to more flexible healthcare roles, or departing from healthcare entirely.[29]

During the initial and subsequent surges, healthcare workers faced uncertainty, increased hospitalizations, overwork, understaffing, massive supply shortages, detriments to mental health, and large-scale burnout. Mental health conditions such as anxiety, depression, and PTSD were observed in healthcare workers. Moreover, a survey comparing pre- and post-pandemic emotional exhaustion among healthcare workers (nurses, physicians, hospital staff, etc.) demonstrated preexisting burnout that was exacerbated by the pandemic.

Healthcare workers serving at the frontlines were at increased risk of infection. In a survey of 20,947 healthcare workers spanning from May to October 2020, 61% of surveyed individuals experienced fear over personal or family exposure to SARS-CoV-2. Anxiety or depression and work overload was reported in 38% and 43% of participants, respectively. Nearly half (49%) of participants reported experiencing burnout. Notably, higher scores were observed in frontline workers (nurses, nursing and medical assistants, respiratory therapists, and housekeepers) and minority populations (women and Black and Latinx employees). Allied health professionals (speech and occupational therapists and social workers) reported 60% burnout—the highest rate among those groups surveyed.[30]

The Impact of COVID-19 on Mental Health in the U.S.

During the pandemic, rates of loneliness, anxiety, depression, substance use disorder, and suicide increased nationwide.

In a June 2020 CDC mental health survey, 41% of participants reported mental health difficulties, with 11% recently considering suicide. Groups with higher mental health risks include essential and frontline workers, ethnic and racial minority groups, unpaid caregivers, and young adults. In addition, 26.3% of survey respondents reported pandemic-related trauma-and-stressor-related disorder (TSRD).[3, 31] During the winter of 2020, the CDC reported the highest number of drug overdose deaths in a year over 81,000. Amidst an ongoing U.S. opioid epidemic, synthetic opioid deaths for cocaine, methamphetamines, and synthetic opioids (predominantly fentanyl) increased by 27%, 35%, and 37% respectively.[3]

Common causes for decreased mental health in the U.S. during COVID-19 include financial instability, unemployment, job loss, homelessness, uninsured status, rising prices (inflation), lack of supplies (food, PPE), pervasive uncertainty, lack of social interaction, prolonged time indoors along with social confinement, loss of normalcy, feelings of frustration, confusion, and hopelessness, dislocation from normal routine, excess technology and social media usage, transition to a predominantly online environment, anxiety and worry regarding the virus and pandemic-related effects, and acute and chronic stress. As healthcare and frontline workers suffered from preexisting and COVID-19-related overwork, stress, and burnout, employees from all sectors faced similar feelings of stress, frustration, and burnout, leading many to exit their current positions.

Several studies have proposed COVID-19-related post-traumatic stress disorder (PTSD) in individuals who experienced particularly traumatizing COVID-19-related events, such as survivors who resided in high-risk hospitals or ICUs, individuals who required intensive treatments (ventilation, intubation), families who lost or witnessed sick loved ones, and vulnerable populations (children, youth, those with preexisting mental health disorders, and ethnic and racial groups who experienced discrimination).[32] Alongside this, individuals who served as their family's primary caretakers experienced increased stressors, especially those tasked with taking care of both their children and parents (the sandwich generation) or those who lost loved ones during the pandemic.
Two major peaks (in the beginning months of 2020 and ending months of 2020) in depression and worry occurred in 2020, followed by gradual resolution, mental health resilience, and relative return to baseline mental health status throughout 2021 and 2022 following vaccination and decreased death rates ***Figure 2***. Mental health struggles saw a peak in April 2020 where a Gallup poll demonstrated stress rising from 46% of surveyed participants in 2019 to 60%, which then declined back to 44% in June 2021. Increases in COVID-19 cases were paralleled by decreases in mental health status; however, this relationship was less well reflected during the January 2022 omicron peak, suggesting stabilizing or improvements in mental health following lower death rates, lower perceived virus severity, and increased vaccination.[33]

The Impact of COVID-19 on Vulnerable Populations in the U.S.

Socioeconomic Status

As COVID-19 intensified, certain populations were more impacted compared to others ***Figure 2***. COVID-19 intensified and highlighted existing socioeconomic status (SES) disparities. SES determinants demonstrated strong associations with COVID-19 outcomes.

Interestingly, COVID-19 mortality was highest for higher SES groups in the beginning of the pandemic (March 2020 – May 2020) but shifted to higher mortality rates in lower SES groups in June 2020 – December 2020; this disparity increased as the

pandemic progressed. Death rates in lower SES counties were reportedly 2.58 times higher compared to higher SES counties.[34] In a study by Magesh et al., county median income was negatively associated with mortality (higher incomes were correlated with lower mortality rates) in White, Hispanic, African American, and Asian, populations.[35] Furthermore, lower educational levels were associated with greater rates of COVID-19 infection and mortality.[36] A study by Thryselius et al. found that individuals from higher SES and those who had earned higher educational degrees were more likely to perceive COVID-19 with higher risks and partake in preventive behaviors.[37]

At the same time, pandemic conditions exacerbated systemic and deeply rooted nationwide food and shelter insecurity. During the pandemic, 52 million people in the U.S. were impacted by food insecurity, which increased by 17 million compared to before the pandemic.[3] Individuals experiencing homelessness faced increased risk factors, including lack of safe housing, adequate food, proper PPE, accessible, adequate, and timely healthcare, and essential support services. Among those residing in shelters, social distancing and preventive practices were compromised as a result of limited space and supplies.[38]

Additionally, amidst nationwide decreases in cancer screenings, individuals from low SES and minority groups were among those most affected.[26]

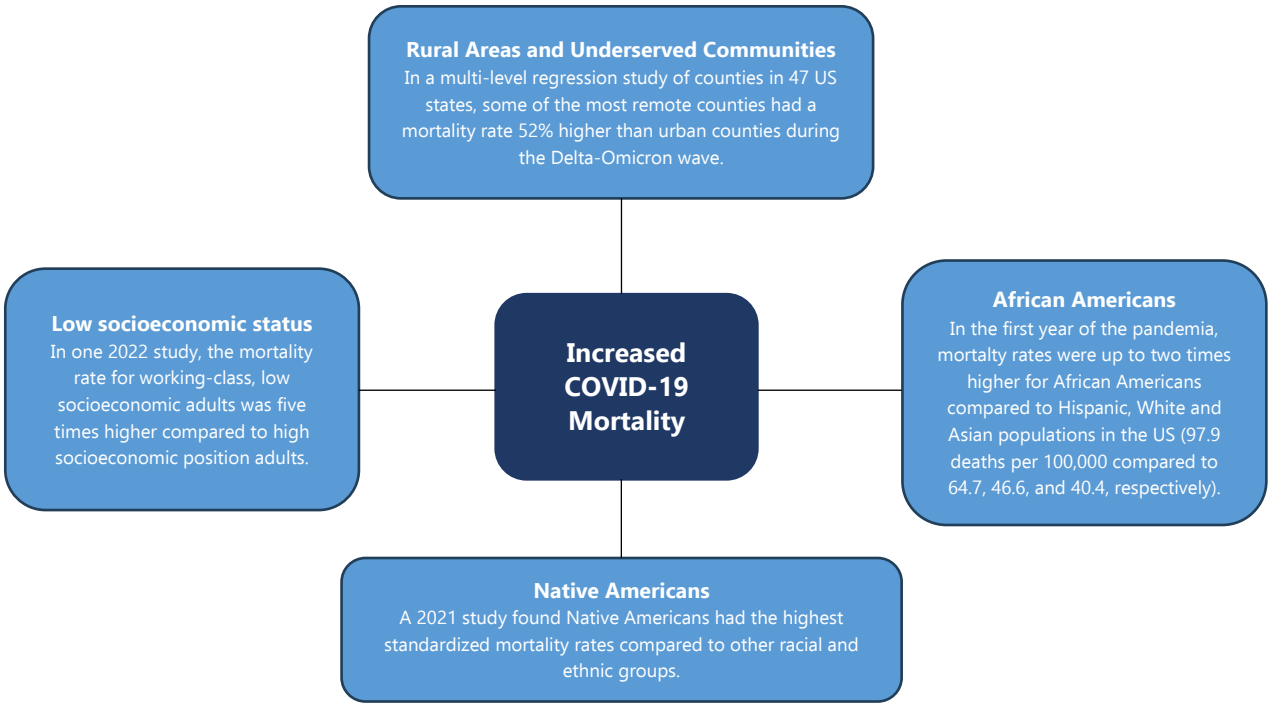
Rural and Medically Underserved Populations

Over half of individuals living in rural areas did not have access to ICU beds compared to higher income areas.[3] Lack of intensive care facilities, along with higher COVID-19 infection rates, chronic disease, limited PPE and testing, preexisting comorbidities, and decreased access to healthcare services created the opportunity for higher rates of morbidity and mortality in rural communities and other underserved areas such as Native American reservations, inner cities, and urban gentrification zones. Food and shelter insecurity and lack of access to mental health services exacerbated these conditions.

For instance, decreased access to primary care providers among Hispanic populations was associated with higher rates of COVID-19 positivity. Among Black populations, rates of uninsurance and lack of healthcare coverage were positively associated with COVID-19 infection.[35]

Interestingly, death rates among different population densities varied throughout the pandemic. Initially, highly and densely populated urban areas experienced the highest death rates. During the first wave, the death rate in highly populated areas was nine times that of less populated areas. However, following the first wave, higher death rates were consistently experienced in the least populated U.S. regions. Moreover, COVID-19 death rate hot spots shifted from the highly populated Northeast region to the less populated Midwest region over the course of the pandemic. Over the long-term course of the pandemic, overall death rates in least populated regions slightly exceed that of highly populated regions: 15 deaths per 100,000 compared to 13 deaths per 100,000.[9]

Figure 2. **Groups Most Affected by COVID-19 in Terms of Mortality.**[52-55]



Racial and Ethnic Minorities

A March 2020 – December 2020 CDC analysis demonstrated higher percentages of COVID-19 hospitalizations in racial and ethnic minority patients compared to White patients.[39]

Death rates adjusted to age were lowest among multiracial, Asian, and Hispanic populations (378.8, 457.9, and 724.1 deaths per 100,000, respectively), and highest among American Indian/Alaskan Natives and Black populations (1,024 and 1,105 deaths per 100,000, respectively) compared to White populations (827.1 deaths per 100,000). However, the age-adjusted death rate for White populations was higher than that of multiracial, Asian, and Hispanic populations.[40] Furthermore, communities with a higher proportion of Black residents exhibited higher COVID-19 infection and mortality rates.[36] Moreover, higher COVID-19 positivity and ICU admissions were found in African, Hispanic, and Asian American groups compared to White patients.[35]

Variations in healthcare and socioeconomic disparities were observed among different racial and ethnic groups. In a March 2021 U.S. Census Bureau report, 18 million adults and 8.8 million children lived in a home without adequate food. Of those facing food insecurity, 16% of the adults were Black, 16% were Latinx, and 6% were White. Of the children included in the report, 20% were Black or Latinx.[3]

In a study conducted by the American Medical Association (AMA), Black and Latinx worker-reported stress due to SARS-CoV-2 exposure or transmission was 70.1% and 74.4%, respectively, compared to 56% of White healthcare workers, though rates for burnout were slightly lower for these two groups compared to White healthcare workers.[30] Additionally, turnover (exiting from healthcare employment) rates were higher, as well as slower to recover, for healthcare workers from marginalized racial and ethnic groups, including female workers with younger children.[41]

Aged Population

Persons older than 60 years, along with persons with preexisting comorbidities (overweight or obese, cardiovascular disease, diabetes, chronic lung or kidney disease, autoimmune diseases, etc.) have an increased risk of COVID-19 infection, morbidity, and mortality.

As of February 2023, roughly 75.4% of total COVID-19 deaths in the United States were from the 65 years and older age group. The second highest age group was 50-64 years, representing 18.0% of U.S. COVID-19 deaths, followed by the middle age category (40-49 years) at 4.1% and the early middle age category (30 – 39 years) at 1.8%. Younger age groups (0-29 years) represented 0.75% of U.S. COVID-19 deaths.[42] Higher COVID-19 mortality in older populations may be due to preexisting comorbidities (chronic heart disease, diabetes, kidney failure, liver disease, etc.), decreased respiratory capacity, decreased muscle mass, increased fat percentage, and malnutrition.

Discussion

COVID-19 disrupted global, national, and personal operations and disproportionately affected vulnerable and disadvantaged groups. The COVID-19 pandemic, and the resulting nationwide response to the pandemic, aggravated longstanding, accumulated healthcare inequities. Socioeconomically disadvantaged, medically underserved, and minority populations experienced higher death rates, as well as were more significantly affected by compounding factors worsened by the pandemic such as food insecurity, homelessness, decreased access to timely and adequate medical care, lack of insurance coverage, and discrimination. Black and Hispanic individuals made up a large percentage of frontline and service workers; increased exposure was augmented by decreased healthcare and insurance coverage and vaccine hesitancy. Compared to White populations, Black populations had lower vaccination rates while also having higher COVID-19 mortality rates.[43] Healthcare systems suffered from low supply, high demand, and burnout, and overall mental health declined during peak pandemic waves. We propose several suggestions for future healthcare and government responses based on these COVID-19 challenges and outcomes with emphasis on generating future policies that will minimize disadvantages to underserved and underrepresented populations and provide more equitable care.

Based on our analysis of the published literature, we are proposing several suggestions *Figure 3* to appropriately deal with potential future pandemics.

Using Technology to Increase Access to Care

The use of technology to adapt to pandemic needs allowed for the expansion of healthcare access to sectors previously underserved, thereby increasing healthcare access as well as reducing travel-associated costs and concerns. Individuals living in rural areas, older adults in longitudinal living facilities, and individuals living in medically underserved areas are better able to access health, therapy, and counseling services in an online format that also provides greater scheduling and location flexibility. Though technology may increase access to care, underserved populations may still not have the adequate infrastructure (computer and Internet access) to access services remotely. Therefore, additional funding would need to be allocated to address the drawbacks of this suggestion. Additionally, telehealth should not be used as a cure-all replacement for in-person clinical exams and evaluations and more so a way to increase patient options and healthcare access. Outreach programs targeting vulnerable populations may also be implemented to increase awareness of available health resources.

Increased Collaboration and Coordination

Implementation of COVID-19 measures varied widely across states, schools, and workplaces; in many cases, policies at one level contradicted policies at another level. Prevention strategies such as mask-wearing and social distancing were implemented at different levels and to different degrees. Lack of a centralized, unified plan and decentralization of the COVID-19 response from the federal government to individual states further worsened

confusion and conflict regarding the status, spread, and response to the virus and left vulnerable groups even more susceptible to infection and lack of access to adequate care, preventive equipment, and resources.

A more robust pandemic response may escalate the pandemic response to an issue of national security involving a centralized government response across multiple departments, states, and locales, and one with unified, clearly delineated procedures and supports for all 50 states.[44] Government officials may consider forming departments or positions staffed with scientists and public health authorities dedicated to proactively planning and implementing policies—in collaboration with government officials—in response to public health crises such as the COVID-19 pandemic. Positions may be formed to specifically direct and oversee public health responses focused on underserved and vulnerable populations.

Collaboration across cultural, political, and social differences is perhaps one of the most important components of a robust pandemic response. Insight can be taken from resource-limited countries such as Laos PDR, which, though faced with a severe shortage of resources and healthcare workers, was able to quickly and cohesively mobilize supplies, personnel, and vaccines to successfully control the virus following a sudden spike in cases.[45] Similar ideas to develop a robust, multi-disciplinary, multi-sector emergency response plan can be taken from a sample of 15 countries in the WHO Africa region in recruiting healthcare workers despite limited resources.[46] Additionally, implementation strategies from high-income countries—such as Canada, Germany, Norway, and Japan—can be integrated to specifically assess vulnerable populations.[47, 48] Building trust and fostering open communication is an important step in creating and executing a more cohesive, coordinated pandemic response.

Preventing Medical Supply Shortages

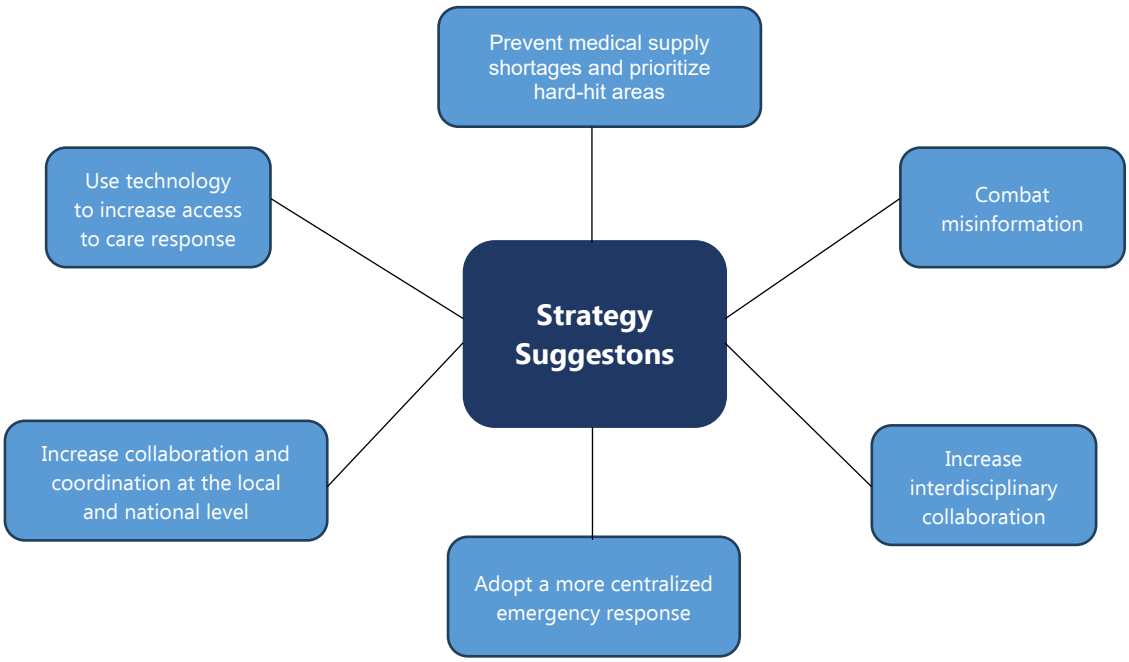
Shortage of PPE and related equipment proved an obstacle in the initial pandemic phase. In conjunction with a centralized government response, companies may be incentivized to shift to PPE production during an emergency state and to increase internal production of equipment (PPE, ventilators) instead of relying on hard-stretched overseas imports. A centralized distribution system could be established for distributing preexisting stocks of equipment and PPE with priority ranking systems in place for COVID-19 hotspots. Priority should be placed on hard-hit healthcare areas and populations identified to be high-risk.[20, 49]

Shifting from a predominantly external to internal source of PPE and healthcare equipment may pose a challenge regarding lack of infrastructure to meet short-term production demands and shortage of companies and personnel willing to participate. Thus, this drawback may require additional funding and consideration before implementation.

Combatting Misinformation

Misinformation persisted widely in the U.S. during the pandemic and in extreme cases resulted in dangerous health behaviors. Vaccine hesitancy was notably prevalent in groups with worse COVID-19 outcomes. In combating misinformation and fostering an environment of trust and collaboration, emphasis should be placed on collaboration between the sciences, social sciences, and communication studies in delivering sound, secure, and factual information in a social media age of rapid information proliferation.

Figure 3. **Proposed Strategies for Effective Responses Against Future Pandemics in the U.S.**



In this technological age, partnerships between science and social media are important in identifying, screening for, and stopping misinformation and finding ways to increase health literacy on a widespread scale in the interest of public health without violating the right to freedom of speech and press.

In a "fight fire with fire approach," the scientific community can use the massive scale and speed of social media to combat misinformation and share vetted, peer-reviewed facts to correct misinformation and increased trust in the scientific, medical, and scholarly community and their findings.

Conclusions

Takeaways from the Pandemic

The SARS-CoV-2 pandemic shook the globe with impacts echoing through all systems, communities, and nations. We present the following takeaways from the COVID-19 pandemic in the U.S.:

- In the U.S., the pandemic was met with an initial stage of confusion, overwhelmingness, and shock to healthcare systems.
    - Healthcare systems faced inadequate supplies, understaffing concurrent with overloading, and mass burnout.

- Long-standing inequities and gaps in healthcare, especially in minority and underserved populations, were exacerbated by the pandemic.
    - Higher morbidity and mortality rates were found for counties with lower average socioeconomic status, rural and underserved communities, certain racial and ethnic minorities, older age groups (65+ years), and individuals with preexisting comorbidities (obesity and heart, lung, liver, and kidney disease).

- Perhaps the most critical lesson and takeaway is the importance of collaboration.
    - The efforts of brave healthcare, frontline, and essential workers, as well as the perseverance of scientists led to the development of a relatively effective vaccine and COVID-19 treatments.
    - The unprecedented sharing of reagents and resources between scientists and doctors from different countries contributed to advances in this area.
    - International journals made special efforts by providing COVID-19 scientific publications through open access forums for scientists to follow the ongoing work on diagnostics, drug, and vaccine development.
    - Collaboration, open communication, and a centralized, cohesive response across cultural, political, and social differences will allow for a more robust future pandemic response—if another such arises—and one that can save millions of lives.

Summary – Accelerating Translation

The purpose of this review was to discuss the impact of COVID-19 in the United States from the perspectives of government policies and the U.S. healthcare system. Specifically, we strive to highlight key COVID-19 challenges, outcomes, and takeaways to further increase awareness among healthcare and public health professionals for more efficient, effective, and equitable healthcare system preparedness and public health responses to deal with future epidemics. A narrative review was conducted and data for this review was obtained through searching the database PubMed for articles addressing COVID-19 in the United States. Articles selected for inclusion ranged from 2020 – 2023 and were written in English. A total of 45 articles were selected for this analysis. The emergence of multiple viral variants was at the center of sequential waves of infection in the U.S., resulting in increased number of cases, hospitalization, and deaths along with associated mental health sequelae in the population.[50] Lack of uniform policies at the local, state, and federal levels exacerbated the situation. These factors contributed to significant healthcare worker burnout. Furthermore, the disease caused higher morbidity and mortality rates in specific groups such as lower average socioeconomic status, rural and underserved communities, Native Americans and African Americans, and older age groups (65+ years). Based on these results and analyses, we proposed several suggestions for healthcare and government responses to address potential future epidemics, including using technology to increase access to care, increasing collaboration and coordination, preventing medical supply shortages, and combatting misinformation.

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Review

The Factors Causing Stress in Medical Students and their Impact on Academic Outcomes: A Narrative Qualitative Systematic Review

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Abstract

Background: This study investigated the causes of stress in medical students and the impact of stress on their academic outcomes. Much is known about the impact of stress on medical students but there is a gap in knowledge regarding the collated overview of literature in this area. This study sought to pull together disparate research to gain a clearer overview of the core drivers of stress. **Methods:** Taking a meta-level approach, a narrative qualitative systematic review of previous systematic reviews was undertaken, following the PRISMA guidelines. This systematic review covered literature published from 2009-2023 where the focus was stress in students studying at medical schools in the United Kingdom. Findings were then assessed for commonly emerging themes. **Results:** From an initial tranche of 3394 articles, a final set of eight systematic reviews was identified. The eight reviews drew on over 309 separate research projects and involved over 500,000 participants. A review of the key findings from each of the eight studies identified five themes: academic pressure, the impact of the institution, students' personality traits, social relationships, and financial stress. The analysis provided clear evidence that stress amongst medical students results in negative academic outcomes. **Conclusion:** The findings suggest a need to reduce stress to help medical students prevent a decline in their academic outcomes and health. From these findings it is recommended that medical schools examine their curriculum to identify areas where they feel they put undue academic pressure on their students and work on ways to remediate this situation.

Introduction

Stress can cause emotional, psychological, and physical turmoil.[1-2] There are several reasons why stress can be experienced, for example there are daily causes of stress - perhaps due to situations at work or home, and there are one-off drivers of stress such as the loss of a loved one or sudden unemployment.[3] Usually when encountering stressful situations, we assess the problem and determine if we have the appropriate resources to manage it. Our body also makes various biological changes to endure this increased demand and to heighten our performance, which in consequence increases our survival prospects. As such, stress can be seen as both a physical and mental process and can even lead to positive outcomes. However, when this stress becomes chronic and continues for a long period of time, it can lead to detrimental outcomes.[4-5]

Stress affects a large number of people. Approximately half a million people experience work-related stress in the UK and, in a study from 2018, 74% of respondents report feeling overwhelmed.[6] Similarly, stress has been increasingly reported amongst university students. The Office for National Statistics reported that first-year students in the UK scored an average life satisfaction of 6.6 out of 10 which is lower than their non-university peers, who scored 7.1.[7] As a whole, university students can be considered as a vulnerable group due to the number of stressors that come into play when facing a new environment, new people, new friendships, and new accommodation. This can be exacerbated by factors such as living away from home for the first time, managing their own finances, adjusting to new routines, and ensuring their learning needs are met.[8]

In addition to the stressors which occur as a student moves from school to university, medical students also report that their new life starts to evolve around studying in a competitive environment – something that can lead to a fear of failure.[9-11] Applying to study medicine generally requires getting good grades, writing a personal statement, completing admissions tests, and attending an interview. This rigorous application process seeks to filter students to ensure the 'best of the best' are selected. Once, students are on their academic programme, they are then faced with years of study and assessment. Over time, such high and consistent levels of stress amongst medical students can lead to burnout, which is characterized by increased levels of emotional exhaustion, depersonalization, and a reduced acuity of personal achievement. From this, we can see that stress is likely to have a detrimental effect on student wellbeing and is therefore likely to impact their academic outcomes.

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(**PAGE**)

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The term 'academic outcomes' is often used interchangeably with terms such as 'academic attainment' or 'academic performance' but there are subtle differences between these terms. This study focuses on the concept of academic outcomes as this is a broad measure of success. The term 'academic outcomes' refers to a wide-ranging sense of achievement based upon factors such as interaction, engagement, attendance, and assessment.[12] By focusing on the overarching concept of academic outcomes this study looks beyond test results and examines stress in relation to the development of academic skills such as logical thinking, practical ability, technical dexterity, and communication skills.[13] Terms such as 'academic attainment' and 'academic performance' mainly focus on measuring student success based on the results of their assessments but being a medical student is more complicated than this.[14-15] By focussing on academic outcomes this paper looks at the impact of stress on the broader experience of being a medical student.

As well as cognitive ability, some of the factors that affect academic outcomes include support networks, self-management, organizational skills, resilience, finance, the accessibility of study resources, and the input of teachers.[16-18] These factors are quite diverse but generally suggest that academic outcomes are dependent on the student, the institution, and the environment. As well as having different factors that affect academic outcomes, there are many different factors that affect stress levels and there are different ways that stress can affect the individual. For example, stress can impact an individual's physical, social, and/or emotional development. Here we can see that academic outcomes are dependent on many factors and that stress has the capacity to affect the individual in several different domains.[19]

Medicine is known for being a very stressful course in comparison to other degrees – mainly due to a larger than average workload and course content, stricter rules regarding attendance and professionalism, frequent examinations, and the responsibility of treating patients.[20] In addition to the stressful nature of undertaking a medical degree, medial students can experience further stress related to their financial circumstances and personal relationships.[20] For example, a study investigating the causes of stress in a medical school in Thailand reported that the main cause of stress experienced by the majority of the students related to academic activity - such as assessment (99%), increased workload (96.3%) and poor results (92.9%).[21] This shows how stress itself can be caused by academic demands, but at the same time, stress can result in poorer academic outputs; which results in a vicious cycle of academic burden causing further stress which results in reduced academic performance which further contributes to stress, and so on.[22] Furthermore, stress amongst medical students can result in burnout, anxiety, depression throughout their academic studies and clinical placements.[20] At the personal level, stress can also cause detrimental outcomes, such as abuse of alcohol and drugs, strained relationships, and suicidal behaviour.[22]

Stress can clearly have an impact on medical students and their likelihood of achieving academic success. This narrative qualitative systematic literature review explores the causes of stress amongst medical students, examines how it can affect their academic outcomes, and offer some guidance as to how stakeholders might start to address this issue.

Methods

The purpose of this qualitative study was to conduct a narrative qualitative systematic review which explored the reasons stress occurs in medical student in the United Kingdom and the impact it has on academic outcomes. The primary aim of this narrative qualitative systematic review was to identify the causes of stress amongst students studying at medical schools in the United Kingdom, as described in the existent literature. The intended secondary outcome was to identify any action points that should be addressed by universities and governing bodies. It is hoped that by undertaking such actions changes can be made that might reduce the impact of stress on medical students with the intention of developing more resilient, confident, and safer future doctors. This study highlights core messages in the extant literature and research, provides an account of how well this topic is investigated, and highlights what can be done to address perceived weaknesses. A systematic review was used to explore this topic and was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[23] A systematic review was identified as the most suitable approach for this type of study as it would allow for oversight of all relevant data.

Search Strategy

This review started by identifying relevant articles. This involved a Boolean search using keywords formed of derivatives of 'medical student', 'stress' and 'skill'. Furthermore, these were used in combination with a series of Boolean "AND/OR" operators and asterisk wildcards which have been summarized in *Table 1*. These terms were used with other terms which aligned with the Medical Subject Headings (MeSH). These terms were used to search three databases: PubMed, Education Research Complete, and Scopus. Three databases were used to increase the likelihood of identifying all relevant literature - as recommended by the PRISMA guidelines.[23] To ensure parity of investigation, the same combinations of search terms were applied to each of the three databases. To assess potential biases in the selected studies, scrutiny of each article was conducted using the Joanna Briggs Institute (JBI) evidence-based critical appraisal tools.[24] The appropriate JBI critical appraisal tool was applied to each article that met the inclusion criteria to ensure trustworthiness across different studies and different populations. To enhance credibility the articles that met the inclusion criteria were also assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.[25] The start date was established in relation to the General Medical Council (GMC) publication 'Tomorrow's Doctors' which outlines standards for undergraduate medical education in the UK. This is a core guidance document for UK Medical Schools and was originally published in 2009.[26] The end

date for the review was 2023, as this was the year the project was undertaken and would allow for the most recent literature.

Table 1. **Illustrating the Combination of Search Terms used in PubMed.**

Databases Searched	PubMed, Education Research Complete, and Scopus		PubMed, Education Research Complete, and Scopus		PubMed, Education Research Complete, and Scopus
Search Terms	Medical Student* OR Medical School* OR Undergraduate Education	AND	Stress* OR Burnout OR Lassitude OR Distress*	AND	Skill* OR Academic success* OR Knowledge OR Understanding

Inclusion Criteria

Studies were included if they addressed the following criteria:

- Studies published from 2009-2023
- Studies that are meta-analyses, reviews, or systematic reviews.
- Studies relating to medical students on undergraduate programmes.
- Studies exploring the difficulties and stress experienced by medical students.
- Studies where the full text is available in English language.

Exclusion Criteria

Studies were excluded if they address the following criteria:

- Studies published before 2009.
- Studies that are randomised controlled trials, clinical trials.
- Studies reported in books or other non-peer-reviewed documents.
- Studies that are not related to medical students.
- Studies that do not explore the difficulties and stress experienced by medical students.
- Full text not available on PubMed in English language.

The selection process involved TJ carrying out the initial search and reviewing the titles and abstracts of the first tranche of literature. This screening checked to see whether papers met the inclusion criteria. After this there was a full screening of the included papers to identify any derivatives of key search terms. This two-stage screening model allowed for clear data identification. When uncertainty arose, guidance was sought from EKB and, based upon the recommendation provided, TJ and EKB came to an agreement of what should be done. For example, when carrying out the initial search, TJ came across studies that were not carried out in the United Kingdom alone. A collaborative decision was made to include such studies if the United Kingdom was one of the countries included. In this way, concerns were discussed, and the reviewers worked to develop a mutual agreement. No significant disputes were identified.

Results

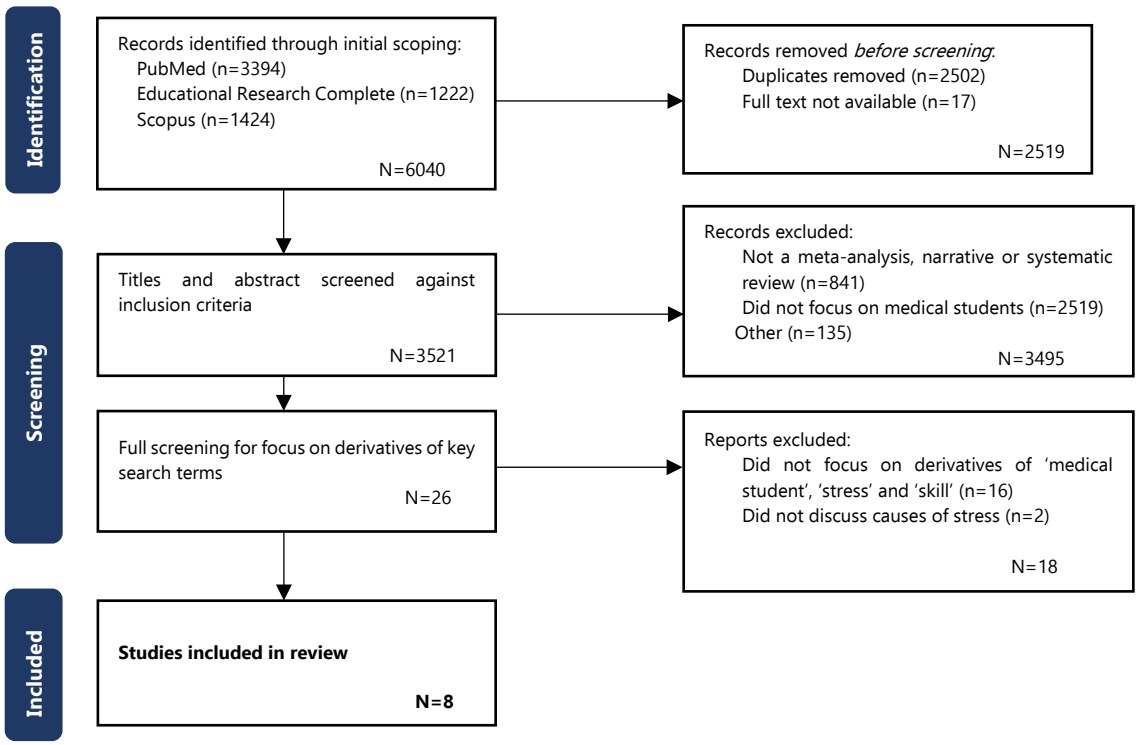
Following the initial search, 6040 studies were identified. There were 2502 duplicates identified and excluded, and a further 17 papers were excluded as they did not have full texts. The titles and abstracts of the remaining 3521 results were then reviewed using the inclusion criteria, leading to 26 papers being identified as suitable. The 26 results were then read in full and screened using derivatives of key search terms. After review, 18 studies were excluded. Sixteen of these papers were clearly outside the scope of this review. Two further studies were excluded: one study investigated methods that can be used to assess student wellbeing and the other explored how mindfulness might reduce stress.[27-28] As neither study addressed the causes of stress, they were excluded resulting in a total of eight studies to be included as part of this systematic review. A full account of the screening system, following the PRISMA guidelines, can be seen in ***Figure 1.***

A total of eight systematic reviews were identified and included as part of this review. Through manual screening and scrutiny of the eight systematic reviews some recurring themes were identified. In identifying these themes, we deliberately avoided using content or thematic analysis as these approaches have been criticized for reducing analysis to a simple mathematical count of repeated terms.[29] Instead, we took a holistic approach to assessing the central themes of each paper – by focusing on the concluding messages of each paper to examine what was central to their findings.[30-31]

Data was extracted and examined through close reading following the JBI guidance for Umbrella Reviews – all key findings were identified in the abstracts of the papers and were verified in their results and discussion sections.[24] Following the JBI guidance on data extraction, core results from each paper were identified and a synthesis of findings was developed. Through close reading of these syntheses, a meta-synthesis was developed that collated the core findings under emerged thematic headings. The eight studies drew on over 309 separate research projects and involved over 500,000 participants. The results are summarized in ***Table 2***. Of the eight studies, five used standardised critical appraisal tools such as the Medical Education Research Study Quality Instrument and the Consolidated Criteria for Reporting Qualitative Studies. Interestingly none used the same standard tool. The meta-synthesis of the key findings from each of the eight studies identified five thematic headings: academic pressure, the impact

of the institution, students' personality traits, social relationships, and financial stress.

Figure 1. **A PRISMA Diagram Illustrating the Identification and Screening Process of this Systematic Review.**



Academic Pressure

Across scoping, narrative, and systematic reviews, one of the key features found to be a factor in driving academic stress was academic pressure.[32-35] This was discussed as the workload demanded from a medical degree as well as the outcomes students feel they must meet - whether from their own targets; the expectations of the academic staff, and/or the confidence placed in them by family and friends. Dealing with high expectations during difficult phases of their learning journey was also found to contribute to stress. For example, Atherley et al. conducted a scoping review of 45 articles investigating the struggles experienced by undergraduate medical students in the transition from the preclinical to clinical years of the medical programme.[32] The review found that educational, social, and developmental expectancy can contribute to such struggles. The findings revealed that students can be overwhelmed by factors such as perceived lack of skills and knowledge, requirements of the programme, expectations of staff and a genuine feeling of not being prepared. This was further emphasized by Gaston-Hawkins et al. who conducted a review exploring the causes and solutions of burnout amongst medical students and trainee doctors and reported that academic demand can cause individuals to sacrifice their own personal interests for the sake of pursuing their academic goals, which can result in their wellbeing becoming compromised.[33] A limitation of this study was that the review was mainly narrative rather than systematic – thus it could be suggested to be cherry-picking data. Furthermore, Gaston-Hawkins et al. only reported on two studies from the UK of which one was associated with medical students and the other associated with residents.

Impact of the Academic Institution

A second theme that emerged from the studies was the impact of the academic institution.[34-36] Discussion in this area referred to matters within the control of the medical school, such as the curriculum, exams, and the delivery of teaching. The reviews found that the curriculum itself can cause stress due to the overwhelming volume of content that students are expected to know, and the competitive culture of medicine. The studies gathered measured resilience, mental wellbeing, academic outcomes, interpersonal dynamics, and the extent to which the activity was considered acceptable by students. The studies also reported on ways to address this. For example, the review of 19 papers by Mohmand, Montero and Solomonian found that improvements to the medical curriculum can decrease stress and increase student wellbeing.[35] These improvements included changing pre-clinical modules to pass/fail; reductions in the level at which some materials are taught, and initiatives to reduce the feeling that gaining good grades was a matter of competition

rather than ability. Here we see that the impact of stress on academic outcomes can be alleviated through curricular changes.

Personality Traits

A few studies emphasized how personality traits, such as being an extrovert or introvert, as well as having emotional stability can impact the level of stress experienced by students.[33-36] For example,

Table 2. **Illustrating the Key Findings from the Eight Studies.**

Authors	Year	Title	Study Type	n	Key findings
Atherley et al.[32]	2019	Beyond the struggles: A scoping review on the transition to undergraduate clinical training	Scoping review	45	In the transition to clinical years of medical school the causes of stress are the gap between pre-clinical and clinical training; learning to fit in, developing personal and clinical relationships, and developing reflective strategies.
Gaston-Hawkins et al.[33]	2020	The Silent Epidemic: Causes and Consequences of Medical Learner Burnout. Current psychiatry report	Narrative/ Selective review	n/a	Burnout increases with progression through medical school. Emotional fatigue can cause stress. Extroverts less likely to exhibit stress. Spiritual students less likely to experience burnout.
Ahmady et al.[34]	2019	Factors related to academic failure in preclinical medical education: A systematic review	Systematic review	89	Instructional design and personal factors can contribute to stress and academic failure in pre-clinical years.
Mohmand, Montero & Solomonian[35]	2022	How are Medical Institutions Supporting the Well-being of Undergraduate Students? A Scoping Review	Systematic scoping review	19	Voluntary measures put in place by medical schools to promote wellbeing can reduce stress. However mandatory activities increase stress.
Hancock & Mattick[36]	2020	Tolerance of ambiguity and psychological well-being in medical training: A systematic review	Systematic review	11	A decreased in levels of tolerance of ambiguity or uncertainty correlates to a decrease in psychological wellbeing.
Yang et al.[37]	2023	Influencing factors of depressive symptoms among undergraduates: A systematic review and meta-analysis	Systematic review	73	Factors contributing to depressive symptoms were categorised as relational, psychological, occupational, sociodemographic, lifestyle and one's likely response to trauma.
Ong et al.[38]	2022	A systematic scoping review moral distress amongst medical students	Systematic scoping review	20	Moral distress is influenced by combined factors, including gender, religion, culture and year of study. Moral distress can lead to stress, anxiety and lack of empathy.
Pisaniello et al.[39]	2019	Effect of medical student debt on mental health, academic performance, and specialty choice: a systematic review	Systematic review	52	A positive correlation between student debt and stress. A negative correlation between student debt and academic performance.

Gaston-Hawkins et al. found evidence that the personality of a medical student can influence the extent to which the individual will experience depression, and that extroverts were less likely to experience a severe form of depression in comparison to introverts.[33] In these studies, we can see that the impact of stress might be personally negotiated by the individual student based on personal characteristics. Further to this, evidence found by Ahmady et al found that emotional resilience, being conscientious and motivated, can positively correlate with academic performance.[34] This finding can be thought of as robust as it was the result of a systematic review of 89 research articles. Emotional resilience relates to the concept of tolerance of ambiguity explored through another systematic review: Hancock and Mattick.[36] Tolerance of ambiguity refers to how an individual manages an unclear and vague situation without getting frustrated or seeking immediate help or guidance. In such circumstances, high levels of tolerance are less likely to lead an individual to feel unduly stressed. Hancock and Mattick looked at a total of 11 studies and found that having a low tolerance of ambiguity indicates that an individual would find it difficult to manage confusing situations and, as a result, their psychological wellbeing would be negatively impacted – a situation that is then likely to impact their academic outcomes. The concept that personality can influence stress and, in consequence, result in the

development of depressive symptoms is further supported by Yang et al. whose systematic review of 73 papers explored the factors contributing to symptoms of depression among undergraduate students.[37] This review identified that the six factors contributing to depressive symptoms were relational, psychological, occupational, sociodemographic, lifestyle and one's likely response to trauma.

Social Relationships

The connection between social relationships and stress was identified in three reviews.[32,36,38] These studies highlighted how different types of relationships can influence stress and the academic outcomes of medical students. The types of relationships discussed included social relationships and clinical relationships - between students, the medical team, and peers. Clearly, building relationships is important in clinical work, where communication skills, with patients and colleagues, are vital; however, the reviews also highlighted issues in this area. For example, Atherley et al. reviewed the struggles faced by undergraduate medical students in the transition from preclinical to clinical years and found that students experienced uncertainties regarding the importance of their role in a team.[32] This led students to prioritise blending in and building a relationship (with the medical team and their peers) rather than learning – a decision that is likely to lead to lower levels of academic outcome. This concept of feeling anxious due to the uncertainty of the clinical environment was also explored in Hancock and Mattick's systematic review where it was reported that individuals who are highly anxious when approaching an uncertain situation experience a negative effect on their psychological wellbeing.[36] Furthermore, Ong et al. identified that social hierarchy can contribute towards moral distress – where students may be particularly wary of their relationships with senior clinicians.[38] The review by Ong et al. was a systematic scoping study of 20 papers, so it carries some weight; also, their findings are anecdotally and instinctively supported. Feeling worried about not integrating with the medical team during clinical placements can increase students' stress levels and can also result in a reduction in empathy.[32,36,38]

Financial Stress

A final cause of stress related to economic hardships and debt. Financial stress was identified as important in three reviews.[37-39] For example, the systematic review conducted by Pisaniello et al. reported that, while there is either a negative or zero correlation between the level of debt and academic performance, the impact on mental health caused by debt is significant.[39] While Pisaniello et al. did not find any immediate causal relationship between debt and performance, it is likely that this level of financial hardship creates the urge for students to seek coping mechanisms such as alcohol and other forms of self-medication, and these practices might impact on an individual's capacity to study. The review also revealed that financial stress can lead students to select specialties that have high pay rates such as surgical specialities, ophthalmology, neurology, and dermatology - which suggests that finance is a key factor in the short and long term. However, a limitation of this review is that, of the 52 studies included, only one was based in the UK which concluded that 42% of students believed that financial stress only contributed to 25% of their overall stress. Other studies in the review were based in the USA, New Zealand, Canada, and Australia where university funding models are different and where medical structures and wages differ. The study by Pisaniello et al. is a robust piece of work, the findings are sound and supported by the scoping reviews of Yang et al. and Ong et al. but may need to be interpreted at the local level.[37-38]

Discussion

Current literature supports the argument that studying medicine is a stressful undertaking because of the extensive course content and high levels of assessment.[20] Moreover, academic stress can be exacerbated by the academic pitch of the taught content caused by the curricular and teaching choices of medical schools.[18] The findings here show clear evidence to support the argument that academic pressure is a cause of stress in medical students.[32-34,37] Alongside the stress that comes from the act of studying, this review also identified support for the argument that stress is further impacted by institutional features such as curricular structure, exams, and the delivery of teaching.[34-36]

Since medical schools are responsible for providing the appropriate support for students and their needs it is important that they consider students' needs and provide the appropriate resources and support.[16-17] All university students have the potential to feel vulnerable when faced with a new environment and the challenges it brings.[8] For medical students this might be further impacted by the longer study period and the concomitant social, emotional, and financial pressures. An example of this was found in this review where economic hardships and debt were identified as causes of stress and where debt was found to have a negative impact on mental health.[37-39] These results are similar to that of existing literature which describes that living away from home and managing their own finances can contribute to stress for any university student and that finance plays a further role in terms of education regarding the accessibility and availability of study resources.[8,18]

Personality traits were identified has impacting emotional stability and emotional resilience.[33-34,36-37] Existing literature also supports this finding and outlines the relationship between self-management and academic outcomes.[17] This can be illustrated through the concept of tolerance of ambiguity which was found in this review. Tolerance of ambiguity is used to describe the way in which an individual can address a confusing situation without getting flustered or asking for help; where a low tolerance of ambiguity is more likely to contribute to stress.[36] This personality trait affects an individual's ability to control their emotions and manage the way in which thoughts, emotions and actions are processed. In such turbulent circumstances, high emotional stability is likely to allow individuals to adopt purposeful learning strategies, thus allowing them to manage their stress levels.

Fear of failure is an added stressor for medical students, therefore, it is important that individuals and institutions look at what causes such fear.[10] The fear of failure relates to the five emergent thematic headings found in this review: academic pressure, the impact of the institution, students' personality traits, social relationships, and financial stress. This fear of failure may be a result of personal or familial expectations (or indeed perceived expectations)[37-39] or situational changes[32-34.] However, there is evidence here that it can be addressed through reflection, personal tutoring, and managed expectations.[34-36] These findings align with previous studies that have identified the impact of change on stress levels, and that have identified methodologies for individual and institutions to help mitigate the impact of stress.[9-11,16-20,22] Medical schools should reflect on what can be done to reduce the fear of failure – offering safety nets such as academic and clinical mentors – and working to reduce the feeling that success in medicine is about competition to be at the top.

This narrative qualitative systematic review revealed that both positive and strained relationships with family and/or friends can contribute to stress and affect academic performance.[34,38] Students might feel that any self-perceived weaknesses let their support network down, and this might lead to them failing to share when times are tough. Conversely, students coming from traumatic or abusive backgrounds might already arrive at medical school with emotional scars that can impact their psychosocial wellbeing.[38] Current literature also highlights the importance of stressors regarding students building new relationships at university.[8] This suggests that students may experience an additional burden if they are trying to manage new friendships alongside existing relationships. However, it can also be said that, as well as relationships contributing to stress, the outcome of stress can also result in strained relationships - most probably due to students neglecting their social circle and spending more time studying.[22] Besides relationships with family and friends contributing to stress, this review also highlighted that clinical relationships with the medical team and peers also contributes to a level of stress.[33] Medical schools may be able to relieve some of this pressure through better signposting of emotional and psychological support (and the removal of any stigma for accessing such support). Medical schools could also work to ensure that all teaching staff are aware of the possibility that there will be students in their classroom who are feeling under pressure.

Limitations

All the papers used were also systematic reviews and were, in turn, dependent on the papers they drew from. Across the eight studies, there was no standardised critical appraisal of literature. Therefore, what was deemed significant may have varied slightly across all the selected reviews. There are limitations is only selecting systematic reviews as each of these will have screened out papers in line with their exclusion criteria, thus, some papers may exist that are not part of the original reviews and, as such, not part of this one. This is likely to be a minor concern as excluded papers are excluded for specific reasons; however, it might be a small limitation. Another possible bias might be potential publication bias. Journals select articles based on their own aims and scope; therefore, there may be unpublished findings that may have been relevant if we had had access to them. The analysis of the eight studies used a holistic approach to assess the central themes rather than a statistical analysis, a process that may have allowed for some researcher bias. The screening process undertaken was enhanced through inter-rater checking but both researchers may be subject to some biases of interpretation; however, this approach was typical of many systematic reviews and was like that used in five of the selected studies.[32-33,35,37-39] Some of these possible biases were countered through ongoing reflexive discussion. In this way, the assurance of quality comes from the rigor of the review, rather than from quantitative measures.

Conclusion

The data gathered from this narrative qualitative systematic review of systematic reviews is important for the current and future wellbeing of medical students. Being able to identify and address the causes of stress means that medical students and medical schools can work to improve outcomes. It is recommended that medical schools and stakeholders such as the General Medical Council work to create guidelines to ensure the protection of the physical and mental wellbeing of medical students. Factors contributing to stress in medical students include academic pressure, the institution, social relationships, financial stress, and the personality traits of students. The impact of these factors includes economic and social hardship, emotional insecurity, and difficulties identifying effective study techniques and resources. Such circumstances corrode social and familial bonds and are likely to be exacerbated if medical schools do not intervene. The academic outcomes of stress include poor academic outputs, burnout, depression, anxiety, low self-esteem, self-doubt, and a reduction in empathy - all of which can influence the likelihood of a successful educational outcome. Although there were only a few studies found that were based in the UK, the breadth of existing literature suggests that this is an experience shared by medical students across the globe.

This review identified eight studies that drew on over 309 separate research projects and involved over 500,000 participants, as such there is clear evidence of the factors causing stress in medical students and their impact on academic outcomes. From this analysis, five themes were identified: academic pressure, the impact of the institution, students' personality traits, social relationships, and financial stress. The results of this review support core messages in the extant literature and align with the idea that the impact of stress is exacerbated for medical students as they face particular challenges.[19-20,32,36,38] While previous studies have identified that starting medical school is a particularly stressful time,[9-11] this review was able to identify that the environment has a continued effect on stress levels.[34-36] Previous research also identified that stress can lead to poor academic outcomes – creating a cycle of stress and poor performance.[22] This study was able to identify that this cycle can be broken if students are able to develop specific coping strategies.[33-36] As well as supporting previous research, the findings of this systematic review add further emphasis in relation to the impact that wider learning support

networks can have on the stress and academic outcomes of medical students.

The task for stakeholders is to develop methodologies to address these factors. Having identified five themes it is recommended that future studies explore ways in which each of these themes can be addressed. It is also recommended that medical schools start by examining their medical curriculum to identify areas where they feel they put undue academic pressure on their students and work on ways to remediate this. It is recommended that future interventions take a person-centred, qualitative approach to gain specific insight into the lived experiences of medical students. In doing so, future research may wish to consider the following list of research questions:

- How can transition points, such as moving into clinical years or progressing through the various years of study, be reworked so as to alleviate undue stress?[32-34]
- What personal and curricular measures to alleviate stress can be drawn from medical students?[35]
- How can medical schools enhance students' tolerance to ambiguity?[36]
- How can medical schools alleviate moral distress among medical students?[37-39]

Summary

This study investigated the causes of stress in medical students and the impact of stress on academic outcomes. In highlighting the core drivers of stress, this study sought to identify what is already known in the extant literature. Taking a meta-level approach, a systematic review of systematic reviews was undertaken, following the PRISMA guidelines. This systematic review explored the causes of stress amongst students studying at medical schools in the United Kingdom. Findings were then assessed for commonly emerging themes. From an initial tranche of 3394 articles, a final total of eight systematic reviews were identified and included as part of this review. The eight studies drew on over 309 separate research projects and involved over 500,000 participants. The breadth of existing data suggests that this is an experience shared by medical students across the globe Some key drivers of stress were found to include academic pressure, the institution, social relationships, financial stress, and the personality traits of students. The academic outcomes of stress include poor academic performance, burnout, depression, anxiety, low self-esteem, self-doubt, and a reduction in empathy - all of which can influence the likelihood of a successful educational outcome. In identifying some of the core causes of stress, it is suggested that medical schools and other stakeholders will have specific areas of focus when it comes to curricular development and study support. The findings suggest a need to reduce stress for medical students to prevent a decline in their academic outcomes and health.

The data gathered from this narrative qualitative systematic review of systematic reviews is important for the current and future wellbeing of medical students. Being able to identify and address the causes of stress means that medical students and medical schools can work to enhance the student learning experience. Most importantly it means that medical schools and stakeholders can work to create guidelines to ensure the protection of the physical and mental wellbeing of medical students. From this analysis, five themes were identified: academic pressure, the impact of the institution, students' personality traits, social relationships, and financial stress. The task for stakeholders is to develop methodologies to address these factors.

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Case Report

A Case Report of Bardet Biedl Syndrome in a Patient from Pakistan who Presented with Osmotic Symptoms associated with Diabetes Mellitus

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Abstract

Background: The primary features of Bardet Biedl syndrome (BBS) are characterized by retinal degeneration, central obesity, post-axial polydactyly, intellectual impairment, hypogonadism, and renal anomalies. The secondary clinical features are syndactyly, delay in the achievement of developmental milestones, diabetes insipidus, diabetes mellitus, congenital heart disease and liver involvement. It is diagnosed when a patient has either four primary or three primary and two secondary clinical features and the management depends upon those predominant features. **Case Presentation:** A 12-year-old boy presented with polyuria, polydipsia and polyphagia. His developmental milestones were delayed and had syndromic features on physical examination. Ultrasound of the abdomen and pelvis showed mild right-side hydronephrosis. His BMI was 28 and HbA1c was 18.3%, and values of LH and FSH were decreased. As a result, he was diagnosed with a case of BBS. He was commenced on insulin therapy with Insulin Regular (Human Insulin) and Insulin NPH (Human Insulin). **Conclusion:** Patients presenting with polyuria, polydipsia and polyphagia, along with the presence of syndromic features, should be assessed for BBS as osmotic symptoms associated with diabetes mellitus can be initial clinical presentation of BBS. Its management depends upon the signs and symptoms of the patient. Various options including weight loss, exercise, oral hypoglycemic drugs, and insulin are available to treat diabetes mellitus in BBS. Some cases can have very high levels of HbA1c on initial presentation, which may require insulin without trying oral hypoglycemic drugs to treat diabetes mellitus in BBS.

Introduction

Bardet Biedl syndrome (BBS) is an autosomal recessive ciliopathy, with a prevalence of 1 in 13,500 to 160,000 people.[1] It has primary as well as some secondary clinical features. The primary clinical features of BBS include retinal degeneration in 94%, central obesity in 89%, post-axial polydactyly in 79%, intellectual impairment in 66%, hypogonadism in 59%, and renal anomalies in 52% of patients.[2] Secondary clinical features of BBS include syndactyly, delay in the achievement of developmental milestones, diabetes insipidus, diabetes mellitus, and congenital heart disease.[3] It is diagnosed when a patient has either four primary or three primary and two secondary clinical features.[2] It is managed according to the signs and symptoms of the patient and requires a multidisciplinary approach.[4]

We present a case of BBS in a 12-year-old male, newly diagnosed diabetic patient who presented with polyuria, polydipsia and polyphagia. He had all the six primary clinical features of BBS. Among secondary clinical features of BBS, he had syndactyly, developmental delay and diabetes mellitus. The presence of osmotic symptoms of diabetes mellitus as a predominant feature of BBS and management of diabetes mellitus in BBS has been rarely discussed in the literature.[7]

Highlights:

- Patients presenting with polyuria, polydipsia, polyphagia along with the presence of syndromic features, should be assessed for BBS.
- The treatment options available treat diabetes mellitus in BBS include weight loss, exercise, oral hypoglycemic drugs, and insulin.

The Case

A 12-year-old boy presented to the outpatient department of Hayatabad Medical Complex, Peshawar, Pakistan complaining of polyuria, polydipsia, and polyphagia. According to the patient's mother, he was obese, had polyphagia and a low intelligence quotient (IQ) since childhood. For the past 6 weeks, he had increased frequency of urination, excessive thirst and increased appetite. He was born out of a non-consanguineous marriage through a normal vaginal delivery and was fully immunized. He started walking at 3 years of age and started speaking at 4 years of age. He was dropped out of school because of learning difficulties. . On examination, he had syndromic features including bilateral post-axial polydactyly in both of his feet *Figure 1,* syndactyly in his right hand *Figure 2,* widely spaced eyes, depressed nasal bridge, and high-pitched sound.

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Figure 1. **Bilateral Polydactyly.**

Figure 2. **Syndactyly in Right Hand.**

His body mass index (BMI) was 28. Head, ears, eyes, nose, and throat examination revealed bilateral conductive deafness and features of retinitis pigmentosa on fundoscopy. Central nervous system examination revealed no sensory and motor abnormalities. Genital examination revealed a small penis (<1cm), small and soft testis, and a redundant scrotum that was difficult to accommodate. The rest of the examination was unremarkable. Laboratory investigations done in the hospital are given below in *Table 1.*

Urinalysis and urine microscopy showed no abnormal laboratory values. An echocardiography was performed which was normal with no structural defects. Ultrasound of the abdomen and pelvis showed mildly enlarged spleen and mild right-side hydronephrosis. He was started on an injection of Insulin Regular (Human Insulin) 2 units three times a day and an injection of Insulin NPH (Human Insulin) 2 units in the morning and 4 units at night for the management of his high blood sugar.

Table 1. **Laboratory Investigations.**

Laboratory Exam	Result	Normal range	Unit
Sodium	132	135-150	mmol/L
Potassium	3.06	3.5-5.1	mmol/L
Chloride	77.8	96-112	mmol/L
Blood Urea	35	18-45	mg/dl
Creatinine	0.4	0.42-1.06	mg/dl
Total Bilirubin	0.3	0.1-1.0	mg/dl
Alanine Transaminase	13	10-50	IU/L
Alkaline Phosphatase	120	35-104	IU/L
Uric Acid	4.7	3.4-7.0	mg/dl
Glucose (Random)	360	70-140	mg/dl
T-3, Total	1.26	0.8-2.0	ng/ml
T-4, (Thyroxin)	11.48	5.1-14.1	ug/dl
Thyroid Stimulating Hormone	0.722	0.3-4.2	uIU/ml
Luteinizing Hormone (LH)	0.01	0.57-12.07	IU/L
Follicle Stimulating Hormone (FSH)	0.79	0.95-11.95	IU/L
Serum Testosterone	17.48	7-75	ng/dl for 12-16 years of age
White Blood Cells	10.5	4-11	$X10^3$/ul
Red blood Cells	4.55	4-6	$X10^3$/ul
Haemoglobin	11.9	11.5-17.5	g/dl
HbA1C	18.3%	4.5-7	%
Serum Calcium	9.2	8.5-10.5	mg/dl
Virology			
Hepatitis B surface Aantign(By ICT)	Negative		
Anti Heatitis C Virus (By ICT)	Negative		
Anti Human immunodeficiency Virus (By ICT)	Negative		

Legend: mmol/L: millimoles per litre; mg/dl: milligrams per decilitre; ng/ml: nanograms per millilitre; g/dl: grams per deciliter; IU/L:Iinternational units per litre; ug/dl: micrograms per deciltre; U/L: Units per litre; uIU/ml: micro-international units per milliliter; ng/dl: nanograms per deciliter; ul: microlitre.

Discussion

The prevalence of BBS ranges from 1 in 13,500 in some Arabian countries like Kuwait to 1 in 1,60,000 in northern Europe.[1] In Pakistan, the exact data regarding the prevalence of BBS is not available. Very few case reports have been reported of this disorder in Pakistan.[5] We report a case of BBS in a 12-year-old male patient from Peshawar, Pakistan who presented with polyuria, polydipsia, and polyphagia. He was diagnosed with diabetes mellitus and was later found to have met the clinical criteria for BBS.

The diagnosis of BBS is made on the basis of clinical signs and symptoms. It has six primary or cardinal features as well as some secondary features. The primary features of this syndrome include cone-rod dystrophy, obesity, hypogonadism, intellectual

impairment, renal abnormalities, and polydactyl.[3,6] Our patient had all of these clinical features. The presence of all the primary features of BBS in a single patient is rare.[7] Cone-rod dystrophy manifested in the form of retinitis pigmentosa on retinal screening He was overweight as his BMI was 28. Hypogonadism appeared in the form of small penis, small and soft testis, redundant scrotum, low levels of LH and FSH and low to normal level of serum testosterone. He was dropped out of school due to learning difficulties, renal involvement occurred in the form of right sided hydronephrosis and he had an extra digit in his both feet. Secondary features of BBS include, syndactyly, delay in the achievement of developmental milestones, diabetes insipidus, diabetes mellitus, and congenital heart disease.[3] Our patient had syndactyly in his right hand. He had developmental delay as he started walking at the age of 3 and speaking at age 4. He was newly diagnosed with diabetes as his random blood sugar was 360 mg/dl and HbA1c was 18.3%.

Our patient had dysmorphic facial features including widely spaced eyes, a depressed nasal bridge, and a long philtrum. These features have been described to be present in cases of BBS. Other facial features of BBS described in the literature but not present in our patient include high arched palate, reduced number of teeth, and retrognathia.[6,8]

BBS is inherited in an autosomal recessive manner. Mutations in twenty one different subtypes in the BBS gene can be responsible for BBS. As BBS is diagnosed clinically by the presence of either four primary clinical features or three primary and two secondary clinical features and does not require the confirmation of the presence of genetic mutation, we did not perform genetic testing on our patient.[2] Moreover, genetic testing was not feasible in our resource limited setting.

Very few cases of BBS with diabetes mellitus have been reported in the literature to the best of our knowledge. Quader et al.[9] described a case of Laurence-Moon-Bardet-Biedl syndrome (LMBBS) in a diabetic patient who presented with loss of vision, obesity, developmental delay and learning difficulties. Our patient was different than that as he initially presented with the osmotic symptoms of diabetes mellitus like polyuria, polydipsia, and polyphagia. On further evaluation, he was later on found to have primary and secondary features of BBS. This initial clinical presentation of BBS with osmotic symptoms is described in very few cases in the literature. Garg et al. also described a case of LMBBS with diabetes in a 22-year-old male patient. Though he presented initially with osmotic symptoms of polyuria and polydipsia, it was described to be an incomplete manifestation of LMBBS due to the lack of digital anomalies.[7]

The management of BBS requires a multidisciplinary approach, aligned with predominant signs and symptoms of the patient.[4] The predominant features in our patient were osmotic symptoms of diabetes mellitus. Diabetes mellitus in patients with BBS can be diagnosed using the guidelines of the American Diabetes Association (ADA).[10] A case-control study conducted by Mujahid et al. has shown that the patients with BBS are two times more likely to develop insulin resistance.[11] Therefore, the effective ways to treat diabetes mellitus in BBS could include exercise, weight loss, and insulin sensitizers including metformin and thiazolidinedianoes.[12] However, few cases of BBS have been reported which show resistance to oral hypoglycemic drugs as well and were ultimately started on insulin. A case report of BBS with diabetes mellitus was reported by Garg et al. in which the patient was resistant to oral hypoglycemic drugs and was consequently started on insulin.[7] Quader et al. also started a 13-year-old boy having BBS on metformin for the control of his diabetes mellitus but the data regarding his follow up and how effectively it controlled his diabetes mellitus was not given.[9] Our patient had very high level of HbA1c. The type of diabetes mellitus which affects the patients with BBS is mostly reported to be type 2 diabetes mellitus[6] and insulin administration is recommended for people whose HbA1C is greater than 10% or blood glucose levels more than 300mg/dl. [13] Apart from that, few patients have been reported to have no response to oral hypoglycemic drugs.[7] Due to these reasons, we started the patient on a basal bolus regime.

The prognosis of BBS is influenced by multiple factors. Patients may suffer functional impairment from progressive decrease in vision. In BBS, the leading cause of death is kidney disease but the life expectancy has been reported to be normal.[14] We arranged a follow up meeting with our patient to see the response to treatment and monitor the long term effects of BBS but he did not show up for follow up.

Summary – Accelerating Translation

Bardet Biedl syndrome (BBS) is a rare disorder which can affect eyes, kidneys, and can cause weight gain and intellectual impairment. It can also cause digital anomalies resulting in extra digits or fused digits. Apart from that developmental milestones can be delayed and a patient can have diabetes mellitus as well. This article describes a case of BBS in a 12-years-old boy and emphasizes the management of high blood sugar levels in BBS. He presented with increased frequency of urination, increased thirst, and increased appetite. His developmental milestones were delayed, he has low intelligence quotient, extra digits on his feet and fused digits in one of his hand. He had widely spaced eyes, depressed nasal bridge, and high-pitched sound. He also had a small penis, a small and soft testis and a redundant scrotum. Ultrasound of the abdomen and pelvis showed mild right-side hydronephrosis. His BMI was 28 and HbA1c was 18.3% and values of LH and FSH were decreased. He was diagnosed with a case of BBS. He was commenced on insulin for the treatment of his high blood sugar levels.

The initial clinical presentation of BBS may vary from person to person. Thorough examination and a high degree of clinical suspicion is required to diagnose it. Its management depends upon the signs and symptoms of the patient. Various options including weight loss, exercise, oral hypoglycemic drugs, and insulin are available to treat diabetes mellitus in BBS. Some cases can have very high levels of HbA1c on initial presentation, which may require insulin without trying oral hypoglycemic drugs to treat diabetes mellitus in BBS.

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Case Report

Disseminated Tuberculosis with Testes Involvement: An Intriguing Case Report

Arnab Kundu,[1] Ramanuj Mukherjee,[2] Ayan Parichha,[3] Gouri Mukhopadhyay.[4]

Abstract

Background: Disseminated tuberculosis (TB) is the presence of two or more noncontiguous sites resulting from hematogenous dissemination of *Mycobacterium tuberculosis*. We report a case of disseminated TB with testicular involvement. **Case:** A 21-year-old male patient presented to the outpatient department with bilateral testicular enlargement and tenderness for last six months. It was suspected to be a case of epididymo-orchitis and empirical antimicrobial therapy was initiated. However, ultrasonography findings were inconsistent with epididymo-orchitis. Two weeks later the patient again presented with increased nodularity in the right testes. Non-seminomatous germ cell tumor was suspected. However, tumor markers came back normal. Magnetic resonance imaging revealed enlarged lymph nodes in the right inguinal and retroperitoneal region raising a suspicion of testicular lymphoma. Positron emission tomography with computed tomography showed multiple lymphadenopathies. Histopathology of the left axillary lymph node finally confirmed the diagnosis to be tuberculosis. No drug resistance were found and the patient responded well to anti-tubercular drugs. **Conclusion:** Diagnosing disseminated TB is difficult as it mimics conditions, such as infarction, cancer, torsion, etc. Attention to small details is necessary. We faced a similar situation in our patient. The patient went through a myriad of tests before finally being diagnosed with TB. Histopathological study was able to get it whereas cytology could not. Similar and totally opposite cases were found in the literature. This highlights the difficulty and importance of these type of cases.

Introduction

Disseminated tuberculosis (TB) is common in low and middle-income countries and especially among children below 15 years of age. However, its prevalence in high-income countries is rising due to various risk factors, such as Human immunodeficiency virus (HIV), immunosuppressive medications, organ transplantation, alcohol consumption, and other comorbidities.[1]

Disseminated TB in an immunocompetent adult comprises less than 2% of all TB cases and up to 20% of all extra-pulmonary TB cases.[1] The true global incidence is likely underestimated due to diagnostic challenges.[1] It can involve many organs like lymph nodes, liver, bone marrow, kidney, testis, etc.

Clinical presentation varies widely in disseminated TB, ranging from subacute or chronic constitutional symptoms like fever, weight loss, and night sweats to multi-organ failure in severe cases.[1] Uncommonly it can present as anorexia and pyrexia of unknown origin.[1] Symptoms in children are quite vague, making the diagnosis quite difficult.[1] It often mimics various conditions like torsion and infarction (painful testicular mass) or cancer (widespread involvement).

The key to differentiate between various differential diagnoses is by diagnostic tests like imaging, microbiological tests, tissue biopsy, etc. Mantoux test (tuberculin skin test, TST) is often negative in disseminated TB thus not reliable.[1] Chest radiograph is often the initial imaging modality, showing characteristic miliary patterns in a majority of cases.[1] Other imaging modalities, including high-resolution computed tomography (CT), abdominal ultrasonography, magnetic resonance imaging (MRI), and positron emission tomographic CT (PET-CT), can assist in identifying affected organs and guiding the collection of appropriate specimens for diagnosis.[1]

Microscopically there are tuberculous granulomas with or without central caseation. Acid-fast bacilli may be found in

Highlights:

- Diagnosing disseminated tuberculosis (TB) is challenging.
- Disseminated TB mimics various conditions like infarction, cancer, torsion, etc.
- In our case, the patient underwent a myriad of tests before getting a definitive diagnosis.
- This case report highlights the importance of histopathology to diagnose disseminated TB as cytological analysis might miss it.
- Disseminated TB is relatively rare in immunocompetent adults and might be missed initially and a high level of suspicion is needed.

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epithelioid cells or inside caseation. The nonspecific nature of the symptoms poses a challenge in diagnosing the disease.[1]

Here, we describe a rare case of disseminated TB with testicular involvement, mimicking cancer. This case report highlights the critical need for considering tuberculosis as a diagnosis in testicular masses, emphasizing the diagnostic challenges and atypical presentations mirroring other condition(s), and is crucial for timely and accurate management.

The Case

Initial Presentation

A 21-year-old male presented to the outpatient department (OPD) with complaints of bilateral testicular enlargement for last six months. On examination, both testes were tender, hard and enlarged with loss of testicular sensation as reported by the patient. He was of average build and had no other complaints. He was not currently on any medications and denied any addictions or sexual contact in his life. He denied any history of pulmonary disease or problem. A provisional diagnosis of bilateral epididymo-orchitis was made and the patient was started on empirical antimicrobial therapy. To confirm the diagnosis, urine was sent for routine examination, microscopic examination, and culture which came out normal. Ultrasonography of the scrotum and testis was also advised.

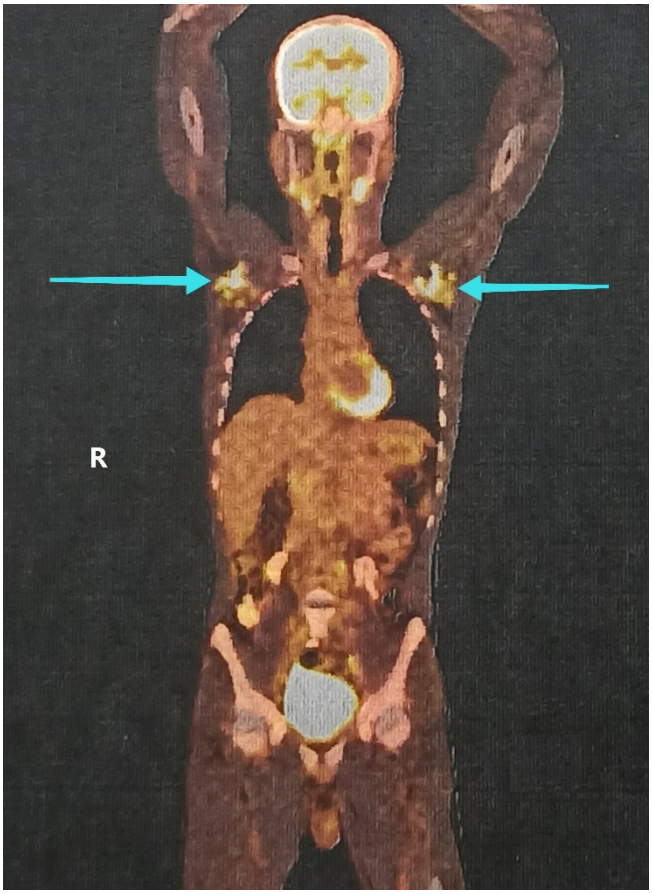
Diagnostic Challenges

A follow-up visit one week after initiating empiric therapy showed improvement, with reduced pain and tenderness. Two weeks later, the patient again presented to the OPD with a new onset nodularity of the right testis with thickening of the spermatic cord which was not present in the previous OPD visit. Based on scrotal edema, clinical findings suggested a suspected non-seminomatous germ cell tumor, clinically categorized as T4 (As per TNM staging system), with invasion of the spermatic cord and pelvic lymphadenopathy.

However, testicular tumor markers were found to be within the normal limits [LDH - 171U/L (120-246U/L), β-hCG - <0.100mIU/ml (<2.6mIU/ml) and α-fetoprotein - <1.3ng/ml (<8.1ng/ml)]. Later on, MRI of the pelvis and scrotum was done which showed ill-defined T2 hypointensities in both testes along with multiple perifocal satellite hypo-intense lesions. Similar involvement is seen in the epididymis and bilateral spermatic cord (more on the right side). A mild right-sided hydrocele was noted. Also, mildly increased fluid in the left testis was observed. Visible parts of the right ureter were dilated. Enlarged lymph nodes in the right inguinal and retroperitoneal region (mainly the left para-aortic region) were noted. A testicular lymphoma was then suspected based on extensive lymphadenopathy and the absence of any history of tuberculosis.

^{18}FDG whole-body PET-CT was done to determine spread. It showed metabolically active multiple lymphadenopathies (bilateral cervical, axillary, retroperitoneal, iliac and inguinal lymph nodes) and active lymphomatous nodules in bilateral adrenal glands, bilateral epididymis and right testis *Figure 1.* Then a CT-guided fine needle aspiration cytology (FNAC) of the right inguinal lymph node was done which showed lymphoid cells with foreign body giant cells. No epithelioid tumor or tumor giant cell was seen.

Figure 1. **Positron Emission Tomography with Computed Tomography Showing Metabolically Active Axillary Lymph Nodes (Blue Arrow). It was Done After Malignancy was Suspected to Determine the Extent of Spread.**

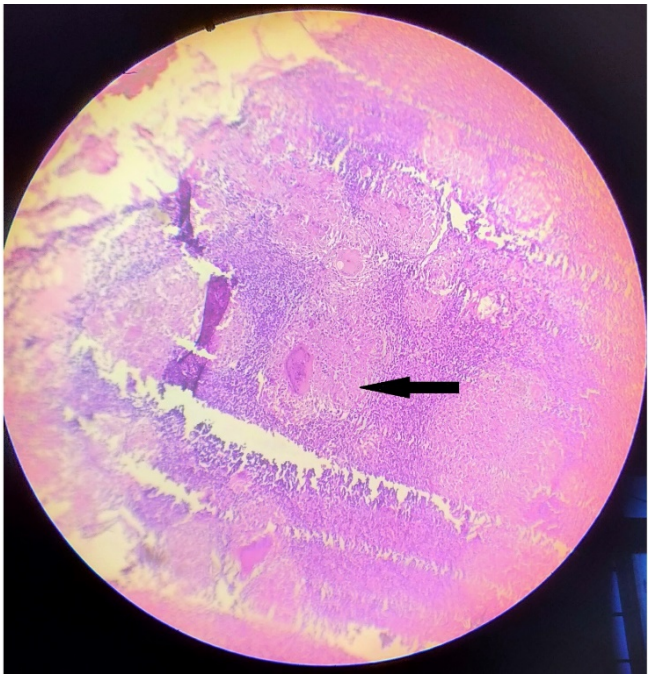


A histopathological examination was advised for confirmation. A left axillary lymph node biopsy was performed and sent for histopathological examination. Preoperative investigations were normal. Mantoux test and triple serology was negative (HIV, Hepatitis B and C). Histopathological examination of axillary lymph nodes showed multiple epithelioid granulomas with Langhans giant cells and foci of caseous necrosis. *Figure 2* Histopathological features were in favor of tuberculous lymphadenitis. A diagnosis of disseminated extra-pulmonary TB with testicular involvement was made.

Treatment and Outcome

No drug resistance was detected in line probe assay. The patient was started on anti-tubercular treatment of isoniazid, rifampicin, pyrazinamide and ethambutol for two months followed by 4 months of isoniazid, rifampicin and ethambutol. During treatment,

***Figure 2*. Histopathological Examination of Axillary Lymph Node Showing Caseating Granuloma (black arrow). This Confirmed the Diagnosis of Tuberculosis.**



the patient was followed up at 1 month, 2 months, 4 months, and 6 months. The patient underwent full remission. Testicular enlargement and nodularity went down and no pain or tenderness were further reported. Lymph node swelling was absent on subsequent visits. The patient now follows up regularly every 6 months *Table 1*.

Discussion

TB can involve many organs like lymph nodes, liver, bone marrow, kidney, testis etc. Acid-fast bacilli may be found in epithelioid cells or inside caseation. Disseminated TB presents with subacute or chronic constitutional symptoms such as fever, weight loss and night sweats. Differential diagnoses include testicular torsion and infarction or cancer. All of these conditions present with testicular enlargement, lump, with or without color changes. Pain is also a common feature but is usually not present in cancer. Also, pain in testicular TB is chronic compared to sudden onset pain torsion and infarction. Specific features of torsion are elevated testis and the absence of cremasteric reflex. Thus, history taking, and clinical examination is important to distinguish between these conditions especially in acute presentations. In testicular masses FNAC is not done due to risk of tumor cell seeding. Only way to do a cytological or histological is an excisional biopsy – This is a significant challenge for the diagnosis of these cases.[2]

***Table 1*. Histopathological Examination of Axillary Lymph Node Showing Caseating Granuloma (black arrow). This confirmed the diagnosis of tuberculosis.**

Timeframe	Diagnostic tests	Findings	Inferences
Onset	Clinical examination (Initial)	Both testes were tender, hard and enlarged with loss of sensation	Epididymo-orchitis suspected
2 weeks	Clinical examination (Follow up)	Nodularity of right testis and thickening of spermatic cord	Non seminoma germ cell tumor with spermatic cord invasion suspected
1 month	Testicular tumor markers	Normal	Diagnosis of cancer was in doubt
2 months	MRI of pelvis and scrotum	Ill-defined T2 hypointensities in both testes along with multiple perifocal satellite hypo-intense lesions. Similar involvement in the epididymis and bilateral spermatic cord (more on the right side). A mild right-sided hydrocele was noted. Also, mildly increased fluid in the left testis was observed.	Testicular lymphoma was suspected
4 months	^{18}FDG whole-body PET-CT	Metabolically active multiple lymphadenopathies (bilateral cervical, axillary, retroperitoneal, iliac and inguinal lymph nodes) and active lymphomatous nodules in bilateral adrenal glands, bilateral epididymis and right testis.	Metastasis of suspected testicular lymphoma
7 months	CT-guided Fine Needle Aspiration Cytology of right inguinal lymph node	Lymphoid cells with foreign body giant cells. No epithelioid tumor or tumor giant cell was seen.	Histopathological analysis suggested
9 months	Histopathology of axillary lymph nodes	Multiple epithelioid granulomas with Langhans giant cells and foci of caseous necrosis	Disseminated TB with testicular involvement

The key to differentiate between various differential diagnoses is by diagnostic tests like imaging, microbiological tests, tissue biopsy, etc. Mantoux test is often negative in disseminated TB thus not so reliable.[1] Diagnosis of disseminated TB can be confirmed if any one of the following is present - isolation of tubercle bacilli, positive PCR or Histologic demonstration of caseating granuloma in the biopsy specimen.[1] In our case, the symptoms were first interpreted as an inflammatory condition (epididymo-orchitis) which initially improved with later relapse and testicular nodularity. Testicular neoplasms were suspected but it did not fit with the diagnostic tests done later. Ultimately it was diagnosed as a disseminated TB with testicular involvement after histologic evidence of caseating granuloma in the axillary lymph nodes. A case similar to ours was reported in a patient by

Namburete EI *et al.*[3] The patient was HIV positive in which case dissemination of TB is common.[1, 3] However, our patient was immunocompetent without any history of pulmonary disease which makes it unique. Najdawi *et al.* reported a totally opposite situation in a case of non-seminoma germ cell tumor presenting with dyspnea and cavitary lung lesions which mimicked TB.[4] Xiao described a case of testicular TB which was diagnosed after orchiectomy as malignancy was suspected and extensive damage to the testis.[5] Mohamed Ali et al. described two cases of testicular tuberculosis from Somalia in immunocompetent patients.[6] One had a history of respiratory TB while other one did not. Muttarak M et al. described a case were the diagnosis was based on ultrasonography, no response to conventional antibiotics, and response to first line anti-TB drugs.[7] All of this exemplifies the complexity of diagnosing this condition and the differentials.[3] In clinical practice, the presentation and history can vary widely as discussed above. Absence of history of any respiratory illness does not necessarily rule out the existence of TB as in our case and the one reported by Xiao, Mohamed Ali et al., and Muttarak M et al. This can be a challenge when a patient presents acutely with the complaints of pain in testes, enlargement and color changes. Histopathology is likely the most effective method to differentiate these conditions as seen in our case and other reported cases.[2-5] Medical management by anti-TB drugs is the mainstay of treatment but sometimes surgical management becomes necessary.[8] This case contributes to the existing literature on disseminated TB and will help clinicians to be more aware and cautious while diagnosing conditions with testicular lesions.

Summary – Accelerating Translation

A 21-year-old male presented with bilateral testicular enlargement. Initially it was diagnosed as epididymo-orchitis. Further investigations revealed nodules, thickening and lymphadenopathy. Later on MRI was done and testicular lymphoma was suspected. The PET-CT confirmed multiple active lymphadenopathies and nodules. Axillary lymph node biopsy was done which lead to a diagnosis of disseminated extra-pulmonary tuberculosis with testicular involvement. The patient responded well to anti-tubercular treatment. This case highlights the complexity of diagnosing disseminated TB and underscores the importance of histopathological examination for confirmation in atypical presentations. Similar and opposite cases have been reported in the literature exemplifying the complexity and importance of these types of cases. Recognizing these cases is essential as it reduces the risk of complications if treatment is initiated early.

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Author Contributions

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Case Report

Continuous Rifampicin Therapy Induced Acute Kidney Injury in a Tuberculous Patient: A Case Report

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Abstract

Background: Tuberculosis (TB) presents with productive cough, hemoptysis, chest pain, fever, weight loss, and night sweats. Anti-tuberculosis treatment (ATT) can affect various organs, including the liver and kidneys. ATT-induced acute kidney injury (AKI) presents with fever, rash, nausea, vomiting, diarrhea, and abdominal pain. It occurs due to type 2 or 3 hypersensitivity and affects individuals who have previously used rifampicin or are currently using it intermittently. **Case:** An 60-year-old lady was diagnosed with TB and started on ATT. After a few days, she complained of reduced food intake and vomiting, yellow discoloration of the skin, abdominal pain and distention, and limb swelling. She was diagnosed as a case of ATT-induced AKI. She didn't have past exposure to rifampicin and was continuously using it this time. **Conclusion:** The key learning point from this case is that ATT-induced AKI can develop even when used in a continuous dosing regime and upon first time exposure despite no history of past exposure. This prompts vigilance in monitoring renal function in patients being started on ATT regimen. This is becasuse, ATT-induced AKI poses risk to patient's life and there is a possibility of developing resistance to anti-tuberculous therapy as a result of discontinuation of treatment. Furthermore, our case suggests that, in addition to immune-mediated mechanisms described in literature for ATT-induced AKI, other pathophysiological mechanisms might also be linked to this pathology and need further research for better understanding and optimization of treatment strategies.

Introduction

Tuberculosis (TB) has ravaged humankind and has remained endemic and epidemic all over the globe.[1] In 2021, about 10.6 million people, including those living with acquired immune deficiency syndrome (AIDS), were inflicted by TB, and 1.6 million died.[2] With the advent of effective anti-tuberculosis therapy (ATT) including rifampicin, isoniazid, pyrazinamide, and ethambutol, the future for patients with tuberculosis seemed promising. However, this was cut short as ATT started showing side effects, and the morbidity related to these side effects was significant. Among these side effects, hepatitis, acute kidney injury (AKI), and optic injury are note-worthy, while rash, pyrexia, and gastrointestinal upset are also seen.[3] Rifampicin is a vital player in the treatment of TB. The main side effect of rifampicin is hepatotoxicity, while acute kidney injury is less commonly noted. The pathophysiology that seems to be at play behind this side effect is a type 2 and type 3 hypersensitivity reaction mediated by anti-rifampicin antibodies.[4,5]

Although AKI is a rare complication of ATT, it does delay the treatment of TB and can thus lead to the development of resistance.

Highlights:

- ATT-induced AKI can develop even upon first exposure to rifampicin.
- ATT-induced AKI can develop even when rifampicin is used in a continuous dosing regimen.
- Apart from immune-mediated mechanisms already described in the literature, other pathophysiological mechanisms might also be responsible for ATT-induced AKI.

The same can be said for liver dysfunction caused by these drugs, as it inevitably leads to a halt or change in the treatment regimen.[4] The most common manifestations of renal dysfunction are skin rash, gastrointestinal upset, fever, and hematuria. The common laboratory findings include raised eosinophil count, anemia, and elevated creatinine.[3] Patients inflicted by hepatitis due to ATT complain of general malaise, anorexia, nausea, vomiting, fever, skin rash, and pruritus, while the laboratory results show raised transaminases and serum bilirubin.[6] Despite this, most patients recover following stoppage or change of the treatment regime.[3]

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Our study presents a unique case of ATT-induced AKI, who presented with chief complaints of reduced food intake and vomiting, jaundice, abdominal pain and distention, and limb swelling. Our case proposes that some other pathophysiological mechanisms might also be linked to causing acute kidney injury in setting of exposure to rifampicin as our patient developed AKI with first time exposure to rifampicin and secondary to continuous usage of rifampicin instead of using it intermittently. Liver function tests were also deranged, suggesting the presence of hepatitis due to ATT. She also developed hypertensive urgency and hypoglycemia as well, which were not previously reported.

The Case

A 60-year-old female patient with the past medical history of hypertension, uncontrolled with oral anti-hypertensives, and diabetes mellitus, controlled with oral hypoglycemics, presented with reduced food intake and vomiting, yellow discoloration of the skin, diffuse abdominal pain and bilateral upper and lower limb swelling for four days. The patient had a sudden onset of progressive yellow discoloration of the skin. Her urine was yellowish, and she had no pale stools. She had a gradual onset of abdominal pain with no radiation and no aggravating and relieving factors. The patient also complained of abdominal distention and limb swelling. There was no history of facial puffiness, dyspnea, orthopnea, and paroxysmal nocturnal dyspnea.

For the last two months, she had intermittent, high-grade fever associated with rigors and chills, productive cough with no hemoptysis, and chest pain. She was started on ATT consisting of rifampicin, isoniazid, pyrazinamide, and ethambutol 15 days ago by a local physician as her chest x-ray showed a cavitary lesion and consolidation in the left lung (*Figure 1*) and the sputum acid-fast bacillus stain was positive.

***Figure 1*. Chest X-ray Showing Cavitary Lesion (shown by a Circle) and Consolidation in the Left Lung (shown by an Arrow).**

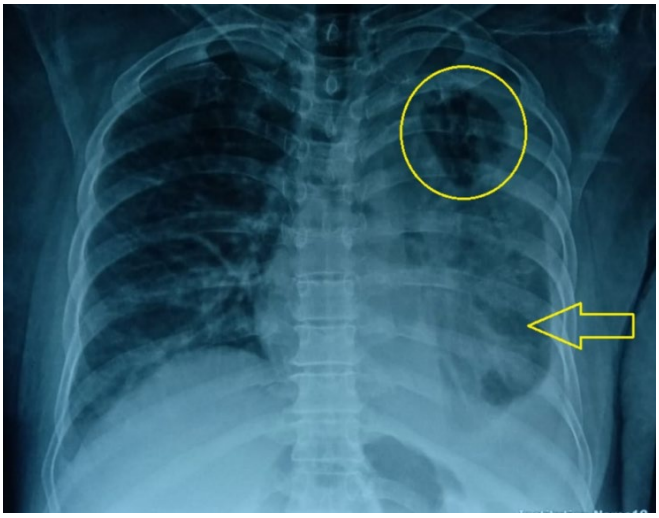

***Table 1*. Laboratory Investigations of the Patient at Admission.**

Name of Exam	Result	Normal range	Unit
Sodium	122 (↓)	135-150	mmol/L
Potassium	4.64	3.5-5.1	mmol/L
Chloride	81 (↓)	96-112	mmol/L
Blood Urea	186 (↑)	18-45	mg/dl
Creatinine	8.8 (↑)	0.42-1.06	mg/dl
Total Bilirubin	1.3 (↑)	0.1-1.0	mg/dl
Alanine Transaminase	208 (↑)	10-50	IU/L
Alkaline Phosphatase	222 (↑)	35-104	IU/L
Serum Albumin	2 (↓)	3.4-5.4	g/dl
Prothrombin time;	21.3 (↑)	12	seconds
Activated partial thromboplastin time	39.8 (↑)	28	seconds
White Blood Cells	20.35 (↑)	4-nov	$X10^3$/ul
Red blood Cells	4.86	4-jun	$X10^3$/ul
Hemoglobin	11.2 (↓)	11.5-17.5	g/dl
Hematocrit	32.2 (↓)	36-54	%
Mean Corpuscular Volume	66.3 (↓)	76-96	fL
Mean Corpuscular Hemoglobin (MCH)	23 (↓)	27-33	pg
MCH Concentration	34.8	33-35	g/dl
%Red Blood Cell Distribution width	14.6 (↑)	11.5-14.5	%
Platelets	628 (↑)	150-450	$X10^3$/ul
%Neutrophils	89.6 (↑)	40-75	%
%Lymphocytes	6 (↓)	20-45	%
#Neutrophils	18.23 (↑)	1.9-8	$X10^3$/ul
C Reactive Protein	10.708 (↑)	<0.5	mg/dl
Virology			
Hepatitis B surface antigen (By ICT)	Negative		
Anti-Hepatitis C Virus (By ICT)	Negative		
Anti-Human immunodeficiency Virus (By ICT)	Negative		
Blood Gas Analysis			
pH (arterial blood)	7.216 (↓)	7.35-7.45	
pCO2	51.0 (↑)	35-45	mmHg
pO2	48 (↓)	75-100	mmHg
HCO3	20.7 (↓)	24-27	mmol/L
Lactate Dehydrogenase	777 (↑)	80-235	IU/L
Creatine Kinase-MB	28 (↑)	<25	IU/L
Troponin I	0.1	<0.6	ng/ml
Hemoglobin A1c	14.5 (↑)	4.6-6.56	%
Urine			
pH	6	4.5-8.0	
Protein	++ (↑)	Negative	
Urobilinogen	Nil	Normal	
Pus/White Blood Cells	6-8 (↑)	0-5/Hpf	
Red Blood Cells	Numerous (↑)	0-5/Hpf	
Epithelial Cells	Few	0-10/Hpf	
Yeast cells	+ (↑)	Negative	
Pleural Fluid			
Volume	2 milliliters		
Turbidity	Slight		
Clot	Nil		
Color	Straw		
Protein	1.6		
Cell Count	15/mm^3		
Red Blood Cells Count	3200/mm^3		
Neutrophils	10%		
Lymphocytes	90%		
Gram Stain	No Micro-Organisms seen		
Ziehl Neelsen Stain	No AFB seen		

Legend: mmol/L: millimoles per liter; mg/dl: milligrams per deciliter; ng/ml: nanograms per milliliter; Hpf: high power field; AFB: acid fast bacillus; mmHg: millimeters of mercury; IU/L: international units per liter; ul: microliter; g/dl: grams per deciliter; fL: femtoliter; pg: picogram; ICT: immunochromatographic test: ↓; decreased: ↑; increased.

Table 2. **Showing Values of Blood Urea Nitrogen, Serum Creatinine, Total Bilirubin, Alanine Transaminase, and Alkaline Phosphatase over the Course of Several Days Starting from the Day of Admission.**

Days	Blood Urea Nitrogen (milligrams per deciliter)	Creatinine (milligrams per deciliter)	Total Bilirubin (milligrams per deciliter)	Alanine Transaminase (milligrams per deciliter)	Alkaline Phosphatase (milligrams per deciliter)
1	186	8.8	1.3	208	222
8	78	7.6	0.5	17	217
15	53	5.6	1.6	12	159
22	50	4.5	1.5	7	154
29	80	5.9	1.1	15	153
36	92	6.3	1.8	5	256
37	74	4.9	n/a	n/a	n/a
38	64	4.8	n/a	n/a	n/a
39	80	4.8	n/a	n/a	n/a
41	71	4.2	0.7	12	218
42	75	3.8	0.8	10	227
43	64	3.5	n/a	n/a	n/a

Legend: n/a: data not available.

At the time of admission into the medical unit, her pulse was 92 beats per minute, her blood pressure was 150/90 mmHg, temperature was 98 degrees Fahrenheit, respiratory rate was 12 per minute, and random blood sugar was 119 mg/dl. Her weight was recorded to be 95 kilogram. General physical examination revealed yellow sclera, pale conjunctivae, and pitting edema of lower limbs up to mid-shins. Pitting edema of bilateral upper limbs was also seen. Systemic examination revealed abdominal distention with shifting dullness.

The rest of the physical examination was unremarkable. After case discussion with senior registrar on-duty, patient was catheterized to measure her urine output and baseline investigations were ordered. Subsequent record of her urine output came to be 380 ml in first 12 hours of admission i.e. she was oliguric (<0.5 ml/kg/hr). Her laboratory investigations are given in *Table 1*.

Ultrasound of the abdomen and pelvis showed coarse parenchymal echotexture with serrated margins of liver, increased echogenicity in both kidneys, moderate abdominopelvic ascites, and bilateral mild to moderate pleural effusion. A Pleural tap was done, whose findings are given in Table 1. During her stay at the hospital, her blood pressure was once recorded to be 190/120 mmHg, and random blood glucose level was recorded to be 65 mg/dl with both being managed appropriately. We followed liver function tests and renal function tests over several days. Values of blood urea nitrogen, serum creatinine, total bilirubin, alanine transaminase, and alkaline phosphatase are given in *Table 2.*

Our patient lacked a record of baseline serum creatinine value. She had a urine output of less than 0.5 ml/kg/hr for more than 12 hours and a serum creatinine value of 8.8 mg/dl. Based upon this data and the need for hemodialysis in this patient as described later on in this text, she was classified into "Injury" class in RIFLE criteria and Stage 3 of AKIN criteria. *Table 3* and *Table 4.* After case discussion with ward seniors and consultant, she was then put on modified ATT regimen (Isoniazid, Ethambutol, and Pyrazinamide) starting from 3rd day of her admission.

Table 3. **Rifle Criteria for Acute Kidney Injury[24]**

Stage	GFR Criteria	UO Criteria
Risk	SCr increased 1.5-2 times baseline or GFR decreased >25%	UO < 0.5 mL/kg/h < 6 h
Injury	SCr increased 2-3 times baseline Or GFR decreased >50%	UO < 0.5 mL/kg/h >12 h
Failure	SCr increased >3 times baseline or GFR decreased 75% or SCr ≥4 mg/dL; acute rise ≥0.5 mg/dL	UO < 0.3 mL/kg/h 24 h (oliguria) or anuria 12 h
Loss of Function	Persistent acute renal failure: complete loss of kidney function >4 weeks (requiring dialysis)	
ESRD	Complete loss of kidney function >3 months (requiring dialysis)	

Legend: GFR: glomerular filtration rate; UO: urine output; SCr: serum creatinine; ESRD: end-stage renal disease.

Table 4. **The AKIN Staging System of Acute Kidney Injury.[24]**

Stage	Serum Creatinine (SCr)	Urine Output (UO)
1	↑ SCr ≥26.5 µmol/L (≥0.3 mg/dL) or ↑SCr ≥150 a 200% (1.5 a 2×)	<0.5 mL/kg/h (>6 h)
2	↑ SCr >200 a 300% (>2 a 3×)	<0.5 mL/kg/h (>12 h)
3[b]	↑ SCr >300% (>3×) or if baseline SCr ≥353.6 µmol/L (≥4 mg/dL) ↑SCr ≥44.2 µmol/L (≥0.5 mg/dL)	<0.3 mL/kg/h (24 h) or anuria (12 h)

Legend: [a]Stage 3 also includes patients requiring RRT independent of the stage (defined by SCr and/or UO) they are in at the moment they initiate RRT.

Hemodialysis sessions were included in her management plan due to fluid-overload state of the patient and she had her first session on the 4th day of admission followed by six more sessions (one per week) until her renal profile plateaued at serum creatinine value of 3.5 to 4.2 mg/dl (refer to *Table 2*; serum creatinine values from day 1 to 43 of admission). Remaining inpatient treatment given to the patient is summarized in *Table 5*.

Given the raised white blood cell count of our patient on arrival (20.35 $X10^3$/ul) with 89.6 % neutrophils (neutrophilic leukocytosis), the patient was commenced on broad spectrum anti-microbial coverage using cefoperazone/sulbactam to provide gram positive and gram negative coverage and moxifloxacin to cover the respiratory microbes including atypical bacteria. The decision to use these specific agents was based on senior consultation keeping in view the availability of agents in the hospital pharmacy.

After recording adequate urine output (> 1 ml/kg/hr) and patient becoming clinically and vitally stable, she was discharged with the advice to continue her modified regimen of ATT and follow up in medicine and nephrology outpatient departments follow-up clinical evaluation, urinalysis, and assessment of renal profile and serum electrolytes and optimization of management of her comorbidities in accordance with post-discharge care for AKI patients as proposed by Tsang JY.[7] She was also registered with regional TB center for appropriate and adequate management of her condition.

***Table 5*. Treatment Given to the Patient in the Hospital.**

Drug	Route	Dose	Frequency
Alprazolam (ALP)	Oral	0.25 mg	Once a day
Amlodipine (Lodopin)	Oral	5 mg	Once a day
Cefoperazone (Sulzon)	Intra Venous	2 g	Twice a day
Dialysis			6 sessions were done during her stay in the hospital
Ethambutol	Oral	400 mg	Once a day
Hypertonic Dextrose 25%	Intra Venous	2 ampules	
Insulin Glargine (Lantus)	Subcutaneous	10 unit	Once a day
Insulin Regular (Humulin R)	Subcutaneous	8 unit	Three times a day
Metoclopramide (Maxolon)	Intra Venous	10 mg	Three times a day
Moxifloxacin (Moxiget)	Oral	400 mg	Once a day
Omeprazole (Risek)	Intra Venous	40 mg	Once a day
Isoniazid	Oral	300 mg	Once a day
Pyrazinamide	Oral	1200 mg	Once a day
Salt Free Albumin	Intra Venous	100 ml	Twice a day

Legend: mg: milligram; g: gram; L: liter.

Discussion

In this article, we discuss a case of active pulmonary TB in a 60-year-old woman who was tested positive for sputum acid-fast bacillus. She was treated with first line ATT and after 11 days, experienced a reduced food intake and vomiting, progressive yellow discoloration of the skin, abdominal pain and distention and swelling in her limbs for four days. Eventually, she was diagnosed with AKI using the AKIN/RIFLE criteria. Due to acute onset of AKI following initiation of ATT and the absence of any other predisposing factor, it was clinically diagnosed as a case of ATT-induced AKI.

TB, a contagious disease, is caused by a bacteria known as Mycobacterium tuberculosis. Pulmonary TB usually presents with cough, hemoptysis, chest pain, fever, weight loss, and night sweats.[1] First-line ATT consisting of rifampicin, isoniazid (INH), pyrazinamide, and ethambutol is usually the mainstay of treatment.[2] While hepatitis, dyspepsia, joint pain, rash, and vision problems are some common adverse effects of ATT,[3] AKI is a rare adverse effect.[8] Studies have reported this to be caused mostly by rifampicin.[5,9] In a retrospective case series from 2006-2016, Sakashita K et al,[3] Found that 15 out of 1430 patients with active pulmonary TB on ATT developed AKI; 14 of which were rifampin-induced and one INH-induced. Chogtu B et al,[4] described a case of ATT associated with AKI whose serological studies revealed the presence of anti-rifampicin antibodies.[4]

Various studies have revealed that patients on ATT develop AKI when they have either an intermittent dosing regimen of rifampicin or a history of exposure to rifampicin.[4,8-10] Muthukumar T et.al,[11] studied twenty five patients of ATT-induced AKI admitted from July 1990 to June 2000. The most common pattern of rifampicin administration that resulted in acute renal failure was intermittent dosing regimen while anemia and thrombocytopenia was observed in 60% of cases.[11] The proposed pathophysiology is a type 2 or type 3 hypersensitivity reaction mediated by anti-rifampicin antibodies produced upon first-time exposure to rifampicin. Subsequent exposure after a drug-free interval leads to drug-antibody complexes formation, leading to cellular damage causing renal glomerular and tubular injury.[4,5]

Furthermore, studies have frequently reported the presence of anemia and thrombocytopenia in ATT-induced AKI cases.[5,10] De Vriese AS et al,[12] proposed that rifampicin-dependent immunoglobulin G and immunoglobulin M exhibit I antigen specificity, expressed on the surface of red blood cells and renal tubular cells, thus explaining hemolytic anemias and renal injury.[12] Emma L Smith et al.[13] demonstrated rifampin-dependent antiplatelet antibodies leading to thrombocytopenia.

Our patient continuously used rifampicin without any past exposure to rifampicin. Yet, she developed AKI on the 11th day of ATT without a laboratory picture of hemolytic anemia or thrombocytopenia, thus proposing that another pathophysiological mechanism might also be linked with ATT-induced AKI.[8] This presentation of our case is very similar to the published case report of Ata F et.al where a 42-year-old Moroccan lady developed AKI secondary to continuous and uninterrupted rifampicin therapy.[14]

The majority of cases of ATT-induced AKI present with fever, rash, and gastrointestinal symptoms (nausea, vomiting, diarrhea, and abdominal pain) and flu-like syndrome.[5,9] In contrast, our patient experienced only vomiting and abdominal pain. Also, the patient had reduced food intake, yellow discoloration of the skin, abdominal pain with distention, and limb swelling, which can be because of ATT-induced AKI with liver involvement or a different clinical picture of the ATT-induced AKI as described in the literature.[15] This shows that clinical presentation of ATT-induced AKI may vary from person to person, warranting regular monitoring of renal function tests before and after starting ATT to detect a complication at an earlier stage. Hematuria and proteinuria were documented in our case in the urinalysis report despite our patient presenting an atypical picture of ATT-induced AKI. These findings are also well-documented in literature,[3,5,10] thus suggesting that they can be used as reliable parameters for detecting this etiology of AKI even in patients with the atypical presentation but a clinical history of rifampicin exposure.

Literature review of ATT-induced AKI revealed rifampicin to be the likely cause in most cases.[16] Based on this review and after case discussion with ward seniors and consultants, she was started on modified ATT regimen that included isoniazid, ethambutol and pyrazinamide. Considering the signs and symptoms of fluid overloaded state (abdominal distention, bilateral upper and lower limb edema), consensus in round discussion was to start renal replacement therapy in form of hemodialysis.

Our patient was managed by temporarily stopping ATT regimen and arranging hemodialysis sessions until adequate urine output (> 1 ml/kg/hr) and plateaued serum creatinine values were obtained after six weeks. This is in contrast with the case of Ata F et.al[14] and their literature review where kidney functions were observed to normalize within three weeks after discontinuation of culprit agents. However, Ata F et.al also mention the use of steroids along with hemodialysis sessions that was not utilized in our case thereby suggesting potential benefit of steroid therapy in speeding recovery in such cases. However, it is important to note that use of steroids for ATT-induced AKI remains a topic of controversy.[14]

During her stay, our patient developed hypertensive urgency (blood pressure was recorded to be 190/120 without the progression of her abnormalities), for which she was managed with anti-hypertensives. This can be because either the potency of antihypertensive medications is decreased in patients who are on ATT or ATT-AKI induced,[17] warranting regular monitoring of blood pressure. Even though our patient was diabetic, she developed an episode of hypoglycemia managed with intravenous 25% dextrose. This can be due to hypoglycemic agents or decreased caloric intake as well.[18] Apart from that, hypoglycemia has been reported due to kidney injury.[19] Therefore, regular monitoring of blood glucose levels should be done.

Limitations

Key limitations of this case report that warrant mention are:

1. Lack of renal biopsy and histopathological studies to support our evidence of drug-induced acute kidney injury/acute interstitial nephritis. In our case report, due to a lack of easy availability and affordability, AKI was not confirmed to be secondary to rifampicin exposure by histopathological (renal biopsy) and serological (rifampicin-dependent antibodies) means. However, the literature review suggests that even without serological and histopathological studies, a diagnosis of ATT/-induced AKI can be made based on clinical grounds (suggestive history and time course) and by excluding other causes.[20] Renal biopsy can provide information about whether acute tubulointerstitial nephritis (ATIN) or acute tubular necrosis (ATN) is the underlying cause of ATT induced- AKI.[21] Knowing this is beneficial as the management differs between them; ATIN is usually treated with discontinuation of offending agent along with immunosuppressive therapy while ATN has no specific therapy.[22] Long term complications such as kidney fibrosis and progression to chronic kidney disease can arise if ATIN is not identified and managed promptly.[22] Furthermore, knowing the underlying mechanism behind ATT induced AKI can also help to determine prognosis as ATIN is associated with better renal recovery than ATN.[21]

2. Lack of baseline serum creatinine level before initiation of ATT.

3. Lack of patient follow-up after discharge from the hospital. Post-discharge care and follow-up is essential in cases of AKI because lack of follow-up can result in re-hospitalization and progression to end stage renal disease (ESRD). It is essential to monitor patient's renal function parameters and assess for development of comorbidities like diabetes and hypertension.

Hypothetical expectations and way forward

From the knowledge we have gathered from our literature review of this case, our hypothetical expectations and the way forward are:

1. The pathophysiological mechanism of ATT-induced AKI proposed and discussed in the literature is an immune-mediated phenomenon usually related to previous exposure or intermittent dosing regimen of rifampicin (the most common culprit medicine in ATT-induced AKI) that leads to the formation of anti-rifampicin antibodies formation and subsequent deposition of rifampicin-antibody complexes upon next time exposure leading to cellular injury.[4,5] A similar mechanism has also been linked to hemolytic anemia and thrombocytopenia, seen as an association in these cases.[12,13] However, in our case report, a patient with no history of previous exposure to rifampicin was put on a continuous dosing regimen of rifampicin and also lacked association of anemia and thrombocytopenia. Thus, our hypothetical expectation is that there might also be some other pathophysiological mechanism responsible for ATT-induced AKI besides the widely reported immune-mediated pathophysiology. A better understanding of its pathophysiology can lead to better treatment modalities and management guidelines that can significantly impact the long-term outcome and burden of ATT associated with AKI.

2. The literature review showed a lack of agreement on the use of corticosteroids in cases of drug-induced AKI or acute interstitial nephritis. While some state no significant benefit with corticosteroids in these settings,[6] others recommend its use due to facilitation in both short and long-term recovery.[23] Even those who recommend their use report that the dosing regimens tailored to this condition vary widely and are not standardized.[23] Further work is required in this field to develop standardized guidelines discussing whether or not and when and how to use steroids in cases of ATT associated with AKI.

In developing countries like Pakistan, where it becomes difficult to accurately diagnose and treat a complication once it develops and keep appropriate follow-up, the resources can be utilized better if they are focused on preventing a complication. Given the high prevalence of tuberculosis in our region, the use of ATT is widespread, and thus, preventing the development of ATT associated with AKI will be far more effective than treating it once it develops. However, the literature needs a discussion on how to prevent the development of this complication. Further work and study into this topic are required to create detailed guidelines.

Summary – Accelerating Translation

Acute kidney injury is a rare side effect of anti-tuberculosis therapy, usually caused by either intermittent use of rifampicin or a history of previous exposure to rifampicin. The pathophysiological mechanism responsible for this is reported to be a type 2 or type 3 hypersensitivity reaction resulting from anti-rifampicin antibodies. Acute kidney injury resulting from anti-tuberculosis therapy usually presents with fever, rash, gastrointestinal symptoms (nausea, vomiting, diarrhea, and abdominal pain), and flu-like symptoms. We present a unique case of anti-tuberculosis therapy-induced acute kidney injury that had a concomitant anti-tuberculosis-induced liver injury as well and presented with the clinical features of reduced food intake and vomiting, yellow discoloration of the skin, abdominal pain and distention, and limb swelling suggesting that clinical suspension of this side effect should be high as signs and symptoms might vary. Rifampicin was used continuously, and this patient had no reported history of rifampicin use, which suggests that another pathophysiological mechanism might be responsible for anti-tuberculosis therapy-induced acute kidney injury instead of type 2 or type 3 hypersensitivity. She developed hypertensive urgency and hypoglycemia during her stay in the hospital, suggesting that vital monitoring should be done in these patients to prevent life-threatening emergency.

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Experience

A Medical Student Experience as an Acting Intern in Colorectal Surgery

Sidharth Misra.[1]

The Experience

Embarking on this journey amidst the wintry Cleveland months, I had the honor of immersing myself in world-class medical practice to accomplish the daunting task of acquiring US clinical experience.[1] I got this opportunity through the structured application process that was put out by the Cleveland Clinic on their website.[2] I always wanted to expose myself to the medical practices in a high-income country so as to emulate the same in my clinical practice, ultimately benefiting my future patients. This experience also allowed me to enlighten my colleagues as I had prepared an elective rotation report for the sole purpose of broad dissemination of knowledge gained during my elective. Traveling from India to Cleveland, a journey spanning 28 hours, led me to 'The Cleveland Clinic,' a heavenly place renowned for its rich history and excellence.[3] I was privileged to pursue my acting internship under the esteemed leadership of the 'Colorectal Surgery Department Chair', a famous name in the field of colorectal surgery. His persona, expertise and compassionate approach have left a lasting impression on me. The fellow to whom I reported on my first day had been an invaluable guide, providing an extraordinary learning experience that can only be described as surreal. *Figure 1* It was a 4-week period which seemed short enough, but I can still relive every moment of it which makes the rotation so special.

"Morning rounds at 6:15 am" was the first message I received from my fellow. A typical week generally consisted of days for OR (operating room), clinic, colonoscopy and dedicated teaching/learning didactic sessions. This structured learning schedule was important to strike a balance between the preoperative, intraoperative, and postoperative management of the patient.

On OR days, my responsibilities included assisting the surgical team, facilitating patient transportation, ensuring patient comfort on the surgical table, aiding in patient preparation, and attentively following my fellow's commands. The daily procedures ranged from complex colon surgeries like laparoscopic hemicolectomies, sigmoid colectomies, and abdominoperineal resections to rectal surgeries such as hemorrhoidectomies, Martius flap repair, anorectal fistulotomy, and Botox injections.

Figure 1. **A Picture with my Fellow in the Colorectal Operating Room at Cleveland Clinic.**

Through discussions with my fellow post-surgery, I gained insights into surgical decision-making, technique selection, and crucial anatomical considerations. These mind stimulating conversations were important to breed the inner surgeon in me as an aspiring medical student/doctor. It also became clear to me that anticipating the next steps in a surgery and learning how to assist the primary surgeon are crucial to becoming a good surgeon. Additionally, I acquired skills in team coordination, understanding the balance between stepping back and taking an active role in the OR process. Scrubbing in for almost every case, I had the opportunity to appreciate anatomy, suture under my fellow's supervision, and even assist in laparoscopic surgeries by driving the camera—a true art in itself. Recognizing the significance of fostering positive relationships with the OR staff, I understood that successful surgery relies on a collaborative team effort.

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As a medical student, my clinic responsibilities entailed obtaining comprehensive patient histories and meticulously updating the electronic medical records. The art of crafting structured, and methodical clinic notes required substantial practice. In the beginning, my focus was to observe the art of patient interaction while ensuring I maintained pace. Prior to each clinic session, understanding the purpose of the patient's visit became paramount. The various reasons for patient visits included preoperative consultations to elucidate surgical details and postoperative progress, routine postoperative colonoscopy/sigmoidoscopy/pouchoscopy, or new visits entailing initial complaint discussions and subsequent steps. In addition, I had the privilege of learning from specialized wound ostomy care nurses. Their expertise lies in stoma care, including patient stoma marking prior to surgery, as well as providing pre- and post- operative counselling.[4] Witnessing the seamless execution of such comprehensive care underscored the significance of well-defined roles and responsibilities. Moreover, it reinforced the understanding that effective task delegation is pivotal in maximizing productivity within a given timeframe.

Friday colonoscopies served as a satisfying culmination of the week, typically involving general screenings, post-diverticulitis evaluations, or follow-up colonoscopies/pouchoscopies. In my capacity as a medical student, my primary role was ensuring efficient patient turnover by assisting with patient transportation, obtaining consent alongside my fellow prior to the procedure, and significantly, developing a keen understanding of colonic anatomy and colonoscopy techniques. The importance of ergonomics struck me deeply, particularly upon learning about the prevalence of carpal tunnel syndrome amongst endoscopists due to extensive colonoscopy procedures.[5] This revelation was reinforced by witnessing a senior colorectal surgeon wearing a wrist brace. The entire experience taught me the importance of effective communication to help improve patient comfort and overall experience.

During my 4-week rotation, every Wednesday from 6:30 to 7:00 am, I had the opportunity to witness comprehensive presentations given by colorectal surgery fellows on important topics like ischemic colitis, anastomotic leaks, stricturoplasty, and key insights from complex cases. This was followed by surgery grand rounds at 7:30 am that featured a resident presenting a case, providing a detailed timeline and surgical details, followed by robust discussions on encountered complications, preventive measures, and valuable takeaways. The entire spectrum from junior residents to senior attendings would actively participate in these discussions, fostering a remarkable, non-judgemental, and an inclusive learning environment. This exemplifies why Cleveland Clinic has been at the forefront of innovation, research, and producing leaders in the field of medicine since its inception in 1921.[6]

Becoming a skilled surgeon requires keen observation and attentiveness with continuous analysis of the situation to actively contribute to the surgical team. It demands lifelong learning with each stage of surgical training marking a new chapter in one's professional development. Teamwork and supporting fellow team members are essential qualities for a successful surgeon, as the surgical process relies on effective collaboration. The beauty of surgery lies in the meticulous attention to detail, a skill cultivated through dedicated practice and self-reflection. Every moment of this unforgettable experience is vividly etched in my memory, and I am looking forward to the next phase of my life that is attaining a general surgery residency in the US.

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Experience

Conducting Research as a Medical Student: A Need for Change

José Rodrigues Gomes.[1]

The Experience

A little History

Flexner's 1910 report was one of the first landmarks in the establishment of scientific research as a pilar of medical curricula. Research as a medical student can be a strenuous task, as the typical curriculum can be incredibly challenging in itself, and the increase in workload associated with research can make it difficult for students to find a healthy balance alongside their social and personal lives, which can lead to serious conditions of stress.[1] This often results in students shying away from research, as often they cannot dedicate themselves to proper research projects within their medical faculty. Currently, there is a shrinking number of physician-scientists, resulting in a considerable loss of scientific potential, especially within the translational research realm.[2] Some of the most significant breakthroughs in medicine have been accomplished by medical students, such as the discovery of heparin by Jay McLean or the sinoatrial node by Martin Flack. And even though a completely different scientific context is acknowledged for these instances, they still emphasize the need for young, proactive, and committed individuals who offer new perspectives.

Current Concerns and Why is it Vital?

There are many reasons why research as a medical student is critical, such as a better understanding of the varying scientific methods, learning to build a passion for a subject, having the opportunity to attend conferences as well the networking and social skills which ultimately help build a robust *curriculum vitae* (CV). Many of which have already been previously addressed more in depth at the International Journal of Medical Students.[2] I have been fortunate enough to be included into my faculty's Cardiovascular Research Unit since my first year. Since then, I have massively improved upon my teamwork and time management skills as well as my work ethic within an academic setting. As I found more opportunities to study and start serving within the unit, I have been able to develop a greater capacity to apprehend and narrate new and often more complex information. I feel this type of experience has been pivotal when deciding to further pursue academic studies, as it has allowed me to discuss and exchange viewpoints with several of my mentors and help me plan to take the best routes to meet my objectives. Students who participated in research projects during medical school were over three times and six times more likely to report interest in research involvement during their future careers and to pursue an academic career, respectively.[3,4,5]

However, I believe these opportunities are still not well systematized into the typical medical curriculum, especially within my home country of Portugal, even though there is a clear demand for them. An estimated 72% of medical students stated that they wanted to perform research, with 31% reporting an interest in actively engaging in research throughout their career.[2] For example, at the College of Medicine, King Saud bin Abdulaziz University for Health Sciences in Saudi Arabia, a survey showed that a large majority of students (79.8%) affirmed the significance of research in the identification and exploration of issues within a subject matter.[5] Additionally, over half of the students (63.6%), expressed keen interest in engaging in research activities during their undergraduate studies. Among the factors driving participation in medical research, the most prominent were the desire to enhance prospects for entry into competitive residency programs, followed by a specific interest in research fields or medical topics, and the aim to bolster one's CV.[5] Therefore, the need to create more opportunities is critical, and must be directly addressed. Admittedly, several attempts have been made, for example in the U.K, through the incorporation of student-selected components[7], the intercalation of a year in research[6] (alongside the typical Bachelor of Medicine and Bachelor of Surgery), or in the U.S. through more ample research and medical curriculums[9] (e.g., *"The Discovery Curriculum"* at Stanford). However, the statistics show that we are still lacking, as for example only 14% of students in U.K. medical schools had submitted an article for publication at the end of their medical degree, and only 22% of students believed they had been taught how to properly write a scientific paper.[10] Therefore, current medical curriculums are still not adapted towards the needs and wants of their students, resulting in low adhesion rates. As discussed with colleagues in both my country and others within the EU, the consensus is that there is still a shortage of

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mentorship, time, and opportunities to conduct research beside the standard medical curriculum.

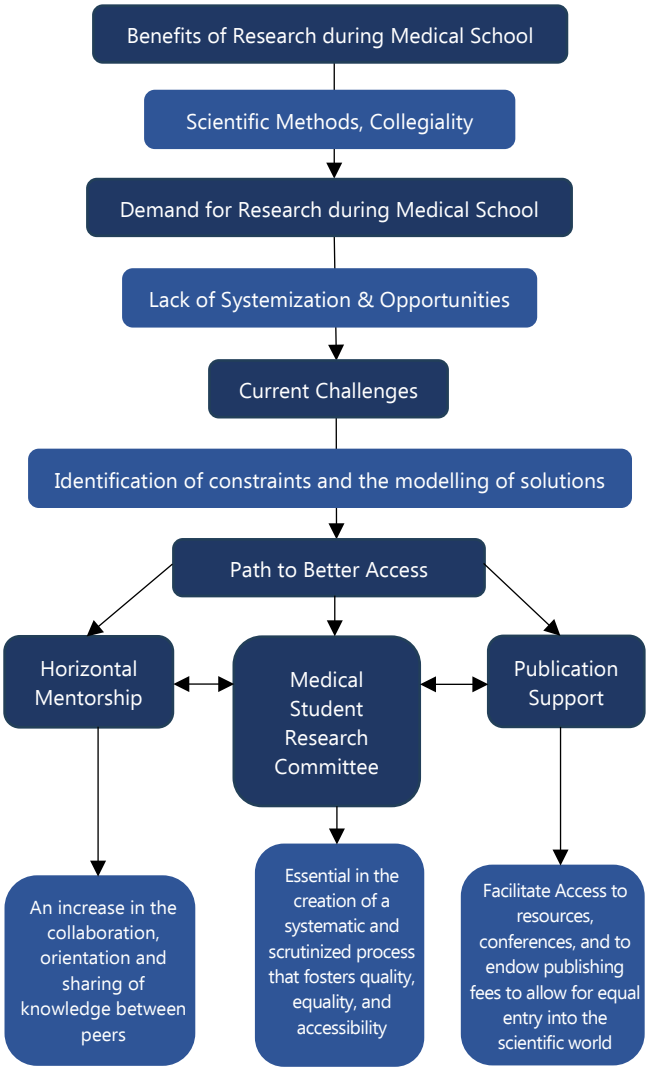
The sooner medical students are integrated into research, the greater the probability of developing long-lasting physician-scientists.[11] By accommodating to this context, it is probable that we have to move away from more conservative and didactic approaches and offer students the opportunity to pursue their interests through a more progressive curriculum that allows for greater flexibility, which has already been referenced by *the Comission on Education of Health Professionals for the 21st Century.*[12]

Recognizing my lack of perspective concerning the insufficient access to research for medical students in the Global South and the issues specific to their context, it is my sincere hope that this acknowledgment serves as a catalyst for collective action. By shining a spotlight on this critical gap, I aim to stimulate not only self-reflection but also motivate fellow colleagues and stakeholders to redouble their efforts in implementing comprehensive research initiatives in the Global South. Only through a concerted commitment to addressing these disparities can we pave the way for a more inclusive and impactful medical education system worldwide. Thus, despite their unwavering dedication to the medical profession, many aspiring doctors in the Global South find their educational journey marred by a significant dearth of access to essential research materials, impeding their ability to stay abreast of cutting-edge medical advancements and hindering the development of a more robust academic foundation. Acknowledging this disparity is a vital step towards fostering a more equitable and inclusive educational landscape, ensuring that aspiring healthcare professionals worldwide have equal opportunities to engage with the latest medical knowledge and contribute meaningfully to the field.

How Can it be Made Accessible?

Although changing medical curriculums is a demanding and time-consuming task that takes many years to be fully completed, there are quick and practical measures that can be better implemented. As highlighted recently, horizontal mentorship arrangements might aid upcoming students to feel more contented asking peers questions, which enables companionship among colleagues and raises communication standards.[13] From personal experience, this is vital as it allows for discussion between colleagues in different year groups, which otherwise would not interconnect and allows for the passage of valuable knowledge. Or through the creation of a medical student research committee, which has already shown to dramatically increase student participation in research and substantially increase both inter- and intra- department communication, and aid in the dissemination of student research as a whole.[14] These measures are fundamental, as most students remain largely uninformed about research projects performed at their medical faculty.[15] Among other forms of support, research departments should also include quotas in order to support students that face publication charges or through new strategies that motivate principal investigators (PIs) to accommodate more undergraduate pupils in their labs (increase lab's budgets, PIs that accept more undergraduate students have a greater input in decisions related to the school's medical curriculum).

Figure 1. **Flowchart on Some of the Proposed Changes and their Intertwining.**



Practically implementing the proposed changes in medical curricula involves a systematic approach. To initiate horizontal mentorship arrangements, the identification of willing mentors, development of a structured program, and orientation sessions for both mentors and mentees are key steps. For the creation of a medical student research committee, it is essential to form a dedicated committee, define clear objectives, conduct training workshops, and ensure seamless integration with department structures. Addressing publication challenges through quotas and incentivizing PIs involves collaboration with the administration, introducing financial support, and communicating the benefits of student involvement. To raise awareness, incorporate information about these initiatives in orientation programs, maintain regular communication channels, and encourage faculty engagement. Continuous evaluation through

feedback loops and the adaptation of strategies based on insights will ensure the ongoing effectiveness of these changes. By carefully implementing these practical measures, the proposed changes can be integrated into the medical education system, fostering a collaborative and research-oriented environment that enhances the overall learning experience for students.

However, it is crucial to anticipate and address potential counterarguments to these proposed changes and implementations. As for example, concerns about resource constraints, asserting that the allocation of additional resources for such initiatives may be impractical given tight institutional budgets. Another counterargument could center on the perceived limited impact of these measures on the overall medical education course, contending that while beneficial for fostering community and research participation, they might not directly enhance the fundamental medical education & research objectives. Resistance to change within established systems may pose a significant hurdle, as faculty and administrators may resist alterations perceived as disrupting traditional structures. Skepticism about the effectiveness of quotas to support students and concerns about compromising the quality of research by encouraging PIs to accommodate more undergraduate students may also be raised. Additionally, critics might question the potential impact on time-intensive clinical training and express sustainability concerns, suggesting that the initial enthusiasm for these measures may diminish over time. Effectively addressing these counterarguments is essential to build a compelling case for the proposed changes, emphasizing their potential benefits while alleviating concerns about feasibility, impact, and sustainability.

A Testimony

I can testify that the integration into my research group has been extremely gratifying, as it offered an additional purpose to my academic life and has made me feel even more worthwhile within my faculty. Together with this, it has aided in opening new academic opportunities, which would have remained largely unavailable if I had not accepted this undertaking. In conclusion, it is essential that students have at their disposal the proper external motivators, such as faculty guidance, distinction, and sustenance, to allow for junior medical research to be conducted appropriately. As this will show that research, is not an overwhelmingly commitment but rather a rewarding and dignifying one.

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Experience

Silent Suffering: Recognizing and Addressing the Emotional Impact of Patient Loss on Medical Students

Grace Kim.[1]

The Experience

The glow of the computer screen cast a soft illumination over the otherwise darkened room. "You are opening the chart of a deceased patient." The words leapt out at me from the screen, stark and unwavering. I blinked, trying to process the information. Just that afternoon, I had left the hospital, leaving behind a patient whose condition had been improving. Waves of sadness and disbelief washed over me as I tried to comprehend the sudden loss. *How could this have happened?* Guilt crept into my chest, heavy and suffocating. I had spoken with the patient's family earlier that day, reassuring them their loved one was making progress.

The following day, I waited for someone, anyone, on the team to mention the patient. But the topic remained conspicuously absent from conversation. *Did they not know what had happened? And if they did, why was no one talking about it? Would speaking up only add to the burden of an already busy team?* After all, I was just a medical student.

In the end, my uncertainty won out, and I remained silent. But in that silence, a question lingered: *What if I had spoken up? More importantly, how can students like me be better equipped to cope with sudden patient loss?*

Reflecting on my personal encounter with patient loss, I have come to understand the necessity of openly discussing and addressing the emotional impact patient loss has on medical students. *What emotions did I experience upon learning about my patient's death? How did I initially navigate and cope with these overwhelming feelings? What factors played a role in my decision to remain silent about my experience with patient loss?* These questions underscore the importance of equipping students with effective coping mechanisms, which are not only essential for our personal well-being but also for our training as future healthcare providers.

Like my own experience, most medical students encounter patient loss during their clinical rotations, triggering a range of complex emotions.[1] Among these, sadness, anger, guilt, impotence, and vulnerability are commonly reported by students.[2,3] Students also often find themselves balancing intense emotional responses with the perceived expectation of maintaining detached professionalism.[4] These encounters can take a significant toll on our mental wellbeing, which may impact the quality of provided patient care. Despite this, research has primarily focused on emotional responses and interventions for resident and attending physicians rather than medical students.[1,5]

Therefore, there is a pressing need to better prepare students for patient loss. Nearly 50% of medical students nationwide have reported that they have felt unprepared to handle the emotional impact of patient loss.[6] While many medical schools have incorporated end-of-life care modules into their curricula, these sessions tend to focus on the dying process within palliative care.[7,8] Similarly, medical schools have made efforts to promote student wellness, although these initiatives often do not specifically address coping with patient loss.[9]

Implementing dedicated sessions in pre-clinical curricula to prepare students for sudden patient loss could effectively reduce emotional distress during these challenging situations. Through these sessions, students would understand that experiencing a range of emotions in response to patient loss is normal and valid. Additionally, they can acquire valuable insights into various coping strategies. Students have previously reported personal coping strategies, such as exercising, writing, seeking support from others, and finding solace in spiritual/religious guidance.[10] Since there is no "one size fits all" approach to coping, it is crucial for students to learn effective coping mechanisms earlier in their training to use throughout their careers and mitigate the risk of burnout.

Additionally, students need to be encouraged to seek debriefs from their teams during their clinical rotations. Debriefing sessions for medical students have been found to be effective in supporting emotional reactions to patient death.[4] Particularly, debriefing may be crucial in helping students balance emotion and professional detachment.[4] However, students report often feeling inadequately supported by their medical teams and

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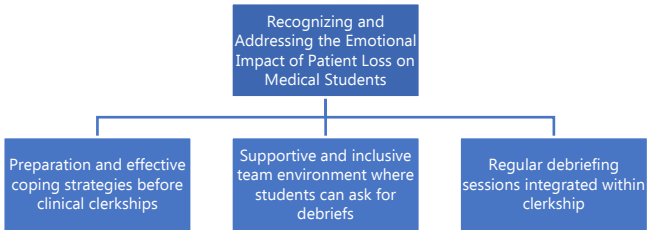
supervisors.[2] Seeking debrief may be especially challenging for students since they may often feel disempowered along the medical hierarchy. Additionally, systemic factors such as workloads and time pressures may hinder residents and attending physicians from prioritizing debrief sessions.[10]

Efforts should be made to establish a supportive and inclusive environment where students feel empowered to seek debriefing sessions without fear of judgement. These sessions can take various forms, including one-on-one conversations with a resident or attending, informal reflection sessions like journaling, or group discussions involving structured reflection questions with fellow students. Regardless of the format, the goals of these sessions remain consistent: to provide a safe space for students to reflect on their experiences, to gain insights on emotional responses and coping strategies from their supervisors and/or peers, and to reassure students that they do not need to confront these challenges in isolation. Implementing regular debriefing sessions into rotation schedules, specifically tailored for students, could also provide structured time and space for reflection and support without disrupting workflow or putting the burden on students to initiate debriefs.

In conclusion, through collaborative efforts and a culture of mutual support, medical education can better equip students with the tools, environment, and curriculum resources necessary to navigate the emotional challenges of patient loss *Figure 1*. Rather than allowing students to endure in silence and question the normalization of patient loss, we need to normalize its emotional complexities and encourage students to seek support. Recognizing and addressing this will ultimately contribute to shaping compassionate and resilient healthcare providers.

Figure 1. **Three Steps to Recognize and Address Emotional Impact of Patient Loss for Medical Students.**



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