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IJMS INTERNATIONAL JOURNAL *of* MEDICAL STUDENTS

***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.

International Journal of Medical Students
Year 2025 - Volume 13 - Issue 3

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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.*

The time between submission and final publication in most cases has been two to four months depending on the diligence of Peer-Reviewers and Authors.

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The journal main office is located in the United States of America (USA). Any publication, dissemination or distribution of the information included in the Journal is permitted if the source is cited (*Int J Med Stud*).

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The *IJMS* acceptance rate in 2022 was 27.5% of the almost 502 submissions. Published articles in 2022 came from 34 different countries. The average days to a first decision is 4 days, 117 for acceptance, and 10 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 Twitter, 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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# International Journal of Medical Students

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IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Editorial

# Blueprints for Discovery: The Anatomy of a Global Medical Student Research Conference

Chloe Carrington,[1] Mihai-Gabriel Zait,[2] Hana Kabil,[1] Moses Stefanus,[3] Elaine Liang,[4] Sajjad Ahmed Khan,[5] Francisco Javier Bonilla-Escobar.[6]

## Introduction

Evidence-based Medicine is the clinical manifestation of new avenues explored through research, from novel treatments to individualized approaches of care. As medical students, we observe this changing landscape of clinical practice as the physicians we shadow engage in the lifelong learning process and adopt these new ways of service delivery. Research holds a myriad of direct benefits for medical students, such as increasing one's competitiveness for specialty training, improving one's understanding of medical literature, and developing new insights that advance precision medicine. However, certain barriers impede research accessibility and pose a threat to the current development of physician-scientists. Research experience has become an expected component for many residency program applications; in Canada, 81% of anesthesiology residency programs require research. Therefore, it is critical that medical students are supported in their efforts to engage in research so that they can adjust to these increasing expectations to engage with research prior to residency training.

Perceptions within medical education in relation to research difficulty, complex methodology, and time limitations contribute to reduced student involvement in research.[1] The International Journal of Medical Students (*IJMS*) aims to change these perceptions by allowing medical students a space to gain skills in research through opportunities to engage in peer review, conference coordination, and presentations. Among such efforts is the World Conference of Medical Student Research (WCMSR), an annual virtual conference held by *IJMS* involving works from topics in Surgery, Pharmacy, Internal Medicine, and more. Medical students are provided with the opportunity to coordinate, plan, and execute the conference while they amplify the voices of their global peers who present their recent research discoveries. Conferences such as the WCMSR have been shown to boost networking skills, support the exchange of information, foster future collaborations, and engage students in a socialization process pertinent to their development as young researchers. In a study in Germany, a survey was conducted to investigate the benefits of attending academic conferences for doctoral and postdoctoral students. Among the 325 doctoral respondents, 57.5% indicated that they learned new information on alternative research methodology and 27.1% found job opportunities or vacancies from attending academic conferences.[2]

By creating events like medical student research conferences, students engage with the research process, celebrate new findings, and network with global peers. These experiences prepare medical students to respond to the increasing need for research experience in their applications to residency training. The purpose of this editorial is to provide guidance on the makings of a medical student research conference like that of the *IJMS* WCMSR that will support student-led initiatives to bridge the research accessibility gap (***Figure 1***).

## The Foundations of a Conference

To coordinate a medical student research conference, one of the first things to consider is the vision and aim of such an event. The purpose of the conference must be outlined to allow identification of the target audience and define the scope. If a conference is catered towards supporting medical student success, then naturally, the target audience could be academics, physicians, and medical and pre-medical students. Activities should be tailored towards medical students, and the keynote speakers should be relevant experts in the topics presented. Participants may be students or recent graduates who wish for their research to be presented to their peers. The central idea is to have selection criteria that aligns with the purpose of the conference. Similarly, the scope of a conference is further determined by the types of research abstracts accepted and the fields of study covered. For instance, a conference could accept abstracts from a single specialty or vary to include research topics in more than one specialization.[3]

Another factor to account for is the format of the conference in which information is disseminated. The choice of conducting the event virtually or in-person largely varies on the scope of the conference. Traditional in-person conferences allow for more

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networking opportunities, workshops, and engagement with a live audience. This allows presenters to interact directly with the audience without the constraint of their scheduled presentation time. However, costs such as travel, accommodations, and catering limit attendee participation. Online conferences, on the other hand, are more likely to mitigate costs, promote inclusivity, such as bypassing travel restrictions for persons with disabilities and permit attendance from anywhere in the world. The primary limitation of the virtual conference format is the reduction of opportunities for face-to-face interactivity.[4]

No matter the format, gaining organizational involvement or medical school affiliations can help boost student morale, networking connections, and resources. For example, a study from Singapore found that co-hosting a conference between nursing and medical students positively impacted student attitudes towards interprofessional education.[5] This highlighted the multi-disciplinary nature of a healthcare team as medical students were exposed to other healthcare professionals with whom they will work alongside in the future, which fostered the early development of interpersonal and interprofessional skills of collaboration. In this way, affiliations between various healthcare professions can increase conference accessibility and reinforce a strong partnership between physicians and other healthcare professionals.

## Creating a Conference Team

Creating a successful international medical student research conference begins with assembling a well-rounded team. The first step is to identify key roles and clearly define responsibilities. The core organizing committee should include conference chairs to manage the overall vision and team tasks, an abstract review committee to assess the abstract submissions, a logistics team to manage the venue or virtual platform and day of conference technical operations, and a marketing team to promote the event to the potential presenters and audience. Additional conference team members to consider including are financial coordinators, conference hosts, and judges. These roles ensure high-quality programming and execution, but they may vary in appropriateness depending on the conference structure.

Recruitment of the team members should take place early to allow time for training, calibration, and coordination, especially if team members are serving from different time zones. A shared communication platform is essential to help streamline collaboration efforts and ensure vision alignment among the team. Establishing a detailed planning timeline is equally critical, and the timeline should be communicated during the recruitment process to ensure team members are available to serve for the duration of their role.

Ideally, the core team should be formed around six months before the event to set dates and secure the venue, with abstract submissions opening three to four months prior. This will provide ample time to curate the vision and execute the conference. Abstract review may be carried out on a rolling basis if standardized grading schemes are in place to assess submission appropriateness for presentation. Abstracts should not be selected before the review of all submission as this could jeopardize the fairness of the submission process for late submissions. The selection process should occur one to two months before the conference, which would give presenters enough time to construct their posters, slides, and other presentation materials. Once the presenters are selected, the schedule can be finalized. During the one-month countdown to the conference, judge and moderator training should commence, along with any last-minute logistics concerns. This structured, stepwise approach to conference team curation will hopefully enable future global, student-led conferences to be organized, equitable, and impactful.

## Building the Conference

Building a successful medical student research conference starts with a transparent abstract submission and peer review system to ensure fairness and integrity. Clear evaluation criteria and a structured process must be set in place to maintain the quality and credibility of events.[6] Equally important is the consideration of the presentation formats. Offering a range of presentation styles, such as oral presentations, posters, and the Three Minute Thesis, broadens participation and allows students to share their research in diverse ways that play to the strengths of different topics. Defining thematic tracks can also help structure submissions and align presentations with conference goals.[7]

Beyond content, the structure of the conference itself must be carefully considered. A well-designed schedule that balances academic sessions with adequate breaks supports sustained attention, networking, and informal discussions between participants.[8] Incorporating keynote lectures, workshops, and networking opportunities alongside research presentations can enrich the overall experience.[9] Consider whether having keynote speakers is appropriate given the scope of research topics presented. For example, the decision not to include a keynote speaker for our upcoming *IJMS* WCMSR 2025 was intended to allocate additional time for medical students to present their work. This was informed by the *IJMS* strong focus on celebrating medical student achievements in research. The design of the conference avoids focusing deeply on a singular academic voice or topic; rather, it is committed to represent a diverse collection of expertise and fields of interest. However, consider including a keynote speaker at research conferences with specific topics of focus within a narrow field of inquiry.

Medical student involvement in the conference organizing committee is critical to the success of such events. By engaging medical students in the planning, logistics, and decision-making processes of conferences, it not only gives them ownership in the process but also fosters the development of leadership, teamwork, and organizational skills that are highly valued in medical education and clinical practice.[7,10] This participatory approach transforms conferences into experiential learning platforms where students move beyond passive attendance into active contribution. Previous studies have shown that such

engagement improves communication skills, strengthens social networks, and deepens students' understanding of academic culture and research dissemination.[9,10] Furthermore, peer-to-peer collaboration in organizing roles can enhance confidence and create a sense of belonging within the professional community, which is especially important for early-career researchers.[10]

Logistical considerations must not be overlooked. Whether physical or virtual, the choice of venue or platform largely determines the accessibility of engagement. Physical events require careful attention to space, circulation, and facilities while virtual and hybrid conferences must address the considerations of time-zone inclusivity and technical support.[9,11] Structuring the program with clear time frames, including breaks and thematic sessions ensures a good flow. Budgeting, securing sponsorship, and setting affordable fees are central factors that determine accessibility, particularly for students from low-resource backgrounds. Transparent communication around costs and available waivers can reduce such barriers to participation.[10] Finally, judging and award systems should be clearly defined, with prior calibration of evaluators to ensure fairness Recognition of excellence motivates presenters and contributes significantly to the academic profile of the event.[12] These key elements create the foundation of an inclusive and impactful conference.

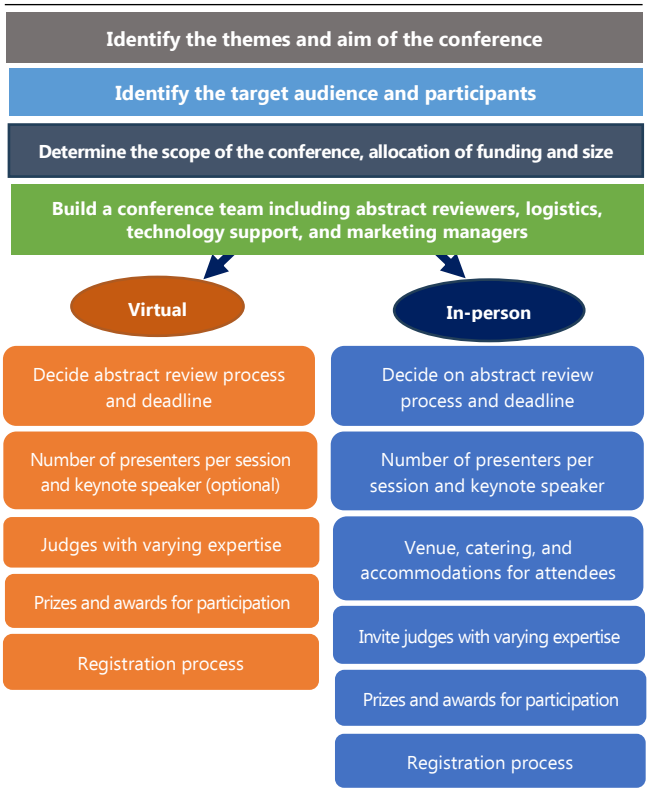
## Promoting the Conference

Any conference has stages involved in managing the external affairs, one of which is the "get to know us" stage where the team contours the vision and the objectives for the conference. It is the stage of selling the conference to the participants, the partners, and other stakeholders.

Once this vision is established, it is time to disseminate the conference details. To start a promotion strategy, it is imperative to identify the target group of presenters and audience members. Then, understand where they get their information. For a medical student research conference targeting medical students and 1st and 2nd year residents, the typical age is twenty two to twenty eight, so consider reaching this audience primarily through social media. TikTok, Instagram, X, Facebook, and LinkedIn are the most popular platforms in this age group, so these platforms would be appropriate to consider posting conference promotions on. The frequency used for posting should be daily, but daily posting in medical student social media pages can sometimes receive negative feedback from group admins or members. Consider also how the pacing of posting can strengthen or weaken the message being sent.

If the conference is being held by an organization, utilize the membership base that is already established by adapting communications to reflect expected engagement. If email lists or webpages are an already established form of communication, engage with these members regularly in this familiar format. This will make sure that heavily invested community members who are more likely to participate are given the opportunity to support the conference.

***Figure 1.*** Stepwise Planning of a Medical Student Research Conference.




Additionally, be aware that partnerships and co-promoting are often at the core of how medical student conferences operate. However, partnerships based on funds, products, or media exposure are also often utilized and could be useful. The partnerships with other conferences are vital to the conference development since ideas can be expanded upon, and co-promoting each other's conference can boost audience reach. Lastly, post-conference marketing is also crucial because it can provide a nostalgic feeling about the conference and reminds the participants of their engagement, which can help maintain a following for the next conference. Extending acknowledgement of contributions made to the conference as well as sharing conference day footage should be considered as sources for the content.

## Implementing the Conference

Achieving a medical student research conference requires careful attention to logistical details, which will help create a rewarding experience for attendees. The process begins with identifying and reserving a venue that meets the conference's needs, including adequate space for oral and poster presentations, a convenient location, and accessibility for participants. It is important to consider whether a conference should be held virtually. Virtual conferences are better able to accommodate a diverse presenter pool and audience across time zones and to avoid the financial and logistical burdens of traveling.

For in-person conference venues, organizers must obtain essential presentation support tools such as poster boards, digital display screens, poster hanging supplies, projectors, microphones, audio-visual equipment, judging tables, chairs, and a podium for

speakers and hosts. Recruiting of catering services for meals or refreshments and, if necessary, partnerships with local hotels for accommodations should be considered.

For virtual conferences, the platform selected must be appropriate to support all conference needs, including live streaming, breakout rooms for parallel sessions, and digital poster presentation capabilities. Technical requirements should be confirmed early, with arrangements for reliable internet connectivity, backup hosting options, and day-of technical support. Arranging a conference schedule with consideration of coordinating time zones for presenters, judges, and hosts will help maximize impact and engagement. Providing training sessions for presenters, judges, and moderators in advance ensures smooth navigation of the platform and a professional experience for attendees.

For hybrid conferences, which are becoming more common in the post-COVID era, organizers must coordinate both physical and virtual elements. The venue should be equipped with reliable audiovisual technology to stream sessions live, support virtual Q&A, and display remote presenters on-site. A robust online platform should allow virtual attendees to access talks, poster sessions, and networking opportunities in real time. Careful scheduling is essential to accommodate multiple time zones, and moderators should be assigned to manage both in-person and online engagement. Providing clear instructions, technical support, and contingency plans ensures that neither audience feels secondary and that the event maintains a unified, professional atmosphere.

Achievement awards are an important component of a successful conference as they recognize excellence and encourage participation. Organizers should coordinate with judges well in advance to determine evaluation criteria and establish whether judging will occur prior to the conference, during live presentations, or both. Clear guidelines and standardized scoring rubrics help ensure fairness and consistency.

Providing tangible recognition, such as certificates, medals, or plaques, not only celebrates the winners but also adds prestige to the event and motivates participants to strive for high-quality research and presentations. It would be prudent to consider the attendance model of the conference when selecting what recognition type would be appropriate. For virtual conferences, personalized, digital certificates can be released immediately following the conference. For in-person conferences, ribbons and medals may be more appropriate as they can be given to the awardees on the day of the conference, but consider providing generic award memorabilia if judging occurs on the day of the conference. On the other hand, digital and delayed physical awards may be more suitable if the conference team decides on awards customized to the awardees.

## Post-Conference Wrap Up

After the conference ends, it is essential to formally thank and recognize everyone who helped contribute to the conference, including the organizers, presenters, judges, and audience members. Announcing the awardees at the end of the conference and later issuing certificates or trophies based on award categories adds gravitas and shows appreciation. Recognizing winners publicly on social media, the conference website, and newsletters is also important to expand conference visibility and motivate future participation. In addition, the sharing or publishing of the abstracts presented through conference supplements, online repositories, or journals is crucial as this allows the presented research to gain traction beyond the event. This not only acknowledges the effort of the presenters but also contributes to dissemination, academic profile building, and increases the likelihood of full publication of presented work.[13]

Feedback is another critical element in wrapping up a conference. Gathering attendees' evaluations and presenter reflections right after the event provides insights into successes and areas for improvement. Studies in medical education have shown that timely and structured feedback significantly improves knowledge, skills, and learner satisfaction underscoring the importance of timely feedback in conference settings.[14]

## Invitation to the IJMS WCMSR 2025

We invite all who are curious about international medical student research to join us for our fourth annual virtual World Conference of Medical Student Research (WCMSR) on **November 15th and 16th, from 8 AM to 5 PM EST**. The WCMSR 2025 will be held virtually and streamed to our YouTube @IJMS and is free to attend.

We welcome outstanding medical students and recent medical graduates (within 2 years) to submit abstracts for original research, case reports, and meta-analyses on topics ranging from clinical medicine to public health.

Selected abstracts will be either chosen for a 10-minute oral presentation (Day 1) or a digital poster presentation (Day 2). This is a unique opportunity to showcase research to a global audience of peers, world-leading physicians, and industry leaders. Presenters will compete for awards and have their work published in the *IJMS* Supplement.

Submit your abstract now at https://ijms.info/IJMS/submission/wizard. The abstract submission deadline is **September 30th, 11:59 PM EST**. Presenting researchers will be contacted with their results by October 20th.

For further information regarding the submission process and guidelines, please visit the conference webpage of the *IJMS* website: https://ijms.info/IJMS/Conference/welcome.

For those with questions about the conference or submission process, the conference team may be contacted via email at conference@ijms.info. To stay up to date on the upcoming conference preparations, consider following our socials. The *IJMS* may be followed on LinkedIn @International Journal of Medical Students (IJMS), X @TheIJMS, YouTube @IJMS, Instagram @ijms.official, and Facebook @ijms.official.

## Conclusion

Medical student research conferences play a critical role in early physician-researcher professional development by encouraging networking, critical appraisal, and staying up-to-date on research innovations. Medical students should be encouraged to participate, coordinate, and present at such conferences to further enhance their preparation for their careers after medical school. Conferences are prevalent during and after residency for healthcare providers to retain knowledge of the most recent advancements in their subspecialties. These events bring together various healthcare professionals and trainees and inspire collaborations, novel treatments, and continuous improvements to patient care.

This guide aims to assist medical students when coordinating a research conference of their own, and it was made to provide a brief overview of considerations and recommendations using our own fourth annual WCMSR as inspiration. The International Journal of Medical Students (*IJMS*) remains committed to fostering scientific thinking, inquiry, and engagement among medical students across the world. By conducting a student-led virtual conference, the journal hopes to shed light on the beauty of research, celebrate early clinician scientists' contributions, and support efforts in bridging the research accessibility gap.

## References

1. Mokhtari B, Badalzadeh R, Ghaffarifar S. The next generation of physician-researchers: undergraduate medical students' and residents' attitudes, challenges, and approaches towards addressing them. BMC Med Educ 24, 1313 (2024).
2. Hauss K. What are the social and scientific benefits of participating at academic conferences? Insights from a survey among doctoral students and postdocs in Germany. Res Eval. 2020;rvaa018.
3. Emory University. Planning your conference. Atlanta (GA): Emory University. Available from: https://conferences.emory.edu/planning/index.html. Cited September 19, 2025.
4. Etzion, D., Gehman, J., & Davis, G. F. (2021). Reimagining academic conferences: Toward a federated model of conferencing. Management Learning, 53(2), 350-362.
5. Chua AZ, Lo DY, Ho WH, Koh YQ, Lim DS, Tam JK, et al. The effectiveness of a shared conference experience in improving undergraduate medical and nursing students' attitudes towards inter-professional education in an Asian country: a before and after study. BMC Med Educ 15, 233 (2015).
6. Maggio LA, Artino AR, Watling CJ, Driessen EW, O'Brien BC. Exploring researchers' perspectives on authorship decision making. Acad Med. 2019;94(12):1914–20.
7. Olthuis G, Leget C, Dekkers W. The role of student conferences in professional development: An exploratory study. Med Educ Online. 2022;27(1):205–12.
8. Fisher JW, Trautner BW. Maximizing the academic conference experience: Tips for your career toolkit. J Grad Med Educ. 2022;14(2):144–148.
9. Chua WJ, Cheong C, Tan K, et al. Impact of student-led medical conferences on learning and professional identity: A cross-sectional study. Med Teach. 2015;37(4):348–53.
10. Zaharatos J, O'Brien C, Weston D, et al. Student-led conferences as a platform for leadership and professional growth. BMC Med Educ. 2023;23:112.
11. Shah S, Diwan S, Kohan L, Rosenblum D, Gharibo C, Soin A. The technological impact of COVID-19 on the future of education and health care delivery. Pain Physician. 2020;23(4S):S367–80.
12. Guay J, Bishop C, Williams R, et al. Publication outcomes of conference abstracts presented at anesthesiology meetings: A systematic review. Can J Anaesth. 2020;67(8):1085–94.
13. Mookherjee S, Ranji SR, O'Sullivan PS. Beyond publishing: the importance of dissemination in medical education. J Grad Med Educ. 2013;5(4):559–560.
14. Castro MABE, de Almeida RLM, Lucchetti ALG, Tibiriçá SHC, da Silva Ezequiel O, Lucchetti G. The Use of Feedback in Improving the Knowledge, Attitudes and Skills of Medical Students: a Systematic Review and Meta-analysis of Randomized Controlled Trials. Med Sci Educ. 2021;31(6):2093-2104.

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Original Article

# Beyond Mentoring: What Medical Students Learned from an Intervention Program with Teen Mothers Experiencing Homelessness

Emily Adler,[1] Victoria Powell,[2] Zilin Cui,[3] Mary Marchese,[4] Morgan Groover,[5] Eileen Condon,[6] Jodi Ford,[7] Judith A. Savageau.[8]

## Abstract

**Background:** Toxic stress from childhood trauma increases risk for chronic diseases such as heart disease and cancer. Prior studies show that trauma's effects can be buffered by compassionate caregiving. This study aimed to bring trauma-sensitive care to Worcester, train medical students as advocates for underserved groups, and assess how an intervention might influence biological and psychological stress in young mothers experiencing homelessness. **Methods:** Medical students, trained by a parenting coach, delivered an evidence-based parenting and mental health curriculum to teen mothers in a shelter. Data came from surveys, focus groups, and hair cortisol samples, with twelve women in the intervention and six in a comparison shelter. **Results:** Surveys, focus groups, and interviews suggested that mothers in the intervention felt more prepared to be supportive caregivers than those in the comparison group. Hair cortisol samples showed no significant changes. A focus group with medical students highlighted increased passion and confidence in advocating for young mothers. **Conclusion:** This pilot demonstrated feasibility and acceptability of workshops and mentoring for young women in shelters. Preliminary results suggest positive shifts in how unhoused mothers viewed parenting and mental health. Although the small sample limited statistical significance, the findings indicate promise for future studies exploring biopsychosocial impacts of such programs. Importantly, educating medical students may generate a ripple effect, as they carry forward skills and commitment to advocating for this diverse and often overlooked population in medical training.

## Introduction

Toxic stress from childhood trauma has been associated with an increased risk of heart disease, depression, cancer, and a reduction in life expectancy by 20 years.[1, 2] Although there are correlations between stressful circumstances and increased substance use, these correlations only begin to explain why children who experience toxic stress have poorer health outcomes; in fact, regardless of high-risk behavior, individuals who experience adverse events are more likely to have chronic illnesses.[3] Previous works have discussed that the body has evolved to respond to acute stress by activating the sympathetic nervous system and hypothalamic-pituitary-adrenal (HPA) axis, which cause stress hormones to be released and mediate the fight-or-flight response.[4] Historically, this response was beneficial in the acute setting when, for example, a person may have needed a boost of adrenaline to run from a tiger.[3] However, more common today, the tiger metaphorically is the stress of living in a community with poverty; this constant fear causes a child's body to marinate in stress hormones, creating a shift in the effects of the sympathetic nervous system from protective to maladaptive, resulting in a cascade of mediators and complex metabolic, immune, neurologic, cardiovascular, respiratory, anthropometric, and even epigenetic changes.[3, 4].

The biopsychosocial effects of childhood trauma seep into adulthood and plague generation after generation due to the permeating nature of Adverse Childhood Experiences (ACEs). Specifically, ACEs include emotional, physical, and/or sexual abuse; exposure to domestic violence; or living with someone who has experienced substance use disorder, mental illness, suicidal thoughts, or imprisonment among others.[5]

Fortunately, strong evidence has shown that childhood trauma and its sequelae can be buffered, treated, and prevented with a compassionate caregiver.[6,7] However, in Worcester, Massachusetts, despite the existence of parenting classes, optimal mentoring with potential to break intergenerational trauma is currently lacking. Furthermore, Worcester parenting

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classes fill up quickly, are challenging to attend via public transportation, and are not specifically designed for teenagers.[8]

In hopes of addressing the lacking support for young mothers in Worcester, for years, UMass Medical School students have partnered with two shelters via a school-sponsored group, Mentors for Young Mothers (MFYM), with the goal of creating a two-way learning opportunity for both medical students and the young mothers experiencing homelessness. The shelters are funded by You Inc., a non-profit dedicated to helping families in Central Massachusetts.

Prior to this pilot study, medical students designed health classes, but they did not feel comfortable addressing parenting or trauma, topics that can help buffer against the intergenerational transmission of trauma.[7] Medical students previously received no training for working with this special population.[8]

With funding from the Remillard Family Community Service Fund, a parenting educator designed a curriculum and trained medical students from Mentors for Young Mothers to bring evidence-based, trauma-informed workshops directly to the group home during scheduled visits from Mentors for Young Mothers. The medical students delivered the curriculum to teen mothers in a group setting and also met monthly one-on-one with the mothers to provide additional support.

The overall aim was to bring high-quality, trauma-sensitive care to the greater Worcester community, train the next generation of physicians as advocates for underserved communities, and examine how an intervention may affect the biological and psychological stress response in an often-overlooked population. Efficacy of the intervention was evaluated through surveys, cortisol levels, and focus group data.

## Methods

A Child Protection Program educator adapted The National Child Traumatic Stress Network guidelines to focus on trauma-informed parenting and mental health in adolescents. Fifteen students, MFYM members selected from applications and interviews, were trained to lead eight trauma-sensitive parenting workshops in one shelter; the comparison shelter received traditional MFYM curriculum, which included nutrition and sexual health education. To assess the impact of the non-randomized community trial, with Institutional Review Board (IRB) approval (#H00018725), participants from both shelters completed surveys,[9,6] provided hair cortisol samples (a biological indicator of chronic stress.[7,8]) and engaged in focus groups. Specifically, these women were selected based on their current living arrangement at the shelters during the time of the trial and willingness to be involved. No women declined the intervention. Eighteen adolescent mothers participated in the program from October 2019 to February 2020.

### I. Intervention

Trained medical students provided the eight trauma-sensitive parenting workshops to the young mothers over the course of ten weeks. Workshops began with mothers sharing highlights/lowlights; the remainder of each session varied with a range of activities, demonstrations, and discussions related to trauma-informed parenting.

The first workshop, Goals, Guiding Principles and Self Care, discussed system-induced trauma and microaggressions, followed by the Hand Activity, where mothers listed a trustworthy person/organization on each finger and reflected on how the group might foster a deep sense of trust. Trauma 101 covered parenting efficacy, guilt, and resilience, which was emphasized in the featured film, Remembering Trauma. How My Own Childhood Trauma May Be Impacting My Decision Making and Parenting explored developmental trauma disorder, depression, and the potential dangers of psychiatric labels. Afterwards, the Rock Activity, where women placed a pebble in a cup for each traumatic event the facilitator read, emphasized the importance of helping others carry the load. In Understanding Trauma's Effects, adverse childhood experiences, protective factors, and attachment theory were discussed, followed by activities that mothers could mimic to help build secure attachments. In Feelings and Behaviors, common myths regarding parenting styles were discussed. In Safety, practical mindfulness techniques, such as grounding, were taught through the Glitter Activity, where mothers swirled glitter in a jar of water and were asked to tease out the colors. Unable to assess until the water settled, the mothers recognized the analogy to their feelings, highlighting the need to sometimes pause before reacting. In Advocacy, the term was applied in the context of team-based therapy. Through vignettes, the group discussed how to advocate for themselves and their children. The final workshop, Connections and Healing: Closing Thoughts, featured the Rubber Band Activity. Mothers placed a rubber band around their four fingers and thumb. Participants were asked to spread their fingers and recognize that when one finger (i.e., person) strains the others (i.e., close family/friends), tension can build. As a review, participants summarized knowledge on healthily handling and/or helping others with life tensions.

Outside of the group sessions, for the intervention, medical students were given $35 per month for one-on-one outings with their individual mentees, who were matched based on shared interests. During these sessions, medical students debriefed on the group sessions and tailored their mentorship depending on their mentee's preferences.

### II: Procedure overview

The University of Massachusetts IRB approved the protocol, and verbal informed consent was obtained from all participants. One week prior to the first workshop, baseline demographics, surveys, and hair samples were obtained from all study participants. A week after the conclusion of the workshops, surveys and hair samples were recollected. In addition, for the participants in the

intervention arm, the medical students led a focus group at this time. One week later, medical students took part in a separate focus group.

Both surveys and samples prior to and following study participation took place at the shelter to mitigate any transportation-related costs that may have precluded the mothers from participation, as this has been described as a potential barrier to participation in similar studies.[12] Furthermore, the collection team consisted of the same four people in order to promote trust between the collection team and the participants.

Mothers were compensated for their time with grocery store gift cards for ten, ten, and fifteen dollars for pre-surveys, post-surveys, and focus group participation, respectively. Women who completed all aspects of data collection, including providing hair samples, received an additional fifteen-dollar grocery store gift card.

**III. Survey design**

Validated pre- and post-educational surveys were used to assess changes in these mothers' caregiving styles and mental wellness. To assess knowledge of trauma informed parenting and parenting self-efficacy, an eight-question scale adapted from a National Child Traumatic Stress Network Pre-Workshop Knowledge Beliefs Survey was used.[9] Summative trauma-informed parenting scores were calculated by adding questions one through six of the Survey 1: Knowledge and Health Beliefs listed under APPENDIX I. Self-efficacy scores were calculated from the sum of questions seven and eight of this survey. Perceived stress scale scores were calculated from a separate survey, shown in Survey 2: Perceived Stress Scale in the appendix.[11] A summary stress score was calculated.

**IV. Hair cortisol collection**

Previous research suggests that hair cortisol can approximate persistent stress (versus blood cortisol levels, which vary dramatically based on time of day).[11,6] However, prior studies have not yet definitively determined how hair cortisol levels might change with added supports, particularly in post-partum adolescents. Hair samples for cortisol were collected from the mothers before and one week after the program's completion in both comparison and intervention groups. A written survey regarding hair care and chemical treatments, based off of the work of prior hair cortisol studies, was administered to each mother prior to hair cortisol collection.[10] This survey is listed under Survey 4: Questions for Hair Cortisol Data Collection in ***Supplementary Material.*** To familiarize mothers and children with the procedure of hair cortisol sampling (and to ensure participants fully understood the procedure), a hairstyling doll was used to demonstrate the collection technique.

Hair samples were folded in tin foil and sealed in a labeled envelope. Collaborators at the University of Massachusetts in Amherst determined the hair cortisol levels using previously validated laboratory techniques.[12] Hair cortisol data were not collected for mothers who were living in the group home for less than one month (given hair grows ~one cm per month).

**V. Focus groups**

In one focus group, mothers were asked how they enjoyed the sessions, their key take-aways, how (if at all) the experience affected parenting styles, how (if at all) their feelings or attitudes about parenting and/or trauma changed, recommendations to improve the curriculum, and additional comments (***Supplementary Material,*** Focus Group 1: Young Mothers' Questions).

In a separate focus group with the medical students, the mentors and workshop leaders were asked what they gained from the sessions and additional recommendations (see specific questions in ***Supplementary IMaterial,*** Focus Group 2: Medical Students' Questions).

**VI: Data analysis**

Women who completed four or more workshops were included in the analysis; this broad inclusion/exclusion criteria was used in this initial community trial because the starting sample of women in the shelters was already small.

Quantitative data was analyzed on Excel and verified in SPSS. Trauma-informed parenting, self-efficacy, and perceived stress scale scores obtained at the beginning of the intervention were subtracted from the end of the intervention scores in both the comparison and intervention groups.

Due to the small sample size and non-normalized data, non-parametric tests were utilized. The Mann Whitney U test was used to compare the change in hair cortisol levels for the intervention and comparison groups. The Wilcoxon Sign Rank test helped to assess the summary of the scores before and after the program in the intervention arm. An alpha of 0.10 was used as a significance level for the one-tailed tests.

For qualitative analysis, transcripts were analyzed by noting key words and grouping based on themes. In hopes of highlighting potential similarities and differences, analysts examined transcripts from the mothers and medical students together.

## Results

**Results: Quantitative Data**

**I. Study population**

The women's ages ranged from 17 to 20 and 21 years-old in the comparison and intervention groups, respectively. Across both shelters, the majority of the women had completed some high school, all of high school, received a GED or HiSET, or had a vocational certificate. Mothers had 1-2 children ages four months to three years. The majority identified as Latina. No major differences were obvious between the comparison and intervention shelters (***Table 1:*** Baseline Data; ***Supplementary Material,*** Survey 3: Demographics). Women were not asked to

provide post survey data if they attended fewer than four workshops.

### Results: Qualitative Data

Four themes were prevalent across focus groups: content, connectivity, confidence, and inspiration.

### I. Content:

Both medical students and mothers noted that they learned about how trauma affects health, the importance of coping with trauma and caring for oneself in order to be a compassionate caregiver, how to approach parenting with a trauma-sensitive lens, and vocabulary for challenging conversations. Direct quotes are noted below:

> *"You learned different things about trauma that may not have learned before…It opened my eyes." – mother.*

> *"I learned that the whole talking about the trauma helped me realize it wasn't my fault…It would help me be a better parent emotionally." – mother.*

> *"I realized I'm too busy. I need to take time for myself to be a better parent to my child…It helped me realize I need to give time for myself and cope with what I went through." – mother.*

> *"Once you learn something, you can't unlearn it. Once you see…how trauma affects your child, you look at them through a different lens…they are not the same person they were before when the learned how trauma affects their child. A little education goes a long way." – mother.*

> *"I gained a better understanding of cycles of intergenerational trauma. I learned how these patterns can repeat themselves but also that they can be broken. I learned about various medical diagnoses in children that really are the effects of trauma masked as a diagnosis." – medical student.*

### II. Connectivity

Both the medical students and the mothers reported that they grew closer in their paired relationship with each other as a result of the sparked conversation surrounding trauma, mental health, and parenting, along with the longitudinal nature of the mentorship. Interestingly, despite not being an explicit goal at the start of the project, the mothers also noted that they grew closer to each other. In multiple sessions, the young women shared stories of intimate partner violence and struggles with familial or significant-other substance use. The women encouraged each other with words as well as non-verbal cues. Beyond the group sessions, almost every medical student could recall times that their mentees had texted them. Outside of the workshops, during one-on-one outings, some of the medical students recalled providing advice regarding resumes, doctors' appointments, interview preparation, and study strategies. In addition to increasing connectivity among mentees and mentors, one participant shared that after learning about the intergenerational effects of trauma, she contacted her own mother, to whom she

***Table 1.*** Baseline Data.

| **Sample size** | **Total** | **Intervention** | **Comparison** |
|---|---|---|---|
| **Number** | **18** | **12** | **6** |
| Age | Total | Intervention | Comparison |
| Mean | 19.4 | 19.9 | 18.3 |
| Median | 20 | 20 | 18 |
| Max | 21 | 21 | 20 |
| Min | 17 | 17 | 17 |
| Education (# of mothers) | Total | Intervention | Comparison |
| 8th grade or less | 0 | 0 | 0 |
| Some high school | 7 | 3 | 4 |
| Graduated high school / received a GED or HiSET / vocational certificate | 10 | 8 | 2 |
| Some college / associate's degree / graduated college | 1 | 1 | 0 |
| Employment (# of mothers) | Total | Intervention | Comparison |
| Employed full-time (and not student) | 0 | 0 | 0 |
| Student with full time job | 0 | 0 | 0 |
| Employed part time (and not student) | 3 | 3 | 0 |
| Student with part time job | 2 | 2 | 0 |
| Student without job | 8 | 4 | 4 |
| Unemployed and not in school | 5 | 3 | 2 |
| Age of children | Total | Intervention | Comparison |
| Mean | 1.6 | 1.4 | 1.9 |
| Median | 1.3 | 1.1 | 2 |
| Max | 3 | 3 | 3 |
| Min | 0.3 | 0.3 | 0.5 |
| Health insurance | Total | Intervention | Comparison |
| None | 0 | 0 | 0 |
| Private through work | 0 | 0 | 0 |
| Private through family member | 0 | 0 | 0 |
| MassHealth | 17 | 11 | 6 |
| Other | 0 | 0 | 0 |
| Unknown | 1 | 1 | 0 |
| Race | Total | Intervention | Comparison |
| Asian / Asian American / Pacific Islander | 0 | 0 | 0 |
| African American / Black | 1 | 0 | 1 |
| Caucasian / White | 1 | 0 | 1 |
| Latina / Latino / Latinx | 15 | 11 | 4 |
| Native American / American Indian / Alaskan Native | 0 | 0 | 0 |
| Multiracial | 1 | 1 | 0 |
| Not listed | 0 | 0 | 0 |
| Prefer not to answer | 0 | 0 | 0 |

had not spoken in years. Below, a medical student shares her thoughts:

> *"I feel honored to be someone [my mentee] trusts – she will text me whenever she has important news – getting her driving permit, finally getting her own housing, when her daughter was sick and in the hospital. I enjoy being someone she feels she can share these moments with." – medical student.*

### III. Confidence

Both mothers and medical students gained confidence upon completion of the program. Asking for a completion certificate highlighted the confidence and pride the women gained by completing the curriculum. Medical students also gained confidence as future providers by learning how to approach sensitive topics (including trauma and mental health), prioritize listening over advising, build relationships (especially with people who have had dramatically different experiences, for none of the medical students had children themselves), and provide education in a way that avoids medical jargon. Medical students are quoted below:

> *"The mom wanted a certificate [upon completion of the workshops] to show that she had learned. It showed me that she felt proud. A lot of women in these situations are not celebrated for their accomplishments. They are not necessarily adding to their resume or getting degrees or good grades, so this certificate to them meant something." – medical student.*

> *"I was thinking about how I can be more trauma informed when I am seeing patients when I am thinking about how their health may be impacted by trauma. I got to see another side of the story. This will help me as a provider." – medical student.*

### IV. Inspiration

While the authors' hope was to inspire the young women living in the shelter, inspiration was a larger theme in the medical student focus group. The student doctors were inspired by their mentees, who demonstrated great resilience. Interestingly, all medical students agreed that this program likely impacted themselves, particularly their outlooks towards their future patients, more than the initially intended audience, the young mothers. Reflections from medical students include:

> *"I have been really inspired by [my mentee] for what she has been able to accomplish despite the obstacles she has faced. It has given me a different perspective on my own life." – medical student.*

> *"The group sessions were humbling…I gained an awareness of the kind of things they've been through and the things that they value having been through those things." – medical student.*

***Table 2.1.*** Summary of Trauma-Informed Parenting Scores.

| Trauma-informed parenting: summary scores | N | Mean | Median | Standard Dev |
|---|---|---|---|---|
| pre intervention group | 12 | 26.6 | 27.5 | 6.9 |
| post intervention group | 8 | 27.3 | 30 | 8.9 |
| pre comparison group | 6 | 30.8 | 30.5 | 3.2 |
| post comparison group | 3 | 21.3 | 27 | 13.4 |

***Table 2.2.*** Comparing Trauma-Informed Parenting Score Changes.

| Trauma-informed parenting: comparing changes | Test | Z score | P value |
|---|---|---|---|
| Change in trauma-informed parenting scores in intervention group (n = 8) vs comparison (n = 3) | Mann Whitney U | 1.54 | 0.06 |
| Trauma-informed parenting scores in intervention group before vs after program (n = 8) | Wilcoxon sign rank | 0.25 | 0.40 |

***Figure 1.*** Comparing Median Trauma-Informed Parenting Scores.

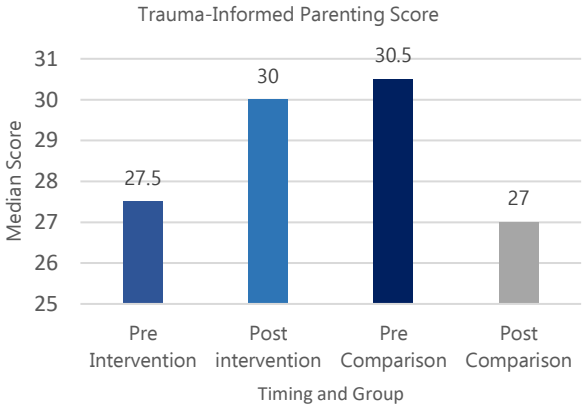


***Table 3.1.*** Comparing Trauma-Informed Parenting Score Changes.

| Self-efficacy: summary scores | N | Mean | Median | Standard Dev |
|---|---|---|---|---|
| pre intervention group | 12 | 10 | 10.5 | 2.8 |
| post intervention group | 8 | 9.6 | 10 | 3.2 |
| pre comparison group | 6 | 10.8 | 10.5 | 1.0 |
| post comparison group | 3 | 6.7 | 8 | 4.2 |

***Table 3.2.*** Comparing Self-Efficacy Score Changes.

| Self-efficacy: comparing changes | Test | Z score | P value |
|---|---|---|---|
| Change in self-efficacy scores in intervention group (n = 8) vs comparison (n = 3) | Mann Whitney U | 1.95 | 0.03 |
| Self-efficacy scores in intervention group before vs after program (n = 8) | Wilcoxon sign rank | 0.85 | 0.20 |

***Figure 2.*** Comparing Median Self-Efficacy Scores.

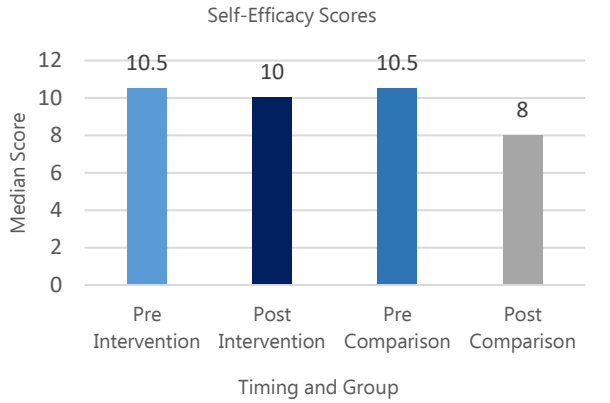


***Table 4.1.*** Summary of Perceived Stress Scale Scores.

| Perceived stress scale: summary scores | N | Mean | Median | Standard Dev |
|---|---|---|---|---|
| pre intervention group | 12 | 18.7 | 21 | 7.2 |
| post intervention group | 8 | 15.4 | 17.5 | 6.4 |
| pre comparison group | 6 | 18.3 | 17.5 | 4.6 |
| post comparison group | 3 | 14.3 | 16 | 3.8 |

***Table 4.2.*** Comparing Perceived Stress Scale Score Changes.

| Perceived stress scale: comparing changes | Test | Z score | P value |
|---|---|---|---|
| Change in perceived stress scores in intervention group (n = 8) vs comparison (n = 3) | Mann Whitney U | -0.31 | 0.38 |
| Perceived stress scores in intervention group before vs after program (n = 8) | Wilcoxon sign rank | -2.12 | 0.02 |

***Figure 3.*** Comparing Median Self-Efficacy Scores.

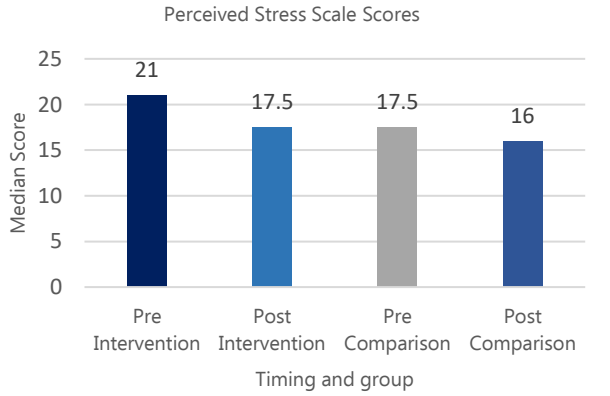


***Table 5.*** Summary of Hair Cortisol Levels.

| Hair cortisol levels (pg/mg) | N | Mean | Median | Standard Dev |
|---|---|---|---|---|
| pre intervention group | 6 | 56.8 | 3.6 | 130.6 |
| post intervention group | 6 | 26.6 | 4.3 | 52.4 |
| pre comparison group | 2 | 3.8 | 3.8 | 3.0 |
| post comparison group | 2 | 28.8 | 28.8 | 39.6 |

# Discussion

## I. Themes

The program goals were to provide lessons in education, young mother support, and research. General quantitative data trends and focus group quotes suggest that trauma-informed parenting scores and confidence increased in the intervention group. In both the comparison and intervention arms, the perceived stress scale scores decreased; however, the intervention group did not show a significant decrease in stress scores versus the comparison. Regardless of the trauma-sensitive curriculum, perhaps by having the support of the women's shelter and its accompanying resources such case managers, the overall stress levels decreased in both groups. Given that the intervention group stress scores did not significantly decrease with respect to the comparison group, the workshops and additional mentorship from medical students likely did not directly lower perceived stress at this time. Since the workshops improved trauma-informed parenting, stress levels are expected to decrease in the future in part due to the improved parenting and self-care skills.

Hair cortisol levels did not significantly decrease, and in the majority of cases, hair cortisol levels surprisingly increased (explaining the decreased mean but increased median), despite most mothers' perceived stress scale scores lowered, hinting a posible assay error. Furthermore, HPA axes can be impaired due to severe stress related to prior trauma, experiencing homelessness, and raising small children as young mothers.[3] In the case of impaired HPA axis, cortisol levels would decrease. If this were true, decreased stress levels would lead to increased cortisol levels. Also, the use of hair products, hormonal contraception, and other medications were not taken into account due to a small sample size; these variables may have contributed to the high cortisol levels measured .[12]

The focus groups showed that both medical students and participants gained confidence by learning about how trauma affects health, parenting with a trauma-sensitive lens, discussing sensitive topics, and connecting with people of varying backgrounds. Even more salient than the lessons learned by the mothers were those learned by the medical students, who gained inspiration from their mentees' resilience, practiced having difficult conversations surrounding trauma and mental health, experiences in active listening and teaching, and windows of the lives of homeless adolescent mothers, an often-stigmatized group that is typically left out of formal medical school curriculums, which often lack lessons on cultural humility. Although previously noted, it is worth emphasizing that the medical students all agreed that the program likely affected their own trajectories as student doctor more than the initially intended audience, the young mothers, who ultimately became the budding physicians' teachers. Our findings suggest that other medical schools would benefit from involving students in similar programming to benefit both learners and the community.

## II. Limitations

Limitations include a small sample size, hair cortisol collection methodology, and potential bias introduced in the focus group.

Given the small sample size and transient population, further research is needed to provide statistically significant findings and generalizability. In the case of self-efficacy, for example, a statistically significant increase was noted in the intervention versus the comparison group, but one of the three participants in the comparison group showed a drop in eight points, causing the analysis to favor a relative increase in the scores of the intervention group. This statistical significance may be questionable because when comparing solely pre and post data in the intervention, the changes were not significant. Alpha levels were also relatively high, as noted in the methods section as 0.10, which may have generously increased the power. Furthermore, if the sample size were larger, the analysis could have taken into account the effects of chemical hair treatments and hormonal contraception, which also affect cortisol levels.[12] A larger sample size would have made it possible to analyze hair cortisol levels and surveys only from women who completed all eight workshops. Due to the small sample, the authors felt the need to include women who had attended four or more workshops in order to avoid reducing the number of data points. However, the varying participation may have led to fewer changes noted.

In addition to a small sample size, hair specimens were taken from scalp to tip for both pre and post collection. These long strands contained hair cortisol from the last several months as opposed to the last three months, the duration of the intervention. Furthermore, prior studies have found that samples of 6 cm or greater have a decreased reliability of cortisol measurement.[10] In the future, sample lengths should reflect the time period being investigated. Likewise, there may not have been enough time between collection and post-intervention for hair cortisol changes. Less than three months, which would correlate to approximately three centimeters of hair, had elapsed during the study. On average, roughly ten-centimeter hair strands were collected, meaning that changes to the last few centimeters of hair would be difficult to detect.

Furthermore, the focus groups were led by medical student leaders, which may have led to bias such that the interviewees may have felt pressured to share predominantly positive reactions to the program. In addition, countless factors, such as support from case workers and familial situations, contribute to stress levels and peoples' abilities to absorb information. Thus, the changes in scores have numerous potential confounding variables.

### III. Conclusion

Our pilot testing with pre/post-intervention surveys and hair cortisol demonstrated that this approach is acceptable to young women in homeless shelters. Of note, this pilot is a novel approach to providing support to a local shelter for young mothers with medical students as educators, backed by an evidence-based trauma-informed curriculum newly designed specifically for teen parents. In addition to the novel curriculum, the adapted survey questions, hair cortisol level obtainment, and focus groups were innovative approaches, which we found to be feasible and hopefully lay the groundwork for future data-driven community interventions. Future studies would benefit from more participants to improve collection methodology and considering additional biomarkers of stress.[7] Further research is also needed to formally evaluate the effects of comparable interventions.

Moving forward, the physicians-in-training should translate their lessons learned to continue advocacy for special populations, which may include individuals experiencing homelessness, single parents, adolescents, self-identified women, minorities, and other groups that may benefit from additional allies and acquaintances. In the future, the mothers may co-lead workshops to utilize their experiences and empower themselves. Also, workshop teachers should always feel empowered to tweak curriculum based on the individual learners in front of them; in our own workshops, we made the lessons more interactive (with the help of our trauma educator) in the later weeks after we noticed more engagement (along with positive informal feedback) during the lessons that were more learner-centered. In addition, to improve consistent participation throughout the study, if funding allowed, the mothers could have been compensated per hour of time (rather than the pre/post tokens of appreciation given in this pilot). This additional funding may have been helpful to a mother, who shared that she was unable to attend a session due to her job. However, paying mothers hourly may cause mothers to feel pressured to stay in the trial. Thus, we would argue that what is more important than funding: building strong relationships and displaying genuine care for the mentees, so that they are intrinsically motivated to attend the sessions with their support group.

In sum, to combat the effects of intergenerational trauma, medical students were trained to deliver an evidence-based, trauma-sensitive parenting and mental health curriculum for young mothers experiencing homelessness. Students are now equipped to educate each other, such that this intervention may continue beyond a one-year project. Our hope is that our work will have a ripple effect, and future mentors will continue to advocate for a stigmatized population typically absent in medical school curricula.

## References

1. Burke Harris N. (2018). The Deepest Well: Healing the Long-Term Effects of Childhood Adversity. Boston: Houghton Mifflin Harcourt.
2. Brown D, Anda R, Tiemeier H, Felitti V, Edwards V, Croft J, et al. (2009). Adverse Childhood Experiences and the Risk of Premature Mortality. American Journal of Preventive Medicine, 37(5), pp.389-396.
3. Jackson Nakazawa D. (2015). Childhood Disrupted: How Your Biology Becomes Your Biography and How You Can Heal. New York: Simon & Schuster.

4. Condon E. Chronic stress in children and adolescents: a review of biomarkers for use in pediatric research. Biol Res Nurs. 2018;20(5):473-96.
5. Sullivan K, Murray K, Kane N, Ake G. Caring for children who have experienced trauma: a workshop for resource parents—Workshop knowledge and beliefs survey. Los Angeles (CA) & Durham (NC): National Center for Child Traumatic Stress; 2014.
6. Bates R, Salsberry P, Ford J. Hair sampling for cortisol analysis with mother-toddler dyads living in low-income homes. Infant Behav Dev. 2020;61:101499.
7. Forchuk C, O'Regan T, Jeng M, Wright A. Retaining a sample of homeless youth. J Can Acad Child Adolesc Psychiatry. 2018;27(3):167-74.

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**Compliance with ethical standards:** Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies; such approvals are acknowledged within the manuscript (IRB approval number: H00018725). This manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; any discrepancies from the study as planned (and, if relevant, registered) have been explained.

**Author Contributions**

Conceptualization: EA, JS, EC, JF, VP. Methodology: EA, JS, MM, MG, EC, JF, VP. Formal Analysis: EA, JS, VP. Investigation: EA, JS, MG, ZC, VP. Resources: EA, JS, EC, JF. Data Curation: EA, JS, VP. Writing - Original Draft: EA, JS, MM, ZC, VP. Writing - Review & Editing: EA, JS, MM, ZC, EC, JF, VP. Visualization: EA, JS, MM, MG. Supervision: JS, EC, JF. Project Administration: EA, JS, MM, MG, VP. Funding Acquisition: EA, JS, JF].

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## Supplementary Material

Supplementary I: SURVEY QUESTIONS

Survey 1: Knowledge and Health Beliefs

The following questions will help us learn more about your experience as a parent. There are no right or wrong answers. For each question, please note your level of agreement or disagreement on a scale from 1 to 6 (where 1=strongly disagree, 2= disagree, 3= slightly disagree, 4= slightly agree, 5= agree, and 6=strongly agree).

1. Doing things for myself is an important part of being a good parent.
2. I feel confident about my ability to handle challenging behaviors.
3. I understand how traumatic events can impact the way my child's brain works.
4. I think defiant kids (i.e., kids not following the rules) need to be praised more.
5. I feel like I have the skills to help my child.
6. I know the warning signs of problems that can come from caring too much for others and not enough for myself.
7. I know I am doing a good job as a parent.
8. I know things about being a young parent that would be helpful to other young parents.

Survey 2: Perceived Stress Scale

These questions will ask about your feelings and thoughts in the last month. Please indicate how often you thought or felt a certain way using a score of 1 – 5 (where 1=never, 2=almost never, 3=sometimes, 4=fairly often, and 5=very often).

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and "stressed"?
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
7. In the last month, how often have you been able to control irritations in your life?
8. In the last month, how often have you felt that you were on top of things?
9. In the last month, how often have you been angered because of things that were outside of your control?
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Survey 3: Demographics

Finally, we are going to ask a few questions about you and your child(ren).

1. How old are you? ___

2. How do you identify yourself? (Please check all that apply)
   a. Asian / Asian American / Pacific Islander
   b. African American / Black
   c. Caucasian / White
   d. Latina / Latino / Latinx
   e. Native American/American Indian/Alaskan Native
   f. Multiracial
   g. Something not listed here: _____
   h. Prefer not to answer

3. What is the highest level of education you have completed (Select one)?
   a. 8th grade or less
   b. Some high school
   c. Graduated high school / Received a GED or HiSET / Vocational certificate
   d. Some college / Associate's degree / Graduated college

4. Are you currently employed (Please check all that apply)
   a. Employed full-time (30 or more hours per week)
   b. Employed part-time (less than 30 hours per week)
   c. Unemployed
   d. Student

5. How many children do you have? _____
   a. How old is your child? _____ (if only one)

If more than one:
   a. How old is your second child? _____
   b. How old is your third child? _____

6. Do you currently have health insurance?
   a. Yes – GO TO Q7
   b. No – SKIP to Q8

7. If Yes, what type of health insurance do you have? (Select one)
   a. Private health insurance through work
   b. Private health insurance through a family member
   c. MassHealth
   d. Something not listed here: _____

8. Have you gotten a physical from a healthcare professional (e.g., a primary care clinician/ MD/NP) in the last 12 months?
   a. Yes
   b. No

Survey 4: Questions for Hair Cortisol Data Collection
We will be measuring cortisol (known as the stress hormone) in hair samples to give us a better idea of your stress level. We need to ask you a few questions about your hair care and health that may naturally affect the cortisol levels in your hair.

1. How frequently do you wash your hair?
Daily
3-4 times a week
1-2 times a week
2-3 times a month
Once a month
Other (please specify):_____

2. Have you used a perm or relaxer on your hair in the last 3 months?
Yes
No

3. Have you bleached, colored, or dyed your hair in the last 3 months?
Yes
No

5. Do you have hair gel, mousse, hair spray or oil on your hair right now?
Yes
No

6. Are you currently pregnant?
Yes
No

7. Have you used hormonal birth control in the past 3 months, including the Depo-Provera shot, the "pill", a patch, an implant or IUD?
Yes
No

8. Have you taken any steroids (e.g., cortisone) by mouth, cream, inhaler or shot in the past 3 months?
Yes
No

Supplementary II: FOCUS GROUP QUESTIONS
Focus Group 1: Young Mothers' Questions

1. How did you like the educational curriculum we offered over the past 8 months?

2. What were some of the take-aways for you from these sessions?
(Reminder of session titles: Goals, Guiding Principles and Self Care; Trauma 101; How My Own Childhood Trauma May Be Impacting My Decision Making and Parenting; Understanding Trauma's Effects; Feelings and Behaviors; Safety; Advocacy; Connections and Healing, Closing Thoughts)

3. Do you have any thoughts on how we should provide this curriculum differently in the future?

4. How, if at all, has this experience effected your parenting style and/or your self-care?

5. Have there been any changes to your feelings or attitudes about parenting and/or trauma after these educational sessions?

6. What kinds of monthly activities did you each do with the medical student you were partnered with? How did these events go?

7. Do you have any other feedback for us about the educational sessions or the activities you did independently with one of the medical students?

8. Are there other topics you would like us to have education sessions about in the future?

Focus Group 2: Medical Students' Questions

1. What, if anything, did you gain from the training sessions? Prompt for details.

2. What, if anything, did you gain from the group sessions? Prompt for details.

3. What, if anything, did you gain from the one-on-one sessions with your assigned mentee (mother)? Prompt for details.

4. If we were to obtain continued funding for this type of project, what would you suggest we do differently the next time? Prompt for details.

5. Ask the students to share a meaningful quote or anecdote from this project that has stuck with them. Prompt for details.

6. Is there anything else that you'd like to share either about your own participation in this project or about the needs of these mothers that we might want to consider addressing in the future?

IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Original Article

# Awareness and Perspectives on the Role of Artificial Intelligence in Primary Care: A Cross-Sectional Survey of Rural and Urban Primary Care Physicians in Alberta, Canada

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## Abstract

**Background:** Artificial intelligence (AI) is increasingly integrated into healthcare, yet physicians' awareness and perspectives remain underexplored. While often associated with imaging, AI applications also include online scheduling, digitized records, virtual consultations, and drug dosage algorithms. This study surveyed Canadian primary care physicians (PCPs) to assess their awareness and attitudes toward AI in healthcare. **Methods:** A cross-sectional survey was distributed via email and newsletters to family physicians across Alberta, including both urban and rural settings. Responses were collected through Qualtrics. **Results:** Of 79 responses, 46 met inclusion criteria. Most respondents practiced in urban areas (63%) and had no prior AI training (65%). Rural physicians reported greater comfort and interest in AI, including its use for monitoring treatment adherence (p=0.043) and analyzing EMR data for health management (p=0.027). Knowledge of AI varied widely: only 30% recognized that deep learning involves artificial neural networks, while 44% reported no knowledge of the concept. Commonly used AI tools included ECG interpreters (65%) and language translators (37%). Physicians showed interest in expanded medical uses of AI. **Conclusion:** There is a lack of knowledge and use of AI tools in medicine, with both urban and rural physicians' responses suggesting a need for more education and training in AI. The "Lack of human connection" was the main fear that was expressed regarding the use of AI in healthcare suggesting concerns about potential impacts on patient-provider relationships. This survey's findings may inform future research into the development and implementation of AI in primary care.

## Introduction

Artificial Intelligence (AI) has the potential to revolutionize the healthcare industry by overcoming barriers and improving efficiency.[1, 4] However, despite the advancements of AI applications in medicine, the attitudes and level of awareness among primary care providers (PCPs) remain unclear.[5, 7]

AI is already integrated into many aspects of healthcare. This ranges from administrative tasks such as appointment scheduling and digital recordkeeping to clinical decision support systems and diagnostic tools.[7, 9] AI will continue to play a critical role for physicians by assisting clinical decision-making, improving practice management, increasing diagnosis accuracy, and helping integrate new healthcare technologies. Some of the well-known examples of application of AI in medicine includes CAD (computer assisted diagnosis) for screening mammography, DXplain (decision support system by MIT), Babylon (UK based patient consulting system), Gremwatcher (infection detection system by University of Washington).[10, 12]

In primary care centers, AI-based technologies can be particularly beneficial as PCPs are responsible for the majority of patient-physician interactions and are the most accessed physician resource.[13] A study by Stewart and Ryan10 found that across the Canadian Provinces, 238 per 1000 individuals contacted their family physicians each month—more than other physician specialists. As AI continues to evolve, understanding PCPs' familiarity, concerns, and perceived benefits is essential to ensure appropriate and effective adoption.[5,14]

Few studies probing the awareness of AI knowledge among healthcare providers, or their attitude toward the increasing integration of AI in healthcare, have been conducted. One review of qualitative evidence reported that healthcare providers across several medical specialties had varied views on the topic, holding beliefs that AI could benefit clinical decision-making, but expressing skepticism and uncertainty about its effectiveness and mechanics.[15] Another review investigating the perspectives of

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radiologists on the topic showed optimism about AI in their field and a desire to learn more, but hesitancy about the degree to which it could be trusted without supervision.[16] Furthermore, the number of studies on PCPs has been more limited. A thematic analysis conducted on discussions among Canadian patients and PCPs highlighted perceived barriers to the implementation of AI in primary care.[2] Concerns included the readiness of existing health systems, the potential for bias, the necessary training, and the difficulty in designing user-friendly tools. It is worth noting that in the past, PCPs have been hesitant to adopt other technologies, such Electronic Medical Records (EMRs), due to similar concerns about accessibility and reliability.[3]

Canadian medical leaders have recently emphasized the importance of AI in healthcare, as seen with the implementation of the AI task force by the Royal College.[17] As well, the Government of Canada has implemented a comprehensive policy on digital health solutions to enhance healthcare delivery. The policy emphasizes interoperability, privacy, security of health information, ethical considerations, and the responsible use of emerging technologies, such as AI in healthcare. However, an assessment of urban and rural Canadian PCPs' knowledge, use, and attitude toward AI in healthcare is lacking.[18] Meanwhile, AI development is advancing rapidly and is offering more solutions that can be utilized by PCPs.

To our knowledge, no prior study has directly compared the perspectives of urban and rural Canadian PCPs on AI integration in primary care. In this study, we conducted a cross-sectional survey of PCPs practicing in Alberta, Canada, to evaluate their awareness, concerns, and interest in using AI in clinical practice. Alberta was selected as the study site due to the authors' affiliations with the University of Calgary and University of Alberta, and access to established physician networks. Currently, 5425 PCPs practice in Alberta, Canada.[19]

We recognize the importance of considering readiness for AI implementation in different practice environments, as rural and urban PCPs may have distinct needs and considerations.20 Rural communities often have been slower at adopting modern technologies, yet with the potential benefits of AI offers, rural physicians might have more to gain from its implementation.[21,22] At the same time, understanding the perspectives and concerns of urban PCPs is crucial, given their higher patient volume and established healthcare infrastructure.[23,24] By considering both rural and urban PCPs, we aim to inform future development in the area and bridge the gap between AI developers and end users for improved integration and efficacy of technology into primary practice.

## Methods

This study is a cross-sectional survey of PCPs currently practicing family medicine in urban and rural healthcare centers in Alberta, Canada. The overall goal of this study was to gauge the readiness of family physicians about the use of artificially intelligent tools in their medical practice. The objectives of this study were two-fold. First, to assess PCPs' level of awareness and understanding of AI, and second, to gather their perspectives on the potential applications of AI in primary care.

### Participants

Our target population was PCPs currently practicing in Alberta, Canada, as well as Family Medicine residents in any year of residency from the province's Family Medicine programs (the University of Calgary and the University of Alberta). Recruitment methods included emailing physicians through the College of Physicians and Surgeons of Alberta (CPSA) medical directory, advertising the survey through the Distributed Learning and Resource Initiatives (DLRI) newsletter at the University of Calgary Cumming School of Medicine, as well as through rural and urban Primary Care Network (PCN) newsletters throughout Alberta. Further, we utilized the local academic network at both the University of Calgary and Alberta, such as personally contacting PCP faculty members to distribute it amongst their networks. Upon survey completion, participants chose to be redirected to a page where they entered a draw for one of ten $50 Amazon gift cards.

### Survey Design

Our research team outlined a list of specific objectives based on the aim of the project and gaps in the current literature. The survey has three primary components: 1) Participant demographics, notably, whether participants have previous knowledge of AI and whether their primary setting of practice is rural or urban Alberta; 2) Baseline knowledge of AI; 3) Assessment of attitudes towards AI, including fears associated with AI use in medicine, and personal comfort with the notion of future AI use in medicine.

A list of closed and open-ended questions was then designed for the survey based on these objectives. The closed-ended questions assessed participants' demographics, practice characteristics, current use of AI in their practice and perspectives on the potential use of AI in their practice. The open-ended questions used the Likert scale and narrative questions to assess participants' perspectives on the potential applications of AI in primary care, as well as their concerns and barriers to the adoption of AI in primary care. Questions assessing knowledge of AI topics were independently assessed for accuracy and validity by a professor of Computer Science with a specialization in data mining. The survey was pilot tested amongst the research team for clarity and ease of understanding before being distributed. The survey was hosted on Qualtrics (Qualtrics, Provo, UT).

### Data Collection

Participants were given a link to the survey and were asked to complete it within a specific timeframe. The data contained no unique identifiers and was securely stored on secured drives with restricted access. Survey responses were collected from October 2022 to February 2023.

### Data Analysis

We received a total of 79 survey responses. Of these, 44 were 100% complete, 2 were over 80% complete, and 33 were less than 20% complete. Per our inclusion criteria, survey responses that were less than 80% complete were excluded from the analysis. This resulted in 46 responses eligible for further statistical analysis, for an overall analyzable response rate of 58%. As a result, some variables may have a smaller number of observations, potentially affecting the generalizability and interpretation of subgroup comparisons.

Demographic data and Likert-scale responses were summarized using descriptive statistics, while open-ended questions were subjected to qualitative content analysis. We performed statistical comparisons of the responses between groups of PCPs including, by gender, by practice location and by length of practice using nonparametric techniques. We decided that nonparametric tests of hypothesis were more appropriate, given the limited number of participants who responded to our survey. For the comparisons involving two groups, we used Mann-Whitney U test, and for the comparison involving more than two groups, we used Kruskal-Wallis test. Data exported from Qualtrics was cleaned and processed in MS Excel in preparation for analysis. Statistical analyses were performed using IBM SPSS Statistics version 28.0.1. We worked with a significance level of 0.05 to determine statistical differences between groups. For other data not presented in the tables, we included as graphs which were created in MS Excel.

### Ethics

The study received ethics clearance from the University of Calgary Conjoint Health Research Ethics Board (REB22-0132) based on the Tri-Council Policy Statement, ethical conduct for research involving humans (TCPS) in accordance with declaration of Helsinki. The survey responses were anonymous and confidential. Incentives such as a gift card raffle were given to encourage participation and to thank participants for their time. Attached to the survey invitation email was a survey a letter of information/implied consent form approved by the University of Calgary Conjoint Health Research Ethics Board which explained how consent would be obtained for the study. Informed consent to participate in the study was obtained from all the participants.

## Results

### Demographics

All participants were either licensed family medicine physicians or residents currently completing family medicine training. Of the 46 responses meeting inclusion criteria ***(Table 1).*** 29 participants worked primarily in urban settings and 17 in rural settings. Respondents spanned a wide range of age groups, with the largest proportion (30%) between 31–40 years old. When it comes to the setting of practice, the largest proportion of respondents worked in private practice (n=36). The smallest group worked in hospital outpatient settings (n=5). 35% of participants reported additional training in a Family Medicine Enhanced Skills area (i.e., specialized fellowship training after completing family medicine residency), and most (65%) had no prior training in AI.

Readiness for Use of AI in Medical Practice by Practice Location

Physicians from rural and urban locations were similar in almost all aspects of readiness for use of AI in medical practice, except for 2 areas. Two areas where statistical differences were noted were in the comfort level of using AI for monitoring patients to remain concordant with treatment (p=0.043) and for using the AI to analyze EMR data to guide health management (p=0.027). For both functionalities, physicians from rural areas indicated higher interest and level of comfort, than the doctors from urban locations. While it did not reach statistical significance, the rural doctors also were more interested to use virtual health assistant and other diagnostic tools if they were given the training to use these tools. Further, despite not being found statistically significant, it is notable that none of the rural physicians trusted AI to diagnose patients independently and neither do they trust AI to design treatment plans independently.

### Readiness for Use of AI by Gender

As shown in ***Table 3,*** Male physicians were more trusting of AI in medical practice than female physicians and the difference was statistically significant (p=0.034). Similarly, male physicians were more interested than female physicians in using a virtual health assistant as a tool (p=0.042) and in using AI to assist in diagnosing patients with close supervision (p=0.028). Furthermore, there is weak evidence indicating that male doctors have interest in using AI for administrative work assistance (p=0.065) and other diagnostic tools (p=0.080). On the other hand, more female doctors would use a language translator tool (p=0.031). While statistically significant, it is important to note that male physicians did not trust AI to diagnose patients independently and nor did they trust AI to design treatment plans independently.

### Readiness for Use of AI in Medical Practice by Length of Practice

There are no remarkable differences in responses among the 3 groups of physicians by length of practice ***(Table 4).*** While it was not found statistically significant, it is important to note that none of the physicians who have been in practice for more than 15 years trusted AI to diagnose patients independently or trusted AI to design treatment plans independently.

### Knowledge of Physicians about Artificial Intelligence

***Figure 1*** combines responses from both rural and urban physicians. For each statement, most physicians were at least somewhat aware of these topics, however, there were differences in awareness depending on the AI statement. Among all physicians, the statement "AI is an interdisciplinary field that allows computers to mimic human intelligence" was the most familiar, with 67% of physicians being Familiar with it. The statements "AI systems are trained using existing data to do an automated predictive task" and "AI is an interdisciplinary field

***Table 1.*** Demographic and Professional Characteristics of Participants (Rural vs. Urban).

| Demographic Profile | Rural | | Urban | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Participants | 17 | 37 | 29 | 63 | 46 | 100 |
| Age | | | | | | |
| 20-30 yrs | 1 | 6 | 7 | 24 | 8 | 17 |
| 31-40 yrs | 5 | 29 | 9 | 31 | 14 | 30 |
| 41-50 yrs | 3 | 18 | 5 | 17 | 8 | 17 |
| 51-60 yrs | 5 | 29 | 2 | 7 | 7 | 15 |
| 61+ yrs | 3 | 18 | 6 | 21 | 9 | 20 |
| Gender | | | | | | |
| Male | 11 | 65 | 11 | 38 | 22 | 48 |
| Female | 6 | 35 | 18 | 62 | 24 | 52 |
| Length of Practice (years) | | | | | | |
| 0-5 yrs | 3 | 18 | 10 | 34 | 13 | 28 |
| 6-10 yrs | 4 | 24 | 5 | 17 | 9 | 20 |
| 11-15 yrs | 3 | 18 | 5 | 17 | 8 | 17 |
| 16-20 yrs | 2 | 12 | 1 | 3 | 3 | 7 |
| 20+ yrs | 5 | 29 | 8 | 28 | 13 | 28 |
| Practice Setting | | | | | | |
| Private practice | 11 | 65 | 25 | 86 | 36 | 78 |
| Hospital outpatient | 2 | 12 | 3 | 10 | 5 | 11 |
| Hospital inpatient | 4 | 24 | 1 | 3 | 5 | 11 |
| Additional Medical Training | | | | | | |
| No additional training | 6 | 35 | 25 | 86 | 31 | 67 |
| Addiction | 0 | 0 | 1 | 3 | 1 | 2 |
| Care of Elderly | 0 | 0 | 1 | 3 | 1 | 2 |
| Emergency Medicine | 2 | 12 | 0 | 0 | 2 | 4 |
| Family Medicine + Anesthesia | 2 | 12 | 1 | 3 | 3 | 7 |
| Maternal /Newborn Care | 0 | 0 | 1 | 3 | 1 | 2 |
| Palliative Care | 2 | 12 | 1 | 3 | 3 | 7 |
| Sport and Exercise Medicine | 0 | 0 | 1 | 3 | 1 | 2 |
| Other training | 4 | 24 | 3 | 10 | 7 | 15 |
| Previous AI Training | | | | | | |
| No training | 13 | 76 | 17 | 59 | 30 | 65 |
| Self-taught | 3 | 18 | 10 | 34 | 13 | 28 |
| Online AI training | 1 | 6 | 3 | 10 | 4 | 9 |
| University course | 1 | 6 | 1 | 3 | 2 | 4 |
| Workshops | 0 | 0 | 2 | 7 | 2 | 4 |

***Legend:*** Survey Participant Demographics were grouped by whether the setting of primary practice for the physician was selected as urban (Edmonton or Calgary) or rural (all other locations). AI training includes online modules/courses, self-taught/readings, and workshops. yrs= years

that allows computers to mimic human intelligence" were also well-known, with more than 60% of physicians being familiar with them. On the other hand, statements related to subset concepts of AI (i.e., Deep Learning and Machine Learning) were the least familiar, such as the statement "Deep learning involves the use of artificial neural networks", with only 30% of physicians being familiar with it and 44% stating they had no knowledge.

Overall, physician awareness of AI was limited and varied depending on the concept.

**Physicians' Use and Interest in AI Tools**

***Figure 2*** highlights physicians' prior use and interest in AI tools. The most commonly used tools were ECG interpreters (65%) and language translators (37%). All other tools had not been used by more than 80% of respondents. Despite limited prior exposure, most respondents expressed interest in adopting AI tools in their practice—particularly for administrative workflow support (80%) and visual diagnostic assistance (78%). Virtual health assistants, however, drew comparatively less interest (48%), even though this trend was not statistically significant.

## Discussion

This study presents the results of a survey of urban and rural primary care physicians in Alberta, Canada, aimed at assessing their awareness and perspectives on the role of artificial intelligence (AI) in primary care. The use of AI in healthcare is a rapidly growing field with the potential to improve patient outcomes and reduce healthcare costs. However, there is a need to understand the perspectives and attitudes of primary care physicians toward the integration of AI in their practice. The survey results reported in this study provide a snapshot of the current state of primary care physicians' knowledge and attitudes toward AI and highlight areas where education and training may be needed to facilitate the integration of AI in primary care.

When asked whether the participants have used any of the AI tools listed, most of the respondents said that they had never heard of them while the vast majority expressed interest in using them were they available. This highlights a key gap between awareness and interest, indicating an opportunity for targeted education. Further, the results show that the majority of physicians have not had prior AI training, with a higher percentage of rural physicians (76%) reporting no prior AI training compared to urban physicians (59%). Regarding knowledge and awareness, overall physicians showed varying levels of knowledge and awareness of AI concepts, with some concepts being more well-known than others ***(Figure 1).*** A potential reason for this unfamiliarity could stem from lack of exposure to and awareness of current technological advancements. This is evident in that up to 85% of respondents said they would use the mentioned AI tools, such as a language translator and an ECG interpreter, were they available to them ***(Figure 2).*** This suggests that there is a potential for greater adoption of AI in healthcare, but education and training may be necessary to increase familiarity and comfort with these tools. Future studies may also explore why physicians may value certain AI tools over others.

Comparing perspectives of urban and rural physicians, more rural physicians reported being trusting of AI's use in medicine than their urban counterparts ***(Table 2).*** Although it is unclear why this difference may exist, it is important to interpret these results with caution, as no statistical differences were found and the relatively small sample size of rural physicians in the survey (34%, n=15) may limit the generalizability of these findings. This difference could stem from variation in perceived workload, resource availability, or openness to workflow assistance, but remains exploratory. Albeit, both groups had similar reservations regarding its use and efficacy, with lack of human connection being the most common reported fear.

***Table 2.*** Readiness for Use of AI in Medical Practice by Practice Location.

| Readiness of Physicians for Use of AI in Medical Practice by Practice Location. | Practice Location | | | | | | P-Value* |
|---|---|---|---|---|---|---|---|
| | Rural | | Urban | | Total | | |
| | n | % | n | % | n | % | |
| Participants | 17 | 37 | 29 | 63 | 46 | 100 | |
| Familiarity with AI | | | | | | | |
| No knowledge | 3 | 18 | 6 | 21 | 9 | 20 | |
| Vaguely aware | 9 | 53 | 12 | 41 | 21 | 46 | 0.768 |
| Familiar | 5 | 29 | 11 | 38 | 16 | 35 | |
| Familiarity with Medical Use of AI | | | | | | | |
| No knowledge | 3 | 18 | 9 | 31 | 12 | 26 | |
| Vaguely aware | 10 | 59 | 11 | 38 | 21 | 46 | 0.807 |
| Familiar | 4 | 24 | 9 | 31 | 13 | 28 | |
| Have used technologies that use AI in my medical practice | | | | | | | |
| No | 11 | 65 | 21 | 72 | 32 | 70 | |
| Maybe | 4 | 24 | 4 | 14 | 8 | 17 | 0.673 |
| Yes | 2 | 12 | 4 | 14 | 6 | 13 | |
| Currently using Artificially Intelligent tools in my medical practice | | | | | | | |
| No | 11 | 65 | 22 | 76 | 33 | 72 | |
| Maybe | 4 | 24 | 3 | 10 | 7 | 15 | 0.517 |
| Yes | 2 | 12 | 4 | 14 | 6 | 13 | |
| Have used AI tools in my medical practice | | | | | | | |
| Virtual Health Assistant | 1 | 6 | 2 | 7 | 3 | 7 | 0.894 |
| Language Translator | 8 | 47 | 9 | 31 | 17 | 37 | 0.282 |
| Administrative Workflow Assistance | 2 | 12 | 4 | 14 | 6 | 13 | 0.845 |
| ECG Interpreter | 10 | 59 | 20 | 69 | 30 | 65 | 0.491 |
| Visual diagnostic tools | 1 | 6 | 5 | 17 | 6 | 13 | 0.275 |
| Other diagnostic tools that use AI | 2 | 12 | 6 | 21 | 8 | 17 | 0.496 |
| Given training, I would use AI tools in my medical practice | | | | | | | |
| Virtual Health Assistant | 11 | 65 | 11 | 38 | 22 | 48 | 0.083 |
| Language Translator | 14 | 82 | 25 | 86 | 39 | 85 | 0.728 |
| Administrative Workflow Assistance | 14 | 82 | 23 | 79 | 37 | 80 | 0.804 |
| ECG Interpreter | 16 | 94 | 23 | 79 | 39 | 85 | 0.182 |
| Visual diagnostic tools | 15 | 88 | 21 | 72 | 36 | 78 | 0.214 |
| Other diagnostic tools that use AI | 15 | 88 | 19 | 66 | 34 | 74 | 0.094 |
| Would be comfortable if AI tools was used in my practice to: | | | | | | | |
| Guide patients through administrative operations in my office | 11 | 65 | 23 | 79 | 34 | 74 | 0.684 |
| Assist with medical billing and coding | 13 | 76 | 23 | 79 | 36 | 78 | 0.605 |
| Assist with writing referral letters to specialist physicians | 12 | 71 | 20 | 69 | 32 | 70 | 0.341 |
| Assist in diagnosing patients with my close supervision | 6 | 35 | 11 | 38 | 17 | 37 | 0.343 |
| Diagnose patients independently | 0 | 0 | 2 | 7 | 2 | 4 | 0.912 |
| Assist with designing treatment plans with my close supervision | 6 | 35 | 9 | 31 | 15 | 33 | 0.317 |
| Design treatment plans independently | 0 | 0 | 2 | 7 | 2 | 4 | 0.760 |
| Monitor patients to remain concordant with treatment plans | 11 | 65 | 11 | 38 | 22 | 48 | **0.043** |
| Analyze patient EMR data to guide health management between visits | 15 | 88 | 21 | 72 | 36 | 78 | **0.027** |
| Would trust AI in my medical practice | | | | | | | |
| Probably not | 5 | 29 | 15 | 52 | 20 | 43 | |
| Probably yes | 10 | 59 | 14 | 48 | 24 | 52 | 0.251 |
| No response | 2 | 12 | 0 | 0 | 2 | 4 | |
| Concerns about trusting AI in my medical practice | | | | | | | |
| Fear of AI taking over my job | 2 | 12 | 4 | 14 | 6 | 13 | 0.845 |
| Fear of the unknown | 4 | 24 | 6 | 21 | 10 | 22 | 0.824 |
| Lack of human connection | 8 | 47 | 14 | 48 | 22 | 48 | 0.937 |
| Lack of understanding | 4 | 24 | 11 | 38 | 15 | 33 | 0.320 |

***Legend:*** * p-value based on Mann-Whitney U test. The prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

***Table 3.*** Readiness for Use of AI in Medical Practice by Gender.

| Readiness for Use of AI in Medical Practice by Gender. | Gender | | | | | | P-Value* |
|---|---|---|---|---|---|---|---|
| | Male | | Female | | Total | | |
| | n | % | n | % | n | % | |
| Participants | 22 | 48 | 24 | 52 | 46 | 100 | |
| Familiarity with AI | | | | | | | |
| No knowledge | 4 | 18 | 5 | 21 | 9 | 20 | |
| Vaguely aware | 10 | 45 | 11 | 46 | 21 | 46 | 0.794 |
| Familiar | 8 | 36 | 8 | 33 | 16 | 35 | |
| Familiarity with Medical Use of AI | | | | | | | |
| No knowledge | 6 | 27 | 6 | 25 | 12 | 26 | |
| Vaguely aware | 7 | 32 | 14 | 58 | 21 | 46 | 0.309 |
| Familiar | 9 | 41 | 4 | 17 | 13 | 28 | |
| Have used technologies that use AI in my medical practice | | | | | | | |
| No | 15 | 68 | 17 | 71 | 32 | 70 | |
| Maybe | 3 | 14 | 5 | 21 | 8 | 17 | 0.704 |
| Yes | 4 | 18 | 2 | 8 | 6 | 13 | |
| Currently using Artificially Intelligent tools in my medical practice | | | | | | | |
| No | 16 | 73 | 17 | 71 | 33 | 72 | |
| Maybe | 4 | 18 | 3 | 13 | 7 | 15 | 0.781 |
| Yes | 2 | 9 | 4 | 17 | 6 | 13 | |
| Have used AI tools in my medical practice | | | | | | | |
| Virtual Health Assistant | 1 | 5 | 2 | 8 | 3 | 7 | 0.607 |
| Language Translator | 7 | 32 | 10 | 42 | 17 | 37 | 0.494 |
| Administrative Workflow Assistance | 5 | 23 | 1 | 4 | 6 | 13 | 0.065 |
| ECG Interpreter | 14 | 64 | 16 | 67 | 30 | 65 | 0.831 |
| Visual diagnostic tools | 4 | 18 | 2 | 8 | 6 | 13 | 0.327 |
| Other diagnostic tools that use AI | 6 | 27 | 2 | 8 | 8 | 17 | 0.080 |
| Given training, I would use AI tools in my medical practice | | | | | | | |
| Virtual Health Assistant | 14 | 64 | 8 | 33 | 22 | 48 | **0.042** |
| Language Translator | 16 | 73 | 23 | 96 | 39 | 85 | **0.031** |
| Administrative Workflow Assistance | 19 | 86 | 18 | 75 | 37 | 80 | 0.337 |
| ECG Interpreter | 19 | 86 | 20 | 83 | 39 | 85 | 0.777 |
| Visual diagnostic tools | 18 | 82 | 18 | 75 | 36 | 78 | 0.580 |
| Other diagnostic tools that use AI | 18 | 82 | 16 | 67 | 34 | 74 | 0.248 |
| Would be comfortable if AI tools was used in my practice | | | | | | | |
| Guide patients through administrative operations in my office | 14 | 64 | 20 | 83 | 34 | 74 | 0.119 |
| Assist with medical billing and coding | 18 | 82 | 18 | 75 | 36 | 78 | 0.551 |
| Assist with writing referral letters to specialist physicians | 17 | 77 | 15 | 63 | 32 | 70 | 0.166 |
| Assist in diagnosing patients with my close supervision | 11 | 50 | 6 | 25 | 17 | 37 | **0.028** |
| Diagnose patients independently | 0 | 0 | 2 | 8 | 2 | 4 | 1.000 |
| Assist with designing treatment plans with my close supervision | 9 | 41 | 6 | 25 | 15 | 33 | 0.305 |
| Design treatment plans independently | 0 | 0 | 2 | 8 | 2 | 4 | 0.499 |
| Monitor patients to remain concordant with treatment plans | 13 | 59 | 9 | 38 | 22 | 48 | 0.192 |
| Analyze patient EMR data to guide health management between visits | 16 | 73 | 20 | 83 | 36 | 78 | 0.431 |
| Would trust AI in my medical practice | | | | | | | |
| Probably not | 6 | 27 | 14 | 58 | 20 | 43 | |
| Probably yes | 15 | 68 | 9 | 38 | 24 | 52 | **0.034** |
| No response | 1 | 5 | 1 | 4 | 2 | 4 | |
| Concerns about trusting AI in my medical practice | | | | | | | |
| Fear of AI taking over my job | 3 | 14 | 3 | 13 | 6 | 13 | 0.910 |
| Fear of the unknown | 6 | 27 | 4 | 17 | 10 | 22 | 0.389 |
| Lack of human connection | 8 | 36 | 14 | 58 | 22 | 48 | 0.141 |
| Lack of understanding | 6 | 27 | 9 | 38 | 15 | 33 | 0.465 |

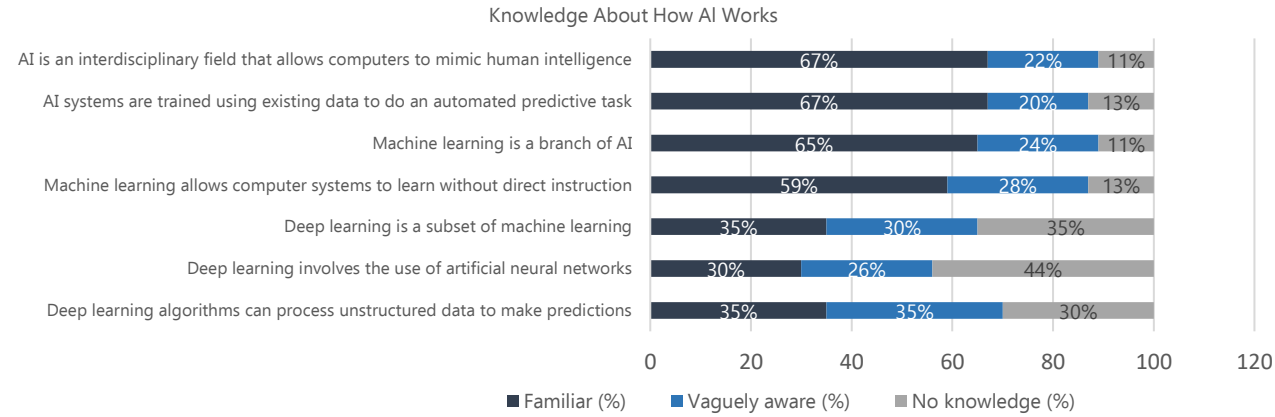
***Legend:*** * p-value based on Mann-Whitney U test. The prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

***Table 4.*** Readiness for Use of AI in Medical Practice by Gender.

| Readiness of Physicians for Use of AI in Medical Practice by Length of Practice. | Length of Practice | | | | | | Total | | P-Value* |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5 yrs | | 6-15 yrs | | 15+ yrs | | | | |
| | n | % | n | % | n | % | n | % | |
| Participants | 13 | 28 | 17 | 37 | 16 | 35 | 46 | 100 | |
| Familiarity with AI | | | | | | | | | |
| No knowledge | 2 | 15 | 3 | 18 | 4 | 25 | 9 | 20 | |
| Vaguely aware | 9 | 69 | 8 | 47 | 4 | 25 | 21 | 46 | 0.557 |
| Familiar | 2 | 15 | 6 | 35 | 8 | 50 | 16 | 35 | |
| Familiarity with Medical Use of AI | | | | | | | | 0 | |
| No knowledge | 4 | 31 | 3 | 18 | 5 | 31 | 12 | 26 | |
| Vaguely aware | 8 | 62 | 8 | 47 | 5 | 31 | 21 | 46 | 0.316 |
| Familiar | 1 | 8 | 6 | 35 | 6 | 38 | 13 | 28 | |
| Have used technologies that use AI in my medical practice | | | | | | | | 0% | |
| No | 9 | 69 | 13 | 76 | 10 | 63 | 32 | 70 | |
| Maybe | 2 | 15 | 3 | 18 | 3 | 19 | 8 | 17 | 0.619 |
| Yes | 2 | 15 | 1 | 6 | 3 | 19 | 6 | 13 | |
| Currently using Artificially Intelligent tools in my medical practice | | | | | | | | | |
| No | 10 | 77 | 12 | 71 | 11 | 69 | 33 | 72 | |
| Maybe | 0 | 0 | 4 | 24 | 3 | 19 | 7 | 15 | 0.965 |
| Yes | 3 | 23 | 1 | 6 | 2 | 13 | 6 | 13 | |
| Have used AI tools in my medical practice | | | | | | | | | |
| Virtual Health Assistant | 1 | 8 | 0 | 0 | 2 | 13 | 3 | 7 | 0.349 |
| Language Translator | 5 | 38 | 5 | 29 | 7 | 44 | 17 | 37 | 0.695 |
| Administrative Workflow Assistance | 2 | 15 | 2 | 12 | 2 | 13 | 6 | 13 | 0.956 |
| ECG Interpreter | 11 | 85 | 11 | 65 | 8 | 50 | 30 | 65 | 0.157 |
| Visual diagnostic tools | 3 | 23 | 1 | 6 | 2 | 13 | 6 | 13 | 0.390 |
| Other diagnostic tools that use AI | 2 | 15 | 2 | 12 | 4 | 25 | 8 | 17 | 0.534 |
| Given training, I would use AI tools in my medical practice | | | | | | | | | |
| Virtual Health Assistant | 5 | 38 | 10 | 59 | 7 | 44 | 22 | 48 | 0.507 |
| Language Translator | 11 | 85 | 14 | 82 | 14 | 88 | 39 | 85 | 0.920 |
| Administrative Workflow Assistance | 11 | 85 | 14 | 82 | 12 | 75 | 37 | 80 | 0.789 |
| ECG Interpreter | 10 | 77 | 15 | 88 | 14 | 88 | 39 | 85 | 0.653 |
| Visual diagnostic tools | 12 | 92 | 14 | 82 | 10 | 63 | 36 | 78 | 0.141 |
| Other diagnostic tools that use AI | 9 | 69 | 14 | 82 | 11 | 69 | 34 | 74 | 0.614 |
| Would be comfortable if AI tools was used in my practice | | | | | | | | | |
| Guide patients through administrative operations in my office | 8 | 62 | 13 | 76 | 13 | 81 | 34 | 74 | 0.769 |
| Assist with medical billing and coding | 9 | 69 | 14 | 82 | 13 | 81 | 36 | 78 | 0.997 |
| Assist with writing referral letters to specialist physicians | 6 | 46 | 15 | 88 | 11 | 69 | 32 | 70 | 0.093 |
| Assist in diagnosing patients with my close supervision | 4 | 31 | 6 | 35 | 7 | 44 | 17 | 37 | 0.832 |
| Diagnose patients independently | 2 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0.201 |
| Assist with designing treatment plans with my close supervision | 3 | 23 | 8 | 47 | 4 | 25 | 15 | 33 | 0.364 |
| Design treatment plans independently | 2 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | 0.678 |
| Monitor patients to remain concordant with treatment plans | 6 | 46 | 10 | 59 | 6 | 38 | 22 | 48 | 0.556 |
| Analyze patient EMR data to guide health management between visits | 9 | 69 | 15 | 88 | 12 | 75 | 36 | 78 | 0.662 |
| Would trust AI in my medical practice | | | | | | | | | |
| Probably not | 6 | 46 | 5 | 29 | 9 | 56 | 20 | 43 | |
| Probably yes | 5 | 38 | 12 | 71 | 7 | 44 | 24 | 52 | 0.244 |
| No response | 2 | 15 | 0 | 0 | 0 | 0 | 2 | 4 | |
| Concerns about trusting AI in my medical practice | | | | | | | | | |
| Fear of AI taking over my job | 2 | 15 | 4 | 24 | 0 | 0 | 6 | 13 | 0.134 |
| Fear of the unknown | 4 | 31 | 3 | 18 | 3 | 19 | 10 | 22 | 0.652 |
| Lack of human connection | 8 | 62 | 6 | 35 | 8 | 50 | 22 | 48 | 0.362 |
| Lack of understanding | 6 | 46 | 4 | 24 | 5 | 31 | 15 | 33 | 0.428 |

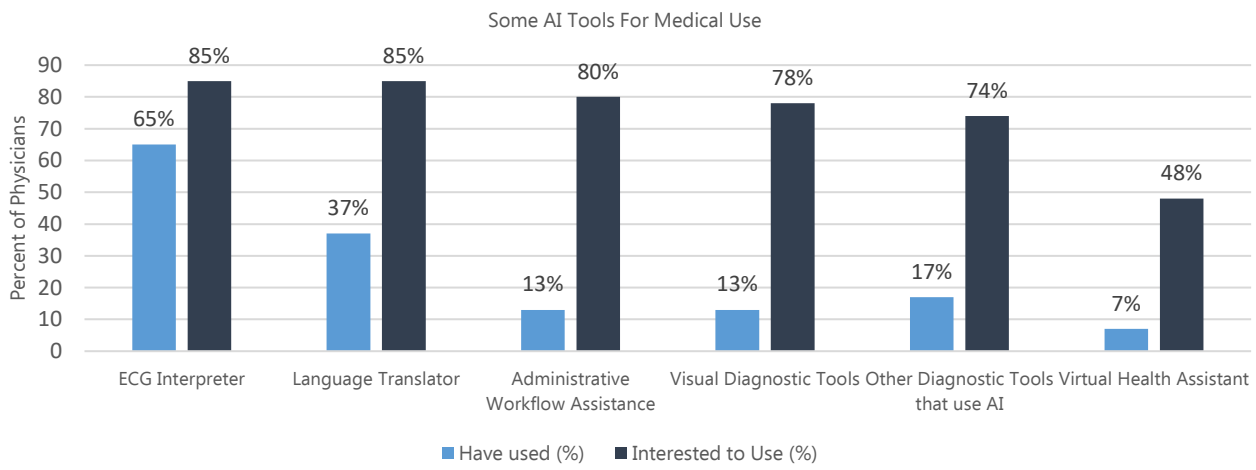
**Legend:** T* p-value based on Kruskal-Wallis test. he prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

***Figure 1.*** Knowledge of physicians about Artificial Intelligence.




***Legend***: Awareness and previous personal knowledge of artificial intelligence among survey participants. Q1: Deep learning involves the use of artificial neural networks; Q2: Deep learning is a subset of machine learning; Q3: Deep learning algorithms can process unstructured data to make predictions; Q4: Machine learning allows computer systems to learn without direct instruction; Q5: AI system are trained using existing data to do an automated predictive task; Q6: AI is an interdisciplinary field that allows computers to mimic human intelligence; Q7: Machine learning is a branch of AI.

***Figure 2.*** Physicians' Interest in Artificially Intelligent Tools for Medical Use.




***Legend:*** Use and interest of artificially intelligent tools among survey participants. From a non-exhaustive list of Artificial Intelligence's uses in medicine, the survey question asks, "have you personally used any of the tools listed?" From a non-exhaustive list of Artificial Intelligence's uses in medicine and assuming appropriate training was given, the survey question asks, "would you use the tools listed if they were available at your workplace or place of practice?"

Physicians' fears regarding AI use in medicine were centred around the lack of human connection, lack of understanding, and fear of the unknown, with fear of lack of human connection being the largest concern overall (48%) ***(Table 2).*** Lack of human connection has always been a fear regarding the use of AI in healthcare.[5] This fear often arises because providers are not aware of where and how AI can fit into their workflow. For instance, some of the tools that were presented in the study such as the ECG interpreter or administrative workflow assistance would not affect the doctor-patient appointment and would rather optimize tasks that must happen before the patient even arrives, potentially freeing up physicians to spend more time with patients.

Other concerns included reliability, where physicians feared the possibility of misdiagnoses and unawareness of internal algorithms and functions. These findings are similar to concerns brought up by other Canadian and English healthcare professionals.[6,7] AI becomes especially problematic when physicians become overly dependent on AI and could miss out on wrongful outputs, simply because of automation bias.[8] These concerns underscore the importance of ensuring transparency in AI design and physician education around the limitations of AI.

These issues lead to key legal questions that arise when challenged by potential medical malpractice as a result of technology, which our current legal systems fall short of and focus on legal principles that are concentrated on human behaviour, which fail to function when applied to AI.[6,9] A potential policy recommendation is to consider AI as an independent person under the law. This means that the AI system can be sued for any acts of negligence and as such will be required to be

insured. The insurance provided will be similar to how physicians can engage in medical malpractice, and claims will be paid directly from their insurance. A major benefit of this policy is that it focuses beyond the manufacturer of AI and urges users to be liable for their decision of using this technology in their facility. However, it is important to consider that it is currently unclear whether AI technologies can be trialled independently.[9]

Aspects of fear and lack of awareness can stem from insufficient exposure to AI during and after training, which can be tackled through a variety of different means.[13,14] Firstly, the introduction of career development courses, offered through conferences, for instance, can provide exposure and a learning opportunity to physicians about modern technology that can help their workflow. These workshops can be led by teams of developers and physicians who are well-acquainted with the tools. The goals of these workshops would be to train physicians on how to use AI tools, how to input information for optimized results and efficiency, and thoroughly learn the benefits and risks associated with AI. These training sessions could educate physicians on how the algorithms function to reduce physician anxiety, establish trust in AI, and reduce patient harm.

Furthermore, the introduction of an AI education block or incorporated teaching through medical school or the family medicine residency program is another potential solution. A report by the College of Family Physicians of Canada proposed an extension of the length of family medicine residency training to three years to enhance their medical education to better meet the needs of the population.[15] This extra year may provide an opportunity to integrate some AI training into the program without reducing clinical hours to better prepare new graduates. Additionally, there is also an ongoing discussion on implementing Digital health literacy competencies into the CanMEDS Framework.[16] These system-level curriculum changes may help normalize AI literacy early in physician training. As the revolution of AI in medicine continues, there will be multiple conversations on how to implement AI into the medical school curriculum.[18] These will be important implementations to consider as AI continues to become more integrated into society.

**Limitations**

While the survey results provide insight into the perceptions of primary care physicians on AI and its use in healthcare, there are limitations to the study. The study only received 79 physician responses, out of which only 46 responses were analyzable, resulting in a small sample size. All respondents were working in primary care, with a majority working in private practices (78%, n=36). This may limit the generalizability of the study's findings to the larger population of physicians, especially those working in other settings, such as community health centers or academic medical centers. Rural physicians made up only 37% (n=17) of the respondents further limiting the study's generalizability.

The analyzable response rate of 58% indicates that a significant proportion of the physicians who received the survey did not respond or did not complete it fully. Also, since this survey was a voluntary survey shared through email, it may have drawn the interest of physicians who already have some interest in AI. This raises questions about the representativeness of the sample. Furthermore, the survey relied on self-reported data, which may be subject to recall bias or social desirability bias. For example, physicians may have overreported their knowledge of AI or may not have accurately recalled their training and work environments. Moreover, the study did not collect data on the race or ethnicity of the participants, which could be important factors in shaping their perspectives on AI in medicine. Therefore, the study's findings should be interpreted with caution and further research is needed to better understand the role of AI in primary practice.

**Conclusion**

Overall, these results suggest that there is a lack of knowledge and use of AI tools in medicine, with both urban and rural physicians' responses suggesting a need for more education and training in AI. There is a high level of interest in using AI to assist with administrative and clerical tasks, moderate interest in using AI to assist with diagnosis and low interest in using AI to independently diagnose or develop treatment plans. Gender-based differences in AI trust were observed, with male physicians less likely than female physicians to trust AI to function independently; these findings remain exploratory and warrant further research.

Given the strong interest expressed by respondents, we suggest the development of structured continuing professional development modules on AI, particularly those tailored to the needs of primary care physicians. These could include hands-on sessions focused on interpreting AI outputs, understanding risks and limitations, and aligning tools with existing workflows.

The data showed broad interest in AI and readiness to use AI among PCPs across a wide variety of demographic variables including gender, rural/urban, age and experience. It is unclear whether there are differences between urban and rural physicians. However, with AI in medicine being advertised as providing tailored solutions, it is important to consider the differences between urban and rural practices. Further research should focus on developing and implementing AI education and training programs for physicians, taking into account the perspectives of these key stakeholders. AI technology has the potential to benefit practice broadly but may have the most to offer in resource limited settings like in the rural environment. Integration of new technology in medical practice has typically started in well-resourced settings and moved outwards towards more resource limited settings such as rural environments. This data set, showing similar interest, experience and readiness between urban and rural settings suggests that it may be possible to integrate and study AI technology in rural environments at an early phase.

This survey's findings may inform future research into the development and implementation of AI in primary care. This includes identifying potential areas where AI can improve primary care delivery, as well as identifying potential barriers to the adoption of AI in primary care. The results of this survey can

inform the development of interventions to increase PCPs' awareness and understanding of AI and to support the integration of AI in primary care practice. As well, the survey results provide valuable information for policymakers, healthcare administrators, and researchers interested in understanding the current state of PCPs' knowledge and attitudes toward AI, and how it may be used to improve the delivery of primary care services.

This project began bridging the gap between PCPs and those at the forefront of AI development to highlight any shortcomings in the primary care healthcare system. Perspectives and ideas gathered from PCPs can help guide future AI applications to be more useful and relevant. Greater collaboration between clinicians, educators, and technologists will be critical to ensure that AI innovations are responsive to real-world clinical needs.

## Summary – Accelerating Translation

**Title:** Awareness and Perspectives on the Role of Artificial Intelligence in Primary Care: A Cross-Sectional Survey of Rural and Urban Primary Care Physicians in Alberta, Canada

**Main Problem to Solve**

Artificial intelligence (AI) is changing healthcare in many ways, from helping with appointment scheduling and paperwork to supporting doctors in making diagnoses. Despite its growing use, we don't know much about how primary care physicians—especially those in rural versus urban areas—feel about AI or how familiar they are with it. Understanding their awareness and opinions is essential to successfully introducing AI into everyday medical practice.

**Aim of the Study**

This study aimed to understand how primary care physicians across Alberta, Canada—both in rural and urban settings—perceive and understand artificial intelligence. Specifically, the study looked at their knowledge of AI, how they've used it, how comfortable they feel using it, and what kinds of AI tools they'd be willing to use in the future.

**Methodology**

Researchers conducted a survey with family physicians and family medicine residents in Alberta. The survey was shared through professional newsletters, direct emails, and physician networks connected to the University of Calgary and the University of Alberta. It asked questions about physicians' background, familiarity with AI, and their opinions on different AI tools and applications in healthcare. A total of 79 responses were received, and 46 met the criteria to be included in the analysis.

**Results:**

Physicians of various ages and experience levels responded. Most (63%) were from urban areas, while 37% were from rural areas. About two-thirds (65%) had no previous training in AI. Interestingly, rural physicians reported feeling more comfortable using AI in specific tasks, such as monitoring treatment adherence and analyzing electronic medical records.

While most physicians had not used many AI tools, the tools they were most familiar with were ECG (heart monitor) interpreters and language translators. Even with limited experience, there was high interest in using AI for tasks like organizing workflow (80%) and visual diagnostic tools (78%).

When asked about their knowledge of AI, most physicians had a basic understanding, but many were unfamiliar with more technical aspects like machine learning and deep learning.

The survey also revealed some gender-based differences. Male physicians were generally more trusting of AI, especially in supporting diagnosis, while female physicians showed more interest in using AI for translation services. However, regardless of gender, few physicians trusted AI to make decisions independently, such as diagnosing patients or creating treatment plans.

**Conclusion**

This study shows that while many primary care physicians in Alberta are interested in using AI, most lack formal training and are unfamiliar with the technology, particularly its more advanced forms. Rural physicians were slightly more open to using AI than urban physicians, suggesting that AI might offer special value in settings with limited resources.

Doctors' biggest concern was that AI might harm the human connection between patients and physicians. They also worried about not fully understanding how AI tools work, and whether the tools could be trusted to make accurate decisions.

To help doctors feel more confident and better prepared to use AI, the study recommends creating targeted training programs. These could include hands-on workshops or continuing professional development (CPD) modules that show physicians how AI tools function and how they can fit into day-to-day practice. In the long term, introducing AI-related topics in medical school and residency could also help future doctors become more comfortable with these technologies.

Ultimately, this research is an important first step in making sure AI is introduced into primary care in a way that supports both doctors and patients. It encourages healthcare leaders, educators, and developers to work together with physicians to create tools that are trustworthy, easy to use, and tailored to the real needs of primary care settings.

## References

1. Johnson KW, Torres SJ, Glicksberg BS, Shameer K, Miotto R, Ali M, et al. Artificial Intelligence in Cardiology. J Am Coll Cardiol. 2018 Jun 12;71(23):2668–79.
2. Tang A, Tam R, Cadrin-Chênevert A, Guest W, Chong J, Barfett J, et al. Canadian Association of Radiologists White Paper on Artificial Intelligence in Radiology. Can Assoc Radiol J. 2018 May 1;69(2):120–35.
3. Avati A, Jung K, Harman S, Downing L, Ng A, Shah NH. Improving palliative care with deep learning. BMC Med Inform Decis Mak. 2018 Dec 12;18(Suppl 4):122.
4. Schwab K, Nguyen D, Ungab G, Feld G, Maisel AS, Than M, et al. Artificial intelligence MacHIne learning for the detection and treatment of atrial fibrillation guidelines in the emergency department setting (AIM HIGHER): Assessing a machine learning clinical decision support tool to detect and treat non-valvular atrial fibrillation in the emergency department. J Am Coll Emerg Physicians Open. 2021 Aug;2(4):e12534.

5. Kassam A, Kassam N. Artificial intelligence in healthcare: A Canadian context. Healthc Manage Forum. 2020 Jan 1;33(1):5–9.
6. Waymel Q, Badr S, Demondion X, Cotten A, Jacques T. Impact of the rise of artificial intelligence in radiology: What do radiologists think? Diagn Interv Imaging. 2019 Jun 1;100(6):327–36.
7. Kueper JK, Terry AL, Zwarenstein M, Lizotte DJ. Artificial Intelligence and Primary Care Research: A Scoping Review. Ann Fam Med. 2020 May;18(3):250–8.
8. Lin S. A Clinician's Guide to Artificial Intelligence (AI): Why and How Primary Care Should Lead the Health Care AI Revolution. J Am Board Fam Med. 2022 Jan 1;35(1):175–84.
9. Amisha null, Malik P, Pathania M, Rathaur VK. Overview of artificial intelligence in medicine. J Fam Med Prim Care. 2019 Jul;8(7):2328–31.
10. Fenton JJ, Taplin SH, Carney PA, Abraham L, Sickles EA, D'Orsi C, et al. Influence of computer-aided detection on performance of screening mammography. N Engl J Med. 2007 Apr 5;356(14):1399–409.
11. London S. DXplain: a Web-based diagnostic decision support system for medical students. Med Ref Serv Q. 1998;17(2):17–28.
12. Kahn MG, Steib SA, Fraser VJ, Dunagan WC. An expert system for culture-based infection control surveillance. Proc Symp Comput Appl Med Care. 1993;171–5.
13. Stewart M, Ryan B. Ecology of health care in Canada. Can Fam Physician. 2015 May;61(5):449–53.
14. Liyanage H, Liaw ST, Jonnagaddala J, Schreiber R, Kuziemsky C, Terry AL, et al. Artificial Intelligence in Primary Health Care: Perceptions, Issues, and Challenges. Yearb Med Inform. 2019 Aug;28(1):41–6.
15. Hogg HDJ, Al-Zubaidy M, Technology Enhanced Macular Services Study Reference Group, Talks J, Denniston AK, Kelly CJ, et al. Stakeholder Perspectives of Clinical Artificial Intelligence Implementation: Systematic Review of Qualitative Evidence. J Med Internet Res. 2023 Jan 10;25:e39742.
16. Santomartino SM, Yi PH. Systematic Review of Radiologist and Medical Student Attitudes on the Role and Impact of AI in Radiology. Acad Radiol. 2022 Jan 29;S1076-6332(21)00624-3.
17. Artificial intelligence (AI) and emerging digital technologies :: The Royal College of Physicians and Surgeons of Canada [Internet]. [cited 2023 Mar 11]. Available from: https://www.royalcollege.ca/rcsite/health-policy/initiatives/ai-task-force-e
18. Teng M, Singla R, Yau O, Lamoureux D, Gupta A, Hu Z, et al. Health Care Students' Perspectives on Artificial Intelligence: Countrywide Survey in Canada. JMIR Med Educ. 2022 Jan 31;8(1):e33390.
19. Number of Physicians by Specialty Within Alberta Health Services Geographic Zones - Open Government [Internet]. [cited 2023 Jul 10]. Available from: https://open.alberta.ca/opendata/number-of-physicians-by-specialty-within-alberta-health-services-geographic-zones
20. Kirby JB, Yabroff KR. Rural–Urban Differences in Access to Primary Care: Beyond the Usual Source of Care Provider. Am J Prev Med. 2020 Jan 1;58(1):89–96.
21. Butzner M, Cuffee Y. Telehealth Interventions and Outcomes Across Rural Communities in the United States: Narrative Review. J Med Internet Res. 2021 Aug 26;23(8):e29575.
22. Buyting R, Melville S, Chatur H, White CW, Légaré JF, Lutchmedial S, et al. Virtual Care With Digital Technologies for Rural Canadians Living With Cardiovascular Disease. CJC Open. 2022 Feb 1;4(2):133–47.
23. Wong TY, Sabanayagam C. Strategies to Tackle the Global Burden of Diabetic Retinopathy: From Epidemiology to Artificial Intelligence. Ophthalmologica. 2019 Aug 13;243(1):9–20.
24. He J, Baxter SL, Xu J, Xu J, Zhou X, Zhang K. The practical implementation of artificial intelligence technologies in medicine. Nat Med. 2019 Jan;25(1):30–6.

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**Conflict of Interest Statement & Funding**

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. This study was supported by DLRI Rapid Rural Health Research Competition.

**Author Contributions**

All authors conceptualized and designed the study, collected the data, conducted the analyses, and drafted and revised the initial manuscript. All authors contributed to the article and approved the submitted version.

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Original Article

# Experiences of Medical Students with Dyslexia in a Post-COVID-19 Curriculum

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## Abstract

**Background:** Dyslexia in medical school is a common condition. With the COVID-19 pandemic, the medical school curriculum has changed. This might lead to differing experiences faced by dyslexic medical students compared to previous literature. **AIM:** This paper explores the experiences of medical students with dyslexia post-COVID-19, specifically on study methods, support, and attitudes towards their diagnosis. **Methods:** A qualitative study involving online interviews of five medical students with a formal dyslexia diagnosis was done. Data was collected over two months, from February to March 2023. Transcripts were analysed using an iterative constant comparative approach, forming themes on the experiences of these medical students. **Results:** Participants experienced a general need to work harder than their peers in certain areas of medical school, especially about traditional learning methods. However, participants highlighted strengths in visual and kinaesthetic learning. They viewed dyslexia as an advantage in areas such as pattern recognition and creative problem-solving, emphasising the concept of neurodiversity. COVID-19 delayed diagnosis and support services but fostered flexible, asynchronous learning that participants found beneficial. While participants valued support such as extra time, they highlighted the need for more inclusive teaching methods. They were more open to disclosure of dyslexia but expressed stigma still exists. **Conclusion:** This study examined the experiences of dyslexic medical students in the UK, uncovering their unique challenges and strengths. While COVID-19 prompted beneficial changes, stigma remains a barrier. We advocate for greater dyslexia awareness, rethinking curriculum design to improve accessibility, and embracing innovative teaching methods to support diverse learners.

## Introduction

The term 'dyslexia' was coined in 1887 by Rudolph Berlin, a German ophthalmologist.1 Since then, the definition of dyslexia has been debated extensively. Dyslexia has traditionally been associated with disability and disadvantage.[2,3] The conventional perception of dyslexia characterises it as a condition marked by reading, spelling, and writing challenges, without affecting one's intelligence.[2,4,5] Further reports show that dyslexia also encompasses difficulties in retaining information, sequencing tasks, organising workload, verbal expression, and emotional factors such as self-esteem and anxiety.[4,6]

However, dyslexia is also linked to positive traits such as design, problem-solving, creative, interactive, and oral skills.[6,7] Individuals with dyslexia have also rejected the negative connotations associated with dyslexia, embracing more positive constructions and integrated aspects of their identity. [2,8,9] This shift has contributed to more people viewing dyslexia through a neurodivergent lens rather than solely as a medical disorder.[10]

In the context of medical education, completing a medical degree requires both academic and clinical practice. This requires a high level of commitment and dedication.[4] This has led dyslexic medical students to have their unique perspectives, strengths and weaknesses.

Medical students with dyslexia often take longer to complete written work and struggle to process information quickly, hindering their performance in lectures and assessments.[4,11] Moreover, dyslexia poses challenges in single-best answer (SBA) and multiple choice question (MCQ) examinations due to the need to process significant amounts of information quickly, straining working memory, and in written exams due to poor handwriting.[4,12] Stigma and reluctance to disclose a dyslexia diagnosis are significant issues. Romberg et al. identified stigma from clinical colleagues as a barrier, and Shaw and Anderson found that dyslexic students face bullying, stigma, and a lack of support.[11,13]

To manage this, dyslexic medical students employ innovative study strategies, including visually appealing materials, varied learning styles, and technology like screen readers.[4] Additionally, providing support, such as extra time during examinations, has proven crucial in enabling dyslexic medical students to perform on par with their peers.[14] Apart from study skills and extra time, United Kingdom (UK) universities do offer dyslexia support

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services and peer support societies, which include one-to-one pastoral care and general organisation for students with dyslexia. These have shown marked improvements in the psychological well-being of people with dyslexia.[15]

Similar issues exist in the nursing profession, where dyslexic student nurses report stigma and the need for additional time in clinical activities.16 Correspondingly, Ridley identified similar issues and underscored the significance of early dyslexia diagnosis in facilitating the learning process for student nurses.17 In navigating their professional roles, dyslexic nurses have adopted various strategies, utilising technology, using visually distinctive aids, building support networks, and setting aside quiet time for documentation.[16,18,19]

The impact of COVID-19 on dyslexic students includes positive outcomes, such as enhanced autonomy during remote learning, and negative ones, such as reduced clinical exposure and concerns about academic rankings.[20] Common themes emerge across healthcare fields, including anxiety about dyslexia disclosure, task difficulties, and coping methods.

**The need for more research**

The landscape of medical education has undergone substantial changes due to the impact of COVID-19, affecting all students, including those with dyslexia.[20,21] These changes have led to diverse experiences and challenges in their academic lives.

Given the evolving nature of medical education post-COVID-19, this study explores the lived experiences of dyslexic medical students, focusing on their study methods, access to support, and attitudes toward their diagnosis. Unlike previous research, this study gathers data during a period when students had resumed in-person classes and placements, navigating transitions influenced by the pandemic. By identifying effective support mechanisms and advocating for inclusive educational practices, this research aims to inform the development of evidence-based policies and resources that enhance learning outcomes and professional success for dyslexic students. Ultimately, these findings aspire to foster greater diversity and inclusivity in medical education, contributing to a healthcare workforce better equipped to address diverse patient needs.

This study will adopt the British Dyslexia Association's definition of dyslexia alongside the neurodiversity perspective as the conceptual framework.[6,10] By applying the neurodiversity paradigm, we aim to investigate both the unique strengths and challenges faced by dyslexic students during this transformative period.

## Methods

The study is a single-centred qualitative study in the United Kingdom (UK) involving a thematic analysis of medical students' experiences with dyslexia in medical school through an interpretivism lens. Five students were interviewed, and their responses were analysed thematically.

**Data Collection**

The qualitative study involved interviews with dyslexic medical students, adopting a semi-structured format to facilitate in-depth exploration.[22] Interviews were carried out from February to March 2023 via Microsoft Teams, recorded and initially transcribed using Teams software, then manually transcribed verbatim.

The primary investigator, DT, conducted interviews. Before the interviews, participants were informed of the interviewer's status as a dyslexic medical student, which empathic understanding and encouraged open sharing of experience.[20]

- Interviews were conducted in a loosely structured fashion, with initial topic guides being iteratively using DT's insider experiences. An iterative approach based on Srivastava and Hopwood's framework guided subsequent interviews.[23] Transcripts were preliminarily coded, with insights from initial interviews shaping topic guides, questions, and probes for subsequent interviews, continuing until the final interview. Topic guide explored experiences about: Thoughts towards diagnosis of dyslexia, experience in medical school, Study Methods, and the impact of COVID-19.

**Inclusion/ Exclusion Criteria**

Participants had to meet all the following inclusion criteria to be eligible:

- Were medical students with a formal diagnosis of dyslexia
- Be in years 1–5 of their medical degree in preclinical and clinical years. These included students intercalating at the medical school, given they had studied at the medical school leading up to their intercalation.

**Ethical Approval**

This study was granted full ethical approval by the medical school in which the study was conducted. Approval Ref. IPREC221207.TAN

**Recruitment**

Recruitment was done from February 1 to March 31, 2023, through posters plastered on the bulletin boards and the university library. An electronic copy of the posters was also disseminated to the different year group chats on WhatsApp. These posters included study information and QR codes linked to an expression of interest form, collecting essential details like name, contact information, and year of study to allow the researcher to facilitate interviews.

Additionally, snowball sampling encouraged interviewed students to recruit acquaintances with dyslexia. The recruitment process is outlined in ***Figure 1.***

All interviewees received information sheets and consent forms before the interviews. Before conducting the interviews, they

were asked to confirm their willingness to participate. They were advised that they could withdraw consent within 28 days of the interview, and their data would be removed from the study.

### Analysis And Synthesis of Evidence

Interview data were transcribed by DT using Microsoft Teams before being manually transcribed verbatim.

The data was then analysed using the thematic analysis framework approach as described by Braun and Clarke.[24] Analysis was influenced by the Iterative Comparative Approach by Srivastava and Hopwood.[23] The first interview transcript was read multiple times, and initial ideas were noted. Relevant codes relating to the study aim were identified and labelled with a descriptive code. Codes were then grouped into themes. Reflection of these themes on the research question was done, and the principal investigator used these reflections to alter the topic guides and questions for the following interview. This process was repeated for all interviews. After all the interviews were completed, a final round of thematic analysis was done. The project supervisor, MHB, reviewed the data and the analysis and checked and challenged them to ensure the findings were substantiated.

Coding was first performed using the NVivo software, which helped organise the preliminary ideas and codes. The codes were later reorganised manually into a Word document, where analysis was done in point form before being translated to the main manuscript.

The analysis was inductive and iterative, with themes evolving from the data. Selective extracts served as evidence for the study's findings. All identifiable information from the final report was redacted.

## Results

A total of five medical students were interviewed. ***Table 1*** shows background information of the participants relating to their diagnosis of dyslexia and their duration in medical school at the time of diagnosis. An overview of themes and subthemes is presented in ***Table 2.***

### A different approach to studying

### Coping with traditional learning

Participants mentioned some difficulty in reading, processing and memorising that they might have compared to their peers. This has led to some of them feeling not only a sense of fear and inferiority but also working even harder than their peers to stay on par with them.

> P2: 'I just feel like I'm not as good as the people around me.'

> P3: 'But also like just like workload with medicine, just like talking about how it felt like it takes me longer to learn'.

Due to difficulties faced with traditional learning, students mentioned finding other ways to circumvent lengthy texts and notes. The methods used included using other sensory styles, such as auditory or visual.

> P5: 'I try to summarise the essential points and apply those by watching videos on YouTube.'

> P1: 'What I do is a lot of reciting verbally.'

> P5: 'I make colourful notes onto like a mind map'.

***Table 1.*** Background of Participants.

| Interviewee Identified | Current Year | Years In Medical School | Duration Since Diagnosis | Diagnosed in Medical School? Y/N |
|---|---|---|---|---|
| P1 | 2 | 2 | >10 Years | N |
| P2 | 4 | 4 | 2 months | Y |
| P3 | Intercalating | 4 | 1 Year | Y |
| P4 | 1 | 2 | 1 Year | Y |
| P5 | 5 | 5 | 4 Years | Y |

***Table 2.*** Themes and Subthemes.

| Themes | Subthemes |
|---|---|
| A different approach in studying | Coping with traditional learning |
| | From disability to neurodiversity |
| Attitude towards dyslexia | Sense of achievement |
| | Labels and disclosure |
| Impact of COVID-19 | Delayed diagnosis and support |
| | Improved work environment |
| | Support |

### From Disability to Neurodiversity

While students take more time to learn, some feel more empowered in medicine's visual and kinaesthetic aspects. One example cited was spotter exams, an assessment that requires students to interpret visual artefacts about anatomy, histology and pathology. Students noted that they found themselves better visual learners and felt advantageous in these aspects.

Others felt more confident during clinical settings, particularly during Objective Structured Clinical Examinations (OSCEs) and clinical placements than traditional learning.

> P2: 'I feel confident in clinical settings... If I'm feeling insecure, it's usually while I'm learning content, but not so much in clinical or OSCE settings.'

> P3: 'I'm quite good at pattern recognition stuff. I like pictures, diagrams and coming up with a diagnosis.'

> P4:'(Dyslexia is) a bit of an advantage with histology, spotter and anatomy'.

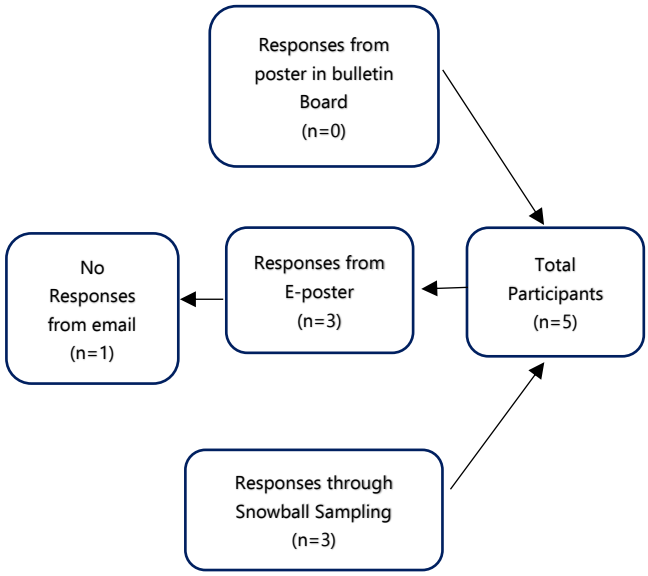
In addition, two students, P3 and P4, explored the concept of neurodiversity. Both held an optimistic view that having doctors

with dyslexia could add value to the medical field due to the unique strengths and way of thinking dyslexic students have.

> P3: 'dyslexia enables one to think about different solutions. I think it's a good thing with medicine because it's ever-changing as a field, and you want people who think differently'

> P4: 'I really prefer linking dyslexia with someone who is neurodiverse because if there is one area that you struggle with, there is (another) area that you are better at'.

***Figure 1.*** Recruitment Process.




## Attitude Towards Dyslexia

### Sense of Achievement

Some participants diagnosed in medical school found their diagnosis upsetting, mentioning it to be a flaw due to their initial perceptions of dyslexia as a disability. Others discovered their diagnosis as a gateway for academic support, such as extra time. The initial negative feelings mentioned were generally short-lasting. Some of the interviewees mentioned a sense of accomplishment with the diagnosis, feeling like they managed to achieve much despite having dyslexia.

> P4: '...At the time, I thought oh my gosh, I can't be perfect. There's something wrong with me... However, after processing this ordeal... I got this far through life, so it's something I am proud of.'

> P1: 'When you accomplish something, you could say, 'I've done this, and it's more difficult for other people to do.''

> P2: 'I was quite upset at first... But at the same time, I was quite proud that I've managed to come so far without the diagnosis and the extra time.'

### Labels and Disclosure

Some of the students believed society had a stigma towards dyslexia. Different interviewees mentioned multiple instances of the word 'label' regarding dyslexia. While some participants understood the 'advantages' of dyslexia, they felt that society distinguished dyslexia by only its negatives.

> P5: 'I didn't apply for (extra time) in the first year... because of the stigma.'

However, there was more openness to disclosing dyslexia. Interviewees were generally comfortable disclosing their diagnosis in the UK if they needed support in a clinical setting. While there might be some initial hesitance, they mentioned not feeling animosity or heavy judgment from peers and supervisors.

> P3: 'If I needed more support, then definitely, but If I were okay, then I wouldn't say anything.'

> P4 also mentioned how it is important to educate medical students and staff about dyslexia, remove such stigma, and get others to understand that there are advantages to this condition.

## Impact of COVID-19

### Delayed Diagnosis and Support

One detriment of COVID-19 was the delayed diagnosis and support for students with dyslexia. This was due to delays in or suspension of certain University services during the pandemic.

> P2: 'I was going to get screened in my first year.... when I came back after COVID, I had just forgotten about it.'

> P3: 'I think definitely (diagnosed) earlier. I think I would have struggled with my end of years in first year and then would have been asked to do it anyway generally.'

In addition, P5 mentioned the delay in using support such as the University dyslexia services during COVID-19.

> P5: 'I only used the benefits of having a (dyslexia service) tutor from the next year onwards.'

### Improved Work Environment

Students generally found the post-COVID-19 environment to be conducive to their learning. There was unanimous mention of increased asynchronous learning through pre-recorded lectures, leading to increased flexibility in their education.

> P3: 'Lectures were all pre-recorded, so I could go at my own pace. I had like a good amount of time to catch up on first-year stuff.'

Synchronous learning, such as online tutorials, also tapped into polling software and quizzes, where the anonymity of these platforms enabled dyslexic students to participate more proactively in lectures, reducing the fear of judgement.

P1: also mentioned that COVID-19 catalysed different innovative approaches to teaching. This may help dyslexic students tap into new learning strategies apart from traditional methods.

P2: Some tutorials used Mentimeter… there is more time to think of an answer and I will not be judged for the wrong answer.

P5: 'COVID-19 sure has increased our use of technology… Students with dyslexia can try new things like VR or AI in the future.'

### Support

Without support, participants still feel disadvantaged compared to their peers. However, there was a general consensus that they could perform on par with others with the appropriate support. Such support included extra time and guided facilitation by professional staff from the school's dyslexia and disability service. However, there were still mentions that more could be done. One example included improving teaching resources to make it more dyslexia friendly.

P2: '…certain measures can be put into place to keep you at the same level as everyone else.'

P4: 'I feel like certain lecturers could change their teaching styles or change their slides to make them a lot more dyslexia friendly, like using diagrams, using a lot more pictures… not making slides overly wordy.'

## Discussion

This study explores the unique difficulties and strengths experienced by dyslexic medical students. Dyslexic students spend more time on learning tasks, finding traditional methods less effective. However, they exhibit notable strengths in clinical settings, leveraging hands-on experiences and inherent skills. The study also highlights various adaptive strategies, including technology and visual aids, facilitating their learning. The impact of COVID-19 and the shift to e-learning has further influenced their study habits, revealing both challenges and benefits. Additionally, the importance of tailored support and increased awareness within medical schools is underscored, advocating for a neurodiversity approach to dyslexia.[3,8,9]

### Difficulties and Srengths Associated with Dyslexia in Medical School

The study's outcomes are consistent with previous research, affirming that dyslexic medical students require more time learning and doing tasks than their peers,[4,16] and acknowledging the necessity of dedicating more time to study activities, particularly reading, writing, and information processing. This finding echoes Shaw's study that traditional methods, including in-person lectures and traditional textbooks, are found ineffective by dyslexic medical school students.[20]

The study revealed that dyslexic medical students exhibited strength and comfort in clinical placements, mentioning communication skills as a strength. Musto's study touched on how dyslexic doctors viewed empathy and communication as strengths in clinical settings.[4] However, prior research mentioned difficulties in healthcare professionals with dyslexia, which participants did not bring up, such as difficulty in organisation, extensive reading, and time management.[4,16] A potential explanation could be that participants, being students, were shielded from time-pressured clinical responsibilities that working doctors and nurses experience, potentially contributing to the lack of observed difficulties. Therefore, while clinical settings might benefit students in terms of hands-on learning and communication with patients and colleagues, there might be difficulties when they have to do many tasks quickly.

Specific assessments, such as visual-based evaluations like the spotter exam, emerged as areas where dyslexic students felt advantaged, aligning with their inherent strengths. Notably, the performance of one interviewee in the abstract reasoning section of the UKCAT exam (a national medical school entrance exam) illustrates how dyslexic advantages such as global abstract reasoning and spatial skills, dynamic reasoning, and inventiveness can play a role.[25]

### Study Strategies

The findings showed diverse strategies adopted by dyslexic medical students to address their academic challenges. Participants gravitated toward summarised note-taking, incorporation of diagrams, and recitation, approaches corroborated by prior research.[16,18,26] Surprisingly, despite the controversy surrounding the efficacy of coloured overlays and papers, participants opted for colourful notes enhanced with drawings and coloured pens to foster a visually engaging learning experience.[27] This aligns with the principle of employing colour to enhance engagement and organisation. [28,20]

The study also emphasised the uses of technology in aiding dyslexic medical students. Participants employed various technological tools to supplement traditional learning methods, echoing the coping strategies noted by Musto, and Shaw and Anderson.[4,20] Locke et al. also highlight technology's significance in supporting dyslexic healthcare professionals through spell-checkers, colour-coded indexes, and calculation aids.[18]

### COVID-19 and E-learning

Generally, the students in this study enjoyed the asynchronous aspect of learning during COVID-19, allowing them to go at their own pace. This corroborates with the findings of Shaw and Anderson, emphasising the potential benefits of transitioning to technology-driven and remote learning, particularly pertinent during the COVID-19 pandemic.[20] Our participants reported reduced stress and appreciated the advantage of personalised pacing in remote learning settings. On the other hand, ' Zawadka et al. highlighted increased stress due to the novelty of online learning at the early pandemic stages.[21] Therefore, while COVID-19 may have been difficult for dyslexic students to adapt initially, they ultimately benefited from its flexibility.

In addition to flexibility, COVID-19 may have extended the learning modalities in medical education. COVID-19 has led to using new distant learning modalities, such as extended reality technology, e-learning tools, and simulation facilities.[30] This has improved blended learning in medical schools, where online learning materials are combined with traditional place-based classroom teaching. With blended teaching being supported for continuation in the post-COVID-19 period, medical students with dyslexia can enjoy a more extensive plethora of learning modalities that venture out of traditional teaching frameworks.[31]

One detriment of COVID-19 was the lack of support for dyslexic students initially. Participants in the study had delays in diagnosis and support at the start of the pandemic. Similarly, medical education experienced postponement of clinical rotation and medical exams during the pandemic.[31] Shaw et al. mention dyslexic medical students having feelings of anxiety at the start of the pandemic, especially when medical schools were transitioning towards distanced learning.[20] Therefore, while the pandemic was largely positive for dyslexic medical students, there may be struggles in the early stages of the pandemic.

### Support and Education

The interviews made it clear that while participants believed they could perform as well as their peers with adequate support, more could be done. However, they felt that most of the support currently given to them was mainly through extra time. Shaw et al.'s research highlights dyslexic students perform comparably with extended time.[14] However, the study emphasises addressing the extra study efforts dyslexic students invest in and creating dyslexia-friendly resources. Using high-contrast colours, clear backgrounds, non-italics, and bolding could enhance support.[32] Additionally, considering essay deadline extensions could alleviate dyslexic medical students' stress.

Interestingly, regarding labels and disclosure, this study found that students exhibit more willingness to disclose dyslexia compared to prior research.[11,12] Echoing Morris and Turnbull, students concur on seeking help when needed.16 However, an overarching observation is the prevailing lack of awareness about dyslexia in medical schools. Findings from this work also support Macdonald's findings, highlighting public misconceptions and Hennesy et al.'s finding of varying knowledge about dyslexia among non-dyslexic medical students.[2,33] As such, there is a benefit in educating medical faculty members and medical students on dyslexia to improve inclusivity and stigma.

The study showcases dyslexia's positive facets, including enhanced creativity and lateral thinking.6 Encouraging the 'neurodiversity' concept over framing dyslexia as a 'disability,' as Lambert and Harriss discuss, could reshape perceptions.34 This shift underscores unique strengths and challenges tied to dyslexia, countering a purely negative view. Ultimately, this shift could lead to a more favourable stance toward dyslexic medical professionals.

### Strengths and Limitations of Study

In this study, we aim to qualitatively explore the experiences of dyslexic medical students in medical school. One limitation was the number of participants in the study. We interviewed a total of five medical students. In addition, snowball sampling was used to obtain participants for the study. These factors may impact the generalizability of the study. This was primarily due to the short window given for recruitment for the project. While this is a small number of students, we hope this will spark discussion and inform future research into the field.

Another potential ethical issue is that the principal investigator, DT, has dyslexia. This might be a cause of possible bias in the research. Having such proximity might result in firmly held opinions and beliefs. This might result in utilising the information to the investigator's benefit.[35] However, efforts are taken to reduce biases. Conceptual frameworks were used to maintain objectivity, such as reflection on actions of position-taking and power and how different actions might embody different meanings.[36] Finally, the involvement in discussions with the principal investigator and MHB also aided in a more objective report

Moreover, there are strengths in the principal investigator of the study being dyslexic. As mentioned, this allows for higher relatability and empathy to participants, helping bridge the power gap between interviewer and interviewee. Furthermore, it allows for greater contextualisation of the data provided to reduce bias in theories and interpretations of human cognition and behaviour by drawing inspiration from neurodivergent individuals' lived experiences and strengths.[37] Participatory research has also proved to improve scientific rigour and credibility.[38]

Finally, participants of the study were also 'member checkers' for the study, following advice from Fram.35 They were sent out the results section of the final report to review, giving feedback on whether the report resonated with them. All five of them responded, stating that it did resonate with them.

## Summary – Accelerating Translation

This study explored the experiences of dyslexic medical students in a UK medical school. Results showed the challenges faced and strengths the participants employed in managing their learning. The positive impact of the response to the COVID-19 pandemic was highlighted, and participants disclosed that there is still a stigma towards dyslexia in medical education.

#### Recommendation

We recommend increasing education about dyslexia within the medical faculty and students, emphasising the challenges and the strengths associated with the condition.10, 13, 20 We also suggest reframing curriculum delivery to make it more accessible for all learners rather than making specific accommodations for neurodiverse students. 4,13. With the rise of technology in medical education, we hope medical schools will move beyond traditional teaching methods and expand their instructional approaches. 20,39

## References


1. Berlin R. [About Dyslexia] Über dyslexie Archiv für Psychiatrie. 1884;15:276-8. German
2. Macdonald SJ. Towards a social reality of dyslexia. Brit J Learn Disabi. 2010;38(4):271–9.
3. Evans W. 'I am not a dyslexic person I'm a person with dyslexia': identity constructions of dyslexia among students in nurse education. J Adv Nurs. 2014 Feb;70(2):360–72.
4. Musto J. How do medical doctors with specific learning difficulties (SpLD) cope in a clinical setting? [dissertation] UEA. 2013.
5. Semple D, Smyth R. Oxford handbook of psychiatry. 4th ed. Oxford ; New York, Ny: Oxford University Press; 2019.
6. British Dyslexia Association. ] 2010 What is dyslexia? Available from: https://www.bdadyslexia.org.uk/dyslexia/about-dyslexia/what-is-dyslexia. Last updated Dec 20, 2024; Cited Dec 24, 2024
7. Everatt J, Steffert B, Smythe I. An eye for the unusual: creative thinking in dyslexics. Dyslexia. 1999;5(1):28–46.
8. Gwernan-Jones R.A life history study with dyslexic adults mapping meaning-making and its relationship to the development of positive self-perceptions and coping skills [dissertation]. University of Exeter, England. 2010. Available from https://eric.exeter.ac.uk/repository/handle/10036/3308. Last updated Sep 30, 2010; Cited Dec 24, 2024
9. Johnson RM. Dyslexia is not a gift, but it is not that simple. Infant Child Dev. 2023;32(5):e2454.
10. Wilmot A, Hasking P, Leitão S, Hill E, Boyes M. Understanding mental health in developmental dyslexia through a neurodiversity lens: The mediating effect of school-connectedness on anxiety, depression and conduct problems. Dyslexia. 2024;30(3):e1775.
11. Shaw SCK, Anderson JL. The experiences of medical students with dyslexia: An interpretive phenomenological study. Dyslexia. 2018 Aug;24(3):220–33.
12. Brennan C, Harrison W. The dyslexic surgeon. Bulletin. 2020;102(3):72–5.
13. Romberg F, Shaywitz BA, Shaywitz SE. How Should Medical Schools Respond to Students with Dyslexia? AMA J Ethics. 2016 Oct 1;18(10):975–85.
14. Shaw SCK, Malik M, Anderson JL. The exam performance of medical students with dyslexia: a review of the literature. MedEdPublish. 2017;6:116.
15. Nukari JM, Laasonen MR, Arkkila EP, Haapanen ML, Lipsanen JO, Poutiainen ET. Neuropsychological intervention of dyslexia has a positive effect on aspects of psychological well-being in young adults – a randomized controlled study. Dyslexia. 2022;28(2):166–84.
16. Morris D, Turnbull P. Clinical experiences of students with dyslexia. J. Adv. Nurs. 2006 Apr;54(2):238–47.
17. Ridley C. The experiences of nursing students with dyslexia. Nurs Stand. 2011;25(24):35–42.
18. Locke R, Scallan S, Mann R, Alexander G. Clinicians with dyslexia: a systematic review of effects and strategies. Clin Teach. 2015;12(6):394–8.
19. Crouch A. Needs/experiences of dyslexic students + support in clinical practice [dissertation].HEA for Health Sciences & Practice, University of Northhampton; 2008
20. Shaw SCK, Hennessy LR, Anderson JL. The learning experiences of dyslexic medical students during the COVID-19 pandemic: a phenomenological study. Adv Health Sci Educ Theory Pract. 2022;27(1):107–24.
21. Zawadka J, Miękisz A, Nowakowska I, Plewko J, Kochańska M, Haman E. Remote learning among students with and without reading difficulties during the initial stages of the COVID-19 pandemic. Educ Inf Technol. 2021 Nov 1;26(6):6973–94.
22. Stuckey HL. Three types of interviews: Qualitative research methods in social health. JoSH-Diabetes. 2018;01:056–9.
23. Srivastava P, Hopwood N. A Practical Iterative Framework for Qualitative Data Analysis. Int J Qual Methods. 2009;8(1):76–84.
24. Braun V, Clarke V. Reflecting on reflexive thematic analysis. Qual Res Sport Exerc Health. 2019;11:1–9.
25. Taylor H, Vestergaard MD. Developmental Dyslexia: Disorder or Specialization in Exploration? Front. Psychol. 2022; 13.
26. S J, Mann E, Wharrad HJ, C FM, less. An empirical exploration of the impact of dyslexia on placement-based learning, and a comparison with non-dyslexic students. Divers. Equal Health Care. 9(2):0–0.
27. Denton TF, Meindl JN. The Effect of Colored Overlays on Reading Fluency in Individuals with Dyslexia. Behav Anal Pract. 2015 Aug 12;9(3):191–8.
28. White J. Supporting nursing students with dyslexia in clinical practice. Nurs Stand. 2007 Jan 17;21(19):35–42.
29. Woodfine BP, Nunes MB, Wright DJ. Text-based synchronous e-learning and dyslexia: Not necessarily the perfect match! Comput. Educ. 2008 Apr;50(3):703–17.
30. Wilcha RJ. Effectiveness of Virtual Medical Teaching During the COVID-19 Crisis: Systematic Review. JMIR Med Educ. 2020;6(2):e20963.
31. Albaker WI, Al Kuwaiti A, Subbarayalu AV, Almuhanna A, Almuhanna FA, AlQudah AA. Strengthening medical education during the post-COVID-19 era for building an effective healthcare workforce: A narrative review. Electron J Gen Med2022;19(5):em396.
32. Association BD. British Dyslexia Association. Dyslexia friendly style guide. Available from: https://www.bdadyslexia.org.uk/advice/employers/creating-a-dyslexia-friendly-workplace/dyslexia-friendly-style-guide. Last updated 2023; Cited 2024 Dec 24
33. Hennessy L, Shaw SCK, Anderson JL. Medical Students' Attitudes towards and Beliefs about Dyslexia: A Single-Centre Survey Study. IJSSES . 20207(4);69-79..
34. Lambert R, Harriss E. Insider accounts of dyslexia from research mathematicians. Educ Stud Math. 2022 Sep 1;111(1):89–107.
35. Fram S. The Constant Comparative Analysis Method Outside of Grounded Theory. Qual Rep. 2013 Jan 7;18(1):1–25.
36. Finlay L. Reflexivity: An Essential Component for All Research? Br. J. Occup. Ther. 1998 Oct;61(10):453–6.
37. Gourdon-Kanhukamwe A, Kalandadze T, Yeung SK, Azevedo F, Iley B, Phan JM, et al. Opening up understanding of neurodiversity: A call for applying participatory and open scholarship practices. bpscog. 2023;1(8):23–7.
38. Macfarlane B, Cheng M. Communism, Universalism and Disinterestedness: Re-examining Contemporary Support among Academics for Merton's Scientific Norms. J. Acad. Ethics. 2008;6:67–78.
39. Javed S, Muniandy M, Lee CK, Husni H. Enhancing teaching and learning for pupils with dyslexia: A comprehensive review of technological and non-technological interventions. Educ Inf Technol. 2024 ;29(8):9607–43.

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**Conflict of Interest Statement & Funding**

Daniel Yi Liang Tan is diagnosed with Dyslexia. There are no other conflicts of interest. NIL financing involved with NIHR (UK) nor NIH (US). Daniel is currently working as a doctor for the Singapore Government.

**Author Contributions**

Conceptualization: DTYL. Data Curation: DTYL. Formal Analysis: DTYL. Investigation: DTYL. Methodology: DTYL. Project Administration: DTYL. Supervision: MHB. Validation: DTYL. Visualization: DTYL. Writing - Original Draft: DTYL. Writing - Review Editing: MHB.

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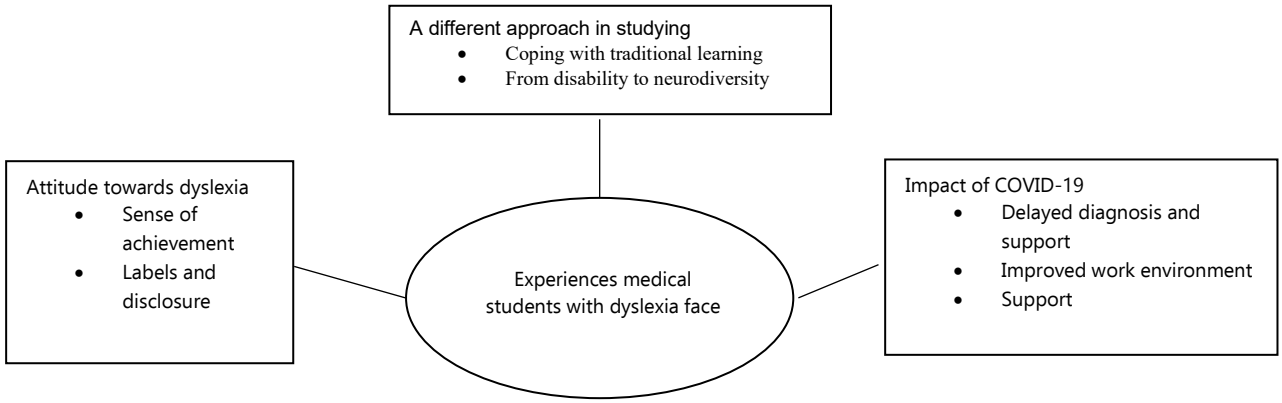
# Supplementary Material

1 summary figure




**Sumpplementary 1 : COREQ: 32 item Checklist**

**Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist**

Please indicate in which section each item has been reported in your manuscript. If you do not feel an item applies to your manuscript, please enter N/A.

For further information about the COREQ guidelines, please see Tong *et al.*, 2017: https://doi.org/10.1093/intqhc/mzm042

| No. | Item | Description | Section # |
|---|---|---|---|
| **Domain 1: Research team and reflexivity** | | | |
| Personal characteristics | | | |
| *1.* | Interviewer/facilitator | Which author/s conducted the interview or focus group? | DT |
| *2.* | Credentials | What were the researcher's credentials? *E.g. PhD, MD* | NIL |
| *3.* | Occupation | What was their occupation at the time of the study? | Medical Student |
| *4.* | Gender | Was the researcher male or female? | Male |
| *5.* | Experience and training | What experience or training did the researcher have? | iBSC Medical Education |
| Relationship with participants | | | |
| *6.* | Relationship established | Was a relationship established prior to study commencement? | Yes |
| *7.* | Participant knowledge of the interviewer | What did the participants know about the researcher? *E.g. Personal goals, reasons for doing the research* | Researcher is dyslexic |
| *8.* | Interviewer characteristics | What characteristics were reported about the interviewer/facilitator? *E.g. Bias, assumptions, reasons and interests in the research topic* | NIL |

| | | | |
|---|---|---|---|
| **Domain 2: Study design** | | | |
| Theoretical framework | | | |
| *9.* | Methodological orientation and theory | What methodological orientation was stated to underpin the study? *E.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis* | Iterative Comparative Approach |
| Participant selection | | | |
| *10.* | Sampling | How were participants selected? *E.g. purposive, convenience, consecutive, snowball* | Purposive/ Snowball |
| *11.* | Method of approach | How were participants approached? *E.g. faceto-face, telephone, mail, email* | 6 |
| *12.* | Sample size | How many participants were in the study? | 5 |
| *13.* | Non-participation | How many people refused to participate or dropped out? What were the reasons for this? | 0 |
| Setting | | | |
| *14.* | Setting of data collection | Where was the data collected? *E.g. home, clinic, workplace* | Home/ University |
| *15.* | Presence of nonparticipants | Was anyone else present besides the participants and researchers? | No |
| *16.* | Description of sample | What are the important characteristics of the sample? *E.g. demographic data, date* | Medical students with Dyslexia |
| Data collection | | | |
| *17.* | Interview guide | Were questions, prompts, guides provided by the authors? Was it pilot tested? | Yes |
| *18.* | Repeat interviews | Were repeat interviews carried out? If yes, how many? | No |
| *19.* | Audio/visual recording | Did the research use audio or visual recording to collect the data? | Yes |
| *20.* | Field notes | Were field notes made during and/or after the interview or focus group? | No |
| *21.* | Duration | What was the duration of the interviews or focus group? | 1 Hour |
| *22.* | Data saturation | Was data saturation discussed? | No |
| *23.* | Transcripts returned | Were transcripts returned to participants for comment and/or correction? | No |
| **Domain 3: analysis and findings** | | | |
| Data analysis | | | |
| *24.* | Number of data coders | How many data coders coded the data? | 1 |

| | | | |
|---|---|---|---|
| *25.* | Description of the coding tree | Did authors provide a description of the coding tree? | Yes |
| *26.* | Derivation of themes | Were themes identified in advance or derived from the data? | Derived from Data |
| *27.* | Software | What software, if applicable, was used to manage the data? | NVivo |
| *28.* | Participant checking | Did participants provide feedback on the findings? | Yes |
| Reporting | | | |
| *29.* | Quotations presented | Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? *E.g. Participant number* | Yes |
| *30.* | Data and findings consistent | Was there consistency between the data presented and the findings? | Yes |
| *31.* | Clarity of major themes | Were major themes clearly presented in the findings? | Yes |
| *32.* | Clarity of minor themes | Is there a description of diverse cases or discussion of minor themes? | Yes |

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Developed from: Allison Tong, Peter Sainsbury, Jonathan Craig, Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups, International Journal for Quality in Health Care, Volume 19, Issue 6, December 2007, Pages 349–357, https://doi.org/10.1093/intqhc/mzm042

IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Original Article

# Frontlines and Crossroads: The Impact of COVID-19 on the Motivations of Medical Students from Selected Philippine Medical Schools in Pursuing Their Medical Studies

Adriel Agunod Cheng,[1] Ysabelle Bianca Andan,[1] Kristine Go,[1] Yeoj Luces,[1] Jeanne Peralta,[1] Jeremy Sumang,[1] Manuel M. Dayrit.[2]

## Abstract

**Background:** Because the Coronavirus disease 2019 (COVID-19) pandemic forced Philippine medical education to shift online, the loss of practical skills and face-to-face clinical interactions affected many students to cope with lifestyle and learning changes. This study aimed to assess the strength and nature of motivations of medical students to pursue their studies during the pandemic, and to propose recommendations to support them through the pandemic and beyond. **Methods**: Inductive thematic analysis was done of semi-structured interviews with 17 medical students selected through purposive convenience, purposive and stratified sampling. Recruitment was carried out through the Association of Philippine Medical Colleges. Eligible respondents were pre-clinical and clinical medical students enrolled in School Year (SY) 2020-2021 who experienced the transition to an online setting. **Results:** The desire to serve motivated most pre-clinical medical students, while financial reward was a factor for clinical medical students. Despite the limitations of online education, lack of social interaction and skills training, medical students had strengthened motivations to continue as the pandemic highlighted the need for physicians, reinforcing their intrinsic desire to serve others despite mental health and financial issues. **Conclusions:** While most medical students felt more motivated in pursuing their studies during the pandemic, there was a desire and call for more support in their studies and training. Their personal stories suggested there is room for improvement in certain aspects of local medical education. Addressing concerns through financial and educational support, and bridging clinical skills with online learning would help create quality healthcare beyond the pandemic context.

## Introduction

The declaration of COVID-19 pandemic by the World Health Organization in March 2020 resulted in government lockdowns throughout the Philippines, causing suspension of onsite work and classes lasting for several months.[1-4] The abrupt transition proved to be challenging for students and medical learning institutions, as modules had to be delivered online. Some did not have access to necessary gadgets and stable internet connectivity.[5]

Although there have been studies on coping mechanisms and motivations of pre-clinical and clinical medical students during the pandemic, it is still poorly understood and there is currently a gap in qualitative literature for third-world countries such as the Philippines with online learning as a variable of concern.[6-9] This qualitative study aimed to assess the strength and nature of motivations of pre-clinical and clinical medical students through a study questionnaire that delves into how the pandemic affected their learning, personal experiences, as well as baseline and current motivations to pursue medicine. Another objective was to determine the impact of online learning on these medical students in lieu of face-to-face classes.[10,11] It was hypothesized that the pandemic strengthened their motivations, negatively impacted their learning, and challenged their personal experiences and coping mechanisms in pursuing their studies.

Through an inductive thematic analysis of the personal stories and key experiences of selected medical students, the study aimed to assess their motivational changes and propose recommendations to improve instructional methods and provide morale, encouragement, and support during the pandemic and beyond.

## Methods

### Study Design

The study uses inductive thematic analysis of data from semi-structured interviews of pre-clinical and clinical medical students in answering a pre-tested study questionnaire as shown in ***Table 1.*** Using the Self-Determination Theory to assess motivation.

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Under the theory, extrinsic motivation is defined as engaging in behaviors or actions for the sake of an external cause (i.e. financial reward, social acceptance), while intrinsic motivation is the engagement in behaviors or actions for one's own sake - for an inherent personal reward (i.e. desire to serve, skill development).[15-17]

The study questionnaire was formed to compare students' baseline and current motivations to pursue medicine, to discover the impact of the pandemic on their learning and perceptions, and to get students' input on how they believe their medical education can be better supported. This methodology is similar to a Greek study that had local medical students answer a qualitative questionnaire based on the Self-Determination Theory adapted to their local context.[18] Informed consent was secured, and assurance of confidentiality was given to the respondents prior to the interviews.

As the COVID-19 pandemic and the shift to online medical education were novel phenomena, an inductive approach to thematic analysis was chosen to code interview data. This methodology structurally captures the narratives of respondents and increases validity as it is known to be exploratory and transparent in qualitative studies. Bias is reduced from prior preconceptions as the data itself determines the themes through several rounds of refinement and analysis of interview transcripts.[19,20] A study in the UK also used thematic analysis to assess medical student perceptions responding to the COVID-19 pandemic and created themes based on students' concerns, worries, and recommendations.[21]

**Participants & Variables**

Through a combination of convenience, purposive and stratified sampling , recruitment of participants was coursed through the social media platforms of the Association of Philippine Medical Colleges-Student Network (APMC-SN) – the largest body of medical students across the Philippines. Out of a total of 71 volunteers garnered from across the country, students were chosen to be interviewed based on a pre-determined demographic profile matrix with six personal background variables to maximize yield of the inductive thematic analysis: 1) public/private schools, 2) male/female, 3) financial aid scholars/non-scholars, 4) with/without doctor relatives, 5) different pre-medical degrees, and 6) living at home/dormitory ***(Table 2).***

**Study Size**

A total of 17 students (7 clinical and 10 pre-clinical) were chosen to be interviewed. Pre-clinical students are those in years 1 to 3 of their medical studies and are not yet exposed to hospital work, while clinical students are medical clerks and interns. Eligible respondents must have been enrolled during School Year (SY) 2020-2021 in a Philippine medical school. The sample size was deemed sufficient as other qualitative studies that measured student motivations in studying medicine had similar sample sizes based on pre-determined selection criteria.[22]

To approximate the geographic distribution of Philippine medical schools, the sample selection was stratified according to density per major geographic location/island group with 3 participants from the National Capital Region (NCR/Metro Manila) where most medical schools are located at, 3 from Luzon, 3 from Visayas, and 1 from Mindanao which has the least number of medical schools ***(Table 3).***

Inductive thematic analysis benefits from unique data sets, hence interviewees were chosen based on a combination of the student profile matrix and respective geographic distributions. Purely random sample selection would compromise quality due to the chance of recurring or omitted profiles.

**Data Sources/Measurement**

Interviews were conducted online through Google Meet, with each session lasting roughly 45 minutes from June to July 2021. Each participant was given the study questionnaire a day prior, and two researchers (1 male, 1 female) conducted each interview. The researchers were third year medical student co-authors from the Ateneo School of Medicine and Public Health (ASMPH) based in NCR. To minimize selection bias, researchers were randomly assigned to their respective interviewees. Interviews were then transcribed from July to September 2021, and inductive thematic analysis was conducted from October to December 2021 for finalization of manuscript.

The general outline/flow of the inductive thematic analysis process involves conducting interviews, transcribing the raw data, creating codes out of the data, theme generation, and several rounds of data analysis. Transcribed interviews were analyzed and ideas from important recurring patterns shared among respondents' answers were made in the form of codes and then themes. Codes are words/phrases derived from participants' interviews that are assigned to data fragments that share a common relationship within the transcript. Themes are a methodology to interpret and make sense of coded data, both unique and generalizable across student groups. The difference between codes and themes is that codes tend to be shorter and simpler, while themes are longer and involve higher-level analysis. An inductive approach means to analyze data without any initial assumptions, letting the codes and themes come out from the raw data.[19,20,23]

To ensure reliability of code generation, the researchers read through and generate codes from transcripts of interviews not conducted personally by them. These were tabulated and discussed by the researchers to check for misinterpretations. Similar codes were grouped together and tallied to find the most common recurring theme. Identifiable features from quotes were removed prior to minimize bias and themes were then validated through several rounds of refinement and analysis amongst the researchers.[23] Reporting of data involved going beyond organizing each narration, by making a coherent story across respondents through the creation of Thematic Analysis Maps. Since respondents discussed using a mix of English and the local

***Table 1.*** Study Questionnaire for Interviews.

| | |
|---|---|
| **I. DETERMINING MOTIVATIONS FOR PURSUING A DEGREE IN MEDICINE** | |
| 1. What about being a doctor attracted you to the profession?<br>2. What are qualities you have that made you want to pursue becoming a physician?<br>3. What were your expectations of medical school and becoming a physician?<br>4. What were your personal goals for this journey (or for pursuing medicine)?<br>5. When you decided to pursue medicine, what kind of rewards did you look for?<br>6. How much did you value these rewards and goals? | |
| **II. LOOKING AT THE IMPACT OF THE PANDEMIC** | |
| ***A. Challenges in Online Learning*** | |
| **Preclinical** | **Clinical** |
| 1. How did your school handle the shift to online learning?<br>2. Can you provide us with a brief description on how you are currently being assessed by your school? (e.g. grading, deliverables, platform, lectures, etc.)<br>a. How are you guys graded?<br>b. How do you have lectures?<br>3. Is there a difference in your performance from when school was face-to-face and now? Why or why not?<br>4. How do you feel about online learning?<br>5. What measures from online learning helped with the adjustment? What can be improved? | 1. How did your hospital handle the training of clerks & interns? Was it online, limited face-to-face, etc.?<br>2. Can you provide us with a brief description on how you are being assessed by your current rotation? How about the assessments of the other rotations you've had so far?<br>3. Is there a difference in your performance from when duty was purely face-to-face and now? Why or why not?<br>4. How do you feel about online learning/training?<br>5. What measures from online learning helped with the adjustment? What can be improved? |
| ***B. Personal Factors*** | |
| 1. How has the pandemic affected you personally?<br>2. Please describe to us your understanding of COVID-19, so, what are the safety measures you take?<br>3. How do you feel about the virus, do you fear COVID-19? How so?<br>4. What would you consider were the major challenges posed to you as a medical student by the pandemic?<br>5. Where do you live now? Are you in your home, or condo?<br>6. Who do you live with now?<br>7. How has the pandemic affected the relationships in your home (or within your place of residence)?<br>8. How has the pandemic affected the relationships outside your home or place of residence? | |
| ***C. Perceptions of Working in Healthcare*** | |
| 1. Regarding our health workers/<br>2. Given the plight of our healthcare workers in this pandemic, what do you think of their working situation?<br>3. What does this mean to you personally? | |
| **III. COMPARING THE MOTIVATIONS OF PRE-CLINICAL AND CLINICAL STUDENTS BEFORE AND DURING THE PANDEMIC** | |
| **Preclinical** | **Clinical** |
| 1. Given the situation, did you ever consider taking time off of school? Why or why not?<br>2. If so, how did the thought cross your mind? What are the factors that made you consider taking time off of school?<br>3. Are you going to continue with your studies?<br>4. If so, what are the factors that made you decide to continue?<br>5. Where do you see yourself working in the future? What makes you say so?<br>6. [Compared to when you first started med school], do you have new expectations, goals, and/or rewards when it comes to becoming a doctor? | 1. Given the situation, did you ever consider taking a leave or time off from duty? Why or why not?<br>2. If so, how did the thought cross your mind? What are the factors that made you consider taking a leave or time off from duty?<br>3. Are you going to continue with your clerkship/internship?<br>4. If so, what are the factors that made you decide to continue?<br>5. Where do you see yourself working in the future? What makes you say so?<br>6. [Compared to when you first started med school], do you have new expectations, goals, and/or rewards when it comes to becoming a doctor? |
| **IV. PROPOSING RECOMMENDATIONS TO MOTIVATE STUDENTS** | |
| 1. Given the situation and your personal experiences as a medical student in this pandemic, how do you think you and other medical students could be motivated to continue with your studies? | 1. Given the situation and your personal experiences as a clerk/intern in this pandemic, how do you think you and other clerks & interns could be motivated to continue with |

***Legend:*** This study questionnaire was used as the basis for the interviews, arranged according to discussing initial motivations for pursuing medicine, the impact of the pandemic on personal motivations, and proposed recommendations to help motivate other medical students.

***Table 2.*** Student Profiles Needed for Inductive Thematic Analysis.

| **Student Profile Matrix** |
|---|
| 1) Student from a traditional/medicine-related undergraduate course<br>(i.e. BS Biology, BS Medical Technology, BS Nursing, etc.) |
| 2) Student from a non-traditional undergraduate course<br>(i.e. BS Management, BS Architecture, BS Engineering, etc.) |
| 3) Student from a family of doctors (either one or both parents are doctors) |
| 4) Student who is a first doctor in the family (none of first-degree relatives are doctors) |
| 5) Financial aid scholar (or someone whose family income was affected by pandemic) |
| 6) Student who is part of the country's regionalization program or is required to render compulsory return service after graduating from medical school |
| 7) Foreign student studying in a Philippine medical school or a student living away from family/residing in a dorm or condo unit |
| 8) Student who considers it difficult to cope with the demands of med school |
| 9) Someone who worked before going to med school<br>(i.e. someone who worked in corporate, government, or practiced in their field after graduation) |
| 10) Student who went on Leave of Absence (LOA) |
| 11) Student who contracted COVID-19 or whose family member contracted COVID-19 |

***Legend:*** Interviewees needed to fulfill at least one of the criteria shown above.

language (Filipino), statistical software was not used to avoid any possible errors in translation.

## Results

Out of 71 students across the country who signed up to be a part of the study population, 17 were chosen to be interviewed based on their demographic and personal profiles. Out of the 17 medical students (7 clinical, 10 pre-clinical) who fit the profile matrix *(Table 2)* and were chosen for one-on-one interviews, 6 came from NCR (3 pre-clinical, 3 clinical), 5 from Luzon (3 pre-clinical, 2 clinical), 4 from Visayas (3 pre-clinical, 1 clinical), and 2 from Mindanao (1 pre-clinical, 1 clinical) *(Table 3)*, which allowed for representatives from medical schools within each major island group in the Philippines.

*Table 4* shows the demographics of the 17 chosen students whose individual profiles served to diversify and maximize the potential yield of thematic analysis from different contextual, cultural and socioeconomic backgrounds in the pandemic setting.

Codes were made for each student based on his/her individual transcripts and six themes were generated via Inductive thematic analysis. *Tables 5 and 6* show the process of creating codes and themes from the raw transcripts, using the direct quotations from the respondents as data for analysis.

***Table 3.*** Tally of Interviewed Respondents from Across the Philippines.

| Groups of Interest | Major Geographic Locations of Medical Schools in the Philippines | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | National Capital Region | | Luzon | Visayas | | Mindanao | | |
| | Needed | Signed Up | Needed | Signed Up | Needed | Signed Up | Needed | Signed Up |
| Pre-Clinical 1st-3rd year | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 |
| Clinical 4th-5th year | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 |
| Total | | 6 | | 5 | | 4 | | 2 |

The following themes were established: 1) how the pandemic highlighted the differences in outlook between pre-clinical and clinical medical students, 2) the challenges of online learning, 3) desiring a lived experience, 4) the loss of boundary between the home and the school environment, 5) processing grit driven by a desire to serve, and 6) the fallacy of sunk cost.

Thematic Analysis Maps *(Figures 1* and *Figure 2)* were made based on codes from the interplay of the six recurring themes and different motivational factors found from the interview transcripts. Major patterns found within each student group are highlighted in gray boxes while supporting codes are coded in white boxes. Codes were arranged in the diagrams based on whether they were intrinsic or extrinsic in nature, and arrows were placed in-between showing the dynamics between codes – how some factors lead to certain changes in motivation.

***Table 4.*** Profiles of Interviewed Respondents.

| Pre-clinical Students | Clinical Students |
|---|---|
| **National Capital Region** | |
| Private, female, non-scholar<br>A doctor in the family<br>BS Public Health<br>Staying at home | Private, female, non-scholar<br>No doctor in the family<br>BS Psychology<br>Staying at home |
| Public, female, non-scholar<br>No doctor in the family<br>BS Biology<br>Staying at home | Public, female, non-scholar<br>A doctor in the family<br>BA Speech Communication<br>Staying at home |
| Private, female, scholar<br>No doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying at home | Private, male, non-scholar<br>A doctor in the family<br>BS Physical Therapy<br>Staying at home |
| **Luzon** | |
| Private, female, scholar<br>No doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying at home | Private, female, scholar<br>No doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying in an apartment |
| Public, male, scholar<br>A doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying at home | Private, male, non-scholar<br>A doctor in the family<br>BS Biology<br>Staying in a condo |
| Private, female, non-scholar<br>A doctor in the family<br>BS Physical Therapy<br>Staying at home | |
| **Visayas** | |
| Public, male, scholar<br>No doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying at home | Private, male, non-scholar<br>A doctor in the family<br>BS Medical Technology<br>Staying at home |
| Private, female, non-scholar<br>A doctor in the family<br>Bachelor in Medical Laboratory Science<br>Staying in an apartment | |
| Public, male, scholar<br>No doctor in the family<br>BS Medical Technology<br>Staying at home | |
| **Mindanao** | |
| Private, male, non-scholar<br>A doctor in the family<br>BS Health Science<br>Staying at home | Private, male, non-scholar<br>A doctor in the family<br>BS Pharmacy<br>Staying at home |

***Legend:*** Demographics of interviewees based on the student profile matrix, stratified per major geographic location.

***Table 5.*** Sample Code and Theme Generation from Direct Quotes.

| **Clinical Medical Students** | | | |
|---|---|---|---|
| **Question** | **Geographic ID** | **Individual Quotes & Codes** | **Clinical Themes** |
| 1. Given the situation and your personal experiences as a medical student in this pandemic, how do you think you and other medical students could be motivated to continue with your studies? | National Capital Region Student #1 | Codes:<br>Internal motivation; Service to others; Faith<br><br>Quotes:<br>"awareness of the current situation in the public hospitals and healthcare challenges makes me more motivated"<br><br>"I still have doubts but the realization that doctors are needed now/importance of doctors realization of being on the right track"<br><br>"the amount of patients that are waiting for you once you finished med school, that should serve as a motivation for us"<br><br>"adjusting is still a personal choice and effort<br>making the most of the situation as students - finding study style that works best " | Need to be internally motivated/understand goals<br><br>Recognizing the need for doctors/the needs of the future patients<br><br>"There is no medical student who isn't motivated because they have to remember they chose this life path"<br><br>The schools/institutions need to take care of their students at this time |
| | National Capital Region Student #2 | Codes: Internal motivation; Faith; Continuous Learning<br><br>Quotes:<br>"Country and world needs doctors"<br><br>"Pursue learning any chance you can get even if it is online Unsure situation in the future so may as well learn now"<br><br>"Importance of mental health Value of family"<br><br>"Divine intervention (God) as a reason for motivation to pursue medicine" | |

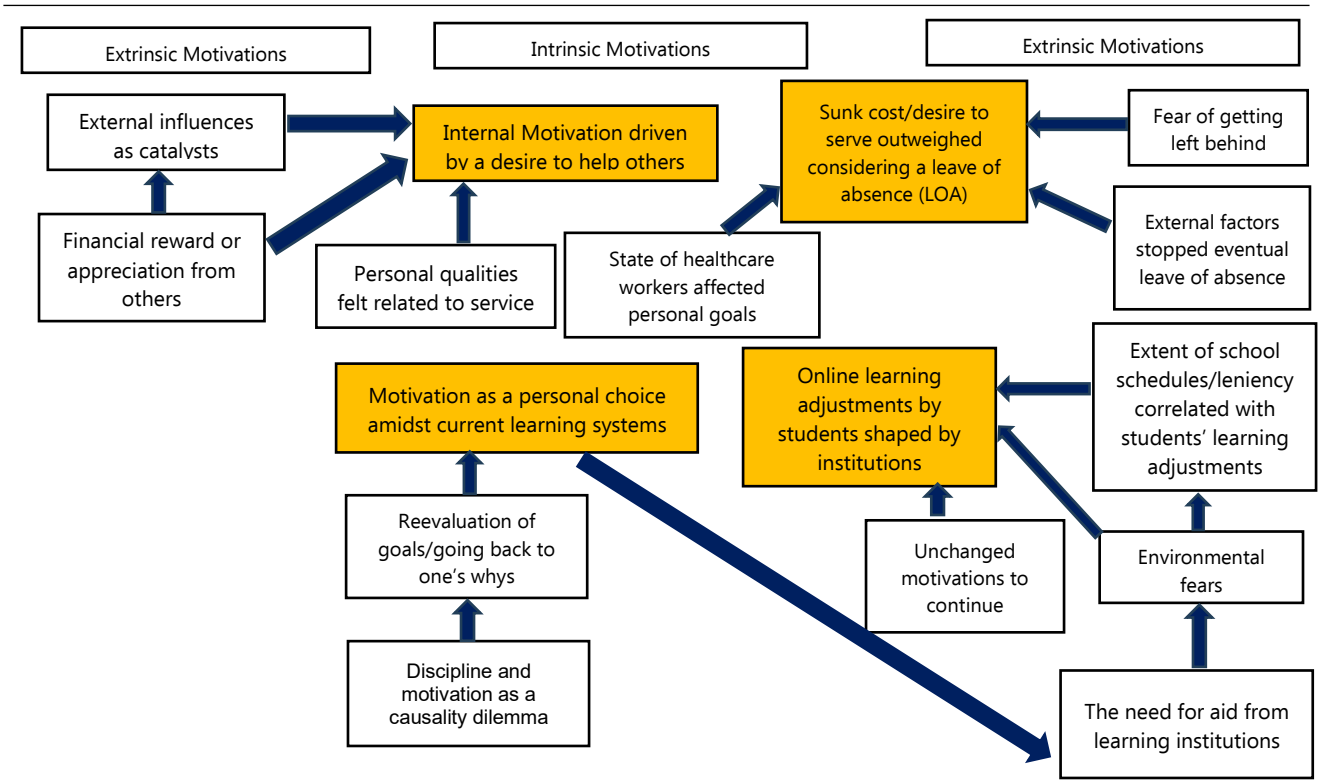
***Legend:*** Individual quotes were tallied and initial codes and themes were created, summarizing key ideas from interviewees.

***Table 6.*** Six Over-Arching Themes Generated from Inductive Thematic Analysis.

| **Theme** | **Codes** |
|---|---|
| *How the pandemic highlighted the differences in outlook between pre-clinical and clinical medical students* | Pre-clinical:<br>• Serving a higher purpose through medicine<br>• Committing to the practice will increase motivation<br>• Increased passion to serve at the plight of healthcare workers<br>Clinical:<br>• Opportunity to have authority<br>• Desire to finish on time to move forward in life stages<br>• Financial motivations—lessen burden on parents, earn money as a doctor<br>• No other viable alternatives<br>• Disheartened by plight of healthcare workers |
| *The challenges of online learning* | • Autonomy of learning<br>• Increased accessibility of study materials<br>• Laziness<br>• Lack of interaction with peers<br>• Loss of interest in the content without real application<br>• Unsustainability of online learning in the global south<br>• Need to maintain a sense of routine |
| *The desire for a lived experience* | • Desire real cadaver dissection<br>• Desire to go back to the hospital<br>• Inadequate clinical skills practice at home |
| *The loss of boundary between the home and the school and the school environment* | • Problems at home affect ability to learn<br>• Need for work-life balance<br>• Intense workload leaves no time for family despite being at home |
| *Grit driven by a desire to serve* | • Desire to make changes in the Philippine health care system<br>• To serve the people not oneself<br>• Accept the uncertainties of working in medicine |
| *The fallacy of sunk cost* | • Desire to finish on time<br>• Parents' investment going to waste<br>• Not wanting to be left behind |

***Legend:*** Final over-arching themes were created from salient codes that recurred across interviewees.

***Figure 1.*** Thematic Analysis Map of Pre-Clinical Students.




***Legend:*** In the analysis of the pre-clinical group, being driven by a desire to help others and the belief in motivation as a personal choice amidst current learning systems were the major intrinsic motivations. Multiple external factors such as the fear of getting left behind by peers and dynamics in relation to learning institutions, lead to students having to adjust to online learning despite their respective personal backgrounds. Financial reward and external influences however were only secondary to each students' own reevaluation of personal goals to help the healthcare system.

## Discussion

### Motivations

Medical education and training in the Philippines is costly for the average Filipino with tuition fees being the highest among post-graduate programs. Medical programs are also considered full-time for the entirety of the four or five years, requiring great time and commitment to complete.

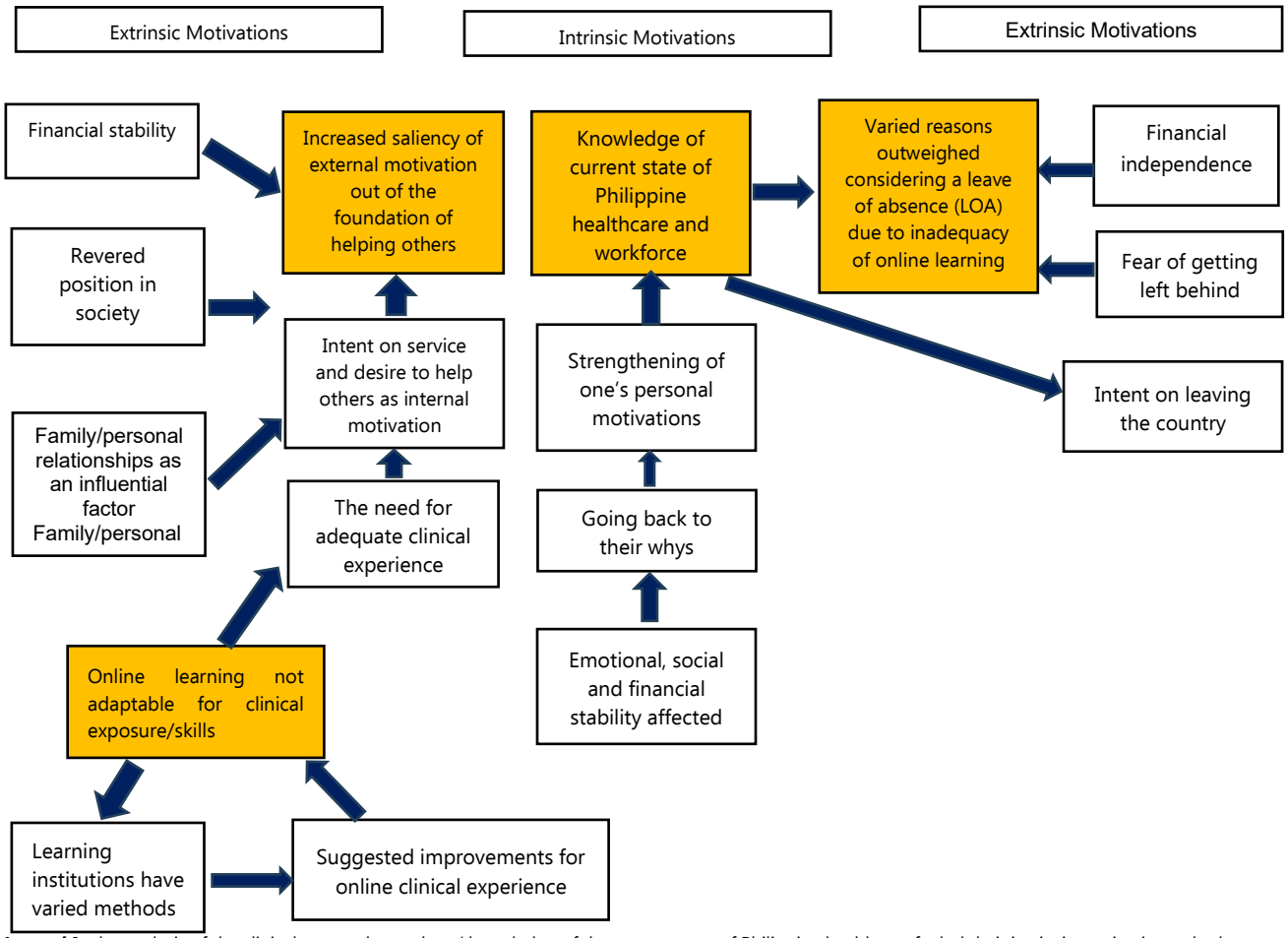
The goal of finishing medical school (Expectancy) comes with hard work, and the rewards (Instrumentality) and perceived value (Valence) as explained by Vroom's Expectancy Theory, may flux throughout each medical student's journey.[24] Students learn how to overcome trials through grit, defined as the perseverance, passion, and sustained commitment to completing specific long-term goals despite setbacks.[25] Personal qualities such as empathy, disliking helplessness, and intellectual curiosity contributed to students pursuing medicine. Recognition and the financial benefits that come with the profession were also of great influence despite possible financial setbacks.

There were differences in outlook between pre-clinical and clinical medical students, as the COVID-19 pandemic became a major point of decision-making for both groups. Clinical students leaned more towards pragmatism, financial independence, and recognition as physicians. Pre-clinical students shared the same desire but with emphasis on contributing to pandemic efforts. "It must be a rewarding feeling to graduate already, because I can finally be of help to people." according to a student from the Visayas region.

### Challenges

It was found that online learning increased medical students' autonomy in their engagement with the material but compromised the application of skills and knowledge in cases. This decreased the motivations of some students as they believed they were not receiving education in line with what is expected from a full-fledged physician.[26] A similar study conducted on medical students from Romania revealed that students enjoyed online learning due to convenience and flexibility of tasks, but noted the disadvantage of lack of direct communication and human interaction with the teachers.[27] It is important to note however that in the Philippines, material inequalities heightened in the pandemic and not all students had access to stable internet and optimal working conditions at home. A local Philippine research on medical students revealed that only 41% of their respondents felt mentally and physically capable to engage in online learning due to difficulty in adjusting learning styles, performing responsibilities at home, and poor communication.[28] The difficulty in adjusting to online medical education for both teachers and students had also been observed in other developing countries.[29]

***Figure 2.*** Thematic Analysis Map of Clinical Students.




***Legend:*** In the analysis of the clinical group, the students' knowledge of the current state of Philippine healthcare fueled their intrinsic motivations whether or not to continue their medical studies. As they were already in their clinical years but not stationed physically in the hospitals, majority felt that online learning was not adaptable for clinical exposure/skills. Despite this, several students wanted to finish as soon as possible to finance themselves and their families.

The perception of being left behind contributed to decreased motivation through an increased sense of resignation that one may not be able to cope with the demands of online learning. The Triangular Feedback Loop of Motivation explains that this phenomenon coupled with home environment stressors may lead to poor academic performance and subsequent stress, as they had to balance obligations of student and family life.[30]

As one intern explained, "There is a big difference in having virtual duty because I find myself becoming so lazy and just wanting the virtual conferences to end. But when I was exposed to the hospital, I was so excited to study what was happening to the patient or what management was done by the doctors." When lockdown protocols in the country were momentarily lifted, pre-clinical students found the limited interactions with peers difficult but still appreciated the increasing availability of study materials at home. Questions of sustainability in were raised as well by students, quoting "But I'm not sure if it will be sustainable, because you know, not everyone is privileged enough to have laptops and internet connection that's stable. So for me, this shouldn't happen until the end of med school, so I don't really recommend to continue this online learning."

These challenges brought about a greater desire for lived experience. This was particularly true for clinical medical students who had to do their clinical rotations online, which translated to a lack of skills and less opportunity to practice confidence and empathy in patient care. Pre-clinical medical students shared a similar desire but for a return to onsite classes, which they felt improved their learning through application of theoretical knowledge with the guidance of their teachers. Some shared that online learning made it difficult to perform given that concepts could not directly be translated. In both cases, their self-efficacy was affected by these limitations and the perceived inability to meet expectations of actual medical practice.

A unique challenge to motivation is mental health, as conditions such as ADHD, depression, and anxiety make it difficult to perform student tasks. As one student explained, "It gives a hindrance to my being a doctor. Depression. It's like you're dragging yourself anywhere, the lack of motivation for things." This is in direct conflict with the notions of intrinsic motivation as

a poor mental health may hinder an interest in the subject matter, a desire to serve others, and the self-aware capacity to learn. Mental health concerns contribute to attrition and decreased academic performance which increases a student's sense of self-doubt in one's ability to be a doctor.[30] Some schools attempted to have mentors connect with students and perform routine check-ups, but some students still expressed that there was a lack of empathy towards them citing increased workload, increased screentime, and a lack of exam result confidentiality. This lead to comparison and feelings of inadequacy.

There is a causality dilemma between students' discipline and motivation in attempting to maximize learning throughout the COVID-19 pandemic, given their respective emotional, social and financial contexts. Despite varying levels of self-doubt, students were ultimately fueled by their personal reasons for pursuing medicine. These intrinsic motivational reasons complemented by extrinsic motivational factors such as the fear of getting left behind by their peers and the desire for financial independence were what stopped them from filing a leave of absence and made them carry on with their medical education.

**Limitations**

The study aimed to provide a narrative of medical education in the Philippines throughout the COVID-19 pandemic through select students and their personal stories based on a profile matrix that aimed to get unique viewpoints from different contexts and socioeconomic backgrounds.

Due to the lockdowns in the country and the lack of internet access of some students, it was not possible to get a larger sample size at the time of data gathering. An ideal target sample size would have been 20, with 10 interviewees each for pre-clinical and clinical groups. To improve sample selection, the researchers made sure to select students from different key geographic locations in the country where most medical schools are located in to simulate geographic distribution.

It is important to note that as this is a qualitative study, the results cannot be generalized to the entire population of medical students in the Philippines. Potential selection bias from profiles are reduced through multiple rounds of internal discussion and code/theme analysis.

**Recommendations**

Different individuals have different stories and thus a larger sample size may be recommended for future researches to gain more input from other geographic locations. The use of surveys with the addition of Likert scales may also supplement the data from interviews and add a quantitative aspect to the study. As for potential research questions, future research can delve into the current state of medical students' motivations post-COVID-19 pandemic. Students may also be asked about their preferences on the use of online and onsite forms of learning medicine.

The interviews gave different perspectives on the changing personal motivations of medical students throughout the COVID-19 pandemic. It was made clear that the motivational foundation of the majority was the desire to serve given the state of Philippine healthcare at the time. Extrinsic factors of financial stability, social recognition, and not wanting to be left behind by peers, were other personal motivators. While not perfect, online learning platforms were a pragmatic means to this end goal.

Motivation came in both intrinsic and extrinsic forms, with both students' personal goals respondents suggesting that faculty maintain constant communication to ensure the effectiveness of the workload and online learning as a whole. Reevaluation of the curriculum rollout and considerations for face-to-face classes or other means of providing skills training and patient interaction may also be discussed between the student body and learning institutions. The hope is to refine online learning methods such that it remains a viable option in the future of medical education and to strike a balance between online learning and sufficient skills training.

These stories have the potential to bring about positive change in local medical education methods applicable to other developing countries if provided with enough data quantifying the experiences of medical students during the pandemic. The insights gathered from the experiences of the students in the study can hopefully start discussions among local school administrators that seek to answer questions such as "How can we help the students cope with online learning given the situation?", "How do we support the students psychologically given that they remain committed to finishing medical school?", "How can we adjust the workload or innovate learning methods so as to make the most out of a difficult situation?" etc.

Similar to previous research conducted on medical students in first world countries, most medical students in the study felt more motivated to continue with their education but desired for more support. Suggested recommendations from them include student wellness programs, increased scholarships withless tuition burden, dedicated faculty to maintain constant communication with students, active discussion between student bodies and learning institutions, and considerations for other means of skills training and patient interaction.

**Conclusion**

The study provides valuable insights into the motivations of medical students of select students in the Philippines during the COVID-19 pandemic and supplements existing literature on online learning during this period. Despite poor communication infrastructure and having to adjust learning styles, pre-clinical and clinical medical students from selected medical schools in the Philippines found ways to persevere. The state of healthcare in the country strengthened their motivations to pursue their studies despite a shift to online learning and changes in socioeconomic contexts. The motivation to serve their country as doctors helped overcome their own personal challenges.

The study serves as a springboard to raise awareness on the need to improve medical education both locally and internationally to

better support medical students. Discussions on how to address their concerns are encouraged among school administrators and faculty to help this next generation of healthcare workers. The hope is to refine online learning methods such that it remains a viable option in the future of medical education, and to find ways to strike a balance between online learning and sufficient skills training for quality healthcare even during states of calamity such as the COVID-19 pandemic and beyond.

## Summary – Accelerating Translation

Frontlines and Crossroads: The Impact of COVID-19 on the Motivations of Medical Students from Selected Philippine Medical Schools in Pursuing Their Medical Studies sought to assess the motivations of medical students to pursue their studies during the COVID-19 pandemic, and to propose recommendations to support them. This was a qualitative study involving semi-structured interviews and inductive thematic analysis of select medical students from across the Philippines. We found that despite the limitations of online education, lack of social interaction and skills training, more students were motivated to continue as the pandemic highlighted the need for physicians. The desire to serve motivated most pre-clinical medical students while financial reward was a factor for clinical medical students. Their personal stories suggest room for improvement in medical education. Addressing their concerns through financial and educational support, and bridging clinical skills with online learning would thus help create quality healthcare beyond the pandemic context.

## References

1. World Health Organization. Coronavirus disease (COVID-19): Situation Report 1 Philippines. 2020. https://www.who.int/docs/default-source/wpro---documents/countries/philippines/emergencies/covid-19/who-phl-sitrep-1-covid-19-9mar2020.pdf?sfvrsn=2553985a_2
2. Amit A, Pepito V, Dayrit M. Early response to COVID-19 in the Philippines. 2021. 12(1): 56- 60. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8143926/#:~:text=1b%20shows%20all%20interventions%2C%20including,declared%20COVID%2D19%20a%20pandemic.
3. CNN Philippines Staff. Octa sees early sign Metro Manila Nearing covid-19 peak as positivity rate goes over 50%. https://cnnphilippines.com/news/2022/1/10/Metro-Manila-COVID-19-peak-Omicron-OCTA.html
4. Department of Health. COVID-19 Case Tracker: December 20, 2021. Department of Health, Republic of the Philippines. https://doh.gov.ph/covid-19/case-tracker
5. Gonzales C. SWS: 31% of families with distance learners have weak internet connection. 2021. https://newsinfo.inquirer.net/1403566/sws-31-of-families-with-distance-learners-have-weak-internet-connection#ixzz8NWfTyjoz
6. Deshetler L, Gangadhar M, Battepati D, Koffman E, Mukherjee R, Menon B. Learning on Lockdown: A Study on Medical Student Wellness, Coping Mechanisms and Motivation during the COVID-19 Pandemic. 2021.https://www.researchgate.net/deref/https%3A%2F%2Fdoi.org%2F10.15694%2Fmep.2021.000050.1?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19.
7. Istadi Y, Raharjo TJ, Azam M, Mulyono SE. Academic Performance in Medical Education During the COVID-19 Pandemic: A Scoping Review. 2022 (13):1423—1438. https://www.dovepress.com/academic-performance-in-medical-education-during-the-covid-19-pandemic-peer-reviewed-fulltext-article-AMEP
8. Adaramola O, Idowu O, Toriola O, Olu-Festus D, Oyebanji T, Uche-Orji C, et al. Coping strategies of Nigerian medical students during the COVID-19 pandemic. 2022 Mar; 56(1): 15–22. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9334952/
9. Ferrel, M. N. and Ryan, J. J. (2020) 'The Impact of COVID-19 on Medical Education', Cureus, 12(3), p. e7492.
10. ION Professional eLearning Program. (n.d.). Strengths and Weaknesses of Online Learning. University of Illinois Springfield. ION Resources. https://www.uis.edu/ion/resources/tutorials/overview/strengths-weaknesses
11. Farber O. Medical students can help combat Covid-19. Don't send them home. 2020. https://www.statnews.com/2020/03/14/medical-students-can-help-combat-covid-19/.
12. Jones S. Interpreting themes from qualitative data: thematic analysis. 2024. https://www.evalacademy.com/articles/interpreting-themes-from-qualitative-data-thematic-analysis
13. Turner D. What's the difference between codes and themes in qualitative analysis? 2022. https://www.quirkos.com/blog/post/whats-the-difference-between-codes-and-themes-in-qualitative-analysis/
14. Maguire M, Delahunt B. Doing a Thematic Analysis: A Practical, Step-by-Step Guide for Learning and Teaching Scholars. Dundalk Institute of Technology. All Ireland Journal of Higher Education. https://ojs.aishe.org/index.php/aishe-j/article/download/335/553/1557
15. Ryan R, Deci E. Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. Contemporary Educational Psychology. 2020.
16. Beckmann J., & Heckhausen H. Motivation as a function of expectancy and incentive. In Heckhausen J., & Heckhausen H. (Eds.), Motivation and Action. Cambridge: Cambridge University Press.; 2018. p. 99–13). 10.1017/cbo9780511499821.006
17. Morris L, Grehl M, Rutter S, Mehta M, Westwater L. On what motivates us: a detailed review of intrinsic v. extrinsic motivation. 2022 Jul; 52(10): 1801–1816.
18. Nikou S, Economides A. A model for Mobile-based Assessment adoption based on Self-Determination Theory of Motivation. 2014 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL2014).
19. Jnanathapaswi S. Thematic Analysis & Coding: An Overview of the Qualitative Paradigm. An Introduction to Social Science Research (pp.98-105) APH Publishing Corporation, New Delhi. 2021. https://www.researchgate.net/publication/356924218_Thematic_Analysis_Coding_An_Overview_of_the_Qualitative_Paradigm
20. Crosley J. What (Exactly) Is Thematic Analysis? Plain-Language Explanation & Definition (With Examples). 2021. https://gradcoach.com/what-is-thematic-analysis/#:~:text=When%20undertaking%20thematic%20analysis%2C%20you,such%20as%20an%20interview%20transcript
21. Patel J, Robbins T, Randeva H, et al. Rising to the challenge: Qualitative assessment of medical student perceptions responding to the COVID-19 pandemic. Clinical Medicine, 2020-11-01, Volume 20, Issue 6, Pages e244-e247
22. Filiana A, Rini M, Prabawati A. Mood Tracking Apps from the Perspectives of Indonesian Students: A Qualitative Analysis. 2023 9th International HCI and UX Conference in Indonesia (CHIuXiD).
23. Saldana, J. M. (2015). The coding manual for qualitative researchers (3rd ed.).SAGE Publications. https://uk.sagepub.com/en-gb/eur/the-coding-manual-for-qualitative-researchers/book273583
24. Schweiki E., Martin N., Beekley A., Jenoff J., Koenig G., Kaulback K. et al. Applying Expectancy Theory to residency training: proposing opportunities to understand resident motivation and enhance residency training. PubMed Central. 2015: 6: 339–346.

25. Stoffel J. and Cain J. Review of Grit and Resilience Literature within Health Professions Education. American Journal of Pharmaceutical Education. 2018: 82(2), 6150.
26. Sansone C., Fraughton T., Zachary J., Butner J., Heiner C. Self-regulation of motivation when learning online: the importance of who, why and how. Education Technology Research and Development. 2011; 59: 199-212. https://link.springer.com/article/10.1007/s11423-011-9193-6
27. Dascalu CG, Zegan G, Antohe M. Correlations between the Motivational Persistence Scale and the Efficacy on Online Medical Learning. IEEE. 2022.
28. Baticulon R, Sy J, Alberto N, Baron C, Mabulay R, Rizada L, et al. Barriers to Online Learning in the Time of COVID-19: A National Survey of Medical Students in the Philippines. Medical Science Educator. 2021;31: 615–626.
29. Tempski P, Danila A, Arantes-Costa F, Marina A,Torsani M, Martins M. The COVID-19 pandemic: time for medical teachers and students to overcome grief
30. Park J, Chung S, An H., Park S., Lee C., Kim S. et al. A Structural Model of Stress, Motivation, and Academic Performance in Medical Students. Psychiatry Investigation. 2012;9(2): 143-149.

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**Author Contributions**

The study has gone through the ethical approval of the University Research and Ethics Committee (UREC) of the Ateneo de Manila University and is fit for publication.

**Author Contributions**

Conceptualization: AAC, YBMA, KJPG, YNCL, JCCP, JITS, and MMD. Methodology: AAC, YBMA, KJPG, YNCL, JCCP, JITS, and MMD. Validation: AAC, YBMA, YNCL, JCCP, and MMD. Formal Analysis: AAC, YBMA, KJPG, YNCL, JCCP, and JITS. Data Curation: AAC, YBMA, KJPG, YNCL, JCCP, and JITS. Investigation: AAC, YNCL, JCCP, and JITS. Resources: YNCL. Writing – Original Draft: AAC, YBMA, KJPG, YNCL, JCCP, and JITS. Writing – Review & Editing: AAC, YBMA, KJPG, YNCL, JCCP, JITS, and MMD. Visualization: AAC, YNCL, and JITS. Supervision: AAC, YBMA, KJPG, JCCP, JITS, and MMD. Project Administration: AAC, YBMA, KJPG, and JITS.

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Original Article

# Impact of Reduced Clinical Time on NBME and OSCE Performance in the Ob/Gyn Clerkship: A Quasi-Experimental Study

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## Abstract

**Background:** Clinical clerkships are crucial in medical education for developing competent physicians. This study examined reduced clinical time during an Obstetrics and Gynecology (Ob/Gyn) clerkship on performance in the National Board of Medical Examiners (NBME) and Objective Structured Clinical Examination (OSCE). It arose from the need to modify curriculum due to pandemic-related restrictions such as social distancing and lockdowns. **Methods:** This retrospective quasi experimental study evaluated four student groups with different clinical exposures. Group 1-7 (n=110) completed standard rotations, while Groups 8-10 had reduced clinical time: Group 8 (n=15) by 50%, Group 9 (n=19) with no clinical time but made up 2 weeks later, and Group 10 (n=14) by 17%. Reductions were supplemented with virtual learning and independent study. NBME and OSCE scores were analyzed to assess the effects of reduced clinical time on performance. **Results:** Analysis using the Wilcoxon rank-sum test revealed no significant difference in NBME and OSCE scores. Groups 8 and 10 displayed slight improvements in median NBME performance, while OSCE scores varied minimally. These findings suggest that reduction in clinical experience did not affect the performance on examinations. **Conclusion:** The results demonstrated no significant differences in NBME and OSCE scores when comparing the experimental groups to the control group. Confounding variables include the differences in motivation levels, varying workloads, and student's sense of burnout. Given the small sample size, the study is quite underpowered. To optimize the learning environment, future studies are recommended to collect data from other clerkships at other universities with similar curricula.

## Introduction

Core clinical clerkships are vital to medical education, providing essential hands-on experience. Medical students' positive experience during the clinical years is crucial for several reasons, including the development of clinical skills, exam preparation, managing burnout, and making informed decisions about future specialties. Striking a balance between these aspects is particularly challenging in clerkships that demand 10 to 12-hour workdays. Clerkship directors face the difficult task of enhancing student satisfaction and well-being while acquiring medical knowledge and attaining clinical competency within these constraints.

One of the primary challenges throughout the clerkship is balancing clinical responsibilities with adequate study time. Prior to the imposed reduction in clinical hours, the Ob/Gyn clerkship at this institution involved ten to twelve-hour workdays, six days a week, with most of this time spent on the wards, in labor and delivery, and in the operating room, leaving a half-day on Friday as the only protected time dedicated to didactics and mastering Ob/Gyn topics. Medical students often express concerns about long work hours, which can impede their preparation for NBME exams; this was no exception at this medical school. The cumulative effects of extended hours, intense workloads, and fatigue significantly contribute to burnout and hinder students' ability to find sufficient time to study Ob/Gyn topics. As a result, students may develop a negative perception of their overall satisfaction with their clerkship experience.

Several studies have explored the consequences of reduced clinical time on medical student performance, providing valuable, though at times methodologically varied insights. Coronel-Couto et al. examined the impact of shortened internal medicine clerkships on the NBME examination performance and clinical experiences.[1] Their findings revealed no statistically significant difference in mean NBME scores between cohorts with traditional eight-week rotations and those with five-week rotations. However, students with shorter rotations reported fewer clinical experiences, suggesting that while exam performance may remain unaffected, the breadth of clinical exposure could be compromised. Nonetheless, the study's generalizability is limited by a relatively small sample size and single-institution design, which may hinder boarder applicability.

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Monrad et al investigated the impact of a 25% reduction in overall clerkship duration (from 48 weeks to 36 weeks) on medical student performance and perceptions.[2] Specifically, the Ob/Gyn clerkship was shortened from six weeks to four and a half weeks at the University of Michigan Medical School during the 2016–2017 academic year to avoid overlapping cohorts, with no other systemic structural changes implemented. The study found no significant differences in NBME examination scores or clinical skills exam scores between shortened and traditional clerkship cohorts. The authors acknowledge that due to a variety of reasons (dual degree programs, leave of absences, etc.) the sample sizes of each cohort vary throughout the year and recognize that there were no significant differences regarding MCAT score, undergraduate GPAs and USMLE step 1 scores. All students in this study were required to take USMLE step 1 prior to entering the clerkships and took a multi-station clinical competency assessment at the completion of their clerkship year. Interestingly, perceptions of clerkship quality improved in some cases despite the reduced duration, suggesting that shorter, more focused clinical experiences could still be effective.

Similarly, Ouyang et al analyzed the effects of clerkship sequence and length on NBME examination performance in the Internal Medicine clerkship.[3] Their study discovered that completing Surgery, Pediatrics, and Family Medicine clerkships prior to the Internal Medicine examination improved scores, and the length of the clerkship positively correlated with exam performance. On average, each additional week of Internal Medicine training was associated with a 0.23-point increase in subject examination scores. Although the finding of a dose-response relationship strengthens the conclusion, the authors did not account for differences in student preparedness or inherent academic abilities, which may confound the relationship between duration and performance. This indicates that both the sequence and duration of clinical rotations may be crucial for exam preparation.

Additionally, Harris et al conducted a retrospective cohort analysis to explore the relationship between student duty hours during an Ob/Gyn clerkship and exam performance.[4] Students recorded their duty hours, which were compared with their NBME subject examination score percentiles. The study defined "long" hours as those exceeding the 75th percentile of weekly duty hours. They found that longer duty hours, with the 75th percentile being 47.1 hours per week, did not correlate with higher shelf exam scores or overall clerkship grades. However, students who worked longer hours during the final two weeks of the rotation, with the 75th percentile being 55.2 hours in the fifth week and 36.9 hours in the sixth week, performed better on the end-of-rotation NBME Ob/Gyn subject examination. These results prompt consideration of how recent, concentrated clinical exposure may influence exam performance; however, the reliance on self-reported duty hours may lead to recall bias and potential misclassification.

In surgery, Myers et al found that heavier clinical loads and less self-study time correlated with higher NBME Surgery subject examination scores.[5] Conversely, lighter clinical loads did not result in higher scores despite increased self-study time, highlighting the importance of hands-on clinical experience in surgical education. Barnum et al discovered that the average number of hours worked per week during the surgical clerkship did not correlate with students; NBME Subject examination scores, clinical performance evaluations, or final clerkship grades of honors.[6] The conflicting findings between these two studies may reflect variation in how workload was measured, differences in institutional culture, or unmeasured student-level variables such as motivation or resilience. This suggests that the quality of clinical exposure may be more critical than the quantity.

On January 30th,2020 the World Health Organization (WHO) declared the outbreak of COVID-19 to be a public health emergency of international concern.[7] The COVID-19 pandemic not only affected public health but also disrupted education at all levels, including graduate and professional schools. In response to the COVID-19 pandemic, the AAMC issued guidance on March 17th, 2020, recommending that all medical schools suspend their clinical rotations 8. Medical education faced challenges due to lockdowns and social distancing measures, which hindered students' access to hospitals and hands-on training essential for their development as physicians. These restrictions significantly impacted the ability to teach critical skills and provided fewer opportunities for students to practice the art of patient care, which is vital for their performance on standardized exams integral to medical school evaluation.[9,12]

Noel et al. conducted a retrospective cohort study at the University of Hawai'i to assess the impact of these changes.13 They found that while clinical exposure—measured by patient logs—declined significantly for Ob/Gyn and other clerkships, NBME subject exam scores did not decline and even improved in some specialties. Notably, students affected by COVID performed worse on physical exam components of the OSCE but better on notetaking and USMLE Step 2 CK, suggesting that increased study time and alternative learning formats may have partially compensated for lost clinical time. However, Ob/Gyn clerkship grades were significantly lower in the COVID-affected cohort, possibly due to decreased in-person learning without adequate grading modifications.

The pandemic prompted rapid adaptations in medical education. Krasowski et al documented adjustments to preclinical medical school curricula in response to COVID-19 restrictions, emphasizing the integration of remote learning strategies.9Similarly, Sohrabi et al reviewed the broader implications of the outbreak, highlighting the global challenges faced by educational institutions.[7] Watson et al advocated for innovative teaching methods to ensure the continuity of medical training during these unprecedented times.10 Although informative , many of these studies are descriptive and lack rigorous pre-post evaluation designs, making it difficult to isolate the effect of specific interventions. Internationally, the impact of the pandemic on medical education was also notable. Bongomin

et al described the disruptions in clinical learning experiences at Makerere University in Uganda, including reduced opportunities for outpatient and emergency care, limited interactions with nurses, fewer peer discussions, and decreased exposure to physical examinations, and ward procedures.[11] Similarly, Tzeng et al evaluated the impact on Objective Structured Clinical Examination (OSCE) performance among Taiwanese medical students, noting that those affected by the pandemic performed worse compared to their pre-pandemic peers.[12] These findings, while compelling, must be interpreted with caution as they are highly context-specific and influenced by regional healthcare infrastructure, student resilience, and local curriculum design. The literature collectively reveals that the impact of reduced clinical time is complex and varies across disciplines, institutions, and geographic settings. Methodological inconsistencies, such as differences in sample size, confounding variables, and study design, limit direct comparisons. The COVID-19 pandemic has offered insights and opportunities for innovative adaptations and strategic changes in medical education, helping to mitigate the negative impacts on student performance. This study aims to contribute to this body of knowledge by examining how changes to the Ob/Gyn clerkship curriculum at Loma Linda University School of Medicine during the COVID-19 pandemic impacted the NBME Ob/Gyn subject examination and the OSCE examination, specifically by evaluating the effect of reduced clinical rotations on these student performance exams.

## Methods

### Study Design

The Ob/Gyn clerkship director conducted this quasi-experimental retrospective study at a large academic medical center in Southern California from March 2020 to June 2020. As these clerkship curriculum changes were forced restrictions instituted due to the pandemic, there was no voluntary consent to be part of this retrospective study. This study was reviewed by the Loma Linda University Institutional Review Board and deemed exempt from IRB oversight as it involved retrospective analysis of de-identified student performance data (IRB# 5250403).

The outcomes of the changes were retrospectively evaluated. The primary objective was for third-year MD students completing their Ob/Gyn rotation during this unprecedented time was to acquire a general understanding of caring for Ob/Gyn patients and perform well on standardized assessments, despite reduced or absent clinical exposure due to COVID-19 regulations. During the study period, the medical school had ten Ob/Gyn rotations per year, each lasting six weeks. This retrospective aimed to assess and compare NBME Ob/Gyn shelf examination and the OSCE scores among four distinct groups: Group 1-7 (control groups n=110), which received the standard clinical rotation as per LCME requirements, and Group 8 (n=15), 9 (n=19, & 10 (n=14), which had a modified curriculum due to reduced or absent clinical experiences. NBME and OSCE scores were evaluated after the six-week rotation. A quasi-experimental design was used to investigate the differences and similarities in overall standardized scores.

### Participants

The class of 2021 third year medical students at Loma Linda University School of Medicine (LLUSM) enrolled in ten separate blocks of six-week Ob/Gyn rotations were included in the study; students in other classes were excluded. The School of Medicine LIFE Community Director prior to the start of the freshman year assigns students into LIFE Community Groups of around ten students with a LIFE Community Mentor. These assignments are based on race, religion, gender, values they mentioned in their application and the college or university students graduated from in an attempt to balance the groups. They are not based on academic status, professional status, or specialty interest. Students were randomly assigned to third year tracks unrelated to the life group they had been assigned to. Prior to the start of each block, in general, there is no shared information about students from prior clerkships already completed. The only information that is shared is if a student has failed greater than 1 NBME to enable these students to be provided additional support. LLUSM students rotate through five sites for the Ob/Gyn clerkship: Loma Linda University Health, Riverside University Hospital System, Adventist Health White Memorial in Los Angeles, AdventHealth in Orlando and Kettering Health Systems in Dayton, Ohio. Each year, the OBGYN clerkship along with all the other clerkships analyzes the comparability of the NBME and OSCE scores along with the student's evaluation of the learning environment for each site. Although there are relatively small numbers at sites other than the main campus, there were no statistical differences in any of the data points for each of the sites for the class of 2021.

### Study groups & Interventions

The study involved four main groups:

1. Groups 1-7, (n=110) (Control Group): This group followed the standard LCME-approved curriculum for the Ob/Gyn third-year medical clerkship. It consisted of six ten-to-twelve-hour days per week in the clinic or hospital, divided equally between Ob and Gyn. In addition, students attended four hours of didactics weekly and a one-hour journal club per rotation. They were required to complete 540 uWise questions, a question bank with clinical vignettes linked to the 11th edition of the APGO Medical Student Educational Objectives.

2. Group 8, (n=15): This group followed Curriculum A, an independent learning and online program, with a 50% reduction in clinical time, resulting in a total of three weeks less clinical time during the Ob/Gyn clerkship.

3. Group 9, (n=19): This group followed Curriculum B, an independent learning and online program, with no

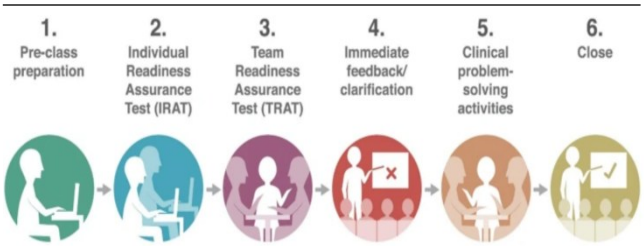
clinical time. However, students were required to make up two weeks of clinical time in their senior year.

4. Group 10, (n=14): This group followed Curriculum B with a 17% reduction in clinical time, totaling one week less clinical time. Once COVID-19 restrictions were lifted, Group 10 returned to the clinical component of their rotations, resuming the standard experience as in Groups 1-7.

***Figure 1.*** Example of an NBME-style question that was provided by the clerkship director, used as a guideline for students to create mandatory practice test questions during their clerkship.

> A 33-year-old woman, gravida 1, para 1, spontaneously delivers a 2460-g (5 lb 7oz) female newborn at 38 weeks' gestation. The newborn has hepatosplenomegaly, patent ductus arteriosus, and cataracts. At 8 weeks' gestation the mother developed a maculopapular rash, enlarged cervical lymph nodes, sore throat, and arthralgias that spontaneously resolved in 1 week. The subsequent prenatal course was uncomplicated. Which of the following tests during pregnancy is most likely to have predicted the findings in the fetus?

***Figure 2.*** Flowchart of the steps involved in a Team-Based Learning session.




## Results

Third-year medical students at Loma Linda University were randomly assigned into four groups

1. Group 1-7, the designated control group, underwent the full six-week Ob/Gyn clerkship.

2. Group 8 had clinical time reduced by half for a total of three weeks of the six-week Ob/Gyn clerkship.

3. Group 9 had participated in zero weeks of clinical activity during the Ob/Gyn clerkship.

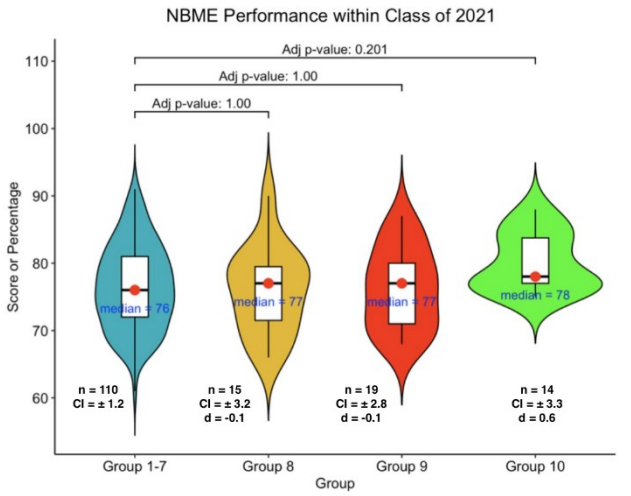
4. Group 10 had clinical time reduced by one week, underwent five weeks of the six-week Ob/Gyn clerkship.

Statistical analysis was performed using the Wilcoxon rank sum test which is the nonparametric equivalent of the paired t-test. A predetermined p-value of 0.05 was used to compare the adjusted p-values of the test groups to the control. The descriptive statistics of the Median and Interquartile range (IQR) were used to summarize standardized NBME and OSCE scores for each study group.

### NBME Performance

Comparing Groups 8, 9, and 10 to the control group, a slight increase in the median NBME performance was appreciated. Group 8 and 9 had a one-point average increase in median performance while Group 10 had a two-point average increase when compared to Group 1-7. Using the Wilcoxon test, the adjusted p-value for Group 8, 9, and 10 were respectively 1.00, 1.00, and 0.201 ***(Figure 3).*** As the predetermined p-value was 0.05, there was no statistical difference between the groups as it relates to the performance on the NBME. Cohen's d were –0.1, -0.1, and 0.6 for group 8, 9, and 10 respectively. This indicates a very small negative effect size for group 8 and 9, when compared to control group 1-7, likely statistical noise. Medium to large effect size for group 10, which suggests a moderately strong improvement compared to control group 1-7. However, CI +/- 1.2 implies none of the effects are statistically significant, possibly due to small sample sizes and/or high variability.

***Figure 3.*** Comparison of NBME performances based on percentage between groups of students from the Class of 2021 with differing amounts of clinical time, displaying adjusted p-values for pairwise comparisons and median scores for each group.



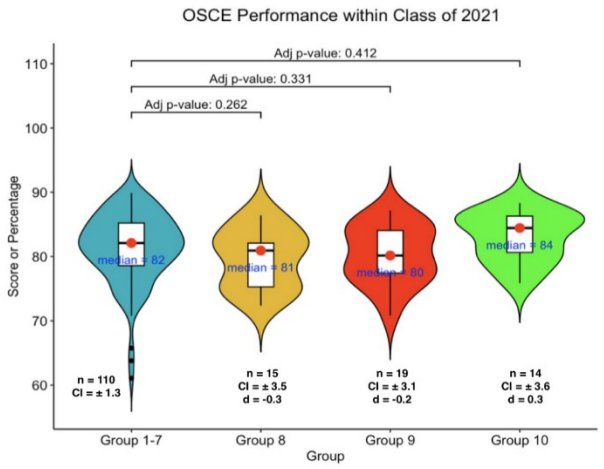

### OSCE Performance

Unlike the slight increase in NBME performance comparing Groups 8, 9, and 10 to the control, the OSCE performance of Groups 8 and 9 demonstrated a decrease in median scores when compared to the control group. Group 10 exhibited an increase compared to the control group. The control group scored a median of 82% on the OSCE. Group 8 scored a median of 81%, Group 9 scored a median of 80%, and Group 10 scored a median of 84%. A predetermined p-value of 0.05 was used to determine statistical significance and the Wilcoxon Rank Sum test determined the adjusted p-values for Groups 8, 9, and 10 which were respectively 0.262, 0.331, and 0.412 ***(Figure 4).*** This indicated that a reduction in clinical time did not yield a statistically significant change in OSCE performance. Cohen's d

were –0.3, -0.2, and –0.3 for group 8, 9, and 10 respectively. This indicates small negative effect size for group 8, 9, and 10, when compared to control group 1-7. However, given CI +/-0.3, the effect is likely negligible.

For both OSCE & NBME performances, there are no baseline comparability or adjustment for potential covariates such as GPA, step 1 score, or rotation order, which can be confounding factors for these results

***Figure 4.*** Comparison of OSCE performances between groups of students from the Class of 2021 with differing amounts of clinical time, displaying adjusted p-values, confidence intervals and effect size for pairwise comparisons and median scores for each group.




## Discussion

The results of our quasi-experimental retrospective study of third year medical students revealed no significant differences in NBME and OSCE scores between the experimental groups with reduced clinical time and the control groups. This finding suggests that a clerkship with reduced or no clinical time does not negatively impact students' median NBME score or OSCE performance. Our results challenge the traditional assumption that increased clinical exposure leads to improved standardized exam scores.
The lack of significant differences in OSCE and NBME scores despite reduced clinical time offers an opportunity to consider re-evaluating and potentially modifying the third-year Ob/Gyn clerkship.

Because this quasi-experimental retrospective study obtained data from a single medical school site rotating through the six-week Ob/Gyn clerkship, the study is considerably underpowered leading to a greater Type II error given the small sample size. Additionally, confounding factors include students rotating at one of five clinical sites, which while required to provide the same amount of clinical time, students may have varying expectations placed on them by residents and attendings and variable patient loads. Moreover, the students may have different motivations in studying for the Ob/Gyn NBME and OSCE. This may have been affected by their personal exposures to illnesses such as COVID-19, difference in at-home responsibilities leading to discrepancies in time dedicated to studying amongst students, or their level of burn out depending on the third-year rotation order. The particular factors utilized in placement of students into specific LIFE Community Groups which invariably led to varying levels of camaraderie, peer support and mentor involvement may be an additional confounding factor.

***Table 1.*** All 36 APGO-Prepared Videos by Category, Topic, Educational Objective and Duration, Available on the APGO YouTube Channel.

| Category | Topic | Objective # | Duration (min) |
|---|---|---|---|
| **Low-risk Obstetrics Gynecology (n=9)** | Maternal-fetal physiology | 8 | 10 |
| | Antepartum care | 10 | 8 |
| | Intrapartum care | 11 | 8 |
| | Postpartum care | 13 | 6 |
| | Lactation | 14 | 8 |
| | Preeclampsia | 18 | 7 |
| | Abnormal labor | 22 | 11 |
| | Postpartum hemorrhage | 27 | 7 |
| | Postpartum infection | 28 | 4 |
| **High-risk Obstetrics Gynecology (n=10)** | Alloimmunization | 4 | 8 |
| | Aneuploidy | 5 | 10 |
| | Multifetal gestation | 20 | 4 |
| | Third trimester bleeding | 23 | 4 |
| | Preterm labor | 24 | 9 |
| | Premature rupture of membranes | 25 | 7 |
| | Intrapartum fetal surveillance | 26 | 9 |
| | Anxiety & Depression | 29 | 10 |
| | Post-term pregnancy | 30 | 6 |
| | Fetal growth abnormalities | 31 | 4 |
| **Reproductiv / Endocrinolo y / Infertili (n=9)** | Preconception | 9 | 8 |
| | Puberty | 42 | 7 |
| | Amenorrhea | 43 | 5 |
| | Hirsutism | 44 | 8 |
| | Normal/Abnormal uterine bleeding | 45 | 9 |
| | Dysmenorrhea | 46 | 3 |
| | Menopause | 47 | 6 |
| | Infertility | 48 | 9 |
| | Premenstrual syndrome | 49 | 3 |
| **Benign Gynecology Female Pelv Medicine Reconstruct e Surge (n=10)** | History | 1 | 8 |
| | Preventative care | 7 | 10 |
| | Ectopic pregnancy | 15 | 4 |
| | Spontaneous abortion | 16 | 4 |
| | Family planning | 33 | 9 |
| | Vulvar & Vaginal disease | 35 | 7 |
| | Sexually transmitted infections | 36 | 9 |
| | Pelvic floor disorders | 37 | 10 |
| | Endometriosis | 38 | 6 |
| | Chronic pelvic pain | 39 | 4 |
| **Gynecology Oncology (n=8)** | Pap smear | 3 | 4 |
| | Disorders of the breast | 40 | 7 |
| | Gestational Trophoblastic Disease | 50 | 5 |
| | Vulvar neoplasia | 51 | 5 |
| | Cervical Disease & Neoplasia | 52 | 9 |
| | Leiomyoma | 53 | 7 |
| | Endometrial hyperplasia & Cancer | 54 | 8 |
| | Ovarian Neoplasia | 55 | 6 |

## Summary – Accelerating Translation

**Title:** Impact of Reduced Clinical Time on NBME and OSCE Performance in the Ob/Gyn Clerkship

Main problem to solve: Medical clerkships are essential in preparing students for clinical practice and standardized exams. However, the COVID-19 pandemic introduced unique challenges by limiting hands-on clinical exposure due to restrictions like social distancing and lockdowns. This raised concerns about the potential impact on student performance in standardized evaluations like the National Board of Medical Examiners (NBME) and Objective Structured Clinical Examinations (OSCE).

**Aim of the Study:** To assess the effects of reduced clinical time on the performance of third-year medical students in NBME and OSCE exams during their Obstetrics and Gynecology (Ob/Gyn) clerkship and to explore alternative methods of ensuring competency without compromising student well-being.

**Methodology:** This study included third-year medical students from Loma Linda University divided into four groups based on their level of clinical exposure during the Ob/Gyn clerkship:

- Group 1, (n=110)(Control): Standard six-week clinical rotation.
- Group 8, (n=15) Clinical time reduced by 50%.
- Group 9, (n=19): No clinical time, with two weeks of clinical makeup in their senior year.
- Group 10,(n=14):Clinical time reduced by 17%.

Students with reduced clinical time participated in either curriculum A or B which included virtual learning modules, independent study, and other alternative educational activities, such as completing case studies, APGO videos, and question bank exercises. Exam scores for NBME and OSCE were analyzed using statistical tests to determine differences among the groups.

**Results:**

- NBME Scores: Groups with reduced clinical time demonstrated slight improvements in median NBME scores (1-2 points higher), but these differences were not statistically significant.
- OSCE Scores: Variability in OSCE scores was observed, with slight declines in Groups 8 and 9 compared to the control, while Group 10 showed a marginal improvement. None of the changes reached statistical significance.

**Conclusion:** Reduced clinical time was not associated with statistically significant performance differences in the NBME nor OSCE exams in the students who had reduced clinical time compared to those who completed the standard rotation in this Quasi-experimental study. Furthermore, the effect size of the curriculum change was insignificant. However, it was reassuring to see that with the reduction in clinical time in this small sample size study, there was no statistically significant decrease in the NBME nor OSCE scores. While clinical exposure remains crucial for skill development, the findings possibly challenge the assumption that more clinical hours directly correlate with better exam performance. This suggests the possibility that alternative, approaches to curriculum design—emphasizing flexibility, independent learning, and student well-being replacing some of the time spent in clinicals may maintain academic outcomes and improve student satisfaction with the clerkship.

Further research is recommended to explore long-term effects on clinical competency and to refine individualized learning plans that accommodate diverse learning preferences while ensuring comprehensive training.

## References

1. Coronel-Couto GM, Landa-Galindez AM, Armas ML, Bonnin R. Time does matter: reduced internal medicine clerkship clinical experiences due to COVID-19. Cureus. 2022;14(12):e32445.
2. Monrad SU, Zaidi NLB, Gruppen LD, Gelb DJ, Grum C, Morgan HK, et al. Does reducing clerkship lengths by 25% affect medical student performance and perceptions? Acad Med. 2018;93(12):1833-1840.
3. Ouyang W, Cuddy MM, Swanson DB. US medical student performance on the NBME subject xxamination in internal medicine: do clerkship sequence and clerkship length matter? J Gen Intern Med. 2015;30(9):1307-1312.
4. Harris BS, Harris HM, Baldwin MA, Dotters-Katz SK. Medical student duty hours, and shelf performance: Is there a correlation? Am J Perinatol. 2024;41(S 01):e2135-e2137. Epub 2023 May 25.
5. Myers JA, Vigneswaran Y, Gabryszak B, Fogg LF, Francescatti AB, Golner C, et al. NBME subject examination in surgery scores correlate with surgeryclerkship clinical experience. J Surg Educ. 2014;71(2):205-210. Epub 2013 Sept 21.
6. Barnum TJ, Halverson AL, Helenowski L, Odell DD. All work and no play: addressing medical students' concerns about duty hours on the surgical clerkship. Am J Surg. 2018;218(2):419-423. Epub 2018 Dec 11.
7. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World health organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). Int J Surg. 2020;76:71-76. Erratum in: Int J Surg. 2020;77:217. Epub 2020 Feb 26.
8. Association of American Medical Colleges. Important guidance for medical students on clinical rotations during the coronavirus (COVID-19) outbreak [press release]. Available from: https://www.aamc.org/news/press-releases/important-guidance-medical-students-clinical-rotations-during-coronavirus-covid-19-outbreak. Last updated March 17, 2020; cited May 20, 2022.
9. Krasowski MD, Blau JL, Chen SJ, Jones KA, Schmidt TJ, Bruch LA. Teaching pathology in an integrated preclinical medical school curriculum and adaptations to COVID-19 restrictions. Acad Pathol. 2021;8:23742895211015337.
10. Watson A, McKinnon T, Prior SD, Richards L, Green CA. COVID-19: time for a bold new strategy for medical education. Med Educ Online. 2020;25(1):1764741.
11. Bongomin F, Olum R, Nakiyingi L, Lalitha R, Ssinabulya I, Sekaggya-Wiltshire C, et al. Internal medicine clerkship amidst COVID-19 pandemic: a cross-sectional study of the clinical learning experience of undergraduate medical students at makerere university, Uganda. Adv Med Educ Pract. 2021;12:253-262.
12. Tzeng TY, Hsu CA, Yang YY, Yuan EJ, Chang YT, Li TH, et al. The impact of COVID-19 pandemic on the learning outcomes of medical students in Taiwan: a two-year prospective cohort study of OSCE performance. Int J Environ Res Public Health. 2021;19(1):208.
13. Noel ER, Mizuo B, Yamamoto LG, Ishikawa KM, Chen JJ, Len KA. Effect of the COVID-19 pandemic on medical student performance and evaluation scores. SVOA Med Res. 2024; 2(1):10-18. Epub 2024 Jun 24.

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**Conflict of Interest Statement & Funding**

The Authors have no funding, financial relationships or conflicts of interest to disclose.

**Author Contributions**

Conceptualization: SC, EH. Data Curation: SC, EH. Formal Analysis: SC, EH. Investigation: SC, EH. Methodology: JS, SC, EH. Project Administration: SC, EH. Supervision: JK, EH. Validation: JS, HP, AM, EH. Visualization: JS, SC, EH. Writing - Original Draft: JS, HP, SZ, SC, EH. Writing - Review Editing: JS, HP, SZ, SC, AM, JK, EH.

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## Supplementary Material

**Appendix:**

**Curriculum A**

Due to COVID-19 regulations, students in Group 8 were removed from clinical rotations and were given Curriculum A as an independent learning and online replacement. They were required to complete seven distinct tasks to enhance their understanding and application of core clinical cases and Ob/Gyn principles. Student requirements included:

(1) Core Clinical Cases: Write up 35 core clinical cases, each spanning one page and formatted as single-spaced documents. These cases included 15 obstetric cases, 15 gynecological cases, and five gynecological cancer cases.

(2) uWise Questions: In addition to the required 540 uWise questions, students were required to complete an additional 150 comprehensive uWise questions and provide evidence of completion to the clerkship coordinator.

(3) Ob/Gyn Uworld Questions: Complete approximately 470 Ob/Gyn Uworld questions and provide proof of completion. The workload was divided weekly to help students stay on track. Uworld is a leading question bank with detailed explanations and educational objectives.

(4) Association of Professors of Gynecology and Obstetrics (APGO) Videos: Watch 46 educational videos prepared by APGO, ranging from three to 11 minutes, covering topics in low and high-risk Ob/Gyn, benign gynecology/ female pelvic medicine and reconstructive surgery (FPMRS), gynecology oncology and reproductive/endocrine/infertility. Students were also required to watch one YouTube or Netflix documentary on COVID-19's impact on pregnant women. A complete list of videos and topics is provided in ***Table 1***.

(5) OB CaseX Interactive Patient Encounters: Engage in eight OB CaseX interactive patient encounters on the OnlineMedEd website, providing a brief critique for each case. CaseX includes interactive pre-recorded videos with patient scenarios, backgrounds, vitals, and imaging studies, guiding students through diagnosis and treatment.

(6) Reading Assignment: Read Beckmann's & Ling's Obstetrics and Gynecology (8th edition) in its entirety. This textbook provides foundational knowledge for Ob/Gyn rotation, national standardized exams, and competent patient care.

(7) Video-based Test Questions: Develop 47 unique test questions, one for each video, and an additional question on the impact of coronavirus on pregnancy. Questions must adhere to NBME style, including a stem and four to five answer options, with detailed explanations for correct and incorrect answers. Test questions were reviewed by the clerkship director, and feedback was provided to students. An example test question was also provided as shown in ***Figure 1.***

**Curriculum B**

Groups 9 and 10 were required to complete ten distinct tasks to enhance their understanding and application of core clinical cases and principles in Ob/Gyn. Modifications were made to Curriculum A: the number of test questions students needed to write was reduced from 47 to five, as the original requirement was deemed excessive for Group 8 and challenging for the clerkship director to review comprehensively.

Additionally, participants were required to write 10 reflection paragraphs per week on each APGO videos, attended weekly test review sessions, and participated in a two-hour team-based learning session each week. Requirements 1-6 are the same as in Curriculum A, while requirements 7-10 are alterations or additions.

(1) Core Clinical Cases

(2) uWise

(3) Ob/Gyn Uworld Questions

(4) APGO and COVID-19 Videos

(5) OB CaseX Interactive Patient Encounters

(6) Reading Assignment

(7) Video Reflections: Write a paragraph on each of the 46 APGO videos and submit 10 reflections by the end of each week on Friday.

(8) Test Question Creation: Develop five, as opposed to 47, test questions from assigned chapters in the reading, adhering to NBME style, and providing detailed explanations of why the correct answer is right and why the others are incorrect.

(9) Test Question Review Session: Attend a weekly test question review session where a compilation of 19 student-written test questions were reviewed and discussed with the clerkship director.

(10) Team Based Learning (TBL) sessions: Attend weekly two-hour sessions via zoom. Participants were provided with reading material that must be studied ahead of time and expected to come prepared for a 15-minute individual readiness quiz (iRAT) followed by a 10-minute team readiness test (tRAT). A discussion of the quiz questions and topic followed for 20-25 minutes. The final component involved one to three complicated cases related to the topic with questions on presentation, workup, and treatment. Students discussed these in a small group breakout room then finally within the whole group with the facilitator ***(Figure 2)*** The topics for the TBL were hypertensive disorders in pregnancy, first trimester bleeding, third trimester bleeding, abnormal uterine bleeding, and primary amenorrhea. TBL, originally designed by Professor Larry Michaelsen in the 1980s for business school, is defined as an active learning and small group instructional strategy that provides students with opportunities to apply conceptual knowledge through a sequence of activities that includes individual work, teamwork, and immediate feedback.

**Clinical Time Makeup for Group 9**

Group 9 was required to undergo two weeks of clinical time makeup during their fourth year of medical school, one week focusing on obstetrics and the other week on gynecology. Although not meant to completely replace the missed clinical components of the rotation, the goal was to give medical students an introduction to the varied clinical experience while ensuring a balanced workload during the limited time available during the medical school curriculum.

The first week had the following specifications:

- One full day or at least a half-day at a local federally qualified health clinic (FQHC). If only a half-day was spent at the FQHC clinic, another clinic experience was scheduled for the remaining half-day.
- Two days of inpatient low risk obstetrics.
- Two days of inpatient high-risk obstetrics.

The second week had the following specifications:

- Two days on benign gynecology or urogynecology female pelvic medicine and reconstructive surgery (FPMRS).
- One day of FPMRS, benign gynecology or gynecology clinic.
- Two days of gynecology oncology.

IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Original Article

# Prevalence and Patterns of Gender-Based Violence Among Undergraduate Students in Nigeria

Ntishor Gabriel Udam,[1] Raphael Augustine Udoh,[2] Emmanuel Aniekan Essien,[3] Iwasam Elemi Agbor,[4] Bonaventure Michael Ukoaka,[5] Ukeme-Obong Akpan Samuel,[1] Esthermaria Otobong Udosen,[1] Terem Gabriel Udam,[6] Kosy Victor Kelechi,[1] Favour Satkyes Bachi.[7]

## Abstract

**Background:** Gender-based violence (GBV) is any harmful act including physical, sexual, and emotional abuse based on gender norms, with significant health, social, and economic consequences. Despite its devastating impact, GBV among males and other under-recognized groups remains understudied. This study assessed the prevalence and pattern of GBV among undergraduates, and respondents' knowledge of its effects. **Methodology:** A cross-sectional study of 413 University of Calabar undergraduates was conducted using multi-stage sampling. The questionnaire inquired about the experience of GBV and respondents' knowledge of its effects. Data was analyzed using Statistical Package for Social Science (SPSS), with logistic regression assessing the association between GBV and age, sex, marital status, and academic year, reporting odds ratios (ORs), 95% confidence intervals (CIs), and p-values to evaluate statistical significance and the precision of estimates. **Results:** GBV prevalence among participants was 19.4%, with emotional violence (threats, intimidation and verbal abuse) being most common (18.6%). Prevalence was slightly higher in males, but not significantly so ($p>0.05$). The logistic regression analysis revealed no significant relationship between GBV and age, sex, marital status, academic year, though older individuals had slightly lower odds of experiencing GBV, while males had slightly higher odds compared to females. Most respondents agreed that GBV has psychological, social and health implications. **Conclusion:** The study showed that GBV affects both male and female Nigerian students. Universities should implement strict policies, awareness programs, and student support systems including a formal GBV reporting system, survivor support services, and mandatory training for students and staff to address GBV effectively.

## Introduction

Gender-based violence (GBV) is not only a pervasive violation of human rights but also poses a public health menace affecting individuals and communities globally. GBV refers to any harmful act perpetrated against a person's will based on socially ascribed differences between males and females, and has no socioeconomic nor ethnic and cultural disparities.[1,2] The United Nations (UN), in the Convention on Elimination of all Forms of Discrimination against Women (CEDAW), describes it as an act likely to result in physical, sexual or psychological harm or suffering to women, including threats or acts of coercion, arbitrary deprivation of liberty, private or public, in the family or community.[3] This definition, although limited in scope because it only addresses GBV among women and neglects male GBV, provides insight into the dimensions of GVB. A subset known as School-Related GBV (SRGBV) refers to acts of violence in and around schools, usually as a result of gender norms and stereotypes.[4] It includes verbal abuse, bullying, sexual abuse, harassment, and other types of violence.

Globally, GBV affects one in three women during their lifetime. Millions of women globally live with the scars of violence, with 35% experiencing physical violence and about 7% of them previously sexually abused during their lifetime, with higher rates observed among intimate partners.[5] Across Central and West Africa, millions of young adults and children endure corporal punishment that leaves emotional scars and damages their right to learn. Over half of all school teachers in these regions also resort to physical disciplinary methods daily.[2] GBV also occurs in men, though it has received less attention in research, legislation and public health policy. "Men experience GBV at varying rates, with 3.4–20.3% facing physical violence, 7.3–37% experiencing psychological abuse, and 0.2–7% subjected to sexual violence.[6] Some African studies also showed that boys were disproportionately punished more than their female counterparts.[2] While figures vary due to factors like cultural norms and reporting mechanisms, studies have consistently highlighted the existence of GBV in all genders. This issue

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devastates survivors of violence and their families and entails significant social and economic costs and psychological burdens.[7]

GBV is enacted in diverse ways, ranging from physical acts to online aggressions manifesting as physical, sexual, or emotional violence.[8] The forms of GBV are not mutually exclusive, as multiple types can happen simultaneously and reinforce each other.[8] Physical violence is the intentional use of physical force against oneself, another person, or a group or community, resulting in or with a likelihood of resulting in psychological harm, injury, deprivation, or death.[9] The most typical variety noted is pushing or shoving, probably due to the ease of commission without necessarily causing considerable harm to the victim.[9] Sexual violence encompasses any sexual act, attempt, or unwanted sexual comments or advances directed at an individual by anyone, irrespective of their relationship or setting. It includes but is not limited to rape, psychological intimidation, blackmail, or other threats, usually in situations where the victim cannot consent due to intoxication, drug influence, sleep, or mental incapacity.[10] Emotional abuse entails mistreatment of a psychological nature rather than physical harm, and encompasses verbal abuse, recurring criticism, and subtler tactics such as intimidation, manipulation and refusal to be pleased. The verbal abuse alters the victim's self-worth and emotional well-being, resulting in an emotionally abused victim.[11]

Traditional attitudes towards women perpetuate GBV. Stereotypical roles where society sees women as subordinates to men create a power skew that enables violent acts in a background of inequity related to race, disability, religion, age, social class, and sexuality. Previous studies have also shown a relationship between place of residence and GBV. Undergraduates who live far away from family and those staying on campus are at an increased risk.[12] Alcohol consumption has been linked to GBV, significantly increasing its likelihood. Family type and early life experiences, including divorce and witnessing parental violence, predispose to GBV later in adulthood.[13] Additionally, diverse social, psychological and mental health outcomes have been linked to GBV, such as insomnia, depression, low self-esteem, fear of future sexual relationships, guilt, undue rage, and in extreme cases, death.[4,14] Also, sexual assault can result in unwanted pregnancies in females, and sexually transmitted infections (STIs), including HIV in male and female genders.[15] Notable effects in males include shame, guilt, and social prejudice (questioning of masculinity), among others.[16] In humanitarian crises, reporting or seeking services for GBV can lead to further threats of violence, social stigma, and ostracization, thus hindering victims from accessing lifesaving services like food, shelter, and healthcare.[15]

While existing research predominantly focuses on GBV among women, there is limited data on GBV experiences among males and other under-recognized groups. Some authors argue that women bear the greater burden of GBV and its consequences, with men wielding GBV as a tool of power and control over women.[17] However, others caution against the silence of male victimhood, suggesting that male experiences are sometimes viewed as diminishing the urgency of GBV against women.[18] This study aims to bridge this gap in knowledge by assessing the prevalence and patterns of GBV in both male and female counterparts in a university setting. The findings will serve as baseline data for future studies and provide evidence-based information for public health policymakers.

## Methods

### Study Design

This study employed a cross-sectional descriptive design to assess the prevalence and patterns of GBV among undergraduate students. Self-administered questionnaires were used to collect data from the participants.

### Study Setting

The study was conducted at the University of Calabar, located in Calabar Municipal, Cross River State, Nigeria. The University comprises 16 faculties and 3 institutes, with a total undergraduate population of 40,645 students.[19]

### Sample Size Determination

The sample size for this study was determined using Cochran's formula, which is applicable when the prevalence is known. The formula used was n=(Z^2 × P × Q)/d^2 , where n represents the minimum sample size, Z is the standard normal deviate, estimated at 1.96 for a 95% confidence interval, P is the proportion of the outcome of interest (58.8%), Q is 1 minus P (0.412), and d is the desired level of precision (0.05). Plugging in these values, the calculation yielded 372.3. To account for a 10% non-response rate, the minimum estimated sample size was adjusted to 413.33, which was then rounded to 413. This precautionary adjustment followed standard sampling practice to ensure adequate statistical power, in case some participants opted out or provided incomplete responses.

### Eligibility Criteria

Participants in this study included all registered full-time undergraduate students at the University of Calabar who provided informed consent and were present in class during the data collection period. This study specifically excluded postgraduate students, students who did not consent to participate, and those who were absent during the time of data collection.

### Sampling Method

A multi-stage sampling technique was employed in this study. In the first stage, selection was done in two phases to ensure representation from both science- and arts-based faculties. First, faculties were categorized into science and arts groups. Then, simple random sampling was done within each category using manual balloting, where faculty names were written on separate slips, shuffled, and randomly picked from a box to select seven out of the sixteen faculties in the University. In the next stage, the

same balloting method was used to randomly determine the departments from selected faculties to administer the questionnaire. In the final stage, a stratified random sampling method was used to get the proportion per study level in the selected department.

### Tools for Data Collection

A structured, self-administered questionnaire was adapted from a previous study[20] for data collection. The sections of the questionnaire comprised the socio-demographic characteristics of the respondents (age, gender, marital status, faculty, academic year and religion), prevalence, patterns, and effects of GBV, along with recommendations to be provided. Age was categorized into two groups; less than 21 years and 21 and above. Marital status was classified as single or married, with married respondents being those who were ever legally married. The academic year was categorized as 100, 200, 300 and ≥400 level represented the first, second, third and fourth and above year of study respectively. To explore students' experiences with GBV, the questionnaire began with a general screening question ("Have you ever experienced gender-based violence?"), followed by a structured items addressing specific forms of violence, including physical, sexual, and emotional/psychological abuse, as well as the frequency of incidents, the relationship to the perpetrator, and the resulting health effects. The questionnaire also consisted of close-ended questions that enabled the collection of relevant data to answer the research questions on the respondents' knowledge of the effects of GBV.

### Method of Data Collection

The questionnaire was pretested at the University of Cross River State (UNICROSS), and amendments were made afterward. It was then administered to each class after prior approval from class representatives and verbal consent from students. To mitigate recall and social desirability bias, questions were framed neutrally, responses were anonymized, participants were assured of confidentiality, and issues were clarified on request. Four hundred and thirteen (413) questionnaires were shared, returned, completed, and found valid.

### Data Analysis

The questionnaire data was verified to minimize entry errors, outliers, and missing values. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 for Windows. The data was analyzed using the measures of central tendency and dispersion. Tables were used to present frequencies. The level of significance was set at a p-value less than or equal to 0.05. Relationships were tested with inferential statistical techniques (chi-square- Pearson, unadjusted) test as this is appropriate for categorical variables.

We also conducted a logistic regression analyses to explore the association between the demographic and academic factors and the outcome of interest. The variables we included in the models were age, sex, marital status, and academic year. These variables were selected based on their relevance in existing literature and their potential influence on gender-based violence (GBV) experiences. Age was included as GBV vulnerability and reporting tendencies may vary across different age groups. Sex was considered because GBV disproportionately affects certain genders, with variations in both prevalence and patterns. Marital status was analyzed as it can influence exposure to GBV, particularly in contexts where intimate partner violence is a major component. Academic year was examined to assess whether exposure to GBV changes over time as student's progress through university, potentially due to increased independence or changing social dynamics. We ran separate logistic regression models for each variable to estimate their individual effects on the outcome and calculated the odds ratio (OR) for each variable along with its 95% confidence interval (CI), without adjusting for the effects of other variables. After examining the unadjusted models, a multivariable logistic regression analysis was conducted, which included all four variables (age, sex, marital status and academic year) at once. This allowed us to see how each factor influenced the outcome while accounting for the other variables. We assessed the statistical significance of each variable by looking at the p-values, with values less than 0.05 indicating a significant relationship with the outcome. We also calculated the 95% confidence intervals for each odds ratio to understand the precision of the estimates. If the confidence interval for an odds ratio did not include 1, we considered the relationship statistically significant.

The goodness-of-fit of the logistic regression model was assessed using the Hosmer and Lemeshow Test that assessed the calibration of the model by comparing observed and expected outcomes, with a non-significant result indicating good fit.[21]

### Ethical Consideration

Ethical approval was obtained from the Ethics Committee of the University of Calabar Teaching Hospital with the with the assigned protocol number UCTH/HREC/33/514. Informed consent was obtained from the participating students who were fully briefed about the study's purpose and procedures. Given the sensitive nature of GBV, particular care was taken to ensure participants were aware of their right to voluntary participation and the option to withdraw at any time without consequence. Confidentiality was strictly maintained throughout the study, and participants were assured that their responses would be anonymized. The questionnaires were filled individually to ensure privacy and encourage honest responses, with no group discussions held to protect participants' privacy:

## Results

Four hundred and thirteen (413) University of Calabar undergraduate students were surveyed using a self-administered questionnaire. The response rate for this study was 100%.

### Socio-Demographic Characteristics

The mean age of respondents was 22.37±3.07 years, with the majority between the ages of 21 – 30 years (73.7%). Higher

proportions were males (50.4%). Unmarried respondents were predominant (74.1%), while individuals who ever legally married comprised 25.9%. Most respondents were Christians (97.8%) ***(Table 1).***

***Table 1.*** Socio-demographic characteristics of the respondents (n=413).

| | Frequency | Percentage |
|---|---|---|
| **Age group/years** | | |
| <21 | 103 | 24.9 |
| 21 and above | 310 | 75.1 |
| **Mean age: 22.37±3.07** | | |
| **Gender** | | |
| Male | 208 | 50.4 |
| Female | 205 | 49.6 |
| **Marital status** | | |
| Single | 306 | 74.1 |
| Ever Married | 107 | 25.9 |
| **Faculty** | | |
| Agriculture | 58 | 14.0 |
| Arts and Humanities | 67 | 16.2 |
| Basic Medical Science | 52 | 12.6 |
| Biological Sciences | 63 | 15.3 |
| Management Sciences | 64 | 15.5 |
| Clinical Sciences | 42 | 10.2 |
| Law | 67 | 14.2 |
| **Academic Year** | | |
| 100level | 82 | 19.9 |
| 200level | 84 | 20.3 |
| 300level | 85 | 20.6 |
| ≥400level | 162 | 39.2 |
| **Religion** | | |
| Christianity | 405 | 97.8 |
| Islam | 2 | 0.5 |
| Others | 7 | 1.7 |

## Prevalence of GBV

The overall prevalence of GBV among the respondents was 19.4%. The most prevalent form was emotional violence, with 18.6% (n=77), while sexual violence had the least occurrence, with 13.3% (n=55) ***(Table 2).***

Older students (>21 years) experienced slightly higher GBV prevalence compared to younger students (<21 years), but this difference lacked statistically significance (p>0.05). Among genders, males experienced a slightly higher prevalence of GBV than females, with prevalences of 19.7% and 19%, respectively. Those who were ever legally married experienced GBV more than their single counterparts. We also found a higher prevalence of GBV among students in higher academic years, with students in 400level and above experiencing it more than those in lower levels of study. However, none of these patterns reached statistical relevance (p>0.05) ***(Table 3).***

The logistic regression analysis showed no significant relationship between the demographic and academic factors studied and the likelihood of experiencing GBV. Older individuals appeared to have slightly lower odds of experiencing GBV (adjusted OR = 0.95, 95% CI: 0.88–1.03), but this effect showed no significant association (p = 0.19). Similarly, while males seemed to have slightly higher odds of experiencing GBV compared to females (adjusted OR = 1.054, 95% CI: 0.64–1.70), this difference was not significant (p= 0.86). Married individuals were somewhat less likely to experience GBV compared to their single counterparts (adjusted OR = 0.72, 95% CI: 0.42–1.23). However, this association was not statistically significant (p = 0.23). Students in higher academic years showed a small, non-significant decrease in the odds of experiencing GBV (adjusted OR = 0.88, 95% CI: 0.69–1.13, p = 0.32). In summary, while the variables of age, sex, marital status, and academic year showed some trends in their relationships with GBV, none of these associations were demonstrable statistically ***(Table 4).***

The model demonstrated a good fit, as indicated by the non-significant result of the Hosmer and Lemeshow Test (p = 0.232), suggesting that the observed and expected frequencies were closely aligned.

***Table 2.*** Frequency and Patterns of Gender-Based Violence.

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Frequency of Occurrence** | | |
| Daily | 11 | 13.8 |
| Weekly | 16 | 20 |
| Two times weekly | 13 | 16.3 |
| Four times monthly | 4 | 5 |
| Monthly | 36 | 45 |
| **Prevalent Patterns** | | |
| Physical | 75 | 18.2 |
| Emotional | 77 | 18.6 |
| Sexual | 55 | 13.3 |

***Figure 1.*** Overall Prevalence of Gender-Based Violence.

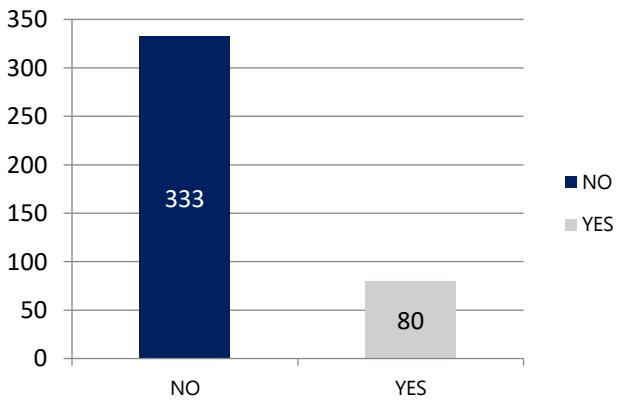

***Table 3.*** Association Between Socio-Demographic Variables and Prevalence of GBV.

| Variable | GBV Yes | GBV No | CHI-SQUARE | P-VALUE |
|---|---|---|---|---|
| **Age group (years)** | | | | |
| <21 | 18 (17.5%) | 85 (82.5%) | 0.32 | 0.57 |
| 21 – 30 | 62 (20%) | 248 (80%) | | |
| **Gender** | | | | |
| Male | 41 (19.7%) | 167 (80.3%) | 0.03 | 0.86 |
| Female | 39 (19%) | 166 (81%) | | |
| **Marital Status** | | | | |
| Single | 53 (17.3%) | 253 (82.7%) | 7.33 | 0.06 |
| Ever Married | 27 (25%) | 80 (75%) | | |
| **Academic Year** | | | | |
| 100 level | 15 (18.3%) | 67 (81.7%) | 7.33 | 0.20 |
| 200 level | 10 (11.9%) | 74 (88.1%) | | |
| 300 level | 16 (18.8%) | 69 (81.2%) | | |
| ≥400 level | 39 (24.1%) | 123 (75.9%) | | |

- **GBV Yes**: Participants who reported experiencing gender-based violence.
- **GBV No**: Participants who did not report experiencing gender-based violence.
- **Pearson Chi-Square (unadjusted)**: Statistical test used to assess the association between the variables and the experience of GBV.

**P-Value**: Significance level of the Chi-Square test; values below 0.05 indicate a statistically significant association.

***Table 4.*** Multivariate Regression for Factors Associated with GBV.

| Variable | Unadjusted OR (95% CI) | Adjusted OR (95% CI) | p-value (Adjusted) |
|---|---|---|---|
| Age | 0.98 (0.89 - 1.07) | 0.95 (0.87 - 1.02) | 0.19 |
| Sex **(ref: Female)** | 1.09 (0.66 - 1.81) | 1.04 (0.64 - 1.70) | 0.86 |
| Marital Status **(ref: Unmarried)** | 0.75 (0.43 - 1.30) | 0.71 (0.42 - 1.23) | 0.23 |
| Academic Year | 0.84 (0.68 - 1.04) | 0.88 (0.68 - 1.13) | 0.32 |

- **Unadjusted OR:** Odds ratio for each variable without adjusting for other factors.
- **Adjusted OR:** Odds ratio for each variable after adjusting for age, sex, marital status, and academic year.
- **95% CI:** 95% Confidence interval for the odds ratio, indicating the range within which the true value of the odds ratio is likely to fall.
- **P-value (Adjusted):** Significance level of the adjusted odds ratio; values below 0.05 indicate a statistically significant relationship with the outcome.

### Effects Of GBV

Respondents were also asked about their awareness of the effects of GBV. Their responses highlighted a range of consequences including loss of self-esteem (96.5%), loss of concentration in school (95.4%), sexually transmitted infections (89.5%), suicidal thoughts (89.2%), sleep disturbance (89%), strained relationship (86.8%), unwanted pregnancy (83.6%), hospital admission (80.9%), urge to abuse alcohol (80.4%) and drugs (77.4%). Other psychological effects include suicidal thoughts (89.2%) and running away from home (84.9%).

## Discussion

We discovered that the overall prevalence of GBV was 19.4% among the population studied, with the male prevalence (19.7%) slightly above that of females (19%). The commonest GBV was emotional violence, and its major effects identified by respondents were psychological, with loss of self-esteem being the most notable.

We had a similar overall prevalence with results obtained in a study among female undergraduates in Port-Harcourt (19.8%).[22] However, our findings sharply contrast earlier studies conducted in Calabar and Northern Nigeria in 2012 and 2011, respectively, with individual prevalences of 51.7%,14 and 58.8%.[20] This difference could result from the disparity in the study population as both studies were done on female undergraduates, with a focus on sexual violence only, not GBV in its entirety. A study on GBV among female healthcare professionals in Northern Nigeria reported a high prevalence of 93.5%.[23] Findings from a similar study in Sierra Leone also had an estimated 62% prevalence.[24] This disparity could be due to the predominant age group among respondents in the studies above, as majority of participants in the studies were of an older age bracket (mean age of 28.69) compared to our study that had a mean age of 22.37±3.07. Older females would be more likely to have more experiences with GBV than the younger age group of females in our study.25Healthcare professionals also tend to be more enlightened about GBV and as such, share their experiences more.

Our study also found that male respondents experienced GBV slightly more than their female counterparts. Although this difference did not reach statistical significance, it suggests that men also experience high levels of GBV. A similar finding was

reported in a 2023 study done in Abuja, Nigeria, which showed that various forms of physical, sexual and psychological abuse were experienced more by male undergraduates than females.[26] However, a study done among men and women in three Nigerian states showed that females respondents (15.1%) experienced GBV more than males (11.8%).[27] Such findings also discovered in a Somali study showed that 35.6% of women reported a greater adult lifetime experience of physical or sexual violence, when compared to 31.2% of male respondents who had been victimized as adults.[28] This results could stem from cultures in these regions that rationalize men's physical aggression towards women. As a result, most studies focus on violence perpetuated against girls and women, which is understandable as females are more vulnerable to gender inequalities and their effects.[18] The higher GBV prevalence among males in our study may be due to the structure and content of the survey instrument, which could influence participant responses. The deviation may also be due to underreporting in previous research due to factors such as societal expectations of male dominance, masculinity and cultural norms discouraging male emotional expression and patriarchy in the university setting. These factors may have discouraged male students from reporting their experiences and underplays the reality and extent of GBV that boys and men experience. While GBV is more commonly studied in women, emerging research highlights its impact on men and other under-recognized groups. Societal expectations of masculinity and cultural barriers may contribute to the invisibility of male and gender-diverse survivors.[29] Applying a gender-inclusive, intersectional lens is essential to understand these issues and ensure that support systems address the needs of all survivors.

We also found that psychological/emotional violence (18.6) was the most prevalent form of GBV encompassing threats, verbal abuse, and intimidation, among others. This was consistent with previous studies that also identified emotional violence was the commonest form of GBV.[22,23,30] A study in Northern Nigeria reported even higher rates of verbal and psychological abuse, which is often easier to commit through words gestures and psychological tactics.20 Additionally, the Northern Nigerian penal code does not forbid domestic violence, but suggests that a man's assault on his wife is not a crime.[31] There is also reluctance by some Northern Nigerian states to adopt the Violence Against Person's Prohibition (VAPP) Act, which proscribes all forms of violence in both private and public settings.[32]

Married respondents had a higher prevalence of GBV compared to the unmarried at some point in their lives, though with less likelihood of experiencing GBV. Although these findings did not reach statistical significance, the observed trend was in keeping with a study in Northern Nigeria, where married women were more likely to experience violence than single women.20Another study done among males and females in 3 Nigerian states, showed that married females were more likely to experience physical violence than their single counterparts.27Global estimates also show that about 33% of African women have experienced Intimate Partner Violence, and about 38% of female murders were committed by their intimate partners.[33] According to the "Marital Power Theory", power imbalance in a marriage contributes to the perpetuation of such violence, and this might play a role.[34] In situations where one partner excessively controls the other partner, many aspects of the relationship, like communication, decision-making and overall relationship satisfaction, are affected. These problems lead to further abuse of power, resulting in emotional, physical and physical violence.[34]

Most respondents agreed that GBV has psychological, social and health implications such as stigma, depression, loss of esteem, contracting sexually transmitted diseases or infections, unwanted pregnancy, and abortion, among others. This finding underscores the reports in previous studies that GBV has a deleterious effect on student's academic performance.[35] It also negatively affects the victims' health, leading to fear, trauma, anxiety, and an increased risk of sexually transmitted infections including HIV/AIDS.[36]

We also found that the likelihood of experiencing GBV decreases slightly with increasing academic year, though this was not significant. The finding suggests that the relationship between academic factors and GBV is more complex than we might expect. While more school experiences accompanies increasing years and shape student's lives, it does not primarily influence GBV risk. A constellation of factors including like cultural attitudes, personal circumstances, and access to support services, might have a stronger influence. For example, in some environments, social norms, the presence of community resources, or support systems might be more important in preventing or addressing GBV. This study's finding that males experienced GBV more than females among has critical implications. It challenges entrenched gender stereotypes and suggests the need to develop inclusive policies and programs that support male victims. The data call for heightened awareness and education regarding male GBV, as well as providing tailored support services, including mental health care and legal assistance in the university community. Addressing cultural and social norms that hinder male undergraduate victims from reporting GBV is paramount. Ensuring the legal framework provides equal protection for all victims, regardless of gender, and fostering a culture of peer support and bystander intervention can contribute significantly to a safer campus environment. These findings emphasize the importance of a holistic and inclusive approach to GBV, ensuring that all victims receive the necessary support and protection. The lack of statistical significance in our findings also underscores the need for further research with larger sample sizes to understand male GBV better and ensure robust, evidence-based interventions. These efforts could lead to more comprehensive and effective approaches to combat GBV across all demographics.

### Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. Firstly, the cross-sectional design limits our ability to infer causal relationships between demographic characteristics and experiences of gender-based violence (GBV). While associations were explored, temporal directionality cannot be established. In addition, although the questionnaire was adapted from prior tools and structured to capture various GBV

forms, it was not formally validated in the Nigerian university context. This may affect the reliability and cultural sensitivity of the measures.

Self-reported responses may also have introduced recall bias, social desirability bias, and potential misclassification of GBV types. Some participants may have underreported or misclassified incidents due to stigma or uncertainty. Moreover, the absence of qualitative or open-ended questions limited our ability to explore the deeper context of these experiences, while the severity and duration of GBV incidents were not assessed, constraining the richness of the data.

Although stratified multi-stage sampling was employed, the analysis did not apply design-based adjustments, such as weighting or clustering corrections. This may have introduced bias in prevalence estimates and underestimated standard errors, which could compromise the accuracy of p-values and confidence intervals. Additionally, the chi-square tests and logistic regression models used were unadjusted and did not control for confounding variables such as alcohol use, prior trauma, place of residence, or socioeconomic background, which may have influenced both exposure and outcome.

Lastly, although informed consent was obtained and participation was voluntary, no structured psychological support or referral system was in place. This represents a limitation in participant protection, especially considering the sensitive and potentially distressing nature of the questions. Despite these limitations, the study contributes valuable insights into GBV patterns among university students and highlights areas for future research.

**Conclusion**

This study highlights the significant burden of GBV among university students in Nigeria. Addressing GBV requires targeted policies, increased awareness, and student support programs to foster a safer academic environment. Further research is necessary for generalization, considering the reported limitations. Future research should also include multiple universities to enhance generalizability and capture regional variations in GBV experiences.

The similar GBV prevalence among genders necessitates a comprehensive approach. To improve awareness and identification of GBV victims, the university should provide formal confidential GBV reporting mechanisms physically and online via the institution's existing website, including online reporting forms, email addresses, and phone numbers. Additionally, advertisements on the website, campus notice boards, and other physical platforms can help raise awareness and encourage reporting of GBV incidents. This mass sensitization about GBV's prevalence, forms, patterns, and effects is essential for both the university community and the public. The university should enforce clear sanctions and penalties against GBV, such as suspension or expulsion for perpetrators, mandatory counseling and public apology in cases of proven abuse. These sanctions should be enforce by university administration, with clear guidelines for reporting and handling cases. Additionally, students and staff must be educated mandatorily to recognize GBV and report it to appropriate authorities, such as campus security, student affairs or designated faculty members.

Victims should be promptly identified, screened, and integrated into support programs within the school and community. Sexual violence victims should receive immediate screening for STIs and emergency contraception. Social support groups such as university counseling services, GBV support centers, peer support groups, women and men's advocacy groups, and help lines can provide safe spaces for sharing experiences and emotional support, advocate for policy changes, and work with authorities to address GBV's root causes. The study underscores the need to address social norms, power imbalances, and gender inequalities across all genders to prevent and respond to GBV effectively. A coordinated approach involving school authorities, governments, civil society organizations, and individuals is essential to eradicate GBV.

## Summary – Accelerating Translation

Gender-based violence (GBV) refers to harmful actions directed at individuals because of their gender. It encompasses a range of behaviors including physical assault, emotional abuse, and unwanted sexual attention or contact. Globally, GBV remains a serious concern, especially among young people, and is known to impact survivors' mental health, social relationships, academic performance, and long-term wellbeing.
While many studies have focused primarily on violence against women and girls, GBV is a broader issue that can affect people of all genders. Unfortunately, limited research exists on how GBV affects university students in Nigeria, particularly studies that include both male and female perspectives. This knowledge gap can hinder efforts to design inclusive interventions and responsive support systems on campuses.

To help address this gap, we conducted a study at the University of Calabar in southern Nigeria to assess the prevalence of gender-based violence among undergraduate students and to explore their understanding of its consequences. The study involved 413 students across seven faculties, who were selected using a multi-stage sampling technique. Each participant completed a structured questionnaire asking about their experiences with different forms of GBV—physical, emotional, and sexual—as well as their knowledge of the possible outcomes of such experiences.

Our findings reveal that GBV is a significant concern among university students. About 19.4% of respondents reported having experienced at least one form of gender-based violence in their lifetime. The most common form was emotional violence, which includes behaviors such as insults, intimidation, or threats. This form of abuse was reported by nearly all students who experienced GBV, and it appeared more frequently than physical or sexual violence.

One notable aspect of our findings is that male students reported slightly higher rates of GBV than female students, although the difference was not statistically significant. This challenges the commonly held perception that gender-based violence is primarily a women's issue and underscores the importance of recognizing that GBV can affect people of all genders.
We also examined whether certain factors such as age, marital status, or academic year were associated with the likelihood of experiencing GBV. None of these factors showed a statistically significant association, suggesting that GBV cuts across demographic categories and may affect any student, regardless of background.

When asked about the consequences of gender-based violence, most students demonstrated a clear understanding of its impact. Respondents recognized that GBV can lead to psychological trauma, physical injuries, social isolation, and long-term emotional distress. This indicates that awareness of the issue is relatively high among students, even though formal mechanisms for addressing it may still be lacking within university settings.

The results of our study carry important implications for both policy and practice. First, they highlight the urgent need for university authorities to establish clear and accessible reporting structures for victims of GBV, including confidential support services and trained counselors. Second, there is a need for campus-wide education campaigns that do not focus solely on female students but include male students and other marginalized groups as well. Third, stronger institutional policies should be implemented to prevent and respond to all forms of GBV, especially those that are less visible, such as emotional and psychological abuse.

In conclusion, this study reinforces the reality that GBV is not limited to any single gender or demographic. It affects a significant number of university students and requires a comprehensive, inclusive response. By expanding our understanding and recognition of all forms of GBV, and by acknowledging that male students can also be affected, institutions can take meaningful steps toward creating safer, more supportive educational environments for everyone.

## References

1. Klugman J, Hanmer L, Twigg S, Hasan T, McCleary-Sills J, Santamaria J. Voice and Agency: Empowering Women and Girls for Shared Prosperity. Washington DC: World Bank Publications; 2014. 239 p.
2. Badri A. School-gender-based violence in Africa: prevalence and consequences. Glob J Arts Humanit Soc Sci. May 1 2014;2(2):1–20.
3. King A. UN Declaration on the Elimination of Violence against Women. In: The Encyclopedia of Women and Crime. John Wiley & Sons, Ltd; 2019. p. 1–2. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118929803.ewac0505. cited Sep 6, 2023.
4. UNESCO, UN Women. Global guidance on addressing school-related gender-based violence. UNESCO Publishing; 2016. 123 p. Available from: https://www.unwomen.org/en/digital-library/publications/2016/12/global-guidance-on-addressing-school-related-gender-based-violence. cited Feb 2, 2025.
5. World Health Organization. Devastatingly pervasive: 1 in 3 women globally experience violence. Available from: https://www.who.int/news/item/09-03-2021-devastatingly-pervasive-1-in-3-women-globally-experience-violence. Last updated Mar 9, 2021; cited Feb 15, 2025.
6. Kolbe V, Büttner A. Domestic violence against men—prevalence and risk factors. Dtsch Arztebl Int. Aug 2020;117(31–32):534–41.
7. Perrin N, Marsh M, Clough A, Desgroppes A, Yope Phanuel C, Abdi A, et al. Social norms and beliefs about gender-based violence scale: a measure for use with gender-based violence prevention programs in low-resource and humanitarian settings. Confl Health.Mar 8, 2019;13(1):6.
8. UN Women. FAQs: Types of violence against women and girls. Available from: https://www.unwomen.org/en/what-we-do/ending-violence-against-women/faqs/types-of-violence. cited Jul 22, 2024.
9. Council of Europe. Physical violence - Gender Matters. Available from: https://www.coe.int/en/web/gender-matters/physical-violence. cited Jul 22, 2024.
10. Akpotor J. Sexism and sexual harassment in tertiary institutions. Gender Behav. 2019;11(1):5237–43. Available from: https://www.ajol.info/index.php/gab/article/view/89805.
11. Dye HL. Is emotional abuse as harmful as physical and/or sexual abuse? J Child Adolesc Trauma. Dec 10, 2019;13(4):399–407.
12. Abubeker F, Dessie Y, Assefa N, Geleto A, Adorjan K, Abdeta T. Prevalence and associated factors of gender-based violence among female students attending private colleges in Harar Town, Eastern Ethiopia. Inq J Health Care Organ Provis Financ. Oct 24, 2021;58:00469580211047197.
13. Wandera SO, Clarke K, Knight L, Allen E, Walakira E, Namy S, et al. Violence against children perpetrated by peers: a cross-sectional school-based survey in Uganda. Child Abuse Negl. Jun 1, 2017;68:65–73.
14. Effa EE, Okokon EO, Nwagbara AB, Bello S. Pattern, determinants and mental consequences of sexual violence among female undergraduate students in Calabar, Southern Nigeria. 2012. Available from: https://www.svri.org/forums/forum2009/presentations/Nwagbara.pdf.
15. International Rescue Committee. What is gender-based violence—and how do we prevent it? Available from: https://www.rescue.org/eu/article/what-gender-based-violence-and-how-do-we-prevent-it. cited Nov 23, 2023.
16. Mphatheni MR, Mlamla NE. Gender-based violence against men and boys: a hidden problem. Afr J Gend Soc Dev. Sep 1, 2022;11(3):59–83.
17. Graaff K, Heinecken L. Masculinities and gender-based violence in South Africa: a study of a masculinities-focused intervention programme. Dev South Afr. Sep 3, 2017;34(5):622–34.
18. Stephenie. Hidden suffering: Gender-based violence (GBV) against boys and men. SACAP. 2020. Available from: https://www.sacap.edu.za/blog/applied-psychology/hidden-suffering-gender-based-violence-gbv-against-boys-and-men/. cited Nov 23, 2023.
19. University of Calabar. Available from: https://unical.edu.ng/faculty.php. cited Jan 13, 2024.
20. Iliyasu Z, Abubakar IS, Aliyu MH, Galadanci HS, Salihu HM. Prevalence and correlates of gender-based violence among female university students in Northern Nigeria. Afr J Reprod Health. 2011;15(3):123–33.
21. Hosmer DW, Lemeshow S. Application of logistic regression with different sampling models. In: Applied Logistic Regression. John Wiley & Sons, Ltd; 2000. p. 203–22. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/0471722146.ch6. [cited Feb 15, 2025].
22. Mezie-Okoye MMI, Alamina F. Sexual violence among female undergraduates in a tertiary institution in Port Harcourt: prevalence, pattern, determinants and health consequences. Afr J Reprod Health. 2014;18(4):79–85.
23. Ibrahim A, Thomas K, Garba S. Gender-based violence (GBV): prevalence and severity of abuse among female healthcare professionals in Northern Nigeria. Jun 26, 2020;2348–9359.
24. UNFPA Sierra Leone. Gender-based violence. Available from: https://sierraleone.unfpa.org/en/topics/gender-based-violence-11. cited Feb 16, 2025.
25. Our Watch. Preventing violence against older women. Available from: https://action.ourwatch.org.au/what-is-prevention/preventing-violence-against-older-women/. cited Jan 30, 2024.
26. Ojo E, Ebenezer D, Adeniyi DS, Ojo A, Ikani P, Abiodun O, et al. Prevalence and causes of gender-based violence (GBV) among students in tertiary institutions in Abuja, Nigeria. World J Public Health. Jun 27, 2023.
27. Oladepo O, Yusuf OB, Arulogun OS. Factors influencing gender-based violence among men and women in selected states in Nigeria. Afr J Reprod Health. 2011;15(4):78–86.
28. Scott J, Achenbach S, Elmi J, et al. Lifetime prevalence, correlates and health consequences of gender-based violence victimisation and perpetration among men and women in Somalia. PLoS Med. 2018;15(11):e1002511. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6074632/. cited Feb 14, 2024.

29. Lang M, Mergaert L, Arnaut C, Vertommen T. Gender-based violence in sport: prevalence and problems. Eur J Sport Soc. Jan 2, 2023;20(1):57–78.
30. Beyene AS, Chojenta C, Roba HS, Melka AS, Loxton D. Gender-based violence among female youths in educational institutions of Sub-Saharan Africa: a systematic review and meta-analysis. Syst Rev. Feb 25, 2019;8(1):59.
31. Legal Information Institute. Nigeria Penal Code Act. Available from: https://www.law.cornell.edu/women-and-justice/resource/nigeria_penal_code_act. cited Jan 30, 2024.
32. Partners West Africa Nigeria. VAPP Tracker. Available from: https://www.partnersnigeria.org/vapp-tracker/. cited Jan 29, 2024.
33. World Health Organization. Violence against women. Available from: https://www.who.int/news-room/fact-sheets/detail/violence-against-women. cited Jan 21, 2024.
34. Treas J, Kim J. Marital power. In: Encyclopedia of Family Studies. John Wiley & Sons, Ltd; 2016. p. 1–5. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119085621.wbefs524. cited Jun 30, 2024.
35. Shockden EI, Bahago BA, Omede J. Well-being and academic attitudes among secondary school students living in a context of life-threatening collective violence in Northern Nigeria. Front Educ. Oct 5, 2023;8. Available from: https://www.frontiersin.org/articles/10.3389/feduc.2023.1025515/full. cited Jul 22, 2024.
36. Wanjiru Q. Causes and effects of gender-based violence: a critical literature review. J Gend Relat Stud. Dec 24, 2021;2(1):43–53.

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Original Article

# Residency-Affiliated Academic Neurosurgeons (RAAN): A Cross-Sectional Analysis of Neurosurgery Residency Program Rankings

Sheeny V Vo,[1] Olivia Duru,[1] Ciarán J. Powers.[2]

## Abstract

**Background:** Existing neurosurgery residency rankings do not assess programs based on graduate placement in academic faculty positions. We sought to develop a novel ranking system of neurosurgery programs to identify programs that produced academic faculty and evaluated these programs relative to established ranking systems. This novel ranking system, the Residency Affiliated Academic Neurosurgeons, was compared to the Doximity Residency Navigator, and Blue Ridge Institute for Medical Research. **Methods:** We evaluated neurosurgeons with positions in Accreditation Council for Graduate Medical Education neurosurgery programs. We looked at those programs websites and faculty under neurosurgery. Certain programs were excluded based on the data not being publicly available. We analyzed the relationship between Residency Affiliated Academic Neurosurgeons with Doximity Residency Navigator and Blue Ridge Institute for Medical Research. We analyzed the median rank of the ranking system per program and the percentage of legacy faculty. **Results:** We included 1623 faculty members in our analysis. This novel ranking system was evaluated against Doximity Residency Navigator and Blue Ridge Institute for Medical Research, revealing strong correlations ($r=0.73$, $p<0.0001$, $r=0.45$, $p<0.001$, respectively). Notably, the percentage of legacy faculty (defined as faculty who are appointed at the same location as residency training) had a significant association with Residency Affiliated Academic Neurosurgeons and Doximity Residency Navigator ($r=-0.33$, $p<0.05$ and $r=-0.38$, $p<0.001$, respectively). **Conclusion:** We developed a ranking of neurosurgery programs based on the placement of graduates in academic positions. RAAN rankings align with existing systems and provide an objective measure of residency program effectiveness in producing academic neurosurgeons.

## Introduction

Medical students weigh numerous factors—including program reputation, faculty expertise, research opportunities, clinical exposure, and geographic location—when creating their rank lists to find the optimal blend of excellence, opportunity, and personal fit. No prior studies have compared publicly available institutional rankings with rankings based on the academic placement of neurosurgery residency graduates.

Various publicly available ranking systems[1,2] have been established that can be applied to residency rank order lists by medical students, however, studies have specifically questioned the validity and reliability of the most prominent one, the Doximity Reputation Navigator (DRN) reputation rank. DRN rankings rely on peer evaluations, while RAAN objectively measures academic placement of graduates The major concern is that DRN is highly subjective since its methodology relies on peer evaluation.[3,6] Multiple studies have identified and reported errors in the Doximity profiles of residency programs and graduates.[7, 8] Additionally, whether DRN reputation data measures necessary "intangibles" or whether the data stems from academic productivity or popularity are important concerns.[5] Conversely, a purely objective ranking system is the Blue Ridge Institute for Medical Research (BRIMR), which only considers a subset of academic programs. It ranks institutions based on National Institutes of Health (NIH) funding, a measure of scientific merit.[9,15] However, NIH funding alone does not fully capture residency program quality, as it does not account for clinical training, faculty mentorship, or graduates' success in securing academic positions.

RAAN ranks neurosurgery residency programs based on the number of graduates securing academic faculty positions, providing an objective measure of program impact - a system that more appropriately assesses residency program effectiveness in graduates' placement in academic positions. We compared RAAN with the other systems (DRN and BRIMR) in predicting successful academic careers in neurosurgery. We sought to provide a more robust tool for assessing residency program quality and effectiveness.

## Methods

### Selection of Neurosurgery Residency Programs

We analyzed 116 Accreditation Council for Graduate Medical Education (ACGME)-accredited neurosurgery residency programs

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using DRN Reputation Rank as of January 2024. We included BRIMR rankings of 50 neurological surgery departments. We excluded the U.S. News & World Report ranking system since it combines neurology and neurosurgery and not neurosurgery alone.[2] Programs without publicly available faculty training data were excluded. We adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure quality and transparency.

### Doximity Residency Navigator (DRN) Reputation Rank[16]

DRN helps inform medical student decisions regarding residency placements. Reputation data, derived from survey responses, is limited to Doximity's board-certified members in the specialty and weighted by alumni status. Each physician could nominate up to 5 residency programs that "offer the best clinical training." DRN classifies self-nominations as alumni or non-alumni and weighs those nominations by a static value less than non-alumni ones. More recent graduates' nominations are weighted more than less recent graduates. Lastly, DRN rationalizes adding more weight to those program directors' nominations due to their insight into residency training curricula.[1]

### BRIMR Rankings of NIH Funding[9]

Each year since 2006, BRIMR, an independent non-profit organization, has published rankings of institutions, departments, and investigators based on funding received by NIH. BRIMIR compiles and releases data obtained by the NIH, reflecting NIH funds awards during a given fiscal year ending on September 30. BRIMR rankings of NIH funding in 2023 ranked 50 neurosurgery school programs with the rank – 1 - the program with the most funding by the NIH. The BRIMR encompasses the factor of scientific vitality and has been used to examine trends in funding for academic specialties.[9]

### Selection of Neurological Surgeons faculty

To select trained neurological surgeons within each residency program in our study, we accessed the departmental faculty pages of each program to extract relevant information. In each accredited residency program, we selected faculty members who specified neurosurgery as their page's residency education/training section. Faculty selection data was validated through institutional websites and publicly available faculty directories. The following information was extracted and recorded: faculty name, residency program name, and fellowship name. We excluded faculty members if neurosurgery was not explicitly listed. We did not include residents and fellows in the analysis.

### Creation of Residency Affiliated Academic Neurosurgeons (RAAN) Ranking

We developed a ranking system of all ACGME neurosurgery residency programs based on program occurrences seen in academic neurosurgeons' residency training. Each residency program was ranked according to the number of its graduates who secured academic faculty positions. Each faculty member contributed equally to the ranking, with programs receiving higher ranks based on greater representation among the included academic neurosurgeons. Programs without representation among the selected academic neurosurgeons were excluded to ensure the ranking system's relevance. This methodology is illustrated in ***Figure 1.*** The resulting ranking system, presented in ***Table 1,*** reflects the residency program's ordinal contributions to the academic neurosurgeon pool in the United States.

***Table 1.*** Summary of Available and Collected Data for Each Information Source.

| Metric | Data Source | Total available | Total collected | % captured |
|---|---|---|---|---|
| **no. of trained residency programs** | Residency Affiliated Academic Neurosurgeons (RAAN) | 1585 | 1396 | 88.08 |
| | Doximity Residency Navigator (DRN) Reputation Rank | 1633 | 1442 | 88.30 |
| | Blue Ridge Institute for Medical Research (BRIMR) | 861 | 612 | 71.00 |
| **no. of programs ranked** | Residency Affiliated Academic Neurosurgeons (RAAN) | 108 | 101 | 93.52 |
| | Doximity Residency Navigator (DRN) Reputation Rank | 116 | 109 | 93.97 |
| | Blue Ridge Institute for Medical Research (BRIMR) | 50 | 49 | 98.00 |
| **no. of faculty** | Residency Affiliated Academic Neurosurgeons (RAAN) | 1546 | | |
| | Doximity Residency Navigator (DRN) Reputation Rank | 1623 | | |
| | Blue Ridge Institute for Medical Research (BRIMR) | 879 | | |

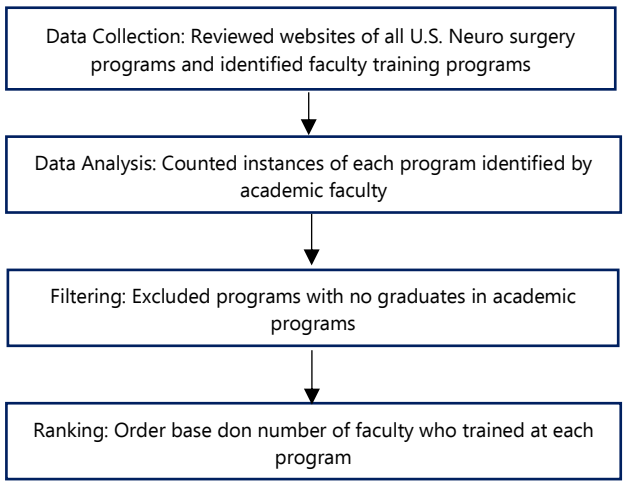
***Legend:*** The table includes the total number of faculty members identified, the number of residency programs ranked, and the coverage rates achieved by each source. Total available refers to the full dataset extracted from the ranking system website, while Total collected represents the publicly accessible data.

### Calculation of % legacy faculty

It is common in neurosurgery that faculty are recruited from their own trainee pool, so-called "legacy faculty". We analyzed the separate rank lists for the number of legacy faculty in each

ranking system (DRN, BRIMR, and RAAN). Here, we defined legacy faculty as individuals who have received training at the same neurosurgery residency program and are current faculty members. We conducted a straightforward calculation to determine the percentage of legacy faculty within these programs. First, we counted the number of faculty members meeting the criteria for legacy status. Next, we tallied the total number of faculty across each selected program. The percentage of legacy faculty was then computed by dividing the count of legacy faculty by the total number of faculty and multiplying the result by 100. This approach provided us with a clear metric to gauge the prevalence of legacy faculty within neurosurgery residency programs.

***Figure 1.*** Flow Diagram of Methodology Used to Develop RAAN.




### Statistical analysis

We performed program-to-program analyses to assess the correlation across ranking systems of the same residency program, utilizing the Pearson correlation test. Furthermore, we performed the same correlation test between the different types of ranking systems, median faculties' residency, types of ranking systems, and percent legacy faculty. We utilized Pearson correlation since the rankings in our dataset were normally distributed. We conducted all statistical analyses using GraphPad Prism (GraphPad Software). Significance was defined as $p<0.05$(*), $p<0.01$(**), $p<0.001$(***), or $p<0.0001$ (****).

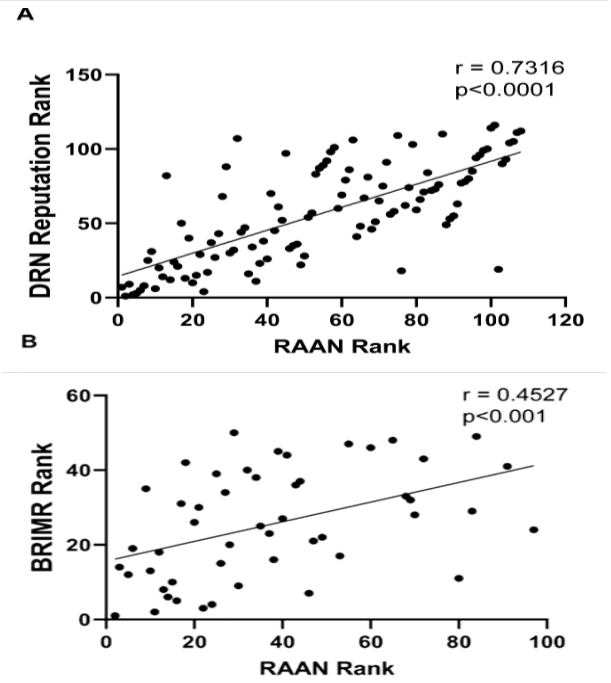
### IRB statement

The study focused on analyzing publicly available data and did not involve patient participation. Consequently, the Institutional Review Board approval and patient consent requirement were deemed unnecessary.

## Results

RAAN ranked 101 programs, covering 93.52% of all ACGME neurosurgery programs and 1,396 faculty members (88.08% of the total faculty). As shown in ***Table 2,*** the top five programs producing ACGME-accredited neurosurgery physicians are Massachusetts General Hospital, University of California-San Francisco (UCSF), University of Pittsburg Medical Center (UPMC), Barrow Neurological Institute, and Johns Hopkins University. *Specific residency programs consistently exhibit positive correlations in RAAN with DRN and BRIMR.* When comparing the RAAN and DRN rankings of 108 residency programs, RAAN rankings for 108 programs correlated strongly with DRN ($r=0.73$, $p<0.0001$, $n=108$), suggesting that programs highly ranked by RAAN are also highly ranked in DRN ***(Figure 2a).*** Similarly, the comparison between RAAN and BRIMR for 50 programs revealed a moderate positive correlation ($r=0.4527$, $p<0.001$, $n=50$), indicating alignment in program evaluations across these systems ***(Figure 2b).*** This demonstrates external validity of the RAAN ranking system.

***Figure 2.*** Correlations Between Residency Affiliated Academic Neurosurgeons (RAAN) rank and both Doximity Residency Navigator (DRN) Reputation rank and Blue Ridge Institute for Medical Research (BRIMR). (A) Correlation plot of Residency Affiliated Academic Neurosurgeons (RAAN) with Doximity Residency Navigator (DRN) reputation rank of matched programs (n=108). (B) Correlation plot of Residency Affiliated Academic Neurosurgeons (RAAN) programs matched with Blue Ridge Institute for Medical Research (BRIMR) (n=50).



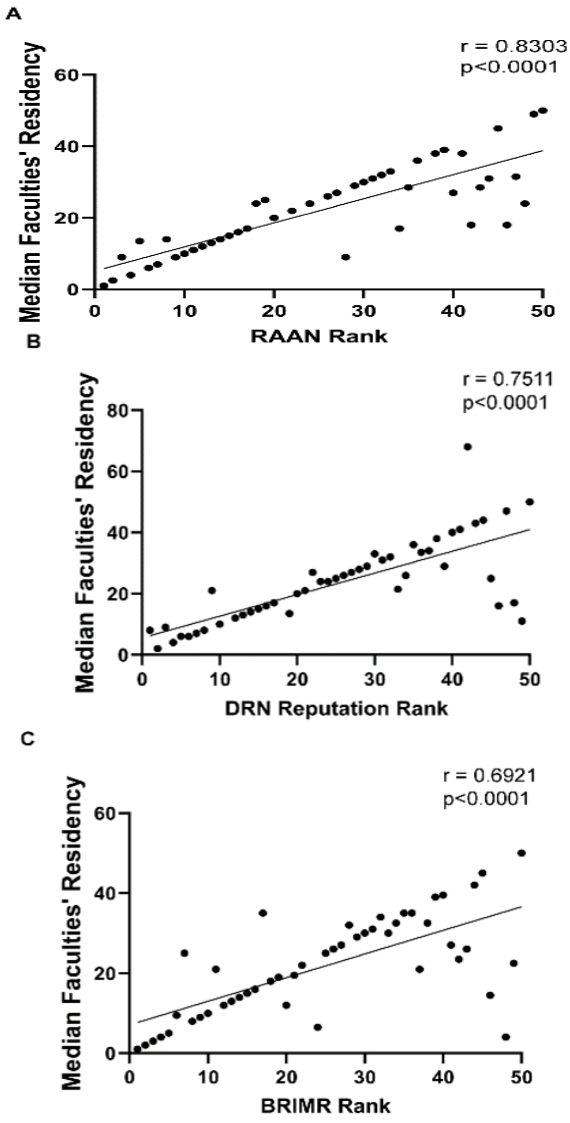

***Legend:*** Individual points represent the matched programs with their respective rank according to system. $p<0.0001$ (****), $p<0.001$ (***), Pearson correlation coefficient. This demonstrates external validity of the RAAN ranking system.

### Different ranking systems show that highly ranked programs are correlated with the median of faculties' residency rank.

We found robust positive correlations across all three ranking systems between the top 50 residency programs and the median faculty residency rank. We limited the analysis to only the top 50 programs in order to focus on programs likely to be of interest to

applicants. The top 50 residency programs in RAAN have a very strong positive correlation with median faculties' residency (r=0.8303, p<0.0001, n=46) ***(Figure 3a).*** In the DRN rank system, the top 50 programs have a very strong positive correlation with median faculties' residency (r=0.7511, p<0.0001, n=48) ***(Figure 3b).*** BRIMR rank system also has a very strong positive correlation with median faculties residency (r=0.6921, p<0.0001, n=48) ***(Figure 3c).*** This demonstrates a consistent trend where higher-ranking programs are associated with more successful faculty.

***Figure 3.*** Correlations between Ranking Systems and Median Faculties' Training Program. (A) The correlation plot of Residency Affiliated Academic Neurosurgeons (RAAN) with median faculties' residency (n=46). (B) The correlation plot of Doximity Residency Navigator (DRN) Reputation rank with median faculties' residency (n=48). (C) Correlation plot of Blue Ridge Institute for Medical Research (BRIMR) with median faculties' residency (n=48).

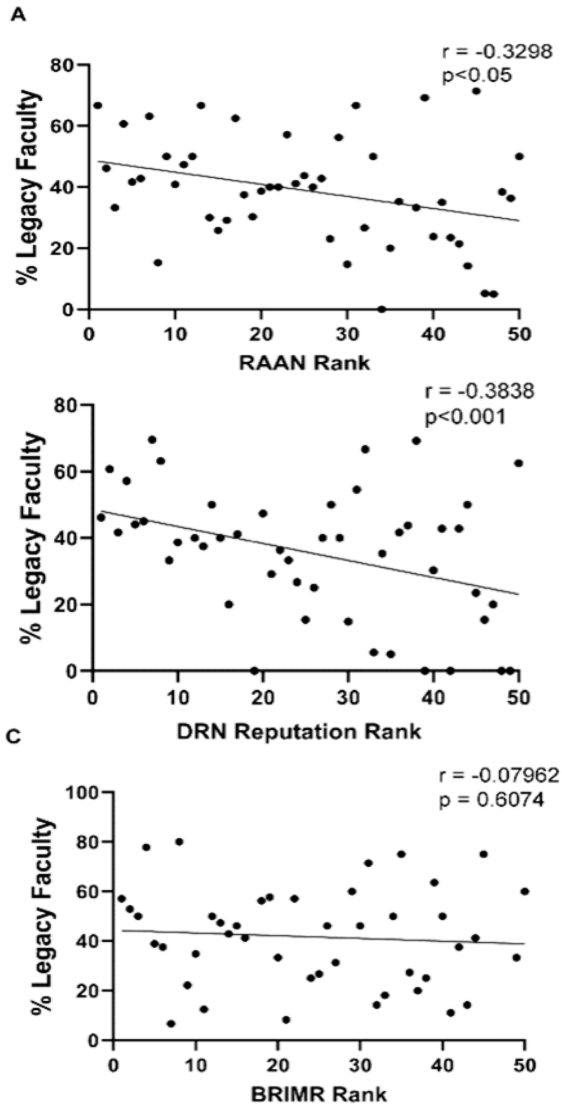



***Legend:*** Individual points represent median faculties' residency rank at a specific program. p<0.0001 (****), Pearson correlation coefficient. This demonstrates a consistent trend where higher-ranking programs are associated with more successful faculty.

**A Higher Percentage of legacy faculty correlates with highly ranked programs in RAAN and DRN.**

In RAAN, the top 50 programs show a correlation with the percentage of legacy faculty (r=-0.3298, p<0.05, n=49***)*** ***(Figure 4a).*** The DRN reputation rank has a more significant correlation (r=-0.3838, p<0.001, n=48) ***(Figure 4b).*** However, in the BRIMR system, the top 50 programs show no significance and are not correlated with the percent legacy faculty (r=-0.07962, p=0.6074, n=44) ***(Figure 4c).*** Regarding RAAN and DRN, better programs have a higher percentage of legacy faculty. This suggests that highly ranked programs keep their graduates as faculty.

***Figure 4.*** Correlations between Ranking Systems and Percent Legacy Faculty. (A) Correlation plot of Residency Affiliated Academic Neurosurgeons (RAAN) with % legacy faculty (n=49). (B) The correlation plot of Doximity Residency Navigator (DRN) Reputation rank with % legacy faculty (n=48). (C) Correlation plot of Blue Ridge Institute for Medical Research (BRIMR) with % legacy faculty (n=44).




***Legend:*** Individual points represent the percentage of legacy faculty at the specific program. p<0.05 (*), p<0.001 (**), Pearson correlation coefficient. This suggests that highly ranked programs keep their graduates as faculty.

***Table 2.*** Residency Affiliated Academic Neurosurgeons (RAAN) Ranking, Doximity Residency Navigator (DRN) Reputation rank, and Blue Ridge Institute for Medical Research (BRIMR) of ACGME Neurological Surgery Programs.

| RAAN | DRN | BRIMR | Program Name |
|---|---|---|---|
| 1 | 7 | N/A | Massachusetts General Hospital |
| 2 | 1 | 1 | University of California (San Francisco) |
| 3 | 9 | 14 | UPMC Medical Education |
| 4 | 2 | N/A | Barrow Neurological Institute at St. Joseph's Hospital and Medical Center |
| 5 | 3 | 12 | Johns Hopkins University |
| 6 | 5 | 19 | University of Washington |
| 7 | 8 | N/A | New York Presbyterian Hospital (Columbia Campus) |
| 8 | 25 | N/A | Brigham and Women's Hospital/Children's Hospital |
| 9 | 31 | 35 | University of Virginia Medical Center |
| 10 | 6 | 13 | Washington University/B-JH/SLCH Consortium |
| 11 | 20 | 2 | UCLA David Geffen School of Medicine/UCLA Medical Center |
| 12 | 14 | 18 | University of Michigan Health System |
| 13 | 82 | 8 | Yale-New Haven Medical Center |
| 14 | 12 | 6 | Baylor College of Medicine |
| 15 | 24 | 10 | University of Pennsylvania Health System |
| 16 | 21 | 5 | Duke University Hospital |
| 17 | 50 | 31 | University of Iowa Hospitals and Clinics |
| 18 | 13 | 42 | University of Southern California/LAC+USC Medical Center |
| 19 | 40 | N/A | Sidney Kimmel Medical College at Thomas Jefferson University/TJUH |
| 20 | 10 | 26 | NYU Grossman School of Medicine |
| 21 | 15 | 30 | University of Miami/Jackson Health System |
| 22 | 29 | 3 | Stanford Health Care–Sponsored Stanford University |
| 23 | 4 | N/A | Mayo Clinic College of Medicine and Science (Rochester) |
| 24 | 17 | 4 | University of Florida |
| 25 | 37 | 39 | New York Presbyterian Hospital (Cornell Campus) |
| 26 | 27 | 15 | Icahn School of Medicine at Mount Sinai |
| 27 | 43 | 34 | University of Wisconsin Hospitals and Clinics |
| 28 | 68 | 20 | University of Maryland |
| 29 | 88 | 50 | Virginia Commonwealth University Health System |
| 30 | 30 | 9 | McGaw Medical Center of Northwestern University |
| 31 | 32 | N/A | Cleveland Clinic Foundation |
| 32 | 107 | 40 | Montefiore Medical Center/Albert Einstein College of Medicine |
| 33 | 44 | N/A | Henry Ford Health/Henry Ford Hospital |
| 34 | 47 | 38 | University of Minnesota |
| 35 | 16 | 25 | University of Utah Health |
| 36 | 34 | N/A | Vanderbilt University Medical Center |
| 37 | 11 | 23 | Emory University School of Medicine |
| 38 | 23 | 16 | University of Texas Southwestern Medical Center |
| 39 | 38 | 45 | Case Western Reserve University/University Hospitals Cleveland Medical Center |
| 40 | 26 | 27 | University of Alabama Medical Center |
| 41 | 70 | 44 | University of Colorado |
| 42 | 45 | N/A | University of California (San Diego) Medical Center |
| 43 | 61 | 36 | Indiana University School of Medicine |
| 44 | 52 | 37 | SUNY Upstate Medical University |
| 45 | 97 | N/A | Albany Medical Center |
| 46 | 33 | 7 | Ohio State University Hospital |
| 47 | 35 | 21 | Penn State Milton S. Hershey Medical Center |
| 48 | 36 | N/A | Wake Forest University Baptist Medical Center |
| 49 | 22 | 22 | Rush University Medical Center |
| 50 | 28 | N/A | Tufts Medical Center |
| 51 | 54 | N/A | National Capital Consortium |
| 52 | 57 | N/A | Dartmouth-Hitchcock/Mary Hitchcock Memorial Hospital |
| 53 | 83 | 17 | University of Louisville School of Medicine |
| 54 | 87 | N/A | University of Illinois College of Medicine at Chicago |
| 55 | 89 | 47 | University of Texas Health Science Center San Antonio Joe and Teresa Lozano Long School of Medicine |
| 56 | 92 | N/A | Loyola University Medical Center |
| 57 | 98 | N/A | George Washington University |
| 58 | 101 | N/A | Temple University Hospital |
| 59 | 60 | N/A | University of North Carolina Hospitals |
| 60 | 69 | 46 | University of Cincinnati Medical Center/College of Medicine |
| 61 | 79 | N/A | Brown University |
| 62 | 86 | N/A | MedStar Health/Georgetown University Hospital |

| | | | |
|---|---|---|---|
| 63 | 106 | N/A | University of Vermont Medical Center |
| 64 | 41 | N/A | University of Rochester |
| 65 | 48 | 48 | University at Buffalo |
| 66 | 67 | N/A | University of South Florida Morsani |
| 67 | 81 | N/A | University of Chicago |
| 68 | 46 | 33 | Oregon Health & Science University |
| 69 | 51 | 32 | Medical College of Wisconsin Affiliated Hospitals |
| 70 | 65 | 28 | Rutgers Health/New Jersey Medical School |
| 71 | 75 | N/A | Allegheny Health Network Medical Education Consortium (AGH) |
| 72 | 91 | 43 | Loma Linda University Health Education Consortium |
| 73 | 56 | N/A | University of Kansas School of Medicine |
| 74 | 58 | N/A | West Virginia University |
| 75 | 109 | N/A | Louisiana State University School of Medicine |
| 76 | 18 | N/A | University of Tennessee |
| 77 | 62 | N/A | Westchester Medical Center |
| 78 | 74 | N/A | University of Missouri–Columbia |
| 79 | 103 | N/A | University of Mississippi Medical Center |
| 80 | 59 | 11 | University of Texas Health Science Center at Houston |
| 81 | 66 | N/A | University of Oklahoma Health Sciences Center |
| 82 | 71 | N/A | University of Kentucky College of Medicine |
| 83 | 84 | 29 | Medical College of Georgia |
| 84 | 72 | 49 | University of Texas Medical Branch Hospitals |
| 85 | 73 | N/A | Cedars-Sinai Medical Center |
| 86 | 76 | N/A | Clinical Center at the National Institutes of Health |
| 87 | 110 | N/A | Spectrum Health/Michigan State University |
| 88 | 49 | N/A | Zucker School of Medicine at Hofstra/Northwell |
| 89 | 53 | N/A | Carolinas Medical Center |
| 90 | 55 | N/A | Medical University of South Carolina |
| 91 | 63 | 41 | Tulane University/Ochsner Clinic Foundation |
| 92 | 77 | N/A | Carilion Clinic–Virginia Tech Carilion School of Medicine |
| 93 | 78 | N/A | University of Nebraska Medical Center College of Medicine |
| 94 | 80 | N/A | Methodist Hospital (Houston) |
| 95 | 85 | N/A | University of California (Irvine) |
| 96 | 94 | N/A | University of Arizona College of Medicine–Tucson |
| 97 | 96 | 24 | University of California Davis Health |
| 98 | 99 | N/A | University of Illinois College of Medicine at Peoria |
| 99 | 100 | N/A | Louisiana State University (Shreveport) |
| 100 | 114 | N/A | Ascension Providence/MSUCHM |
| 101 | 116 | N/A | University of Connecticut School of Medicine |
| 102 | 19 | N/A | Mayo Clinic College of Medicine and Science (Jacksonville) |
| 103 | 90 | N/A | Beth Israel Deaconess Medical Center |
| 104 | 93 | N/A | University of Arkansas for Medical Sciences (UAMS) College of Medicine |
| 105 | 104 | N/A | St. Louis University School of Medicine |
| 106 | 105 | N/A | Riverside University Health System |
| 107 | 111 | N/A | Cooper Medical School of Rowan University/Cooper University Hospital |
| 108 | 112 | N/A | Southern Illinois University School of Medicine |

***Legend:*** The top five programs producing ACGME-accredited neurosurgery physicians (RAAN) are Massachusetts General Hospital, University of California-San Francisco (UCSF), University of Pittsburg Medical Center (UPMC), Barrow Neurological Institute, and Johns Hopkins University.

## Discussion

Our study introduces RAAN, a novel ranking system that effectively correlates the number of academic neurosurgeons with their alma mater's program rank. This correlation underscores RAAN's potential to influence future methodologies for evaluating residency programs, particularly its role in highlighting programs that produce and retain academic neurosurgeons. This may indicate that faculty at the highly ranked DRN programs may have stayed at their residencies location and contributed towards the DRN reputation rank. The significant alignment between RAAN and traditional ranking systems like DRN and BRIMR suggests that our RAAN methodology could complement existing measures by providing a more nuanced perspective on program effectiveness. Since DRN is widely used by medical students but lacks objectivity, RAAN provides an alternative based on objective metrics.[17,18] The significant positive correlation of RAAN with DRN suggests that the matched programs producing the high numbers of academic neurosurgeons (RAAN) are also ranked reputationally well (DRN). This also suggests that DRN may capture meaningful academic reputation signals. This coincides with the size of the neurosurgery residency program correlating with the Doximity reputation – as identified by Feinstein et al., expanding the size of a residency program by one resident correlated with a rise in Doximity rank ranging from 0.80 to 6.32 ranks, varying by specialty rank.[19] On a program-to-program basis, the DRN ranking system, at least for the top 10 reputation-ranked institutions, remains stable yearly and is not impacted by subjective data.3 The correlation between RAAN and BRIMR may suggest that research output does not associate with faculty

placement. Notably, the positive correlation between programs producing a high number of academic neurosurgeons with high amounts of NIH funding suggests that the number of academic neurosurgeons in residency programs trained may be associated with NIH funding. These highly funded programs may attract more academic neurosurgeons who prioritize discovery and scientific merit. This may be important in the decision to award funding for individual researchers depending on their location. The correlation between ranking systems of matched programs indicates an underlying factor across academic neurosurgery faculty.

The positive correlation between the median rank of faculties' residency and RAAN indicates that the programs producing high numbers of academic neurosurgeons have faculty trained from highly ranked programs. Notably, this suggests that programs like Massachusetts General Hospital, UCSF, UPMC, Barrow Neurological Institute, and Johns Hopkins University – programs that produce higher numbers of academic neurosurgeons – essentially employ more faculty trained from those programs. This indicates a strong association between academic neurosurgeons employed at institutions and those producing the most academic neurosurgeons. Reputationally, the data shows that higher ranked programs typically have faculty trained from higher ranked programs. One possible explanation for these findings is that larger programs correlated with reputation rank may have more residents and alums responding to the Doximity survey.19 In the context of NIH funding, the results follow the same trend where programs with the most NIH funding mainly hire faculty trained at well NIH-funded programs.[20] Furthermore, NIH funding likely influences faculty recruitment by fostering strong scientific mentorship.[12] This warrants further investigation of each program on a faculty basis.

We analyzed each program's directory and gathered that the most prolific programs are hiring faculty trained at their own institutions. In the case of RAAN, those programs producing more academic neurosurgeons may also be hiring many of their own trained physicians. Additionally, this may suggest that larger programs intrinsically retain more faculty. There may be an association in which programs producing high numbers of academic neurosurgeons also hire more faculty that trained at the program. Finding an association of legacy faculty across RAAN and DRN suggests that program rank may be associated with how much of their faculty they are hiring. This finding is consistent with the fact that graduates from the top 25 medical schools were more likely to enter a high-ranking neurosurgical residency program.[21] This emphasizes the hiring tendencies of programs from the upper echelons of academia to "inbreed."

The implications of our findings extend beyond individual program rankings, potentially influencing broader educational policies and accreditation standards. This investigation within residency institutions and their faculty shows that various factors may interplay on the journey of becoming an academic neurosurgeon. Applicants interested in pursuing neurosurgery and staying in academia may benefit from prioritizing programs with higher RAAN scores, as these programs have a track record of placing graduates into faculty positions. Our findings support those of Khalafallah et al., namely that the training environment strongly impacts the career path of academic neurosurgeons.[22] DRN enormously impacts medical students when creating their rank lists. It is crucial to be aware of the limitations of the existing ranking systems. By offering an additional ranking system based on objective criteria,[23] our proposal of RAAN should aid in addressing limitations and provide a more robust evaluation of neurosurgery residency programs. These findings underscore the importance of ranking systems derived from multiple facets to ensure they capture a representative snapshot of program quality. The application of this process for ranking of other academic medical specialties is unclear, although we would expect similar findings regardless of the specialty.

**Limitations**

We did not account for programs that did not list faculty and their educational background which may skew rankings by underrepresenting their academic contributions. While we accounted for residency retrieved from faculty, during the downstream analysis, some programs have several locations, and the faculty did not specify. Another limitation could arise from larger residency programs which may inflate rankings for larger programs in the RAAN ranking system. Additionally, as the analysis relied on publicly available data not every academic neurosurgeon was definitely identified. Also, we did not verify faculty with board certifications since there may be academic neurosurgeons who are early in their careers as neurosurgeons and are still board-eligible. Lastly, RAAN does not account for long-term career success only faculty placement. Future studies should assess whether RAAN-ranked programs produce neurosurgeons who achieve leadership positions, research impact, and other markers of academic success.

**Conclusion**

The introduction of RAAN adds a valuable dimension to the evaluation of neurosurgery residency programs by quantifying the contribution of these programs to the field of academic neurosurgery. Our findings highlight the pivotal role of residency training not just in fostering individual careers and sustaining the academic vitality of the neurosurgery field at large. RAAN provides an objective ranking system based on graduate academic placement, offering a valuable tool for applicants and program directors. This approach will aid medical students in making informed choices and guide program directors in refining their curricular offerings to better prepare the next generation of academic neurosurgeons. Future ranking systems could include information on academic productivity in addition to academic position for greater robustness. Ultimately, our study underscores the necessity of a multi-faceted evaluation system in maintaining the rigor and relevance of medical training in neurosurgery.

## Summary – Accelerating Translation

A Novel Ranking System for Neurosurgery Residency Programs: Residency-Affiliated Academic Neurosurgeons (RAAN)

There currently remains no ranking system where academic placement is taken into consideration. Many medical students embarking on the

journey towards a career in neurological surgery consider many factors when creating their residency rank list. Using established ranking systems such as Doximity Residency Navigator (DRN), underscores the complexity of this decision-making process. Despite the multifaceted nature of residency program evaluations, the alignment of these rankings with the pursuit of an academic career remains unclear. In this study, we aimed to elucidate the influence of residency institution rankings on the pursuit of academic careers in neurological surgery. Our objective was to establish whether there exists a significant association between the rankings of residency institutions and the placement of graduates in academic positions.

Utilizing the Doximity Residency Navigator (DRN), we compiled a comprehensive list of Accreditation Council for Graduate Medical Education (ACGME)-accredited neurological surgery residency programs. From each program, we extracted and compiled data on trained neurological surgery physicians' residency information. This dataset facilitated the development of a novel ranking system based on the programs' production of neurosurgery academic teaching faculty – referred to as Residency-Affiliated Academic Neurosurgeons (RAAN). We explored the relationship between residency institution rankings, as determined by our proposed RAAN ranking system, and the placement of graduates in academic careers. Our methodology allowed for a comprehensive examination of the factors influencing career trajectories in neurological surgery

Our analysis reveals strong positive correlations between RAAN and DRN ($r=0.7316$; $p<0.0001$), as well as between RAAN and BRIMR ($r = 0.4527$; $p < 0.001$), suggesting consistency across different systems. Additionally, top-ranked residency programs in all three systems demonstrate strong positive correlations with median faculty residency ranks.

By establishing a novel ranking system based on the production of academic teaching faculty, we provide valuable insights into the factors guiding medical students' residency program selection. These findings provides medical students with a new tool that allows them to create a rank list based on their academic career goals. Our findings contribute to a deeper understanding of the dynamics shaping academic career pathways in neurological surgery and offer valuable guidance for aspiring neurosurgeons navigating the residency selection process..

## References

1. Doximity Residency Navigator. Doximity. Available from: https://residency.doximity.com./; cited 2024 May 02.
2. U.S. News & World Report. Best Medical Schools: Research. Available from: https://www.usnews.com/best-graduate-schools/top-medical-schools/research-rankings.; cited 2024 May 02.
3. Barpujari, A, Gajjar, AA, Lavadi, RS, Agarwal, N, Chan, AK, & Mummaneni, PV. Neurosurgery Residency Rankings: An assessment of Doximity's survey-based data and objective program characteristics. Interdisciplinary Neurosurgery.
4. Smith BB, Long TR, Tooley AA, Doherty JA, Billings HA, Dozois EJ. Impact of Doximity Residency Navigator on Graduate Medical Education Recruitment. Mayo Clin Proc Innov Qual Outcomes. 2018;2(2):113-118.
5. Wilson AB, Torbeck LJ, Dunnington GL. Ranking Surgical Residency Programs: Reputation Survey or Outcomes Measures? J Surg Educ. 2015;72(6):e243-e250.
6. Ashack KA, Burton KA, Dellavalle RP. Dermatology in Doximity. Dermatol Online J. 2016;22(2):13030/qt2r79s88k.
7. Smith SC, Abramowicz AE. Program Misrepresentation in the Doximity Residency Navigator. J Grad Med Educ. 2023;15(4):436-438.
8. Lorch AC, Miller JW, Kloek CE. Accuracy in Residency Program Rankings on Social Media. J Grad Med Educ. 2019;11(2):127-128.
9. Parslow TG, Roskoski R Jr. A Primer on BRIMR: Understanding the Rankings of NIH Support from the Blue Ridge Institute for Medical Research. Am J Pathol. 2022;192(3):392-394.
10. Noble P, Ten Eyck P, Roskoski R Jr, Jackson JB. NIH funding trends to US medical schools from 2009 to 2018. PLoS One. 2020;15(6):e0233367.
11. Chandrakantan A, Adler AC, Stayer S, Roth S. National Institutes of Health-Funded Anesthesiology Research and Anesthesiology Physician-Scientists: Trends, Promises, and Concerns. Anesth Analg. 2019;129(6):1761-1766.
12. Lonser RR, Smith LGF, Tennekoon M, Rezai-Zadeh KP, Ojemann JG, Korn SJ. Creation of a comprehensive training and career development approach to increase the number of neurosurgeons supported by National Institutes of Health funding. J Neurosurg. 2020;135(1):176-184.
13. Lewit RA, Black CM, Camp L, Brott N, Cottrell JM, Herman T et al. Association of Surgeon Representation on NIH Study Sections With Receipt of Funding by Surgeon-scientists. Ann Surg. 2021;273(6):1042-1048.
14. Conte ML, Schnell S, Ettinger AS, Omary MB. Trends in NIH-supported career development funding: implications for institutions, trainees, and the future research workforce. JCI Insight. 2020;5(17):e142817.
15. Patel PA, Gopali R, Reddy A, Patel KK. National Institutes of Health funding trends to ophthalmology departments at U.S. medical schools. Semin Ophthalmol 2021, 1:1e7
16. Doximity Inc. Residency Navigator 2023–2024. Our residency research methodology.
17. Peterson WJ, Hopson LR, Khandelwal S, White M, Gallahue F, Burkhardt J, et al. Impact of Doximity residency rankings on emergency medicine applicant rank lists. West J Emerg Med. 2016;17(3):350–354.
18. Rolston AM, Hartley SE, Khandelwal S, Christner JG, Cheng DF, Caty RM, et al. Effect of Doximity residency rankings on residency applicants' program choices. West J Emerg Med. 2015;16(6):889–893.
19. Feinstein MM, Niforatos JD, Mosteller L, Chelnick D, Raza S, Otteson T. Association of Doximity Ranking and Residency Program Characteristics Across 16 Specialty Training Programs. J Grad Med Educ. 2019;11(5):580-584.
20. Roy E, Egro F, Zalewski A, Smith BT, Losee JE, Nguyen VT. Influence of Residency Training on Research Productivity and Plastic Surgery Career. Annals of Plastic Surgery 2020;85(6):p 672-676.
21. Hovis GEA, Harris MH, Nguyen A, Picton B, Kuo CC, Hamidi S, et al. Analysis of Current Neurological Surgery Residents and Prior Medical Education: Do Medical School Attributes Matter? World Neurosurg. 2023;172:e695-e700.
22. Khalafallah AM, Jimenez AE, Daniels M, Bydon A, Cohen AR, Tamargo RJ, et al. Educational Program Rankings Are Independently Associated With Residents' Academic Career Trajectory in Neurological Surgery. J Surg Educ. 2020;77(5):1312-1320.
23. Hulou MM, Slone SA, Samaan CA, Essibayi MA, Hofler RC, Graffeo CS, et al. Exploring the Validity and Reliability of Neurosurgery Residency Program Rankings: A Quantitative Analysis. World Neurosurg. 2024;182:e400-e404.

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**Author Contributions**

Conceptualization: SV, OD. Data Curation: SV. Formal Analysis: SV. Investigation: SV, CJP. Methodology: SV. Software: SV. Supervision: CJP. Validation: SV. Visualization: SV. Writing - Original Draft: SV, OD, CJP. Writing - Review Editing: SV, CJP.

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Short Communication

# Associations Between Physical Activity and Age-Related Anti-Mullerian Hormone Decline: Insights from All of Us Research Program

Paige Coyne,[1] Robert Leone,[2] Ze Meng,[3] Richard E Leach,[4] Sara Santarossa.[5]

## Abstract

**Background:** Anti-mullerian hormone (AMH) is used to measure ovarian reserve and female fertility levels. Physical activity is thought to influence fertility and warrants further investigation, especially using objective measures. **Methods:** Using the All of Us Research Program dataset, the relationship between normal age-based decline in AMH and levels of physical activity were examined. Inclusion criteria were: ≥ 1 AMH test in electronic health record, AMH level < 7 ng/ml, and ≥ 30 days of valid Fitbit data within 1 year prior to AMH test. Final dataset included 24 participants. **Results:** Generalized linear regression models were fitted between log transformed AMH level and daily average activity intensity minutes (sedentary, lightly active, fairly active and very active) and daily step counts. Daily average of "very active" minutes showed a trend towards a positive effect on preventing the decline of AMH levels (B = 0.02 (95% CI 0-0.04), p = 0.136), though results were not statistically significant. **Conclusion:** Despite its small sample size, this study is one of the first to report a positive correlation, approaching significance, between objectively measured physical activity and preserving AMH, suggesting that daily high intensity physical activity may extend ovarian reserve. Further studies, with large, diverse samples are needed to provide clearer numbers for optimal engagement in physical activity and AMH level for fertility.

## Introduction

Infertility is a prominent issue for women and their partners. Nearly 14% of premenopausal women in the United States have impaired fecundity, the physiological ability to produce a child.[1] Impaired fertility is not only associated with reduced fecundity (e.g., disruption of ovarian function, fallopian tube obstruction, physical characteristics of uterus)[2] but also with social factors, such as prolonged times of unwanted non-conception (i.e., postponing pregnancy).[3,4] For women seeking to conceive, fertility can be evaluated via physical exams, laboratory tests, and/or imaging. Often, anti-mullerian hormone (AMH; produced by the granulosa cells of antral follicles), a marker of ovarian reserve, is used to predict age-based decline in fecundity and prediction of the response during ovarian stimulation in treating infertility. Serum AMH levels increase in childhood, reaching their maximum around age 15, remaining stable until around age 25, and then progressively decline to menopause.

In addition to age and other biological factors, many lifestyles behaviors (e.g., physical activity, smoking, and alcohol) are believed to influence ovarian reserve. With regards to physical activity, consensus regarding its influence on fertility remains somewhat unclear, with studies reporting contradicting findings (i.e., positive, negative, or no relationship).[5,6] For example, results of a systematic review by Hakimi and Cameron posit the presence of a U-shaped association between physical activity and ovulation, suggesting that moderate physical activity can assist women in maintaining optimal hormonal balance and regular ovulation.[7] These results are supported by findings from Kiranmayee et al., who reported that self-reported regular, physical activity was associated with improved age-specific levels of ovarian reserve markers, including AMH.[8] Findings from another systematic review and meta-analysis (all self-reported measures of physical activity) support the possibility that vigorous physical activity may negatively impact fertility, but contradict aforementioned reports by concluding no association between moderate physical activity and fertility.[9] A third systematic review, which reported mixed findings, also

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highlighted the need for additional research using objective measures of physical activity (e.g., activity tracking devices) and fertility (e.g., serum AMH) in lieu of previously relied upon subjective instruments.[6]

The All of Us Research Program (AoURP) dataset provides a unique opportunity to retrospectively study the effects of physical activity on fertility using wearable and clinical data. Run by the National Institutes of Health, AoURP aims to collect health-related information (e.g., electronic health records, genomics, physical measures, participant surveys and wearables) from 1 million or more Americans, with a particular focus on populations typically underrepresented in biomedical research. This study analyzed the AoURP dataset to examine the relationship between normal age-based decline in AMH and varying levels of physical activity.

## Methods

### Study Population

The study population was sourced from the National Institutes of Health AoURP database (dataset v7; R2022Q4R9), available to authorized users on the Research Workbench. All participants provided written informed consent at the time of study enrollment, and institutional review board approval was obtained for primary data collection.[10,11] To preserve participant privacy, data provided to researchers through the Researcher Workbench undergoes extensive de-identification and data transformation procedures. Secondary analysis of the de-identified data was considered not human subjects research by the Henry Ford Health Institutional Review Board. All aspects of the project adhered to the tenets of the Declaration of Helsinki.

Among 409,420 participants enrolled as of February 15, 2024, participants needed to meet the following criteria to be included in the current sample: a) 1+ AMH test records in their electronic health records (Logical Observation Identifiers Names and Codes 38376-8), b) normal AMH level range (< 7ng/ml),[12] and c) 30+ days of valid Fitbit data (more than 10 hour heart rate data at given day)[13,14] within 1 year prior to AMH test date.

### Statistical Analysis

For participants with multiple AMH test results, the earliest test result was used for the following analysis. AMH test results were log-transformed with log (AMH+1). Daily average minutes were calculated for four different activity intensity measurements, based on metabolic equivalents (METS), from Fitbit activity summary table: sedentary (< 1.5 METS), lightly active (1.5-3.0 METS), moderately-fairly active (3.0-6.0 METS), and very active (> 6 METS). Daily average steps count was also calculated for valid days within a year prior to AMH test date.[13-17]

To explore the potential association between physical activity and AMH, a series of generalized linear regression models (GLM) were fitted between log transformed AMH level and the four daily average activity intensity minute measurements and daily step counts. Each model was adjusted for the age when AMH was tested (AMH age). All statistical analysis codes were edited and executed with R 4.0.1 in AoURP Workbench. GLMs were built in the pre-installed "stats" package.

## Results

Within the AoURP dataset (V7: R2022Q4R9) dataset, 1381 participants had AMH test results and 14,947 participants had Fitbit data. Of which, 71 participants had both AMH test results and Fitbit data. After removing participants whose AMH test result values were abnormal (> 7 ng/ml) or missing, 60 participants remained. Participants without 30+ days of valid Fitbit data within 1 year prior to their AMH test date were then removed, resulting in a final sample of 24 participants from 6 different states. The majority of participants were White and from Pennsylvania. See ***Table 1*** for further cohort characteristics.

Results of the GLMs are presented in ***Table 2.*** Despite a limited sample size, results of the GLMs suggest that a unit increase of daily average of "very active" minutes has a positive effect, approaching significance, on preventing the decline of AMH level (B = 0.02, 95% CI 0-0.04, p = 0.136). Age, a known factor to cause AMH decline, was negatively associated with AMH in all 6 models.

***Table 1.*** All of Us Research Program Dataset Cohort Characteristics.

| Cohort Characteristics | Mean (SD) |
|---|---|
| AMH age* (years) | 35.23 (4.70) |
| AMH (ng/ml) | 2.30 (2.05) |
| BMI (kg/m$^2$) | 34.70 (10.74) |
| Sedentary minutes/day | 808.14 (180.85) |
| Light active minutes/day | 202.11 (50.11) |
| Moderate-fairly active minutes/day | 12.10 (8.18) |
| Very active minutes/day | 14.14 (9.96) |
| Daily steps | 6897.51 (2578.99) |

***Legend:*** AMH, anti-mullerian hormone; BMI, body mass index; SD, standard deviation.*The age when AMH was tested.

***Table 2.*** Results of Generalized Linear Regression Models Between Log Transformed Anti-Mullerian Hormone (AMH) Level and Fitbit Daily Average Activity Intensity Minutes17 and Daily Step Counts, Adjusted for AMH Age (Age in Years When AMH Was Tested) in an All of Us Research Program Dataset (N=24)

| Activity | Main Effect (95%CI) | P-value | Age Effect (95%CI) | P_val_age |
|---|---|---|---|---|
| Sedentary minutes/day | 0 (0-0) | 0.440 | -0.09 (-0.14 to -0.05) | 0.001 |
| Lightly active minutes/day | 0 (0-0) | 0.979 | -0.09 (-0.14 to -0.04) | 0.003 |
| Moderate-fairly active minutes/day | 0.01 (-0.02 to 0.03) | 0.678 | -0.09 (-0.13 to -0.04) | 0.001 |
| Very active minutes/day | 0.02 (0-0.04) | 0.136 | -0.09 (-0.13 to -0.05) | 0.001 |
| Daily steps/1000 | 0.04 (-0.05 to 0.12) | 0.375 | -0.08 (-0.13 to -0.03) | 0.003 |

## Discussion

Here, we describe preliminary findings regarding the association of age-based decline in AMH and levels of physical activity among women using a AoURP dataset. AMH has long been a biomarker used to predict ovarian reserve. Given that many women are waiting longer to pursue motherhood and that AMH levels naturally decline starting in a women's mid-twenties, it is important to understand how other factors, such as modifiable lifestyle behaviors, can influence AMH levels and fertility. The aim in presenting these preliminary results is to encourage other researchers to explore the use of objective physical activity to better understand the relationship between normal age-based decline in AMH.

Despite a small sample, there was a positive correlation, approaching significance, between daily average of very active minutes and preserving AMH, suggesting that daily high intensity physical activity may extend ovarian reserve. We present these results for illustrative purposes only. Many studies have demonstrated a link between physical activity and fertility with inconclusive results or have focused on extreme/unhealthy amounts of strenuous physical activity and negative outcomes on female reproductive health.[5,9] Moreover, much of the literature has utilized self-reported measures of physical activity (e.g., computing outcome variables of minutes/week physical activity intensity) or fertility,[5,6] and/or measured fertility via time to pregnancy or probability of conception through retrospective comparison.[5,6,9] Self-reported data tends to overestimate physical activity due to social desirability bias (e.g., participants may overestimate their activity levels to appear healthier or more active than they are).[18,19] Recall bias is another limitation of self-reported data as participants might forget or fail to accurately recall the intensity, duration, or frequency of their physical activity, leading to inaccurate reporting, especially over longer periods.[18] Thus, in addition to our sample being too small to conduct further analyses, it is difficult to compare our results (which utilized objectively measured, daily physical activity and AMH as a measure of fertility) to previous reports, based on the aforementioned methodological differences.

In terms of practical recommendations, based on our findings, it might be beneficial for women, particularly those concerned with fertility and ovarian reserve, to incorporate regular, vigorous physical activity into their routines. However, we caution that more research is needed to determine the ideal intensity, duration, and frequency of physical activity necessary to see meaningful changes in AMH and fertility outcomes. Given the methodological limitations of prior studies that relied on self-reported physical activity, our study, which uses objectively measured activity data, provides a valuable contribution to the literature. It suggests that higher intensity activity could be beneficial for maintaining ovarian reserve, but more studies are needed to establish clear guidelines and causal relationships. For now, these results should be seen as exploratory, and future research should focus on expanding the sample size and further investigating the effects of different types of physical activity on fertility biomarkers like AMH.

### Limitations

Although the AoURP builds a biomedical dataset from a diverse group of participants from across the United States, a limitation of the current study is the small homogenous (White and predominantly from Pennsylvania) sample - skewing results/restricting generalizability, limiting external validity, and reducing the statistical power of findings. It should also be noted that, although we adjusted the GLM for age, other factors (e.g., body mass index and ethnicity) were not adjusted for in this analysis because of the sample's small and homogenous nature. A major strength of the current study was the objective measure of physical activity; future studies should consider supplying the wearable device to participants, so ownership is not a barrier,[20,21] resulting in a more robust dataset. An additional limitation to note is that an AMH test is likely only requested/conducted if one was having fertility issues, resulting in a sampling bias. Lastly, the majority of the data in the current study came from obese women, which may influence the relationship between physical activity and fertility.[6] Thus, a future consideration in studies with larger samples is to further explore the influence of overweight/obesity with physical activity on fertility.

### Conclusion

Although AMH levels begin their natural decline in a woman's mid-twenties, many women are choosing to delay motherhood until later. Preliminary findings suggest a potential link between physical activity and AMH preservation, though larger studies are needed to confirm this association. More robust research is also needed to determine what level of preservation is needed to ensure significantly higher fecundity. Additionally, future studies (controlled, intervention-based) with large, diverse samples are also needed to provide clearer understanding and identify optimal physical activity engagement (e.g., time, intensity, and frequency) to support the preservation of AMH and increase chances of fertility..

## Summary – Accelerating Translation

**Title:** Can Physical Activity Help Preserve Fertility? Exploring the Role of Exercise in Anti-Müllerian Hormone (AMH) Levels

Main Problem to Solve: Many women are choosing to delay motherhood until later in life. However, female fertility naturally declines with age, making it more difficult to conceive. One common way to assess fertility is by measuring anti-müllerian hormone (AMH), which reflects the number of eggs (ovarian reserve) a woman has. Despite this, there is limited understanding of how lifestyle factors—like physical activity—may influence AMH levels and, by extension, fertility.

Aim of the Study: To examine whether there is a relationship between objectively measured physical activity (using Fitbit devices) and AMH levels in women. This could help determine whether exercise plays a role in preserving ovarian reserve and potentially supporting fertility.

**Methodology**: The study used data from the National Institutes of Health "All of Us" Research Program, which collects medical and lifestyle data from a diverse U.S. population. Eligible participants were women with at

least one recorded AMH test, AMH levels within the normal range (less than 7 ng/ml), and at least 30 days of valid Fitbit data within one year prior to their AMH test. The final sample included 24 participants.

Researchers analyzed the relationship between AMH levels and daily physical activity intensity—categorized as sedentary, lightly active, moderately active, and very active—as well as total daily step count. Generalized linear regression models were used to examine the relationship, adjusting for participant age.

**Results:** The analysis suggested a positive trend between the number of "very active" minutes per day and higher AMH levels, indicating that more intense daily physical activity may help slow the natural decline in ovarian reserve. While this finding did not reach statistical significance—likely due to the small sample size—it still provides a meaningful signal worth investigating further. As expected, age showed a negative association with AMH levels across all models.

**Conclusion:** This is one of the first studies to explore the relationship between physical activity and AMH using objective data from wearable devices, rather than self-reported questionnaires. The preliminary results suggest that vigorous daily physical activity could help preserve ovarian reserve, and thus support fertility.

While the findings are promising, they are based on a small, relatively homogenous group (mostly White women from Pennsylvania), which limits how broadly the results can be applied. Larger studies with more diverse populations are needed to confirm these findings and determine the optimal type, intensity, and duration of physical activity to support AMH levels and fertility.

In practical terms, women who are concerned about their fertility might benefit from incorporating regular, high-intensity exercise into their routines. However, more research is needed to provide specific guidance. These results should be considered exploratory and used to guide future studies focused on identifying lifestyle strategies to support reproductive health.

## References

1. National Center for Health Statistics, Centers for Disease Control and Prevention. FastStats: Infertility. Available from: https://www.cdc.gov/nchs/fastats/infertility.htm. Last updated Oct 1, 2024; cited Mar 18, 2025.
2. Centers for Disease Control and Prevention. Infertility: frequently asked questions. Available from: https://www.cdc.gov/reproductive-health/infertility-faq/. Last updated May 15, 2024; cited Mar 18, 2025.
3. Schmidt L, Sobotka T, Bentzen JG, Nyboe Andersen A; ESHRE Reproduction Society Task Force. Demographic and medical consequences of the postponement of parenthood. Hum Reprod Update. 2012;18(1):29-43.
4. Vander Borght M, Wyns C. Fertility and infertility: definition and epidemiology. Clin Biochem. 2018;62:2-10.
5. Mussawar M, Balsom AA, Totosy de Zepetnek JO, Gordon JL. The effect of physical activity on fertility: a mini-review. F S Rep. 2023;4(2):150-8.
6. Brinson AK, da Silva SG, Hesketh KR, Evenson KR. Impact of physical activity and sedentary behavior on spontaneous female and male fertility: a systematic review. J Phys Act Health. 2023;20(7):600-15.
7. Hakimi O, Cameron LC. Effect of exercise on ovulation: a systematic review. Sports Med. 2017;47(8):1555-67.
8. Kiranmayee D, Praveena T, Himabindu Y, Sriharibabu M, Kavya K, Mahalakshmi M. The effect of moderate physical activity on ovarian reserve markers in reproductive age women below and above 30 years. J Hum Reprod Sci. 2017;10(1):44-8.
9. Zhao F, Hong X, Wang W, Wu J, Wang B. Effects of physical activity and sleep duration on fertility: a systematic review and meta-analysis based on prospective cohort studies. Front Public Health. 2022;10:1029469.
10. All of Us Research Program Investigators. The "All of Us" Research Program. N Engl J Med. 2019;381(7):668-76.
11. Mayo KR, Basford MA, Carroll RJ, Dillon M, Fullen H, Leung J, et al. The All of Us data and research center: creating a secure, scalable, and sustainable ecosystem for biomedical research. Annu Rev Biomed Data Sci. 2023;6(1):443-64.
12. Visser JA, de Jong FH, Laven JS, Themmen AP. Anti-Mullerian hormone: a new marker for ovarian function. Reproduction. 2006;131(1):1-9.
13. Marques IG, Kitsiou S, Gerber BS, Buchholz SW, Bustamante EE, Marquez DX. Feasibility of a Latin dance program with mHealth for middle-aged and older Latinxs (BAILA TECH). Translational Journal of the American College of Sports Medicine. 2021;6(1):e000143.
14. Speier W, Dzubur E, Zide M, Shufelt C, Joung S, Van Eyk JE, et al. Evaluating utility and compliance in a patient-based eHealth study using continuous-time heart rate and activity trackers. J Am Med Inform Assoc. 2018;25(10):1386-91.
15. All of Us Research Program, National Institutes of Health. Data Browser. Available from: https://databrowser.researchallofus.org/2023. Last updated Oct 1, 2023; cited Mar 18, 2025.
16. Dayal M, Sagar S, Chaurasia A, Singh U. Anti-mullerian hormone: a new marker of ovarian function. J Obstet Gynaecol India. 2014;64(2):130-3.
17. FitBit. Fitbit Web API Data Dictionary, version 8. Available from: https://enterprise.fitbit.com/wp-content/uploads/Fitbit-Web-API-Data-Dictionary-Downloadable-Version-2023.pdf. Last updated Aug 22, 2023; cited Mar 18, 2025.
18. Prince SA, Adamo KB, Hamel ME, Hardt J, Connor Gorber S, Tremblay M. A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. Int J Behav Nutr Phys Act. 2008;5:56.
19. Adams SA, Matthews CE, Ebbeling CB, Moore CG, Cunningham JE, Fulton J, et al. The effect of social desirability and social approval on self-reports of physical activity. Am J Epidemiol. 2005;161(4):389-98.
20. Omura JD, Carlson SA, Paul P, Watson KB, Fulton JE. National physical activity surveillance: users of wearable activity monitors as a potential data source. Prev Med Rep. 2017;5:124-6.
21. Strain T, Wijndaele K, Brage S. Physical activity surveillance through smartphone apps and wearable trackers: examining the UK potential for nationally representative sampling. JMIR Mhealth Uhealth. 2019;7(1):e11898.

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Review

# Global Impact of Burnout Syndrome in Medical Students During the COVID-19 Pandemic: A Systematic Review

Maria Konstantina Tzioti,[1] Athanasios Douzenis.[2]

## Abstract

**Background:** The prevalence of burnout syndrome among medical students is a growing concern, warranting comprehensive exploration, particularly in the context of the COVID-19 pandemic. This review aims to elucidate the burnout phenomenon, considering its impact on medical students' mental health, physical well-being, and academic performance. **Methods:** A thorough analysis was conducted, drawing on data from 31 studies encompassing over 37,000 participants in 25 countries. A systematic search across PubMed, Google Scholar, APA PsycNET, and Scopus utilized specific keyword combinations related to COVID-19, medical students, and burnout syndrome. The selected studies were evaluated to ensure relevance to the research aim. **Results:** The review reveals burnout complexity, highlighting its diverse manifestations, exacerbated by the pandemic. Varied outcomes emerged from the studies, reflecting contrasting impacts on students. During lockdown, some reported having spent quality time with their families and delved into their academic interests, while others suffered due to the absence of clinical engagement. A notable correlation between burnout levels and academic year was observed, though interpretations differed among studies. Factors such as gender, family status, coping mechanisms, and the absence or presence of a supportive network were identified as influencers of burnout likelihood. **Conclusion:** Medical student burnout persists as a significant challenge, intensified by pandemic disruptions to academic and clinical experiences. Urgent proactive measures by academic institutions are crucial to safeguard future physicians' well-being, with implications for enhancing healthcare delivery. This study underscores the immediate need to prioritize strategies for burnout prevention and management in medical education.

## Introduction

According to the World Health Organization (WHO), "Burnout" (or "burn-out") is an occupational phenomenon, as stated in the 11th Revision of the International Classification of Diseases (ICD-11). Even though it is not classified as a medical condition, it represents an established factor influencing health status or contact with health services. Defined as a syndrome resulting from chronic workplace stress that has not been successfully managed,[7] burnout is characterized by three main hallmarks, namely emotional exhaustion, depersonalization, and reduced personal accomplishment.[37]

When referring to medical students, exhaustion is attributed to rigorous academic requirements, alongside a prevailing sense of cynicism and disinterest in studying, coupled with feelings of incompetence. Taking into consideration the high workload, the competitive nature of the field, the emotional toll of their studies, feelings of isolation, and a lack of adequate support, it is not surprising that medical students are more susceptible to experiencing burnout compared to their peers in other academic disciplines. On a global scale, medical students encounter notably heightened rates of burnout syndrome,[24,37,47] varying widely, with estimates ranging from around 10% to as high as 77% when evaluated using the Maslach Burnout Inventory Student-Survey (MBI-SS).[37] According to a recent meta-analysis, the prevalence of burnout in medical students is estimated to be over 37%,3 while other sources state that at least half of all medical students may be affected by burnout during their university years.[7,29] More specifically, as highlighted by recent research, first-year students exhibit the lowest frequency of burnout, with the prevalence of this phenomenon increasing as they progress through medical school.[29]

According to studies, experiencing even a single burnout symptom can have negative effects on the educational process, leading to problems such as drowsiness, fatigue, eating disorders, migraines, emotional instability, and even the use of illicit drugs.[29,37] Apart from the above, there is a well-established relationship between burnout, depression, and anxiety among medical students, which, in turn, has a significant impact on multiple facets of their physical, mental, emotional, and social well-being.[37] The potential long-term outcomes for healthcare professionals also give rise to significant concerns, encompassing heightened occurrences of medical errors, decreased levels of

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empathy towards patients, compromised care quality, and a decline in professional standards.[37]

The risk of burnout among medical students has multiplied during the SARS-CoV-2 pandemic, as uncertainty, quarantine measures, and ongoing stressors have intensified their psychological burden. The advent of the COVID-19 has had a profound impact on their mental and physical well-being, altering learning behaviors and deteriorating work performance and study, particularly for those in clinical years.[29,37]

This review aims to assess burnout syndrome and its associated factors among medical students worldwide during the COVID-19 pandemic. Additionally, there is an endeavor underway to juxtapose the incidence of burnout pre- and post-pandemic within the same demographic. Moreover, we examine potential strategies for intervention and prevention of burnout, encompassing initiatives both by the students themselves and academic institutions..

## Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement is an evidence-based approach for reporting in systematic reviews and meta-analyses. We used the PRISMA statement to guide the reporting of this systematic review.[10]

Primarily, we developed a range of text words, synonyms and subject headings for the three major concepts in this review of 1) burnout, 2) COVID-19 pandemic, and 3) medical students. We then combined phrases related to these main categories, namely "COVID-19", "Coronavirus disease 2019", "Medical students", Medical school students", "Burnout syndrome", "Professional burnout" with "AND" and "OR" and used them to undertake a systematic search of four electronic databases from the beginning of the pandemic to September 2023. Databases searched were PubMed, Scopus, APA PsycNET, and Google Scholar. We also utilized data from other sources (e.g., BMC Medical Education) to gather further information for composing different sections of this present review. For instance, we used these data to direct on how to appropriately apply the PRISMA guidelines to our systematic review.10 Other studies provided insights into the comparison of burnout levels between pre-pandemic and pandemic periods,16 as well as into coping mechanisms used to manage stressful events.63 However, we did not include data from sources other than PubMed, Scopus, APA PsycNET and Google Scholar in the PRISMA flow diagram, as we did not initially intend to incorporate them into the research, thus not selected using the same criteria, such as publication date prerequisites and absolute congruence with the research inquiries. Finally, we merged results exclusively from database search using reference-management software (Zotero) and duplicates removed.

Only studies meeting the following criteria were included: free access, original studies, available in the English language, and reporting data published from January 2020 to September 2023. This timeframe was chosen because it includes both the beginning and the peak of the COVID-19 pandemic, offering a complete picture of its effects on medical students' burnout levels. All pertinent studies published up until the time of our review in September 2023 are included. Each of the studies involved medical students as participants, yet not exclusively, as they may have also included residents, students from diverse academic disciplines, and so forth. Moreover, all publications had the burnout syndrome as their primary focus, with a specific emphasis on the impact of the COVID-19 pandemic on the prevalence of this phenomenon. Due to the limited number of eligible publications, we did not exclude studies without a control group of medical student burnout incidence before the pandemic. Additionally, we included studies investigating risk factors for burnout emergence or revolving around prevention and management strategies. In research papers that included professionals from other fields in the sample (e.g., nurses, doctors, residents, or students from other academic disciplines), we extracted only data related to medical students for the present review.

Articles were excluded if they did not meet the above criteria. Literature assessing hypothetical vignettes or scenarios rather than actual experience was excluded, in addition to studies that focused on general well-being or psychological well-being but not specifically burnout. Articles that focus on medical teachers, trainees, residents, nurses and nurse students were excluded.[10]

### Study selection and data extraction

A single reviewer (MKT) conducted the initial assessment of titles and abstracts. Due to practical constraints, a complete duplicate screening was not feasible. To ensure rigor and reliability, a validation step was implemented. The second author (AT) randomly reviewed a subset of the studies, examining one out of every twenty titles and one out of every five abstracts. Given the exploratory nature of this review, which aimed to summarize the available evidence on burnout during pandemics, this validation step was deemed sufficient to mitigate bias and maintain accuracy. Any disagreements identified were discussed thoroughly until a consensus was reached. The screening and validation processes were conducted manually, as limited resources and the need for flexibility in reviewing heterogenous data precluded the use of software. The diverse study designs and outcomes necessitated a nuanced evaluation, which was more effectively managed through non-automatic review. Copies of full articles were then obtained for those that were potentially relevant to at least one research query explored in this review, namely the variation in burnout rates among medical students in different regions globally, risk factors associated with psychosomatic exhaustion symptoms, and preventive or/and intervention strategies. Inclusion criteria were then applied, and the following data were extracted: lead author, publication year, country, sample, outcome measure, primary aim and key findings.

***Table 1.*** Summary of Included Studies.

| Lead author | Year | Country | Participants | Primary aim | Outcome measure | Key findings |
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| **Aebischer [1]** | 2020 | Switzerland | 550 medical students and 227 residents | To assess the physical and psychological health of Swiss medical students involved in the COVID-19 response and compare it with their non-involved peers | Generalized Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9), Maslach Burnout Inventory (MBI) | Students involved in the COVID-19 response reported lower levels of burnout, compared with their non-involved peers (median 1 vs 3 on de-personalisation item, p <0.001). Frontline students had lower levels of burnout than frontline residents. |
| **Alkureishi [2]** | 2022 | US | 3826 medical students | To assess the impact of the initial phase of the pandemic on burnout, stress, and loneliness among US medical students, while identifying risk and protective factors for informing support interventions. | MBI-HSS, Perceived Stress Scale (PSS-10), UCLA scale | Half of students experienced burnout (29% high depersonalization, 40% high emotional exhaustion, 42% low personal accomplishment). No significant difference was found by sex (52% males vs. 48% females, P = 0.07). Burnout during the pandemic was lower than pre-pandemic (50% vs. 52%). Risk factors for high burnout levels: second- & third-year students, racial minorities, financial strain, experiences of racism. Nearly half of the respondents volunteered during the pandemic, reporting lower burnout. |
| **Asl [4]** | 2021 | Iran | 251 medical students | To meditate the role of compassion in the relationship between COVID-19 anxiety syndrome and COVID-19 burnout | COVID-19 Anxiety Syndrome Questionnaire, Compassion Scale, and COVID-19 Burnout Scale | COVID-19 burnout had a positive and significant relationship with the overall score of anxiety syndrome (r = 0.42, P = 0.01), while it has a negative and significant relationship with compassion (r = −0.37, P = 0.01). |
| **Bolatov [5]** | 2020 | Kazakstan | 619/798 medical students (TL/OL) | To investigate the mental state of the medical students switching to online learning (OL) in comparison with the mental state of the students who had traditional learning (TL) | Copenhagen Burnout Inventory (CBI-S), PHQ-9 scale, GAD-7 scale, Patient Health Questionnaire-15 (PHQ-15) scale, and 5-point adapted Snell's questionnaire (FCV-19) | Prevalence of burnout syndrome decreased after transitioning from TL to OL (28% vs 17% p<0.001), whereas the prevalence of colleague-related burnout increased (general average scores on the CBI-S scale during the TL and OL were 40 and 33, respectively, p < 0.001). The prevalence of burnout decreased in 4th-year students. The level of cynicism increased in all study groups (1–6 years) after switching to OL. |
| **Compton [11]** | 2020 | Singapore | 179 medical students | To assess medical students' preference for re-entering the clinical setting during the COVID-19 pandemic and to explore personal and environmental characteristics associated with that preference. | Oldenburg Burnout Inventory (OLBI), Tolerance for Ambiguity Scale, Modified Treatment Self-Regulation Questionnaire, Modified Archer's Health Promotions Motivation Survey, Author-developed measure of professionalism related to COVID-19 | About one-third of students preferred not to return to the clinical setting.<br>Students favoring a return exhibited greater autonomous (internal) motivation, a stronger sense of professional responsibility and lower self-perception of harboring risk to patients compared to the group preferring not to return. |
| **Daryanto [12]** | 2023 | Indonesia | 413 medical students | To assess burnout prevalence and its associated factors among Indonesian medical students during the COVID-19 pandemic | MBI-SS | Around one-sixth (17.9%) of medical students experienced burnout during the COVID-19 pandemic (29.5% reported high level of emotional exhaustion, 32.9% depersonalization), with a higher prevalence among preclinical students (higher levels of emotional exhaustion, depersonalization, and lower levels of personal accomplishment). |
| **Duarte [14]** | 2022 | Portugal | 462 medical students | To explore the mediating role of resilience and life satisfaction in the relationship between perceived stress and burnout among medical students in the context of COVID-19 | PSS-10, Resilience Scale-25 items, Satisfaction with Life Scale (SWLS), OLBI | Regarding burnout, the students scored an average of 40, with a standard deviation of 7 and a range of 22–61 (OLBI). Positive association was found between exhaustion burnout and stress (β = 0.329, p < 0.001), while there was a negative association between resilience (β = 0.029, p = 0.001) and exhaustion burnout and between life satisfaction (β = −0.215, p = 0.002) and exhaustion burnout. |

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| **El Mouedden [16]** | 2022 | Belgium | 194 medical students and residents | To describe academic and professional burnout levels and their associations with working in COVID-19-related care and with perceived COVID-19 impact on studies and internships among medical students and residents | French version of the MBI-SS | High professional burnout (17%), lower academic burnout (0.5%). Compared to previous studies, higher professional burnout, similar personal accomplishment. COVID-19 impact: Higher impact on studies and work for those involved in COVID-19 care. Emotional exhaustion, reduced personal accomplishment, interpersonal issues, and cynicism due to COVID-19. |
| **Forycka [19]** | 2022 | Poland | 1858 medical students | To assess resilience, well-being and burnout among Polish medical students in the COVID-19 era | Resilience Scale 14; RS-14, Medical Student Well-Being Index, MBI | 1311 students answered all MBI-GS(S) questions and two-dimensional and three-dimensional burnout scores were calculated (59.9% and 54.2% respectively). Low resilience levels were observed. Higher resilience was associated with a better attitude towards online and hybrid classes. 16.8% of respondents would volunteer to be at the pandemic frontline, showing lower exhaustion, cynicism, and higher academic efficacy. |
| **Frajerman [20]** | 2022 | France | 1925 students (medical n=1597, pharmacy students n= 233, dental students n= 95) | To assess mental health in health students from the same university and identify the associated factors. | Hospitalization Anxiety and Depression scale, Composite International Diagnostic Interview-Short Form, MBI | Burnout: 42% among nonclinical students (dental/pharmacy/pre-clinical students) and 65% among clinical students and residents. |
| **Jezzini-Martinez [29]** | 2023 | Mexico | 613 medical students | To assess burnout syndrome and its associated factors among medical students during the COVID-19 pandemic | MBI-SS | Most students had burnout symptoms (54.2%) High emotional exhaustion (79.6%), high cynicism (57.3%), and low academic effectiveness (36.4%) were also prevalent. Highest burnout and cynicism were observed in the 6th year, emotional exhaustion in the 3rd, and lowest academic efficacy in the first year. Female students had a higher incidence of burnout, emotional exhaustion and cynicism compared to male students who were statistically more prevalent towards lower academic effectiveness. Death of a family member due to COVID-19 increased the risk of burnout. |
| **Joshi [30]** | 2022 | USA, Saudi Arabia, India | 487 medical students | To examine the association between burnout in medical students based on gender and residency specialty choice during COVID-19 | MBI, Oldenburg Burnout Inventory (OLBI) | More female participants reported that COVID-19 affected their energy levels (68.9%), interest in education (53.2%), and developed reservations about their residency specialty choice (46%) Female participants also experienced higher levels of emotional exhaustion and physical exhaustion compared to male participants. |
| **Kasemy [32]** | 2022 | Egypt | 3582 participants (1056 staff members and 2526 students) | To investigate the technostress creators and outcomes among University medical and nursing faculties and students as direct effects of the remote working environment during the COVID-19 pandemic. | Scale developed by Ragu-Nathan et al., Utrecht Work Engagement Scale | Medical staff members and students reported moderate-to-high technostress associated with high burnout, strain, and cortisol level. |
| **Liu [33]** | 2022 | China | 817 medical students | To investigate the influencing factors and mechanism of academic burnout in medical students' online learning process. | Adapted DASS Scale developed by Lovibond and Lovibond, Gregory MSPSS, 10-Item Connor–Davidson Resilience Scale (CD-RISC), MBI-SS | In online learning, medical students' stress was positively correlated with academic burnout, with their resilience playing a partial mediating role. Social support did not directly affect academic burnout but reduced it indirectly through enhancing resilience. Stress negatively impacted resilience. Higher resilience was associated with lower academic burnout. |

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| **Metakides [35]** | 2023 | Cyprus | 333 medical students | To investigate medical students' burnout and motivation levels in each of the six years of their studies during the COVID-19 pandemic and identify independent predictors of burnout and motivation. | OLBI-S, updated Strength of Motivation for Medical School (SMMS-R) | Higher burnout levels correlated with lower motivation to study medicine. Burnout levels differ significantly between the 6 years of medical school, peaking in years two and four whereas being the lowest in year one. Being a female, studying in the fourth year vs. first year, having a perceived beginner/intermediate vs. advanced/expert technology level and a perceived poor school support system were independently associated with higher burnout levels. |
| **Muaddi [37]** | 2023 | Saudi Arabia | 444 medical students | To estimate the prevalence of burnout and its determinants among medical students at Jazan University during the COVID-19 pandemic. | Arabic version of the MBI-SS | The prevalence of burnout was 54.5%. Burnout reached its peak during the fourth year whereas it was the lowest in the internship year. Males (54.0%) and females (55.0%) had almost similar burnout rates. The most important predictive factor was having separated parents. Financial instability, being a resident in mountain areas and being delayed in college level are also associated with higher burnout risk. |
| **Nasr [39]** | 2023 | Lebanon | 120 medical students | To evaluate changes in the prevalence rates of burnout among Lebanese pre-final and final year medical students while taking into consideration the impact of COVID-19 on both the academical and clinical experiences. | Copenhagen Burnout Inventory questionnaire | The overall burnout prevalence was 40.01% (39.36% personal burnout, 41.52% work-related burnout, and 39.16% pandemic-related burnout). Theoretical learning and clinical training were reported to be affected in respectively 66.70% and 71.70%. 10% of the students have regretted choosing medicine and 67.50% felt comfortable to get to the next academic level. |
| **Phillips [42]** | 2022 | N/A | 53 medical students | To address the relationship between medical student volunteer motivations and specific outcomes during the COVID-19 pandemic | Volunteer Functions Inventory (VFI) | Altruistic and humanitarian values-centric motivation predicts positive volunteering outcomes (increased resilience, improved ability to deal with disappointment and loss, enhanced ability to cope with the COVID-19 pandemic, increased volunteer empathy) Values-centric motivation promotes student empathy and resilience, especially in activities with patient contact. Career-centric motivation does not predict positive outcomes and these students are more likely to engage in research-oriented activities. |
| **Qu [44]** | 2022 | China | 995 medical students | To investigate the mediating role of general academic emotions in procrastination and burnout among Chinese medical students during the COVID-19 pandemic. | Chinese version of the MBI-SS, Aitken Procrastination Inventory (API), General Academic Emotion Questionnaire for College Students (GAEQ). | Significant positive correlation between procrastination and burnout. Procrastination had positive associations with negative academic emotions, while it had negative associations with positive academic emotions. The contributions (as mediators) of GAEs to burnout and procrastination were 21.16% (NAEs), 29.75% (PAEs), 54.25% (NDEs) and 23.69% (PDEs). |
| **Rolland [45]** | 2022 | France | 11754 medical students | To assess French medical students' mental health. | Hospitalization Anxiety and Depression scale, Composite International Diagnostic Interview-Short Form, MBI | Prevalence of 7-day anxiety symptoms, 7-day depressive symptoms, 12-month MDE, and 12-month suicidal thoughts were 52%, 18%, 25%, and 19% respectively. Burnout syndrome concerned 67% of clinical students and residents and 39% of preclinical students. Having important or very important financial issues, experienced humiliation, sexual harassment and sexual abuse were associated with an increased risk of MDE. |
| **Ruiz [46]** | 2022 | Guatemala | 159 medical students (2017), of whom 132 participated in the second phase (2020) | To assess levels of burnout in 2017 and then again in December 2020 | Spanish version of the MBI-SS | Rates of burnout were higher during the pandemic. Rates of depersonalization had not increased, and levels of personal accomplishment had. |

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| **Silistraru [50]** | 2022 | Romania | 126 medical students | To investigate the prevalence of burnout in Romanian medical students during the COVID-19 pandemic and to identify the presence of intentional shift in medical specialty compared to their initial pursued choice | MBI-GS(S) | 36.5% of the medical students experienced burnout. Exhaustion and Cynicism, which are associated with depersonalization, showed high scores compared to the average scale while the Professional Efficacy score was relatively high. About one third of the respondents (30% Cluj students and 37.5% Iasi students) considered changing residency options. |
| **Sulaiman [52]** | 2023 | Qatar | 272 health profession students (dental, medicine, pharmacy, health sciences) | To evaluate the prevalence of burnout and its relationship to anxiety and empathy during the COVID-19 pandemic among health profession students in the main governmental institution in Doha, Qatar using validated instruments | MBI-GS(S), Generalized Anxiety Disorder (GAD-7), Interpersonal Reactivity Index (IRI) | Burnout was found to be prevalent amongst the students. The mean scores for the MBI-GS(S) subscales of emotional exhaustion, cynicism, and professional efficacy were 4.07, 2.63, and 3.97, respectively. Anxiety was found to be a strong predictor for burnout and burnout was positively associated with empathy. |
| **Tee [53]** | 2022 | Malaysia | 378 clinical year undergraduate medical students | To determine the prevalence of anxiety and burnout, and the coping mechanisms among clinical year undergraduate medical students in Universiti Kebangsaan Malaysia (UKM) during the COVID-19 pandemic | DASS-21, CBI, Brief-COPE | The prevalence of anxiety and burnout were 44.2% and 22.2%, respectively. There was a significant difference in the percentage of students with extremely severe anxiety in the presence and absence of burnout, 23.8% vs. 4.8%. Among the three coping mechanisms, avoidant coping had a significant positive moderate correlation with both the presence of anxiety and the presence of burnout. Meanwhile, coping that was neither approach nor avoidant had a positive weak correlation with the presence of burnout. |
| **Tokumasu [54]** | 2023 | Japan | 211 medical students | To investigate the differences in stress perception of medical students depending on in-person communication and online communication during the COVID-19 pandemic | Jefferson Scale of Empathy, Japanese version of the PSS, developed by Cohen et al. | No significant association between perceived stress and online communication, but the number of people with which students had in-person communication and the length of communication were associated with a reduction in perceived stress. In subgroup analysis, the number of people with in-person communication and the length of communication had significant associations with stress reduction even in the group of students who had a preference for being by themselves. |
| **Wilkes [56]** | 2021 | Canada | 101 medical students | To review medical student wellness in the context of the collaboration of a core study group in the UK with 12 countries around the world | Short-form general health questionnaire (GHQ-12), OLBI | 21% reported a mental health condition, most commonly an anxiety disorder and or depressive disorder. Study (81%), relationships (62%), money (35%), and accommodation or housing (10%) are the most significant stressors. 14% tested CAGE positive and 20% reported having taken a non-prescription substance to feel better or regulate their mood. 75% met specific case criteria for exhaustion on the Oldenburg Burnout inventory and 74% met criteria for the GHQ questionnaire. |
| **Yang [58]** | 2023 | China | 4661 undergraduate students | To compare the mental health conditions and academic burnout between medical and non-medical undergraduates in China when the COVID-19 pandemic is mitigating | Academic Burnout Scale (ABS), PHQ-9, GAD-7, Epworth Sleepiness Scale (ESS), PSS-10, 3-item Alcohol Use Dependence Identification Test (AUDIT-C) | Compared with medical undergraduates, non-medical undergraduates had higher rates of moderate to severe depression symptoms, moderate to severe anxiety symptoms, alcohol abuse/dependence, excessive daytime sleepiness, high perceived stress, high level of fatigue, low QOL, and higher academic burnout score. |

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| **Zhang [59]** | 2021 | China | 684 medical students | To evaluate the association between learning burnout and social support in Chinese medical students. | Lian version of the MBI, Social Support Rating Scale (SSRS) | 315 students (46.12%) met standard criteria for learning burnout. Seniors, low family income and low social support were significant predictors of learning burnout. After adjusting for the grade and family income, there was a significant and relevant association between social support and learning burnout. |
| **Zis [60]** | 2021 | Cyprus | 154 medical students | To investigate what the impact of digital learning due to the COVID-19 pandemic was on the burnout and overall mental health (MH) of medical students. | MH domain of the 36-item Short Form Health Survey (SF-36), MBI-SS | The overall burnout prevalence was similar (pre-COVID-19 18.1% vs. COVID-19 18.2%). However, the burnout prevalence dropped significantly in year 4 (pre-COVID-19 40.7% vs. COVID-19 16.7%), whereas it increased significantly in year 6 (pre-COVID-19 27.6% vs. COVID-19 50%). Emotional exhaustion decreased significantly in year 4 but increased in year 6, and cynicism increased in all years. The overall MH deteriorated significantly between the two periods (pre-COVID-19 58.8 ± 21.6 vs. COVID-19 48.3 ± 23). |
| **Žuljević [61]** | 2021 | Croatia | Medical students. 437 before and 235 after lockdown - 160 participant responses eligible for pairing | To evaluate the impact of the first COVID-19 lockdown in 2020 on the burnout and study satisfaction of medical students. | OLBI, Copenhagen Burnout Inventory | No significant difference for both paired and unpaired participants in study satisfaction before and after lockdown. No evidence for an increase in the level of burnout before and after lockdown, both in independent and paired samples. |
| **Zúñiga [62]** | 2021 | Chile | 102 fourth-year medical students | To report the implementation and impact of an eight-week multifaceted mindfulness-based self-care program on medical students' distress and well-being during the COVID-19 pandemic. | MBI-HSS, PSS, IES-R, Brief-COPE, Mindful Attention Awareness Scale (MAAS), Mental Health Continuum Short-Form (MHCSF), Connor-Davidson Resilience Scale (CD-RISC) | Burnout prevalence decreased from 48% to 24%, whereas students with high dispositional mindfulness increased from 25% to 44%. Burnout reduction was mostly due to decreased emotional exhaustion. Additionally, students reported lower levels of stress, self-blaming, and traumatic stress reactions alongside an increased use of active coping strategies and resilience levels after the program. |

## Data analysis

The analysis of the findings followed a narrative synthesis approach, which was conducted in stages aligned with the study objectives.[10] This narrative approach was chosen due to the diverse nature of the outcome measures employed in the studies. While many studies employed variations of the same measure, they were not consistently applied across all studies, making a narrative synthesis the appropriate method in this context. A quantitative approach was deemed unsuitable because the measures could not be directly compared.43 In light of this, we concluded that while a meta-analysis would be a powerful tool for synthesizing the data of our review, it would not be feasible in this case, primarily due to the heterogeneity in study designs (e.g., methodologies, sample sizes, research designs, and measurement tools, such as different burnout scales). Such variability would make it challenging to pool results meaningfully and could risk introducing bias or misrepresentation of the findings. Moreover, the number of studies was limited, and some presented insufficient data reporting. For all these reasons, we chose the narrative synthesis approach over a meta-analysis that would, by definition, lack statistical robustness. Initially, summaries of the eligible studies and their outcomes were compiled and presented in ***Table 1.*** Subsequently, an exploration of data patterns was carried out manually to identify consistent findings related to the study objectives. An in-depth analysis of the findings investigated the relationships between various study characteristics, with particular emphasis on the number of participants and outcome measurements, and their respective outcomes, compared findings across different studies, and assessed how the utilization of distinct outcome measures, methods, and settings influenced the resulting data. The stages of this narrative synthesis process are illustrated in ***Figure 2.***

While the narrative synthesis approach allowed for a comprehensive analysis of diverse studies, it is not without limitations. The subjective character of this method could lead to bias because it mainly depends on the reviewers' interpretations. Furthermore, it may be difficult to make straight comparisons and generalizations due to the variations in research designs and outcome measures. The findings are further limited by potential selection bias and the exclusion of studies written in languages other than English. Notwithstanding these difficulties, the narrative synthesis offered a methodical way to combine and analyze the diverse data, ensuring a thorough examination of the research goals.

## Quality Assessment

We used the Critical Appraisal Skills Programme (CASP) checklists to perform a quality assessment and guarantee the rigor and quality of the included studies. This 10-item tool is designed to

assess the methodological trustworthiness, applicability, and conclusions of each study.64 Precisely, the CASP incorporates three main sections when appraising a systematic review to answer to these questions: are the results valid; what are the results; will the results help locally. Important factors like the clarity of the research objectives, suitability of the study design, recruitment strategy, data collection techniques, ethical considerations, and the validity and reliability of the findings were all examined in each study and are detailed in ***Table 2***. This quality assessment provided an additional layer of rigor to our systematic review, ensuring that the conclusions drawn are based on high-quality evidence

## Results

### Search Results

Using the search strategy outlined above, 579 references were retrieved, comprising 110 articles from PubMed, 346 articles from Scopus, 85 articles from PsycNET and 38 articles from Google Scholar. Among these publications, 250 were excluded at the subsequent stage of the study, with 68 being duplicates and the remaining 182 removed due to technical issues with the Scopus database that prevented us from accessing the initial list of results after secondary assessment. To maintain the integrity of our study, we decided to exclude these records. Of the 329 records assessed through title and abstract screening, 259 were removed due to their lack of relevance to the study objective or due to limited accessibility. From the remaining 70 reports, it was not feasible to retrieve full text for 4 of them, resulting in full text screening for 66 articles. At this early stage, it was not always clear whether the studies focused on medical students, burnout syndrome, or the timeline of the COVID-19 pandemic. To avoid prematurely excluding potentially relevant studies, we permitted studies that were not clearly irrelevant to proceed to the full-text review. This approach allowed for a more detailed assessment, ultimately leading to the exclusion of studies that did not meet the inclusion criteria upon closer examination. Among these 66 articles , 7 did not focus on medical students, 18 did not refer to the burnout syndrome and/or the COVID-19 pandemic, 6 utilized very small sample populations or specific, non-representative groups of medical students, and 4 articles were not original research papers but rather meta-analysis, clinical trials, etc. Consequently, an additional 35 records were eliminated, ultimately culminating in the inclusion of thirty-one studies ***(Figure 1).***

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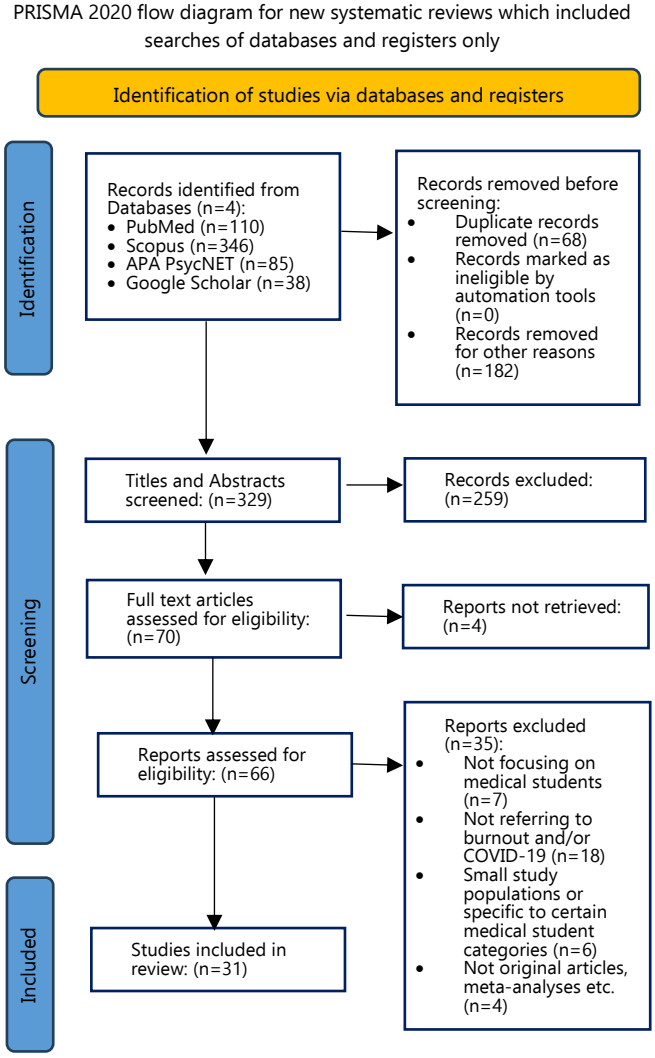
***Figure 1.*** PRISMA Flow Diagram.




***Legend: From:*** Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

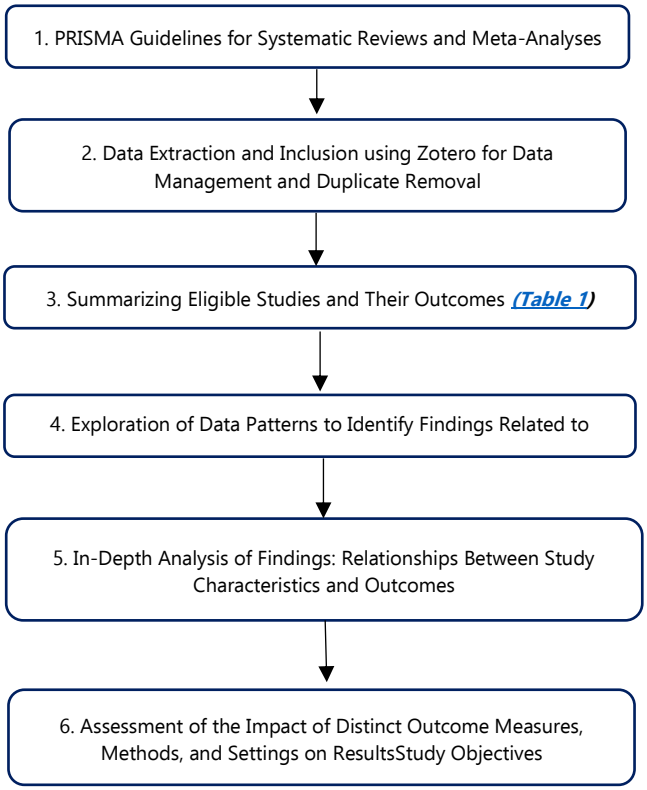
prematurely excluding potentially relevant studies, we permitted studies that were not clearly irrelevant to proceed to the full-text review. This approach allowed for a more detailed assessment, ultimately leading to the exclusion of studies that did not meet the inclusion criteria upon closer examination. Among these 66 articles , 7 did not focus on medical students, 18 did not refer to the burnout syndrome and/or the COVID-19 pandemic, 6 utilized very small sample populations or specific, non-representative groups of medical students, and 4 articles were not original research papers but rather meta-analysis, clinical trials, etc. Consequently, an additional 35 records were eliminated, ultimately culminating in the inclusion of thirty-one studies ***(Figure 1).***

### Characteristics of Included Studies

The main characteristics of the included studies are listed in ***Table 1.*** The range of sample size was between 53 and 11754. There

was a total of 37166 participants from 25 different countries across all the studies. The year of the studies included were from 2020 to 2023. Most of the thirty-one studies included in this review were cross-sectional and examined the impact of the COVID-19 pandemic on the levels of burnout among medical students by comparing their results with data from pre-pandemic studies. Only three of these studies incorporated a control group as they were conducted in two distinct phases, one before and one during the pandemic. These phases involved students from the same educational institutions, ensuring the ability to draw dependable conclusions. Ten publications enlisted students from multiple institutions.

***Figure 2.*** Narrative Synthesis Process Flowchart.




Concerning the outcome measurements, in 18 studies the Maslach Burnout Inventory (MBI) was employed, the Perceived Stress Scale (PSS) was utilized in 5, the Oldenburg Burnout Inventory (OLBI) was chosen in 6 cases, and 3 studies incorporated questionnaires related to COVID-19, often utilizing the FCV-19S. Four investigations encompassed the Generalized Anxiety Disorder (GAD), and three included the Patient Health Questionnaire (PHQ). Furthermore, four studies utilized the Copenhagen Burnout Inventory (CBI-SS), while two studies adopted outcome measures such as the Depression, Anxiety, Stress Scale (DASS), or the brief COPE respectively.

## Review Findings

The studies that were included found that an outsize proportion of medical students, exceeding 35% in most of the studies, experienced prominent levels of burnout. This was observed irrespective of the presence of the COVID-19 pandemic, as indicated by references.2,20,29,37,39,45,50,59 The results of the studies were often conflicting regarding the comparison of the prevalence of burnout before and during the pandemic, as some studies showed a higher prevalence,46 while others indicated a lower one,2,5 and some exhibited no significant variation.60 What remains consistent across a spectrum of research findings is the notable prevalence of the burnout syndrome among medical students. Furthermore, certain studies presented contradicted findings regarding the comparison between medical students and other undergraduates. On the one hand, Shpakou et al. revealed least satisfaction with life and more elevated level of perceived stress for future doctors compared with students of physical culture and pedagogical departments. On the other hand, Yang et al. indicated a heightened incidence of perceived stress, depression and anxiety, lower QOL, and elevated academic burnout scores among health sciences students compared with those from other academic disciplines.

### I. Demographic Factors

Gender, age, and the year of medical school of students were identified as potential predictors of burnout in several studies, though the findings were not consistent. In total, five studies attempted to investigate gender as a risk factor for burnout.[2,29,30,37,44] Two research teams indicated higher rates of burnout in females, two showed no significant correlation, and one study indirectly suggested an increased likelihood of burnout for male students. Jezzini-Martinez et al. and Joshi et al. suggested that female students exhibit poorer overall mental health compared to their male peers,[29,30] identifying notably higher emotional exhaustion scores in those students. According to the Mexican study, female medical students had higher burnout scores, while lower academic effectiveness was described primarily among male participants.[29] On the contrary, other researchers found no significant differences in total burnout scores between genders,[2,37] while Alkureishi et al. reported higher stress levels among females.[2] Moreover, Qu et al. reported statistically significant stronger negative and positive deactivation emotions (NDEs, PDEs) for males. This indicated that academic emotions such as hopelessness and boredom as well as pride and relief more frequently lead male than female students to procrastination and eventually burnout.

Conflicting results were found among studies that compared levels of burnout and overall mental health between undergraduate medical students in different academic years of their university degree. A study in Switzerland, involving both students and residents, indicated that clinical-year students involved in the COVID-19 response had lower rates of burnout, depression, and anxiety compared to their non-involved peers,[1] while according to Polish researchers respondents who volunteered to be at the pandemic frontline, showed lower exhaustion, cynicism, and higher academic efficacy.[19] Another research, encompassing students from 22 medical schools, demonstrated elevated levels of burnout in students during their second and third years of education.[2] Interestingly, Metakides et al. and Muaddi et al. results coincided on burnout levels varying

***Table 2.*** CASP Checklist for Systematic Reviews.

| | Section A: Are the results of the review valid? | | | | | Section B: What are the results? | | | Section C: Will the results help locally? | |
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| **Paper Lead Author** | Did the review address a clearly focused question? | Did the authors look for the right type of papers? | Do you think all the important, relevant studies were included? | Did the review's authors do enough to assess the quality of the included studies? | If the results of the review have been combined, was it reasonable to do so? | What are the overall results of the review? | How precise are the results? | Can the results be applied to the local population? | Were all important outcomes considered? | Are the benefits worth the harms and costs? |
| **Aebischer [1]** | Yes. The study examines the physical and psychological health impacts on medical students involved in the COVID-19 response in Switzerland. | Yes. The study used a cross-sectional survey method, which is suitable for assessing health impacts. | Can't tell. While the study used a cross-sectional survey method, it is not clear if all relevant studies were included. | Yes. The authors assessed the quality of the included studies by examining the methodologies and outcomes. | Yes. The results were combined in a reasonable manner to provide a comprehensive view of the health impacts | The overall results indicate that medical students involved in the COVID-19 response experienced significant physical and psychological health impacts. | Can't Tell: The precision of the results is not explicitly detailed, but the findings are supported by the data presented | Yes. Applicable to medical students globally. | Yes. The study considered a range of physical and psychological health outcomes, which are important for understanding the impact. | Yes. Understanding the health impacts on medical students can inform future support strategies. |
| **Alkureishi [2]** | Yes. Focused on the impact of the early COVID-19 phase on medical students. | Yes. They conducted a multisite survey relevant to the topic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. They utilized a detailed survey method. | Yes. They compared data from multiple sites. | The early phase of COVID-19 had a significant negative impact on student well-being. | Can't tell. Specific statistical precision measures are not mentioned. | Yes. Applicable to medical students globally. | Yes. They looked at various aspects of well-being. | Yes. The study highlights important areas for intervention. |
| **Asl [4]** | Yes. Investigated the mediating role of compassion between COVID-19 anxiety and burnout. | Yes. Focused on studies related to COVID-19 anxiety and burnout. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Detailed analysis of the mediating factors. | Yes. They assessed relationships between variables. | Compassion mediates the relationship between anxiety and burnout. | Can't tell. Specific statistical precision measures are not mentioned. | Yes. Applicable to medical students globally. | Yes. Focused on anxiety, compassion, and burnout. | Yes. Provides insights into intervention strategies. |
| **Bolatov [5]** | Yes. Examined the impact of online learning on mental health. | Yes. Included studies on online learning and mental health. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Detailed methodological approach. | Yes. Combined data from relevant studies. | Online learning had a positive impact on mental health. | Can't tell. Specific statistical precision measures are not mentioned. | Yes. Applicable to medical students globally. | Yes. Focused on mental health outcomes. | Yes. Positive implications for online learning strategies. |
| **Compton [11]** | Yes. Investigated students' preferences for returning to clinical settings. | Yes. Relevant studies on student preferences and clinical settings. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Detailed methodological approach. | Yes. Combined data on preferences. | Students preferred returning to clinical settings with adequate safety measures. | Can't tell. Specific statistical precision measures are not mentioned. | Yes. Applicable to medical students globally. | Yes. Focused on preferences and safety concerns. | Yes. Important for planning clinical rotations. |
| **Daryanto [12]** | Yes. Investigated burnout prevalence and factors during COVID-19. | Yes. Relevant studies on burnout among medical students. | Yes. Comprehensive analysis of burnout factors. | Yes. Detailed methodological approach. | Yes. Combined data from relevant studies. | High prevalence of burnout, with several associated factors identified. | Yes. Statistical precision is discussed. | Yes. Applicable to medical students globally. | Yes. Considered various burnout factors. | Yes. Important for addressing burnout. |
| **Duarte [14]** | Yes. Examined resilience and life satisfaction as mediators between stress and burnout. | Yes. Relevant studies on stress, burnout, and resilience. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Detailed analysis of mediating factors. | Yes. Combined data on stress and burnout. | The results indicate that resilience and life satisfaction mediate the relationship between stress and burnout among medical students during COVID-19. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered stress, burnout, resilience, and life satisfaction, which are critical for understanding the full impact on medical students. | Yes. Understanding these relationships can help develop supportive measures. |

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| **El Moueddeen [16]** | Yes. The study focuses on academic and professional burnout in medical students and residents during the first COVID-19 lockdown in Belgium. | Yes. The authors looked for studies that examine burnout among medical students and residents during the COVID-19 lockdown. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by examining the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of burnout experiences. | The results indicate significant experiences of burnout among medical students and residents during the first lockdown. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered both academic and professional burnout, which are critical for understanding the full impact. | Yes. Understanding burnout experiences can help develop supportive measures. |
| **Forycka [19]** | Yes. The study focuses on resilience, well-being, and burnout among Polish medical students during the COVID-19 pandemic. | Yes. The authors examined papers that explore resilience, well-being, and burnout among medical students during the pandemic | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of resilience, well-being, and burnout. | The results indicate significant issues related to resilience, well-being, and burnout among medical students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered resilience, well-being, and burnout, which are critical for understanding the full impact on medical students. | Yes. Understanding these factors can help develop supportive measures. |
| **Frajerman [20]** | Yes. The study focuses on the mental health of medical, dental, and pharmacy students. | Yes. The authors examined papers that explore mental health among students in medical, dental, and pharmacy fields. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of mental health among these student populations. | The results indicate significant mental health issues among medical, dental, and pharmacy students. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical, dental and pharmacy students globally. | Yes. The study considered various aspects of mental health, which are critical for understanding the full impact on students. | Yes. Understanding mental health issues in these student populations can help develop supportive measures. |
| **Jezzini-Martinez [29]** | Yes. The study focuses on assessing burnout syndrome and associated factors among medical students during the COVID-19 pandemic. | Yes. The authors examined papers related to burnout among medical students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of burnout and associated factors. | The results indicate significant burnout syndrome and identify various associated factors among medical students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various factors associated with burnout, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |
| **Joshi [30]** | Yes. The study focuses on factors influencing burnout in millennial medical students during the COVID-19 pandemic. | Yes. The authors examined papers related to burnout among millennial medical students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of factors influencing burnout. | The results indicate significant factors influencing burnout among millennial medical students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various factors influencing burnout, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |

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| **Kasemy [32]** | Yes. The study focuses on technostress creators and outcomes among Egyptian medical staff and students during the COVID-19 pandemic. | Yes. The authors examined papers related to technostress among medical staff and students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of technostress creators and outcomes. | The results indicate significant technostress creators and their outcomes among medical staff and students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. The results are specific to Egyptian medical staff and students but can be informative for similar populations in other regions. | Yes. The study considered various aspects of technostress, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |
| **Liu [33]** | Yes. The study focuses on the impact of social support and stress on academic burnout among medical students in online learning, with resilience as a mediating factor. | Yes. The authors examined papers related to social support, stress, resilience, and academic burnout among medical students. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of the impact of social support and stress on academic burnout. | The results indicate significant impacts of social support and stress on academic burnout, with resilience playing a mediating role. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students in online environments globally. | Yes. The study considered social support, stress, resilience, and academic burnout, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |
| **Metakides [35]** | Yes. The study focuses on burnout and motivation to study medicine among students during the COVID-19 pandemic. | Yes. The authors examined papers related to burnout and motivation among medical students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of burnout and motivation. | The results indicate significant burnout and its impact on motivation to study medicine among students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered burnout and motivation, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |
| **Muaddi [37]** | Yes. The study focuses on assessing burnout among medical students during the COVID-19 pandemic. | Yes. The authors examined papers related to burnout among medical students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of burnout among medical students. | The results indicate significant burnout among medical students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various aspects of burnout, which are critical for understanding the full impact. | Yes. Understanding burnout and its associated factors can help develop supportive measures. |
| **Nasr [39]** | Yes. The study focuses on burnout rates among Lebanese pre-final and final year medical students during the COVID-19 pandemic. | Yes. The authors examined papers related to burnout among medical students during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of burnout rates. | The results indicate significant burnout rates among Lebanese pre-final and final year medical students during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various aspects of burnout, which are critical for understanding the full impact. | Yes. Understanding burnout rates can help develop supportive measures. |

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| **Phillips [42]** | Yes. The study focuses on medical student volunteerism and its impact during the COVID-19 pandemic. | Yes. The authors examined papers related to medical student volunteerism during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of the impact of volunterism. | The results indicate significant impacts of medical student volunteerism during the pandemic. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various aspects of volunteerism and its impacts, which are critical for understanding the full impact. | Yes. Understanding burnout rates can help develop supportive measures. |
| **Qu [44]** | Yes. The study focuses on the mediating role of general academic emotions in burnout and procrastination among Chinese medical undergraduates during the COVID-19 pandemic. | Yes. The authors examined papers related to academic emotions, burnout, and procrastination among medical students. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of the mediating role of academic emotions. | The results indicate significant mediating effects of general academic emotions on burnout and procrastination among medical undergraduates. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered academic emotions, burnout, and procrastination, which are critical for understanding the full impact. | Yes. Understanding burnout rates can help develop supportive measures. |
| **Rolland [45]** | Yes. The study focuses on mental health and working conditions among French medical students. | Yes. The authors examined papers related to mental health and working conditions among medical students. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. The results were combined reasonably to provide a comprehensive view of mental health and working condition. | The results indicate significant impacts of working conditions on mental health among French medical students. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered various aspects of working conditions and their impacts on mental health, which are critical for understanding the full impact. | Yes. Understanding burnout rates can help develop supportive measures. |
| **Ruiz [46]** | Yes. The study clearly focused on comparing the prevalence of burnout in medical students before and during the COVID-19 pandemic. | Yes. The authors focused on studies relevant to burnout in medical students during the specified periods. | Can't tell. The comprehensiveness of the search is not specified. | Yes. The authors assessed the quality by evaluating the methodologies and outcomes of the included studies. | Yes. Combining the results was reasonable to compare the prevalence before and during the pandemic | The review found an increased prevalence of burnout among medical students during the COVID-19 pandemic compared to before. | Can't Tell. The precision of the results is not explicitly detailed but is supported by the presented data. | Yes. Applicable to medical students globally. | Yes. The study considered key outcomes like prevalence rates and contributing factors. | Yes. Understanding prevalence can help in designing interventions to mitigate its effects. |
| **Silistraru [50]** | Yes. The study focused on burnout and residency choices among Romanian medical students during lockdown. | Yes. They examined papers addressing burnout and medical education during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. They assessed the quality of the studies included. | Yes. Combining results provided a comprehensive overview of the impact on Romanian students. | The review indicated significant burnout levels and shifts in residency preferences among students. | Can't tell. Specific precision metrics were not detailed. | Yes. Applicable to medical students in Romania and worldwide. | Yes. Important outcomes such as burnout levels and residency choices were considered. | Yes. Understanding these factors can help in policy-making and educational planning. |

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| **Sulaiman [52]** | Yes. The study focused on burnout, anxiety, and empathy among health profession students during the pandemic. | Yes. They included papers on mental health and burnout among health profession students. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Quality assessment was conducted for included studies. | Yes. It was reasonable to combine the results for a comprehensive analysis. | The study found high levels of burnout, anxiety, and variable levels of empathy among students. | Can't tell. The precision of the results was not explicitly discussed. | Yes. Applicable to medical students in Qatar Univeristy and worldwide. | Yes. Key outcomes like burnout, anxiety, and empathy were considered. | Yes. Insights from the study can inform support strategies for students. |
| **Tee [53]** | Yes. The study focused on anxiety, burnout, and coping mechanisms among medical students. | Yes. The authors included papers relevant to mental health among medical students during the pandemic | Can't tell. The comprehensiveness of the search is not specified. | Yes. Quality assessment was mentioned. | Yes. Combining results was reasonable to understand the overall impact. | The review found significant levels of anxiety and burnout, with various coping mechanisms employed by students. | Can't tell. Precision details were not explicitly provided. | Yes. Applicable to medical students in Malaysia and worldwide. | Yes. Important outcomes such as prevalence of anxiety, burnout, and coping mechanisms were considered. | Yes. The findings can guide interventions to support student mental health. |
| **Tokumasu [54]** | Yes. The study focused on stress perception related to in-person and online communication among medical students. | Yes. They included papers related to stress and communication modes during the pandemic. | Can't tell. The comprehensiveness of the search is not specified. | Yes. Quality assessment was conducted for included studies. | Yes. Combining results was reasonable to understand the overall impact. | The study found differences in stress perception based on the mode of communication. | Can't tell. The precision of the results was not explicitly discussed. | Yes. The results are applicable to Japanese medical students and medical students worldwide. | Yes. Important outcomes such as stress perception and communication modes were considered. | Yes. Understanding stress perception can help in planning better communication strategies. |
| **Wilkes [56]** | Yes. The study focused on the wellbeing and mental health of medical students in Canada during the pandemic. | Yes. They included studies relevant to mental health and wellbeing among medical students. | Can't tell. The study did not detail the search strategy comprehensively. | Yes. Quality assessment of included studies was mentioned. | Yes. Combining the results provided a comprehensive overview of mental health and wellbeing. | The review found significant mental health challenges and varying levels of wellbeing among Canadian medical students. | Can't tell. The precision was not explicitly discussed. | Yes. The results are applicable to Canadian medical students and medical students worldwide. | Yes. Important outcomes like mental health status and wellbeing were considered. | Yes. Understanding these factors can help in developing support strategies for students. |
| **Yang [58]** | Yes. The study focused on mental health and academic burnout among undergraduates during the pandemic. | Yes. The review included studies on mental health and academic burnout during the pandemic. | Can't tell. The search strategy was not fully detailed. | Yes. The quality of included studies was assessed. | Yes. Combining results was reasonable for a comprehensive analysis. | The review found significant mental health challenges and academic burnout among undergraduates. | Can't tell. Precision details were not explicitly provided. | Yes. The findings are relevant to the population of Chinese undergraduates. | Yes. Important outcomes like mental health conditions and academic burnout were considered. | Yes. Understanding these issues can help in designing interventions for student support. |
| **Zhang [59]** | Yes. The study focused on the role of social support in learning burnout among medical students. | Yes. They included studies relevant to social support and learning burnout. | Can't tell. The search strategy was not fully detailed. | Yes. Quality assessment of included studies was conducted. | Yes. Combining results was reasonable for a comprehensive analysis. | The review found that social support plays a significant role in mitigating learning burnout among medical students. | Can't tell. Precision details were not explicitly provided. | Yes. The findings are applicable to medical students in similar contexts. | Yes. Important outcomes like social support and learning burnout were considered. | Yes. Insights from the study can inform support strategies to reduce burnout. |
| **Zis [60]** | Yes. The study focused on the impact of digital learning on burnout and mental health among medical students. | Yes. They included studies relevant to digital learning and its impact on students' mental health. | Can't tell. The search strategy was not comprehensively detailed. | Yes. The quality of included studies was assessed. | Yes. Combining results provided a comprehensive overview of the impact of digital learning. | The review found that digital learning had a significant impact on burnout and mental health among medical students. | Can't tell. Precision details were not explicitly provided. | Yes. The findings are applicable to medical students experiencing digital learning environments. | Yes. Important outcomes like burnout and mental health impacts were considered. | Yes. Understanding these impacts can help in designing better digital learning strategies. |

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| **Žulje vić [61]** | Yes. The study focused on the impact of the first COVID-19 lockdown on study satisfaction and burnout among medical students. | Yes. They included studies on study satisfaction and burnout during the lockdown. | Can't tell. The search strategy was not comprehe nsively detailed. | Yes. Quality assessme nt was conducte d for included studies. | Yes. Combin ing results was reasona ble for underst anding the overall impact. | The study found changes in study satisfaction and burnout levels pre- and post-lockdown. | Can't tell. Precision was not explicitly discussed. | Yes. The findings are applicable to medical students in Split, Croatia but also worldwid e. | Yes. Important outcomes like study satisfaction and burnout were considered. | Yes. Understandi ng these impacts can help in designing intervention s to support students. |
| **Zúñi ga [62]** | Yes. The study clearly focused on assessing the impact of a self-care program on burnout and mindfulness among medical students during the COVID-19 pandemic. | Yes. They included studies that evaluated the effects of self-care programs on burnout and mindfulness in medical students. | Can't tell. The search strategy was not comprehe nsively detailed. | Yes. The article indicates that the quality of the included studies was assessed, although specific details on the assessme nt process are not provided. | Yes. Combin ing results from similar interve ntions to assess overall effectiv eness is reasona ble and provide s a more compre hensive underst anding of the progra m's impact. | The review found that the self-care program led to reduced burnout and increased mindfulness among medical students, suggesting positive mental health outcomes. | Can't tell. Precision was not explicitly discussed. | Yes. The results can be applied to medical students who are experienci ng similar stressors and challenge s, especially in the context of the COVID-19 pandemic . | Yes. Important outcomes like burnout and mindfulness were considered, which are critical measures of mental health and well-being. | Yes. The benefits of reduced burnout and increased mindfulness are significant. The self-care program likely has a positive impact. |

significantly between the 6 years of medical school, peaking in year four. Daryanto et al. state that burnout presented a higher prevalence among preclinical students during the pandemic.[12] In contrast, two French studies reported similar burnout prevalences, ranging between 39% and 42% among nonclinical students and between 65% and 67% among clinical students and residents.[20,45] Jezzini-Martinez et al. also found significant correlation between school year and burnout, describing highest burnout and cynicism in the 6th year, emotional exhaustion in the 3rd, and lowest academic efficacy in the first year.[29]

As evident from the findings, there is substantial variation among the results of different studies, rendering it challenging to determine any discernible pattern regarding the escalation or reduction of burnout rates throughout the academic years. This divergence could be attributed to disparities in geographic locations, different lockdown conditions and distinct educational curricula implemented by each university included.

### II. Pandemic vs. Pre-Pandemic Burnout Levels and Education

Regarding the comparison of burnout levels between two distinct chronic periods (pre-pandemic and during the pandemic), the studies incorporated in this investigation once again do not exhibit unanimous consensus. Some research indicates an escalation in burnout levels during COVID-19 outbreak,16,46 while others contend that they remained relatively stable.60,61 Additionally, there are a few studies that have documented a decline in burnout among medical students.[2,5] This observed inconsistency arises from differences in study designs (cross-sectional vs. longitudinal), population characteristics (e.g. sample size, year of study), and contextual factors, including country-specific responses to the pandemic, healthcare system characteristics, and variations in educational approaches, such as remote learning, changes in clinical rotations, and mental health support.

The pandemic affected both theoretical learning and clinical training.[39] According to a Kazakhstan study, the prevalence of burnout syndrome, depression, anxiety, and somatic symptoms decreased after transitioning from traditional to online learning.[5] One study found that rates of depersonalization had not increased;[46] notwithstanding, most of the studies reported increased prevalence of colleague-related burnout, indicating the negative impact of online learning on students' communication and interpersonal relationships.[5,50] Tokumasu et al. did not reveal significant association between perceived stress and online communication. Nonetheless, there was a notable reduction in perceived stress observed when students engaged in face-to-face interactions, which was evident even in the subgroup of those who preferred being by themselves.[54]

Hence, the pandemic exerted distinct effects on various facets of burnout, specifically those associated with the educational process and interpersonal communication. It manifested a propensity to ameliorate the former while concurrently presenting an adverse influence on the latter. This phenomenon aligns logically with the fact that, during the lockdown period, educational demands were notably less stringent than usual as students had more available time to absorb new knowledge, facilitated by the absence of commutes and the limited availability of time-consuming extracurricular activities. In parallel, the importance of interpersonal relationships was inadvertently underprioritized, thereby negatively impacting the psychological well-being of students due to the lack of face-to-face interactions with peers and colleagues. This phenomenon may explain the preference of approximately two-thirds of

students, as emphasized by Compton et al., to return to clinical settings, showcasing increased internal motivation, a stronger sense of professional responsibility, and diminished self-perceived risk to patients, in comparison to those who preferred not to return.[11]

Additionally, it is noteworthy that higher resilience was linked to a more positive attitude towards online and hybrid classes,[19] whereas moderate-to-high technostress reported by Egyptian medical students was associated with heightened levels of burnout, strain, and cortisol levels.32 Kalauni et al. demonstrated that Nepali students with internet access at their residence were less likely to exhibit depressive symptoms compared to those lacking internet services. Furthermore, results from a Cypriot study indicated that perceiving oneself as a technology novice or intermediate, as opposed to an advanced or expert, and perceiving a deficient school support system were independently associated with elevated levels of burnout.[35]

### III. Social Factors

As indicated by numerous research studies, the family environment of students and their interpersonal relationships, specifically their friendships, played a pivotal role in molding the levels of resilience they displayed throughout the lockdown. The most significant predictive factor for the occurrence of burnout was the divorced parental status, as it was observed to be above 77% in students with divorced parents or parents living separately, while only half of the students with married parents reported burnout.[37] These findings align perfectly with concurrent studies on the mental health of medical students and underscore the crucial role of a stable and content family environment in safeguarding the psychological well-being of young individuals.[38]

Another critical factor is whether the students themselves or their close relatives had been infected with COVID-19. Respondents who had been diagnosed with COVID-19 or had a family member or friend who had been infected exhibited elevated stress levels[2] while the death of a family member due to COVID-19 increased the risk of burnout.[29] Regarding the domestic environment, students living alone during quarantine were more susceptible to depression during online learning[5] and about half of the participants in a US study had high loneliness scores.[2]

In terms of social support, two Chinese studies investigated its association with burnout.[33,59] Liu et al. did not demonstrate a direct influence of social support on academic burnout rates but showed that it reduced indirectly through enhancing resilience. Stress negatively impacted resilience, while social support positively influenced it. Higher resilience was associated with lower academic burnout.[33]

Concerning the aspect of social support, two Chinese studies delved into its correlation with burnout, as indicated by references.[33,59] In the study by Liu et al. it was revealed that social support exerts an indirect influence on academic burnout rates by fortifying resilience.[33] Additionally, Zhang et al. established that low social support serves as a significant predictor of learning burnout.[59]

### IV. Psychological factors

Among the identified studies, three revealed worsening of the overall mental health (MH) due to the COVID-19 pandemic.[19,53,60] According to Forycka et al. 26.4% of those who reported diagnosed mental conditions presented more severe burnout in all three dimensions and worsened symptoms, while Tee et al. found a significant difference in the percentage of students with extremely severe anxiety in the presence (23.8%) and absence (4.8%) of burnout. Finally, a study conducted in a Cypriot university revealed that overall MH deteriorated significantly between the two periods (pre-COVID-19 and COVID-19).60

### V. Volunteering and Coping Mechanisms

Among the thirty-one studies included in the research, three reported a positive impact of volunteering on the overall mental health of medical students.[2,19,42] Specifically, according to a study in the US, students who volunteered during the pandemic were less likely to report burnout, high emotional exhaustion, and low personal accomplishment than those who did not volunteer. The same study did not show significant differences between pandemic volunteer and non-volunteer students for stress and loneliness.[2] The findings of Polish researchers align with the aforementioned, highlighting that individuals who worked voluntarily on the pandemic frontlines displayed greater resilience, lower exhaustion and cynicism, as well as enhanced academic efficacy in terms of burnout.[19] As per Phillips et al., volunteering fosters resilience, emotional empathy, and the overall well-being of medical students. Researchers identify two types of volunteerism: one rooted in altruistic and humanitarian values and the other primarily focused on advancing students' careers. Value-centered volunteerism has a positive influence on participants' well-being, enhancing resilience, coping with challenges, and addressing the COVID-19 pandemic. It also boosts emotional empathy, regardless of the student's educational stage. Those motivated by these values are more inclined to select volunteer activities involving patient interaction, promoting empathy and resilience. Conversely, career-centric motivation lacks a positive predictive effect and tends to lead students toward research-oriented activities.[42]

Coping mechanisms refer to the specific efforts, both psychological and behavioral, that humans apply to overcome or minimize stressful events.[63] Two studies investigated the coping strategies adopted by medical students during the pandemic using the brief-COPE inventory, showing a significant correlation of avoidant coping strategies with burnout.[53,62] A study conducted in Saudi Arabia indicated a prevailing tendency toward avoidant coping strategies in the overall scores. Notably, these strategies were more pronounced among female and preclinical students and emerged as a predictor of anger and sadness.[26] A study in Belarus, involving students from different academic fields, also highlighted that medical students tended to prefer avoidance coping mechanisms. While most respondents used active coping methods, future medical professionals frequently adopted avoidance strategies, such as evading the issue and seeking support with emotionally oriented coping. In contrast, avoidance strategies were less common among pedagogical students and rarely seen among student-athletes.[49]

Regarding clinical-year students in Malaysia, they predominantly prefer employing approach coping strategies, such as active coping, seeking emotional support, practicing acceptance, seeking information, positive reframing, and planning. As of avoidant coping strategies, which include behavioral disengagement, self-distraction, denial, venting, substance use, and self-blame, they showed a significant, moderately positive correlation with the presence of both anxiety and burnout. On the other hand, coping methods that were neither approach nor avoidant exhibited a weak, positive correlation with the presence of burnout.[53] Lastly, a Chilian study evaluated the impact of a mindfulness-based self-care program on medical students during the COVID-19 pandemic, emphasizing the significance of transitioning from avoidance to active problem-solving to reduce burnout components and enhance dispositional mindfulness.[62]

## Discussion

The already hard path for medical students has become even more complex with the advent of the COVID-19 pandemic. Even before the pandemic, the burnout rates among medical students were significantly higher than those of their peers in other academic disciplines, primarily due to the rigorous medical training.[12] This review examined the prevalence of burnout among medical students prior to and during the COVID-19 pandemic, as well as the factors that may have contributed to its occurrence. It is critical to comprehend the dynamics of burnout in medical education because it can have a significant impact on students' mental and physical well-being, educational outcomes, and, ultimately, patient care. Here, we discuss the key findings and implications of this comprehensive analysis.

### Prevalence of Burnout Among Medical Students

Concerns about burnout are not novel among medical students. Even before the pandemic, the academic rigors, high workload, and emotional stressors associated with medical training made students particularly susceptible to burnout. This review confirms the alarming prevalence of burnout in medical students, although the exact rate is hard to determine. In some studies, it is estimated to be around 17-23%,[12,16,53,60] while in others exceeds 50%.[2,20,29,37] It is unclear whether students who are in their preclinical or clinical years are more prone to burnout due to contradictory research findings. This is a complicated matter that is impacted by a number of variables, such as the psychological stamina of each student, their stress management techniques, the amount of support they receive from their family, and their willingness to interact with patients during the pandemic.

### Impact of the COVID-19 Pandemic

The COVID-19 pandemic has increased medical students' vulnerability to burnout. The uncertainties, quarantine restrictions, and psychological anguish brought about by the pandemic have intensified the challenges they face. Many students experienced an escalation in burnout levels during the pandemic, with the burden of online learning and reduced clinical exposure taking a toll on their well-being. While some studies reported a decline in burnout levels, the overall prevalence of burnout remained high. Importantly, a substantial proportion of students expressed a strong desire to return to clinical settings, emphasizing the importance of in-person training and its impact on their motivation and professional responsibility.

### Factors Influencing Burnout

Numerous factors were found to influence burnout in medical students. Gender, age, and the stage of medical school were identified as potential predictors, though the findings were not consistent. For example, female students were more likely to report poorer overall mental health compared to males. Clinical-year students involved in the COVID-19 response appeared to have lower rates of burnout, depression, and anxiety. Interestingly, a mix of conflicting results emerged when comparing burnout between medical students and undergraduates in other fields, highlighting the complex interplay of factors affecting burnout.

The family environment, particularly the parental status, also played a significant role. Students with divorced or separated parents were more likely to experience burnout. Additionally, students who had experienced COVID-19 infection within their family or close circle exhibited elevated stress, depression, and anxiety scores. This further underscores the need for holistic support systems to address the emotional and psychological challenges that students face during the pandemic.

### Interventions and Preventive Strategies

As demonstrated by various studies presented in this review, engaging in voluntary activities has a positive impact on medical students' mental health. Volunteering is associated with lower rates of burnout and greater resilience, highlighting the potential benefits of altruistic and value-centered volunteerism. This suggests that institutions and programs that encourage volunteer activities may contribute to students' well-being. The establishment of a supportive network is also pivotal for mental health, especially during lockdowns and periods of mandatory isolation. Lastly, as mentioned in a Belarusian study, the level of physical activity is directly linked to psychological well-being and life satisfaction,[49] thus medical students should incorporate sports in their program, aiming for a well-balanced routine.

Another effective measure to prevent burnouts is the adoption of dynamic instead of avoidance coping mechanisms. Studies showed that active coping, seeking emotional support, practicing acceptance, seeking information, positive reframing, and planning are more effective strategies in addressing stressful situations. Contrariwise, a significant correlation between avoidant coping and anger, sadness and eventually burnout has been established. Therefore, it is vital to implement programs to teach medical students how to properly implement helpful strategies.

### Limitations

While this comprehensive review sheds light on burnout among medical students during and post the COVID-19 pandemic, it is essential to acknowledge its limitations. First and foremost, the narrative synthesis approach that has been elaborated is of subjective nature and may have introduced bias due to reliance on reviewers' interpretations. The inclusion criteria implemented, such as the requirement for studies to be freely accessible and

published in English from January 2020 to September 2023, may have excluded valuable research papers. In order to guarantee objective interpretation of the original text and minimize the risk of potential misinterpretations resulting from translations, the authors' language proficiency constraints led to the decision to limit studies to English publications. It is noteworthy that there were comparatively few studies that were excluded on the basis of language criteria, and most of them had a small participant pool.

The heterogeneity of outcome measures across the included studies introduced variability in the results, rendering it impossible to perform a uniform quantitative analysis. Moreover, the diverse study designs and the inclusion of studies from 25 countries with differing cultural and educational systems contributed to discrepancies in reported prevalence and risk factors for burnout. The quality and methodology of the included studies, as well as potential biases, may have influenced the overall findings. Furthermore, many studies lacked a control group, thus failing to discuss the baseline burnout levels among medical students before the pandemic started. These limitations pinpoint the need for continued research to address these challenges and provide a more comprehensive understanding of burnout among medical students in the context of the pandemic and beyond. More precisely, to fully address the gaps in understanding burnout, we suggest that future research should focus on longitudinal studies investigating the long-term effects of pandemics on burnout in medical students. This approach will help assess how burnout evolves over time and whether it persists after the crisis. Furthermore, studies focused on specific factors contributing to burnout—such as workload, social support, and access to mental health resources—could yield valuable insights. To ensure consistency in measurements across various studies, standardized measurement tools should be employed, enhancing the comparability and reliability of the findings. Finally, specific interventions implemented during disruptions, such as online learning, mental health support, and flexible curricula, should be evaluated to explore which strategies are most effective in mitigating burnout during such periods.

### Conclusion and Implications

This review underscores the critical importance of addressing burnout among medical students, both during and beyond the COVID-19 pandemic. It is essential for medical schools and institutions to recognize the unique challenges faced by students and implement strategies to mitigate burnout. These strategies may include facilitating in-person clinical experiences, providing comprehensive support systems, encouraging volunteerism, and promoting active coping mechanisms. By adopting a holistic approach, medical educators and policymakers can contribute to the well-being of future healthcare professionals, ensuring they are better equipped to provide high-quality care to patients.

However, further research is needed to explore the long-term impacts of burnout on the quality of medical education, patient care, and the mental health of healthcare providers. Additionally, studies should continue to investigate the evolving dynamics of burnout, especially as the medical education landscape continues to adapt in response to the ongoing pandemic and other unforeseen challenges. By prioritizing the well-being of medical students, we can foster a flourishing and more resilient healthcare workforce.

## Summary – Accelerating Translation

**Title:** COVID-19 Impact and Burnout Syndrome in Medical Students: A Comprehensive Systematic Review

Main Problem to Solve: Burnout is a common challenge that has long been associated with the rigorous path of medical students. Stressors and uncertainties have intensified due to the COVID-19 pandemic, which has brought new complexities. Understanding the dynamics, prevalence, and contributing factors to medical student burnout in the context of the pandemic is the main concern.

**Aim of Study:** Our study aims to comprehensively explore burnout among medical students, shedding light on its prevalence, impact, and associated factors, with a specific focus on the challenges posed by the ongoing COVID-19 pandemic. We seek to provide valuable insights for individuals, institutions, and legislators to effectively address and mitigate burnout, contributing to the well-being of medical students and the overall resilience of the healthcare workforce.

**Methodology:** We adopted a systematic approach using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Our search strategy covered electronic databases (PubMed, Scopus, APA PsycNET, Google Scholar) from the beginning of the pandemic to September 2023. A range of inclusion criteria was applied to select relevant studies, resulting in a comprehensive analysis of 31 studies encompassing diverse methodologies and outcomes.

**Results:** The search yielded 579 references, and after meticulous evaluation, 31 studies met our inclusion criteria. Findings consistently revealed a prevalence of burnout exceeding 35% among medical students, with varying estimates due to study heterogeneity. Conflicting evidence emerged regarding changes in burnout levels before and during the pandemic. Factors influencing burnout were multifaceted, encompassing demographic variables, the pandemic's impact on education, social factors, and psychological elements. Notably, interventions like volunteering and dynamic coping mechanisms demonstrated positive impacts on mitigating burnout.

**Conclusion:** Our research highlights the alarming prevalence of burnout among medical students, with rates consistently exceeding 35%. The pandemic has exacerbated these issues, impacting their educational experience, psychological well-being, and social dynamics. Factors such as demographic variables, academic progression, and family environment contribute to burnout. The pandemic's influence on burnout levels exhibited varied outcomes, with some studies reporting an escalation, others indicating stability, and some even suggesting a decline. Online learning and reduced clinical exposure had both positive and negative effects, while volunteering was found to be a protective factor against burnout. Last but not least, institutions and policymakers must implement strategies to foster a supportive educational environment. By prioritizing the well-being of medical students, we contribute to a flourishing healthcare workforce better equipped to provide high-quality patient care.

## References


1. Aebischer O, Weilenmann S, Gachoud D, Méan M, Spiller TR. Physical and psychological health of medical students involved in the COVID-19 response in Switzerland. Swiss Med Wkly 2020;150:w20418.
2. Alkureishi ML, Jaishankar D, Dave S, Tatineni S, Zhu M, Chretien KC, et al. Impact of the early phase of the COVID-19 pandemic on medical student well-being: A multisite survey. J Gen Intern Med 2022;37:2156–64.
3. Almutairi H, Alsubaiei A, Abduljawad S, Alshatti A, Fekih-Romdhane F, Husni M, et al. Prevalence of burnout in medical students: A systematic review and meta-analysis. Int J Soc Psychiatry 2022;68:1157–70.
4. Asl EM, Boostani H, Behrouzian F, Rostami H. The mediating role of compassion in the relationship between COVID-19 anxiety syndrome and COVID-19 burnout. Journal of Education and Health Promotion 2021;10.
5. Bolatov AK, Seisembekov TZ, Askarova AZ, Baikanova RK, Smailova DS, Fabbro E. Online-learning due to COVID-19 improved mental health among medical students. Med Sci Educ 2021;31:183–92.
6. Bukhari GMJ, Saleem HB, Saleem J, Batool M, Majeed F, Batool H. The impact of covid-19 on the education of medical students of Federal Medical College, Islamabad, Pakistan. J Med Sci 2023;31.
7. WHO. Burn-out an "occupational phenomenon": International Classification of Diseases. Available from: https://www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases; updated 2019 May 28;
8. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. World Psychiatry 2016;15:103–11.
9. Campos R, Pinto V, Alves D, Rosa CP, Pereira H. Impact of COVID-19 on the mental health of medical students in Portugal. J Pers Med 2021;11:986.
10. Chunming WM, Harrison R, MacIntyre R, Travaglia J, Balasooriya C. Burnout in medical students: a systematic review of experiences in Chinese medical schools. BMC Med Educ 2017;17.
11. Compton S, Sarraf-Yazdi S, Rustandy F, Radha Krishna LK. Medical students' preference for returning to the clinical setting during the COVID-19 pandemic. Med Educ 2020;54:943–50.
12. Daryanto B, Kurniawan J, Wiranigitasari, Hioe F, Nurhadi P, Yudhantara DS. Prevalence of burnout and its associated factors among medical students during COVID-19 pandemic in Indonesia: A cross-sectional study. PLoS One 2023;18:e0285986.
13. de Andres Crespo M, Claireaux H, Handa AI. Medical students and COVID-19: lessons learnt from the 2020 pandemic. Postgrad Med J 2021;97:209–10.
14. Duarte I, Alves A, Coelho A, Ferreira A, Cabral B, Silva B, et al. The mediating role of resilience and life satisfaction in the relationship between stress and burnout in medical students during the COVID-19 pandemic. Int J Environ Res Public Health 2022;19:2822.
15. Ekmekci Ertek İ, Özkan S, Candansayar S, İlhan M. The impact of the COVID-19 pandemic on the mental health of medical students. J Surg Med 2022;6:162–7. https://doi.org/10.28982/josam.1061178.
16. El Mouedden I, Hellemans C, Anthierens S, Michels NR, DeSmet A. Experiences of academic and professional burn-out in medical students and residents during first COVID-19 lockdown in Belgium: a mixed-method survey. BMC Med Educ 2022;22.
17. Ernst J, Jordan K-D, Weilenmann S, Sazpinar O, Gehrke S, Paolercio F, et al. Burnout, depression and anxiety among Swiss medical students – A network analysis. J Psychiatr Res 2021;143:196–201.
18. Esguerra S, Chiu FT, Espinoza A, Williams D, Clithero-Eridon A. Are medical students happy despite unhappy conditions: a qualitative exploration of medical student cohorts during disruptive conditions. BMC Med Educ 2023;23.
19. Forycka J, Pawłowicz-Szlarska E, Burczyńska A, Cegielska N, Harendarz K, Nowicki M. Polish medical students facing the pandemic—Assessment of resilience, well-being and burnout in the COVID-19 era. PLoS One 2022;17:e0261652.
20. Frajerman A, Chaumette B, Krebs M-O, Morvan Y. Mental health in medical, dental and pharmacy students: A cross-sectional study. J Affect Disord Rep 2022;10:100404. https://doi.org/10.1016/j.jadr.2022.100404.
21. Golui P, Roy S, Dey I, Burman J, Sembiah S. Resilience and its correlates among medical students in the Eastern part of India during the coronavirus disease 2019 (COVID-19) pandemic. J Family Community Med 2022;29.
22. Guadix SW, Sha C, Sandrone S, Safdieh JE, Sarva H. The impact of COVID-19 on neurology education: A medical student perspective. Front Educ 2020;5. https://doi.org/10.3389/feduc.2020.567421.
23. Halperin SJ, Henderson MN, Prenner S, Grauer JN. Prevalence of anxiety and depression among medical students during the Covid-19 pandemic: A cross-sectional study. J Med Educ Curric Dev 2021;8:238212052199115.
24. Hansell MW, Ungerleider RM, Brooks CA, Knudson MP, Kirk JK, Ungerleider JD. Temporal Trends in Medical Student Burnout. Fam Med 2019;51:399–404.
25. Harries AJ, Lee C, Jones L, Rodriguez RM, Davis JA, Boysen-Osborn M, et al. Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. BMC Med Educ 2021;21.
26. Ifrah Naaz S, Hussein RM, Khan HB, Hussein MM, Arain SA. Emotional responses and coping strategies of medical students during the COVID-19 pandemic. Saudi Med J 2022;43:61–6.
27. Ilić IM, Ilić MD. The relationship between the burnout syndrome and academic success of medical students: a cross-sectional study. Arh Hig Rada Toksikol 2023;74:134–41.
28. IsHak W, Nikravesh R, Lederer S, Perry R, Ogunyemi D, Bernstein C. Burnout in medical students: a systematic review. Clin Teach 2013;10:242–5.
29. Jezzini-Martinez S, Martinez-Garza JH, Quiroga-Garza A, Quiroz-Perales XG, Gil-Flores L, de la Fuente-Villarreal D, et al. Assessment of burnout syndrome and associated factors among medical students during the COVID-19 pandemic. J Affect Disord Rep 2023;14:100616.
30. Joshi VR, Younger JM, Das S, Goud BKM, Pramanik K. Factors influencing burnout in millennial medical students during the COVID-19 pandemic! Ir J Med Sci 2023;192:513–9.
31. Kalauni BR, Prasad Joshi Y, Paudel K, Aryal B, Karki L, Paudel R. Depression, anxiety and stress among undergraduate health sciences students during COVID-19 pandemic in a low resource setting: a cross sectional survey from Nepal. Ann Med Surg (Lond) 2023;Publish Ahead of Print.
32. Kasemy ZA, Sharif AF, Barakat AM, Abdelmohsen SR, Hassan NH, Hegazy NN, et al. Technostress creators and outcomes among Egyptian medical staff and students: A multicenter cross-sectional study of remote working environment during COVID-19 pandemic. Front Public Health 2022;10.
33. Liu Y, Cao Z. The impact of social support and stress on academic burnout among medical students in online learning: The mediating role of resilience. Front Public Health 2022;10.
34. Luberto CM, Goodman JH, Halvorson B, Wang A, Haramati A. Stress and coping among health professions students during COVID-19: A perspective on the benefits of mindfulness. Glob Adv Health Med 2020;9:216495612097782. .
35. Metakides C, Pielemeier L, Lytras T, Mytilinaios DG, Themistocleous SC, Pieridi C, et al. Burnout and motivation to study medicine among students during the COVID-19 pandemic. Front Med (Lausanne) 2023;10.
36. Minh LD, Phan HH, Le Mai DN, Dat NT, Tri NM, Ha NV, et al. Pattern and perceived changes in quality of life of Vietnamese medical and nursing students during the COVID-19 pandemic. PLoS One 2022;17:e0279446.
37. Muaddi MA, El-Setouhy M, Alharbi AA, Makeen AM, Adawi EA, Gohal G, et al. Assessment of medical students burnout during COVID-19 pandemic. Int J Environ Res Public Health 2023;20:3560.
38. Nakhostin-Ansari A, Akhlaghi M, Etesam F, Sadeghian MH. Suicidal ideation and its associated factors in medical, dental, and pharmacy students: A cross-sectional study during COVID-19 pandemic. Psychiatry J 2022;2022:1–10.

39. Nasr C, Bou Sanayeh E, Nasr C, Merheb G, Massoud M. Burnout rates among Lebanese pre-final and final year medical students during the COVID-19 pandemic: A multi-centered survey-based study. Work 2023;74:1265–76.
40. Natalia D, Syakurah RA. Mental health state in medical students during COVID-19 pandemic. Journal of Education and Health Promotion 2021;10.
41. Peng P, Hao Y, Liu Y, Chen S, Wang Y, Yang Q, et al. The prevalence and risk factors of mental problems in medical students during COVID-19 pandemic: A systematic review and meta-analysis. J Affect Disord 2023;321:167–81
42. Phillips HE, Jennings RB, Outhwaite IR, Grosser S, Chandra M, Ende V, et al. Motivation to impact: Medical student volunteerism in the COVID 19 pandemic. Med Sci Educ 2022;32:1149–57.
43. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in systematic reviews A product from the ESRC methods programme. Lancaster.ac.uk 2006. https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/fhm/dhr/chir/NSsynthesisguidanceVersion1-April2006.pdf
44. Qu R, Ding N, Li H, Song X, Cong Z, Cai R, et al. The mediating role of general academic emotions in burnout and procrastination among Chinese medical undergraduates during the COVID-19 pandemic: A cross-sectional study. Front Public Health 2022;10.
45. Rolland F, Hadouiri N, Haas-Jordache A, Gouy E, Mathieu L, Goulard A, et al. Mental health and working conditions among French medical students: A nationwide study. J Affect Disord 2022;306:124–30.
46. Ruiz R, Fernandes DA, Vásquez A, Trigueros A, Pemberton M, Gnanapragasam SN, et al. Prevalence of burnout in medical students in Guatemala: Before and during Covid-19 pandemic comparison. Int J Soc Psychiatry 2022;68:1213–7.
47. Saeki S, Shimato M. Mental health support for the current and future medical professionals during pandemics. JMA J 2021;4:281–3.
48. Shadid A, Shadid AM, Shadid A, Almutairi FE, Almotairi KE, Aldarwish T, et al. Stress, burnout, and associated risk factors in medical students. Cureus 2020.
49. Shpakou A, Naumau IA, Krestyaninova TY, Znatnova AV, Lollini SV, Surkov S, et al. Physical activity, life satisfaction, stress perception and coping strategies of university students in Belarus during the COVID-19 pandemic. Int J Environ Res Public Health 2022;19:8629. .
50. Silistraru I, Olariu O, Ciubara A, Roșca Ștefan, Roșca RO, Stanciu S, et al. Burnout and online medical education: Romanian students in lockdown and their residency choices. Int J Environ Res Public Health 2022;19:5449.
51. Šimić Š, Černy OE, Bevanda M, Bevanda D, Rizikalo A, Marijanović I. Impact of COVID-19 pandemic on mental health of medical students at the university of mostar. Psychiatr Danub 2021;33 (Suppl 10):114-119. PMID: 34672283.
52. Sulaiman R, Ismail S, Shraim M, El Hajj MS, Kane T, El-Awaisi A. Experiences of burnout, anxiety, and empathy among health profession students in Qatar University during the COVID-19 pandemic: a cross-sectional study. BMC Psychol 2023;11.
53. Tee KR, Ismail AS, Ang YH, Hishamuddin HH, Paul VJ, Aizuddin AN, et al. Prevalence of anxiety and burnout, and coping mechanisms among clinical year medical undergraduate students in Universiti Kebangsaan Malaysia amidst the COVID-19 pandemic. Int J Environ Res Public Health 2022;19:13010.
54. Tokumasu K, Nishimura Y, Sakamoto Y, Obika M, Kataoka H, Otsuka F. Differences in stress perception of medical students depending on in-person communication and online communication during the COVID−19 pandemic: A Japanese cross-sectional survey. Int J Environ Res Public Health 2023;20:1579.
55. Wercelens VO, Bueno ML, Bueno JL, Abrahim RP, Ydy JGM, Zanetti HR, et al. Empathy and psychological concerns among medical students in Brazil during the COVID-19 pandemic. Int J Psychiatry Med 2023;58:510–21. .
56. Wilkes TC, Lewis T, Paget M, Holm J, Brager N, Bulloch A, et al. Wellbeing and mental health amongst medical students in Canada. Int J Soc Psychiatry 2022;68:1283–8
57. Wissing RO, Hilverda F, Scheepers RA, Nieboer AP, Vollmann M. Peer relationships buffer the negative association of online education with education satisfaction and subsequently with study engagement among undergraduate medical students. BMC Med Educ 2022;22.
58. Yang Q, Liu Y, Yang WF, Peng P, Chen S, Wang Y, et al. Mental health conditions and academic burnout among medical and non-medical undergraduates during the mitigation of COVID-19 pandemic in China. Environ Sci Pollut Res Int 2022;29:57851–9.
59. Zhang J-Y, Shu T, Xiang M, Feng Z-C. Learning burnout: Evaluating the role of social support in medical students. Front Psychol 2021;12.
60. Zis P, Artemiadis A, Bargiotas P, Nteveros A, Hadjigeorgiou GM. Medical studies during the COVID-19 pandemic: The impact of digital learning on medical students' burnout and mental health. Int J Environ Res Public Health 2021;18:349.
61. Žuljević MF, Jeličić K, Viđak M, Đogaš V, Buljan I. Impact of the first COVID-19 lockdown on study satisfaction and burnout in medical students in Split, Croatia: a cross-sectional presurvey and postsurvey. BMJ Open 2021;11:e049590.
62. Zúñiga D, Torres-Sahli M, Nitsche P, Echeverría G, Pedrals N, Grassi B, et al. Reduced burnout and higher mindfulness in medical students after a self-care program during the COVID-19 pandemic. Rev Med Chil 2021;149:846–55.
63. Sreeramareddy CT, Shankar PR, Binu VS, Mukhopadhyay C, Ray B, Menezes RG. Psychological morbidity, sources of stress and coping strategies among undergraduate medical students of Nepal. BMC Med Educ 2007;7.
64. CASP checklists. CASP - Critical Appraisal Skills Programme n.d. https://casp-uk.net/casp-toolschecklists/.

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Case Report

# Cerebellitis as a Rare Manifestation of HSV Encephalitis: A Case Report

Cole Cimoch,[1] Daniel Groblewski,[2] David Mendoza.[2]

## Abstract

**Background:** Herpes Simplex Virus (HSV) is a common cause of encephalitis. A feared complication of HSV encephalitis is hemorrhage and necrosis of the brain parenchyma most commonly in the temporal lobe(s). Less common sites of focal necrosis include the insula and inferior frontal lobes. A rare presentation of HSV encephalitis is cerebellitis. **Case:** A 74-year-old female presented with a 1-month history of progressive balance difficulty and dizziness. The neurological exam showed truncal ataxia and scanning dysarthria. Serum labs were largely unremarkable, except for elevated sedimentation rate (ESR). Brain MRI revealed diffuse cerebellar swelling and T2 signal changes, with left medial enhancement. Cerebrospinal fluid (CSF) analysis showed elevated red blood cells (WBCs 5, RBCs 438, protein 54.7, glucose 64) and was positive for HSV-1 PCR. The CSF autoimmune encephalopathy panel was negative. She was treated with acyclovir 10 mg/kg every 8 hours for 14 days and IV methylprednisolone 1000 mg daily for 5 days, followed by an oral prednisone taper. Clinical improvement in ataxia and dizziness was observed soon after treatment began, with decreased cerebellar edema and enhancement on repeat MRI. After discharge, the patient lost follow-up, and long-term neurological status remains unknown. **Conclusions:** Recognition of atypical HSV encephalitis is crucial as encephalitis has a broad differential and CSF HSV PCR is a widely available and highly specific test. Rapid administration of acyclovir is the current standard of care. An addition of pulse dose methylprednisolone may also impart symptomatic and radiographic benefit.

## Introduction

Encephalitis is defined as inflammation of the brain parenchyma and represents a significant cause of neurological morbidity and mortality worldwide. It often presents with a prodromal phase characterized by fever, lethargy, and headache. This is followed by more severe manifestations such as mental status changes, seizures, and non-focal neurological deficits. Among the various infectious agents, Herpes Simplex Virus type 1 (HSV-1) is recognized as the most prevalent cause of sporadic encephalitis in developed countries.[2]

HSV-1 is a double-stranded DNA virus belonging to the Herpesviridae family, which comprises eight distinct pathogens. These pathogens include Herpes Simplex Virus type 2 (HSV-2), Varicella-Zoster virus (VZV), Cytomegalovirus (CMV), Epstein-Barr virus (EBV), and Human Herpesvirus 6, 7 and 8. HSV-1 has a predilection for the central nervous system. The virus typically remains dormant in the trigeminal ganglia as a latent infection and can become reactivated, leading to encephalitis. Primary infections account for only 30% of HSV-1 encephalitis cases.[1] A feared complication of HSV-1 encephalitis is the development of hemorrhage and necrosis in the temporal and frontal lobes, resulting in significant long-term neurological sequelae.[2] Isolated inflammation of the cerebellar parenchyma, cerebellitis, due to HSV-1 encephalitis is extremely rare in both the pediatric[11] and adult population.[3,4]The objective of this case report is to describe a rare instance of HSV-1-induced cerebellitis in an immunocompetent adult. This case highlights the importance of considering HSV-1 in the differential diagnosis of cerebellar inflammation, and addresses the ongoing clinical debate regarding the use glucocorticoids in HSV encephalitis treatment.

**Highlights:**

- A rare presentation of HSV encephalitis is cerebellitis.
- This case demonstrates the importance of maintaining a broad differential diagnosis when evaluating other etiologies that may mimic ischemic stroke.
- The use of adjunctive steroids in conjunction with acyclovir in the treatment of HSV encephalitis remains a subject of ongoing investigation.

## The Case

### Patient Background

A 74-year-old female with a past medical history significant for diabetes mellitus, hyperlipidemia, hypertension, hypothyroidism, and atrial fibrillation, presented with a one-month history of progressively worsening balance and dizziness. She denied excessive alcohol consumption and reported no history of Human Immunodeficiency Virus (HIV) infection or immunosuppressive therapy.

### Clinical Examination

Upon presentation the patient was afebrile, and vital signs were stable. A comprehensive neurological examination revealed

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truncal ataxia and subtle scanning dysarthria, characterized by slurred and irregular speech. The exam also showed right eye ptosis which was reported to be chronic. Fundoscopic exam was normal. There was no evidence of nystagmus, dysmetria, motor or sensory deficits.

### Laboratory Findings

Laboratory tests revealed serum studies, with the exemption of slight hypernatremia 146 mEq/L, within normal ranges. There was an elevated erythrocyte sedimentation rate (ESR) of 88 mm/hr suggestive of an active inflammatory process. Vitamin levels, including thiamine (B1) and B12, were normal.

### Imaging Studies

A CT scan of the brain showed multiple areas of mild hypoattenuation within bilateral cerebellar hemispheres, and an area of slightly higher density within the hypoattenuation of the left cerebellar hemisphere.

An MRI of the brain revealed diffuse swelling and T2 signal changes throughout the cerebellum, with associated left medial enhancement ***(Figure 1).*** These findings raised suspicion for an inflammatory process affecting the cerebellum, prompting further investigation with a lumbar puncture.

### CSF Analysis

The CSF contained 5 white blood cells (WBC)/mm$^3$, 438 red blood cells (RBC)/mm$^3$, protein 54.7 mg/dL, and glucose 64 mmol/L. There was no evidence of pleocytosis, hyperproteinorrachia, or hypoglycorrhachia. The analysis revealed erythrocytosis, with an RBC count of 438. Although a traumatic tap was considered, this was deemed unlikely given the relatively consistent RBC count across multiple CSF samples. While erythrocytosis could suggest a hemorrhagic process, follow-up MRIs demonstrated no signs of subarachnoid hemorrhage. In terms of inflammatory markers, the IgG index, IgG synthesis rate, and myelin basic protein levels were within normal limits, and no oligoclonal bands were detected. These findings reduced the likelihood of demyelinating conditions such as multiple sclerosis.

### Autoimmune Panel

A Mayo ENC2 autoimmune panel of the CSF was negative, minimizing the likelihood that that the etiology of the cerebellitis was autoimmune.

### Diagnosis

The CSF analysis demonstrated HSV-1 PCR positivity, confirming the diagnosis of HSV-1 cerebellitis.

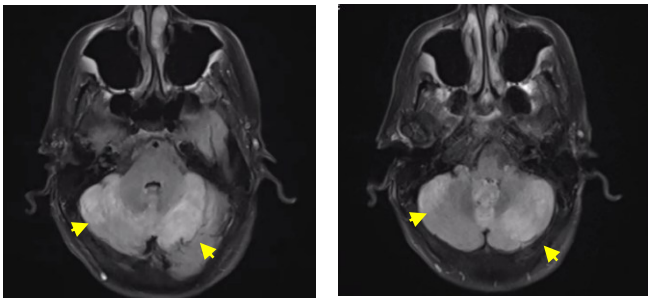
### Treatment

The patient was promptly initiated on antiviral therapy with acyclovir at a dose of 10 mg/kg every 8 hours for 14 days. They were also treated with intravenous methylprednisolone 1000 mg daily for 5 days which was followed by a tapering course of oral prednisone. The rationale of glucocorticoids being added to the treatment regimen was to reduce the likelihood of vasogenic edema demonstrated on imaging contributing to a long-term neurological deficit.

### Outcome

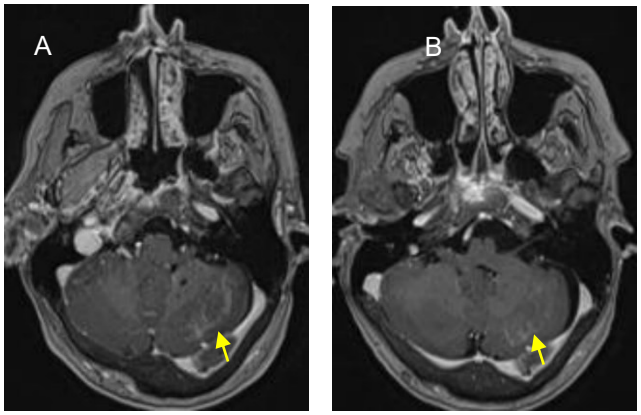
Shortly after the initiation of treatment, the patient exhibited clinical improvement of ataxia, dizziness, and scanning dysarthria. A repeat MRI of the brain demonstrated decreased cerebellar edema and enhancement, indicating a positive therapeutic response ***(Figure 2).*** Patient consented to the use of their case for publication. The patient was subsequently discharged to a rehabilitation facility. Unfortunately, numerous attempts to contact the patient for follow-up were unsuccessful, leaving their long-term neurological status unknown.

***Figure 1.*** Axial T2 FLAIR Brain MRI Showing Diffuse Hyperintense Signal Throughout the Cerebellar Hemispheres, Consistent with Cerebellar Edema.



***Legend:*** Yellow arrows indicate areas of prominent signal abnormality in both hemispheres.

***Figure 2.*** (A) Pre- and (B) Post-Treatment Axial Contrast-Enhanced MRI (MG-RAGE sequence) Showing Left Cerebellar Enhancement.




***Legend:*** The left image shows diffuse cerebellar swelling and enhancement prior to treatment. The right image demonstrates marked improvement in cerebellar enhancement following 14 days of acyclovir and 5 days of intravenous methylprednisolone.

## Discussion

The subacute onset of progressively worsening balance with dizziness could have multiple localizations including a peripheral vestibulopathy, sensory ataxia or central spinocerebellar tract lesion. The combination of truncal ataxia, and subtle scanning dysarthria suggested the cerebellum or central spinocerebellar tract as the localization. Given the patient's history of diabetes mellitus, hyperlipidemia, hypertension, and atrial fibrillation—

established risk factors for vascular disease and thromboembolism—ischemic cerebellar stroke was strongly considered as the primary diagnosis. Systemic symptoms such as fevers, chills, and weight loss, which could suggest an infectious or neoplastic etiology, were not present. The absence of papilledema on fundoscopic examination, and lack of a compressive lesion on initial CT scan excluded intracranial hypertension. Encephalitis initially was lower on the differential because the patient was afebrile, and there was an absence of rapidly progressive mental status changes, seizures, and non-focal neurological deficits. This case underscores the critical importance of maintaining a broad differential diagnosis when evaluating other etiologies that may mimic ischemic stroke.

The differential diagnosis for truncal ataxia secondary to cerebellitis in an adult is broad and encompasses various inflammatory, autoimmune, metabolic, neoplastic, vascular and infectious etiologies. Clinically, acute cerebellitis can manifest with ataxia, nystagmus, dysarthria, dysmetria, vertigo, and nausea.[12]

Inflammatory diseases with cerebellar involvement include celiac disease which is associated with HLA-DQ2/DQ8 and can have positive autoantibodies against transglutaminase and endomysium. Autoimmune thyroiditis can manifest with cerebellar symptoms in Hashimoto's encephalopathy. Post-infectious conditions such as Miller Fisher syndrome, a variant of Guillain-Barré syndrome, can present with areflexia, ataxia, ophthalmoplegia, sometimes with anti-GQ1b antibody positivity.[12]

In the realm of autoimmune encephalitis presenting with ataxia, specific antibodies such as mGluR1, CASPR-2, and GABA-B receptor antibodies have been associated.[12] Recently, the paraneoplastic antibody Purkinje cell cytoplasmic autoantibody 1 (PCA-1) has been associated with isolated acute cerebellitis with an underlying gonadal malignancy, the most common being epithelial ovarian cancer.[9]

Metabolic causes of ataxia can arise from B12 deficiency, thiamine and vitamin E deficiency. Neoplastic etiologies of cerebellitis are most commonly low-grade gliomas in adults, but more aggressive medulloblastomas and lymphomas can occur.[5] Vascular causes such as cerebellar strokes also contribute to the differential diagnosis of acute cerebellar syndrome.

Infectious causes of cerebellitis are frequently attributed to viral pathogens, with Epstein-Barr virus (EBV), Varicella-Zoster virus (VZV), being among the most common.[14] Bacterial pathogens including Mycoplasma pneumoniae and Borrelia burgdorferi have also been associated with cerebellitis. Listeria monocytogenes is particularly notable as it can cause rhombencephalitis involving the brainstem and cerebellum, especially in immunocompromised individuals.[14]

While HSV is a well-known cause of encephalitis, it is not commonly considered an infectious cause of cerebellitis. HSV-1 encephalitis most commonly involves the temporal and frontal lobes. The occurrence of HSV isolated cerebellar involvement is rare and not well-documented in medical literature.

Acyclovir, an antiviral agent, is the standard of care for HSV encephalitis treatment. Acyclovir has significantly reduced the mortality associated with HSV encephalitis, from an estimated 70% to 15-20%.[7] Despite this reduction in mortality, patients can still experience long-term neurological sequelae. Only 50% of patients achieve a full neurological recovery one-year post-treatment with acyclovir.[7] Thus, adjunctive therapy in combination with acyclovir has been proposed to minimize long term neurological deficits from HSV encephalitis.

Adjunctive glucocorticoids have been considered as a potential adjunctive therapy as their anti-neuroinflammatory properties have proven benefit in other central nervous systems infections like bacterial meningitis.[6] It has been hypothesized that overactivation of the host immune system leads to an extensive inflammatory cascade which damages neurons and glia cells contributing to neurological deficits, rather than direct damage by HSV infection.[6] However, the use of glucocorticoids in conjunction with acyclovir is controversial due to the theoretical risk of immunosuppression, which could lead to further HSV activation. Glucocorticoids inhibit the transcription factor NF-KB, crucial for cell-mediated immunity comprised of natural killer cells and CD8+ lymphocytes. These immune pathways are essential for eliminating an intracellular viral infection like HSV, by decreasing viral replication. Suppression of these pathways via glucocorticoids could be detrimental in the context of an active infection.[13] Thus, the benefit of glucocorticoids could outweigh the theoretical risk of HSV activation if there is extensive cerebral edema or increased intracranial pressure.

Currently, there is no clear consensus on the role of glucocorticoids in HSV encephalitis treatment. In a retrospective case series, glucocorticoid treatment in combination with acyclovir was correlated with improved outcomes.[8] However, a meta-analysis did not demonstrate a clear benefit for adjunctive steroid treatment in the treatment of viral encephalitis.[6] A prospective randomized controlled trial, GACHE, aimed to explore whether acyclovir combined with dexamethasone was superior to acyclovir with placebo in patients with confirmed HSV encephalitis. Unfortunately, the trial was terminated prematurely due to low enrollment, and the limited data gathered from 41 patients randomized showed no significant difference between the two study arms.[10] The results of the completed prospective DexEnceph trial, which addresses long term neurological status after adjunctive steroid treatment has not yet been published.[15] With the recent discovery that HSV encephalitis can trigger post infectious encephalitis,[15] the effects of immunomodulating treatment are yet to be determined.

The literature on HSV encephalitis treatment with isolated cerebellitis in adults is very limited. After an extensive search, the authors identified three cases in the medical literature to the best of their knowledge: Two patients—a 24-year-old female and a 19-year-old female with HIV on antiretroviral therapy—were treated with acyclovir and glucocorticoids. Both patients showed

symptomatic improvement after two weeks and did not suffer any long-term neurological sequelae in subsequent follow-ups.[4] A 29-year-old female treated with acyclovir noted symptom improvement and an MRI taken one month later showed decreased cerebellar inflammation, although her long-term neurological status remains unknown.[3]

Anecdotally, these case reports suggest a potential beneficial role of steroids in the treatment of HSV cerebellitis. A limitation of this case report and Campos et al.[3] is that the long-term neurological status of the patient could not be assessed. The use of adjunctive glucocorticoids in the treatment of HSV cerebellitis and encephalitis remains unclear and is a subject of ongoing investigation. While glucocorticoids may be considered to reduce cerebral edema, routine use remains limited due to the risks of possible immunosuppression, and interference with viral clearance. Treatment decisions should be guided by clinical presentation, patient-specific factors, and new emerging evidence.

## References

1. Armangué T, Olivé-Cirera G, Martínez-Hernández E, Rodés M, Peris-Sempere V, Guasp M, et al. Neurologic complications in herpes simplex encephalitis: clinical, immunological and genetic studies. Brain. 2023;146(10):4306–19.
2. Bradshaw MJ, Venkatesan A. Herpes simplex virus-1 encephalitis in adults: pathophysiology, diagnosis, and management. Neurotherapeutics. 2016;13(3):493–508.
3. Campos LG, Rossato R, Santos RP, Duarte JA, Vedolin L. Acute cerebellitis caused by herpes simplex virus. Clin Biomed Res. 2019;39(1):104–5.
4. Ciardi M, Giacchetti G, Fedele CG, Tenorio A, Brandi A, Libertone R, et al. Acute cerebellitis caused by herpes simplex virus type 1. Clin Infect Dis. 2003;36(3):e50–4.
5. Guerreiro Stucklin AS, Grotzer MA. Cerebellar tumors. Cerebellum Disord Treat. 2018;155:289–99.
6. Hodzic E, Hasbun R, Granillo A, Tröscher AR, Wagner H, Tim M, et al. Steroids for the treatment of viral encephalitis: a systematic literature review and meta-analysis. J Neurol. 2023;270:3603–15.
7. Jouan Y, Grammatico-Guillon L, Espitalier F, Cazals X, François P, Guillon A. Long-term outcome of severe herpes simplex encephalitis: a population-based observational study. Crit Care. 2015;19(1):1–9.
8. Kamei S. Evaluation of combination therapy using aciclovir and corticosteroid in adult patients with herpes simplex virus encephalitis. J Neurol Neurosurg Psychiatry. 2005;76(11):1544–9.
9. McKeon A. Purkinje cell cytoplasmic autoantibody type 1 accompaniments. Arch Neurol. 2011;68(10):1282.
10. Meyding-Lamadé U, Jacobi C, Martinez-Torres F, Lenhard T, Kress B, Kieser M, et al. The German trial on aciclovir and corticosteroids in herpes-simplex-virus-encephalitis (GACHE): a multicenter, randomized, double-blind, placebo-controlled trial. Neurol Res Pract. 2019;1(1):1–10.
11. Paketci C, Edem P, Okumus C, Sarioglu FC, Bayram E, Hiz S, et al. Herpes simplex virus-1 as a rare etiology of isolated acute cerebellitis: case report and literature review. J Neurovirol. 2019;26(2):270–2.
12. Pedroso JL, Vale TC, Braga-Neto P, Dutra LA, França MC Jr, Teive HAG, et al. Acute cerebellar ataxia: differential diagnosis and clinical approach. Arq Neuropsiquiatr. 2019;77(3):184–93.
13. Ramos-Estebanez C, Lizarraga KJ, Merenda A. A systematic review on the role of adjunctive corticosteroids in herpes simplex virus encephalitis: is timing critical for safety and efficacy? Antivir Ther. 2013;19(2):133–9.
14. Sawaishi Y, Takada G. Acute cerebellitis. Cerebellum. 2002;1(3):223–8.
15. Matthews E, Beckham JD, Piquet AL, Tyler KL, Chauhan L, Pastula DM. Herpesvirus-associated encephalitis: an update. Curr Trop Med Rep. 2022;9(3):92–100

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Case Report

# When Fire Meets Shadow: A Rare Case of Tolosa-Hunt Syndrome Associated with Discoid Lupus Erythematosus

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## Abstract

**Background:** Tolosa-Hunt Syndrome (THS) is a rare inflammatory disorder presenting with painful ophthalmoplegia due to granulomatous involvement of the cavernous sinus or superior orbital fissure. Though autoimmune diseases such as systemic and discoid lupus erythematosus (SLE/DLE) are known to overlap with other disorders, their association with THS remains poorly documented. DLE, a chronic photosensitive condition with scarring skin lesions, is particularly rare in conjunction with THS. This report explores a case of THS associated with DLE, highlighting diagnostic complexities and therapeutic strategies. **Case:** A 54-year-old woman presented with right-sided headache, diplopia, and ocular pain. Examination revealed right third cranial nerve palsy, hyperpigmented macular lesions, and alopecia areata. Imaging demonstrated cavernous sinus inflammation, and laboratory findings included elevated ESR, positive dsDNA titers, and a homogeneous immunofluorescence pattern. A biopsy confirmed DLE, aligning with clinical and imaging findings of THS. The patient was treated with corticosteroids and mycophenolate mofetil, resulting in sustained symptom resolution with no relapse during follow-up. **Conclusion:** This case underscores the need to consider autoimmune conditions like DLE in patients with THS, suggesting a possible shared autoimmune mechanism. Early recognition and timely initiation of immunosuppressive therapy with corticosteroids and mycophenolate mofetil were key to achieving remission, supporting their use as first-line treatment. This report adds to the limited literature on DLE-associated THS and highlights the importance of thorough diagnostic evaluation and long-term follow-up to monitor progression and prevent recurrence. Additional reports are needed to improve understanding of the pathophysiology, clinical features, and optimal management of these rare coexisting conditions.

## Introduction

Tolosa-Hunt Syndrome is a rare condition characterized by painful ophthalmoplegia, involving the third, fourth, and/or sixth cranial nerves. It is caused by nonspecific inflammation in the cavernous sinus or superior orbital fissure, though the exact cause remains unknown.[1]

Autoimmune diseases, such as systemic lupus erythematosus (SLE) and discoid lupus erythematosus (DLE), present with a range of systemic and cutaneous manifestations, with some reports suggesting an overlap of lupus with THS. Discoid lupus erythematosus (DLE), the most common form of cutaneous lupus erythematosus, is a chronic, scarring, photosensitive autoimmune skin condition characterized by erythematous and scaly lesions.2 Although THS has been reported with other autoimmune conditions, its coexistence with DLE is rare and poorly documented in the literature. To date, only one published report has described an association between THS and DLE, further emphasizing the rarity of this presentation.

This case report details a unique presentation of THS associated with DLE, highlighting the diagnostic challenges and therapeutic approach. The report emphasizes the importance of thorough differential diagnosis, including autoimmune and granulomatous disorders, and underscores the role of immunosuppressive therapy in achieving symptomatic relief and preventing recurrence in such rare, complex cases. Additionally, this case

**Highlights:**

- Uncommon Association: Demonstrates the rare coexistence of Tolosa-Hunt Syndrome (THS) and Discoid Lupus Erythematosus (DLE), contributing to limited existing literature.
- Clinical Challenge: Highlights the complexity of diagnosing overlapping autoimmune and neuro-ophthalmic disorders, requiring careful evaluation and integration of clinical, imaging, and biopsy findings.
- Therapeutic Insights: Shows the efficacy of combining corticosteroids with mycophenolate mofetil, providing practical treatment guidance for similar cases.
- Broadens Understanding: Expands knowledge of DLE's systemic manifestations, specifically its involvement in cranial neuropathies and painful ophthalmoplegia.
- Educational Value: Offers clinicians a structured approach to managing rare presentations, emphasizing a multidisciplinary diagnostic and therapeutic strategy.
- This report is critical for advancing the understanding and management of rare autoimmune and inflammatory disorders.

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demonstrates the critical importance of a meticulous general examination in identifying subtle, systemic manifestations that may provide crucial diagnostic clues in complex presentations like this. Informed consent was obtained in written format from both the patient and the patient companion for publication.

## The Case

### History

A 54-year-old female with no known comorbidities came to the neurology OP with chief complaints of sudden onset double vision for 2 days and pain in right eye on rightward gaze for 2 days with right sided unilateral headache for 1 week. The headache was continuous, right-sided, with a pin-pricking sensation and no identifiable triggers such as work exposure, talking, chewing, brushing of teeth, etc. It was not associated with nausea, vomiting, giddiness, or blurring of vision. The headache was predominantly present in the daytime thereby not affecting the sleep and the patient had no similar pattern of headache in the past. There were no complaints of vision loss, vomiting, nausea, fever, neck pain or stiffness, redness of eye, excessive tears, trauma and abnormal sweating of face.

### Examination

On examination, the patient had pallor and macular lesions. These lesions were 5 in number and hyper pigmented in nature with irregular shape and margins having no associated pain. Alopecia areata was also noted. On cranial nerve examination, right 3rd cranial nerve palsy was observed with inability to adduct, elevate/depress right eye but intact 4th and 6th cranial nerve. The 5th cranial nerve was normal except for pain in the right V1 dermatome i.e. ophthalmic branch of the trigeminal nerve. Other neurological and systemic examinations yielded no significant findings.

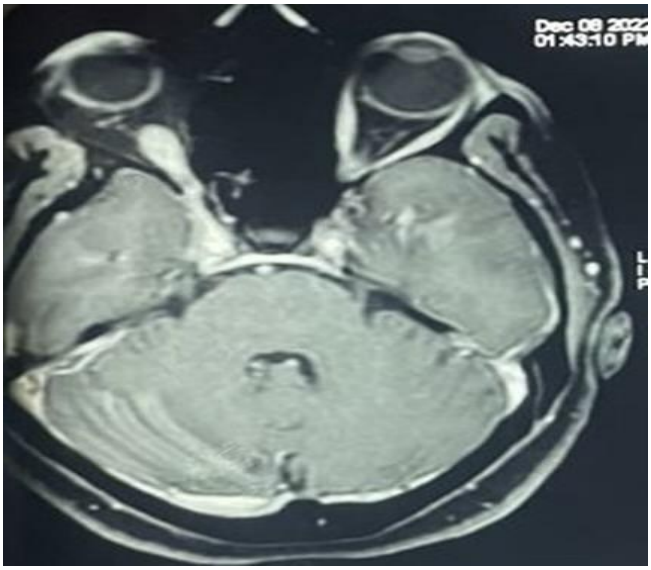
***Figure 1.*** Hyperpigmented Macular Lesions in the Earlobe and Concha.

With this patient history and examination findings, the pathology can be localized to either the cavernous sinus, superior orbital fissure or orbital apex syndrome. As the colour vision and the visual field were normal, the optic nerve is found to be intact ruling out orbital apex syndrome. Some inflammatory etiologies that could be suspected are infectious (mucormycosis), granulomatous (Tuberculosis, sarcoidosis, Tolosa Hunt syndrome, IGG4 disease) and connective tissue disorders.

### Investigations

For further management, the patient was admitted and necessary investigations were carried out. Complete blood count showed decreased hemoglobin and elevated erythrocyte sedimentation rate (ESR). High erythrocyte sedimentation rates (ESRs) and high titres of antinuclear antibodies (ANAs) are associated with progression to SLE in patients with DLE, and SLE patients with DLE3. Fasting and postprandial blood glucose levels were within the normal range. To identify if the pathology developed from the cavernous sinus or superior orbital fissure, MRI brain contrast was ordered which showed asymmetric thickening of the right cavernous sinus more than the left thereby confirming our localisation. The lesion also extended into the superior orbital fissure and orbit. Normal CSF analysis ruled out infectious causes(mucormycosis) and normal IgG4 and ACE levels ruled out granulomatous etiology. Indirect immunofluorescence showed a homogeneous pattern with 4+ positivity for antinuclear antibodies (ANA). The C3 and C4 levels were normal with an ENA panel showing 2+ titres for dsDNA. A biopsy of the skin lesion was taken which helped us confirm the diagnosis of Discoid Lupus Erythematosus (DLE) presenting with Tolosa Hunt Syndrome.

***Figure 2.*** MRI Brain Contrast Showing Asymmetric Thickening and Enhancement of the Right Cavernous Sinus More than the Left.



### Treatment

With this diagnosis in mind, the patient was treated with pulse steroid therapy for 3 days followed by oral steroids. As the patient was progressing to Systemic Lupus Erythematosus, Mycophenolate mofetil was added after consulting a

***Table 1.*** Summary

| | |
|---|---|
| **Clinical Presentation** | Right-sided headache, diplopia, right eye pain, hyperpigmented skin lesions, alopecia areata |
| **Differential Diagnoses** | - Infectious pathology (e.g., mucormycosis)<br>- Granulomatous diseases (e.g., tuberculosis, sarcoidosis, IgG4-related disease)<br>- Tolosa-Hunt Syndrome<br>- Connective tissue disorders |
| **Key Investigations** | - CBC: Anemia, elevated ESR<br>- Blood glucose: Normal<br>- MRI Brain (Contrast): Right cavernous sinus thickening and enhancement<br>- CSF: Normal<br>- IgG4 and ACE levels: Normal<br>- ANA: 4+ homogeneous pattern<br>- dsDNA: Positive<br>- Skin Biopsy: Confirmed Discoid Lupus Erythematosus |
| **Final Diagnosis Reasoning** | - Cavernous sinus localization supported by MRI<br>- Normal CSF and granulomatous markers ruled out infection and sarcoidosis/IgG4 disease<br>- Positive autoimmune markers and skin biopsy confirmed DLE<br>- Cavernous sinus inflammation with autoimmune profile favored Tolosa-Hunt Syndrome secondary to autoimmune process |
| **Management** | - Pulse corticosteroid therapy<br>- Oral steroids tapering<br>- Mycophenolate mofetil added for immunosuppression |
| **Outcome** | Symptomatic improvement, no relapse during 5-month follow-up |

rheumatologist, as a precautionary measure. Patient improved symptomatically with no events of relapse.

## Discussion

Tolosa-Hunt syndrome is a nonspecific granulomatous inflammation marked by the infiltration of lymphocytes and plasma cells, primarily affecting the cavernous sinus and occasionally extending into the superior orbital fissure or orbital apex.1

This case presents a unique combination of Discoid Lupus Erythematosus (DLE) with THS, an association scarcely documented in the literature. Discoid lupus erythematosus (DLE) is the most common type of cutaneous lupus erythematosus. It is a chronic, scarring, photosensitive autoimmune skin condition characterized by red, scaly lesions.[4] The pigmented macular variant is a lesser-known morphological form that should not be missed by clinicians while diagnosing DLE.[5] The patient's hyperpigmented skin lesions and positive immunological markers (notably, dsDNA positivity and homogeneous immunofluorescence pattern, positive skin biopsy) aligned with DLE diagnosis, while cranial nerve findings and MRI supported THS due to cavernous sinus inflammation. Alopecia areata and Hyperpigmented macular lesions in the earlobe and concha are highly suggestive of DLE and calls for further investigation to confirm the diagnosis.

The coexistence of DLE with THS may suggest a shared autoimmune mechanism, as noted in other autoimmune disorders linked with THS. It has been proposed that inflammatory lesions in autoimmune conditions can target structures within the cavernous sinus, manifesting as ophthalmoplegia.[6] While the exact autoimmune cause of THS remains unclear, it has been observed in connection with various systemic and autoimmune inflammatory diseases such as SLE, sarcoidosis and immune mediated vasculitis such as Wegner's granulomatosis. In certain instances, THS can be the presenting symptom of these conditions.[7,8]

A thorough review of literature yielded only one other similar case that was reported by Amy W Yu. et al. This further emphasizes the rarity of such a presentation in a patient. Amy W Yu. et al discusses THS's etiology and diagnostic challenges, which focuses on the need for thorough differential diagnosis and comprehensive immunological testing, especially in atypical presentations like this one. Both patients presented with ipsilateral headache followed by painful ophthalmoplegia due to isolated third nerve palsy, with imaging confirming cavernous sinus and superior orbital fissure involvement, consistent with THS. In both cases, DLE was diagnosed via skin biopsy, with characteristic facial lesions. However, our patient had positive autoimmune markers (ANA, dsDNA, 4+ homogeneous immunofluorescence) and no comorbidities, while the case report had negative autoimmune labs but a background of multiple systemic illnesses. Both had normal CSF and responded well to steroids, confirming the diagnosis of THS, likely secondary to autoimmune inflammation.

In this case, early and aggressive immunosuppressive therapy with steroids and mycophenolate mofetil led to symptom resolution, demonstrating the importance of prompt treatment to prevent relapse. Use of other immunosuppressants such as azathioprine and methotrexate are restricted to corticosteroid resistant cases. Injectable cyclophosphamide has been sparsely used with only one documented case suggesting successful treatment.[9] An initial regimen of pulse steroid followed by oral therapy aids in effective and rapid symptom amelioration.[10,11] This aligns with standard THS management, where corticosteroids are the primary treatment, and steroid-sparing agents are considered for recurrent or refractory cases. The patient's prognosis is favorable, given her positive response to steroid therapy and

immunosuppressive treatment, with no observed relapses. Long-term follow-up for a period of 5 months was carried out in the patient as it is essential to monitor for potential progression to SLE or recurrence of THS symptoms. This is in concordance with current management guidelines which advise a minimum follow up period of 6 months to ensure that the cranial nerve palsies resolve and to adequately taper the steroid dosage. Periodic MRI and serology is done to monitor for improvement. Continued monitoring and maintenance of immunosuppressive therapy will be critical in managing her condition and preventing future exacerbations.

Current literature lacks sufficient evidence to suggest a strong link between THS and autoimmune diseases. However, reported cases suggest that THS may coexist with other autoimmune disorders, such as SLE and Hashimoto's thyroiditis.[12,13]

This report thus underscores the importance of considering THS in patients with lupus presenting with cranial neuropathies and supports immunosuppression as an effective therapeutic strategy.

## References

1. Bugeme M, Cissé O, Mukuku O, Diop AG. Tolosa-Hunt syndrome: a painful ophthalmoplegia. Case Rep Neurol Med. 2020;2020:8883983.
2. Westerberg BD, Mudarikwa L, Cooke M. The relationship between sleep quality and cognitive functioning in children: a systematic review. Int J Pediatr Otorhinolaryngol. 2020;138:110383.
3. Khandpur S, Reddy B, Aggarwal A. Determining risk factors for developing systemic lupus erythematosus in patients with discoid lupus erythematosus. Br J Dermatol. 2011;165(5):901–8.
4. Ashraf E, Ghouse AN, Siddiqui S, Siddiqui S, Khan Z. Discoid lupus erythematosus: a cross-sectional study from the Sindh Institute of Skin Diseases, Karachi, Pakistan. Cureus. 2020;12(10):e11201.
5. George R, Mathai R, Kurian S. Cutaneous lupus erythematosus in India: immunofluorescence profile. Int J Dermatol. 1992;31(4):265–9.
6. StatPearls Publishing. Tolosa-Hunt syndrome. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459225/. Last updated Aug 8, 2023; cited Jul 29, 2025.
7. Calistri V, Mostardini C, Pantano P, Pierallini A, Colonnese C, Caramia F. Tolosa-Hunt syndrome in a patient with systemic lupus erythematosus. Eur Radiol. 2002;12(2):341–4.
8. Trobe JD, Hood CI, Parsons JT, Quisling RG. Intracranial spread of squamous carcinoma along the trigeminal nerve. Arch Ophthalmol. 1982;100(4):608–11.
9. Patel J, Duggal L, Jain N, Singh BG, Basnet A, Bisht A. Tolosa–Hunt syndrome in a patient of lupus. Indian J Rheumatol. 2018;13:141–2.
10. Pasricha JS. Pulse therapy as a cure for autoimmune diseases. Indian J Dermatol Venereol Leprol. 2003;69:323–8.
11. Porta S, Danza A, Arias Saavedra M, Carlomagno A, Goizueta MC, Vivero F, et al. Glucocorticoids in systemic lupus erythematosus: ten questions and some issues. J Clin Med. 2020;9(9):2709.
12. Yu AW, Finkelsztein EJ, Cheng NT. A case of Tolosa-Hunt syndrome with discoid lupus erythematosus. Neurohospitalist. 2020;10(1):48–50.
13. Vailati A, Marena C, Comis S, Aristia L, Sozzé E, Galenda P, et al. Hashimoto's thyroiditis in association with Tolosa-Hunt syndrome: a case report. Thyroid. 1993;3(2):125–7.

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Case Report

# A Rare Case of Extensive Bilateral Fibroadenomas in a Young Woman

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## Abstract

**Background:**

Fibroadenomas are benign, solid nodules in the breast commonly found in women less than 35 years of age. Typically, fibroadenomas do not exceed 3-4 per breast, and the occurrence of five or more is uncommon with only 6 cases in the literature reporting 20 or more fibroadenomas in each breast. **Case:** We present a case of an 18-year-old female, initially diagnosed with bilateral fibroadenomas, progressing to an extensive presentation of over 25 fibroadenomas per breast by the age of 26, a rarity in the medical literature. Despite recommendations for a mastectomy due to the high fibroadenoma count, the patient, after consulting with the physician and understanding the risk of progression of size, number, or dysplasia, opted for watchful waiting, citing concerns about future breastfeeding. **Conclusion:** This case highlights the importance of shared decision-making and agreeing to conservative management with close monitoring in managing extensive fibroadenomas in young women, considering their impact on future reproductive choices. We aim to raise awareness of such uncommon presentations and encourage further reporting to broaden understanding and management strategies.

## Introduction

Fibroadenomas are benign, solid nodules in the breast commonly found in women less than 35 years of age.[1,2] Typically, fibroadenomas do not exceed 3-4 per breast, and the occurrence of five or more is uncommon.[1] A 2016 cohort study concluded the risk of breast cancer for women with fibroadenoma of the breast is similar to that for women with a diagnosis of benign breast disease.[3] In a population-based study, 2.5% of women with benign breast disease developed breast cancer, compared to 1.5% without benign disease, indicating a modest absolute risk increase.[4] A 1% increase in risk is not usually considered clinically significant. Remarkably, more than 20 fibroadenomas per breast has only been demonstrated in six published cases found by the authors. A diagnosis of multiple fibroadenomas, especially in such extensive cases, can have significant psychological and quality-of-life implications. Patients may experience anxiety related to the potential risk of malignancy, body image concerns, and the burden of repeated clinical evaluations or interventions. Shared decision-making is crucial in these cases, balancing the risks and benefits of surgical removal versus conservative management while addressing the patient's emotional well-being and quality of life. This article presents a rare case of extensive bilateral fibroadenomas of the breast with an estimated 25 fibroadenomas per breast by the age of 26.

**Highlights:**

- Progression of a rare case of a young female who developed approximately 50 fibroadenomas, with over 25 in each breast, by the age of 26.
- Shared decision-making is imperative in the management and treatment of extensive fibroadenomas, particularly for young women concerned about breastfeeding.
- Conservative management can be a viable alternative in extensive benign breast disease, balancing patient preferences and clinical risks

## The Case

An 18-year-old female with no prior comorbidities, no risk factors, and a negative family history of breast cancer presented to the office with multiple breast lumps bilaterally. Initial ultrasonography revealed four distinct masses, two in each breast. Her medical history included nodular fasciitis of the sartorius muscle and basal cell carcinoma on the right knee. Family history was non-contributary. Due to this, no genetic syndromes were suspected. Three of the masses were ovoid-shaped with a well-circumscribed margin. The other mass was irregularly shaped, spiculated, and raised suspicion for malignancy. This led to excision of all four masses which were subsequently sent off to pathology for evaluation. Histologic examination revealed a diagnosis of fibroadenomas for all four lesions.

A year later, the patient was evaluated secondary to polymenorrhagia, and breast imaging revealed ten new distinct masses consistent with fibroadenomas. She was instructed to follow up in six months to see if there was any progression. Her follow-up appointment showed no progression in size, shape, or number of fibroadenomas.

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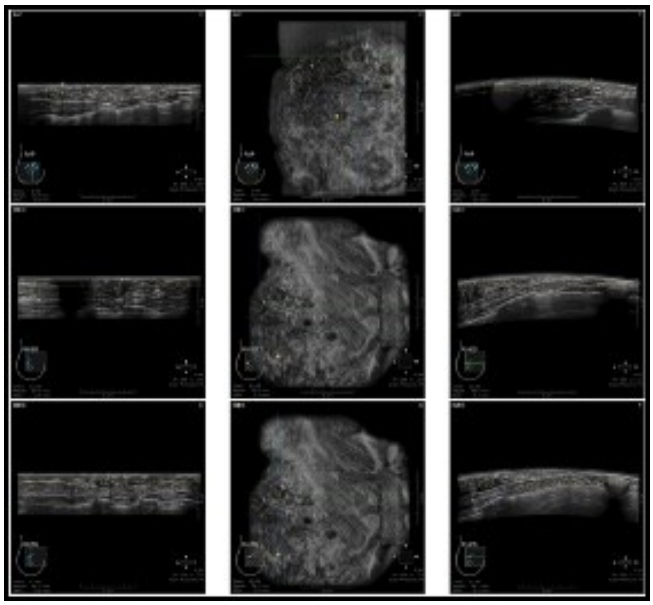
At the next follow-up visit, approximately 18 months after the initial examination, imaging detailed nineteen total fibroadenomas compared to the ten she had before. Mass sizes ranged from 0.36 cm to 2.43 cm with no single lesion raising suspicion for malignancy ***(Figure 1).***

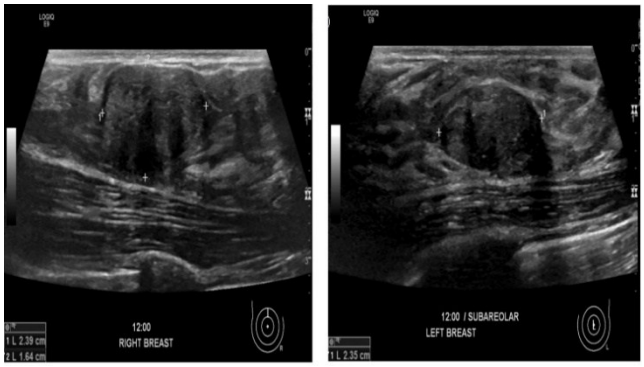
***Figure 1.***



***legend:*** A 3-dimensional Ultrasonography Showed Multiple Hypoechoic Lesions with Sharp Demarcation at the Follow-up Appointment.

Seven years after the initial presentation, the patient was reevaluated to establish care with a new physician. Imaging revealed extensive bilateral fibroadenomas, estimated to be over 25 fibroadenomas per breast. These range between 0.5 cm and 2.6 cm in maximum dimension. Many are larger than prior ultrasounds with growth rates within acceptable range. Due to the extensive quantity, the largest masses were measured as a means to track growth rates. The largest on the right was along the 12:00 axis and measured at 1.6 x 2.3 x 2.4 cm (Figure 2). The largest on the left was subareolar at 12:00 measuring 1.4 x 2.6 x 2.4 cm ***(Figure 2).***

***Figure 2.***




***Legend:*** Ultrasonography of the Largest Masses Were Consistent with Ovoid, Well-circumscribed Fibroadenomas. Borders of the Masses are Marked with a White Cross.

With the progressive increase in fibroadenomas, as well as the high risk of recurrence, the patient was advised on total mastectomy as treatment. However, due to the patient's desire to breastfeed, along with no single suspicious lesion, conservative management was agreed upon after a thorough discussion with the patient. After the commencement of breastfeeding, a mastectomy was still advised due to the risk of recurrence, continuous growth, risk of hidden malignancy, and multiplication of lesions.

As of the writing of this manuscript, the patient has been breastfeeding for 4 months without complications or limitations in milk production. Upon palpation, the masses have enlarged compared to the most recent baseline pre-pregnancy, though they have not been evaluated via ultrasonography. This increase in size does align with physiologic increase of estrogen during pregnancy increasing tumor size.

## Discussion

Fibroadenomas are painless, usually unilateral, mobile, solid, benign breast nodules. They are solid and are usually found in women under 35 years old but may appear at any age. These nodules typically shrink after menopause making them less common in postmenopausal women. Histologically, fibroadenomas are composed of stroma and epithelium located in the breast tissues. Fibroadenomas have been characterized as firm, rubbery masses with a smooth ovoid shape upon palpation.[1]

The pathophysiological mechanism of fibroadenomas is yet to be elucidated fully. One theory has linked oral contraceptives (OCPs) to fibroadenoma development, but the mechanisms behind this remain uncertain.[5] Another study found that the epithelial tissue in fibroadenomas showed a high binding affinity for estrogen, supporting the link between high estrogen levels or high volume of estrogen receptors, and subsequent fibroadenoma development.[6] Genetic testing will most likely play a future role in diagnosis and management of fibroadenomas.[7] More research is needed to further enlighten the role OCPs, estrogen, and genetics.

This patient was found to have firm nodules upon the first breast exam at eighteen years old. Initial ultrasound revealed two masses in each breast. While fibroadenomas are estrogen-sensitive, a progression to more than 20 per breast has only been demonstrated in six published cases found by the authors. Of these, 5 underwent total excision, and the other underwent mastectomy due to the presence of 100 fibroadenomas.[8-12]

Remarkably, this patient developed an estimated 50 fibroadenomas between both breasts before the age of twenty-six. Excision was considered, but due to her history of recurrence, it was not recommended. She was advised to consider total mastectomy due to the extensive number of lesions, potential occult malignancy, cosmetic reasons, and high recurrence risk. Despite mastectomy recommendations, the patient opted for

watchful waiting, prioritizing future breastfeeding after understanding the risks. Considering the benign nature and quantity of the tumors, along with the patient's consistent follow-up history, a follow-up-as-needed schedule was determined to be appropriate. The patient was advised on the importance of self-monitoring for any changes in symptoms, such as alterations in tumor size, quality, number, pain level, or cosmetic appearance of the breasts, which would require prompt re-evaluation. Additionally, she was encouraged to schedule a follow-up appointment after the completion of childbearing to further discuss her medical and surgical options

**Conclusion**

This case presents the uncommon occurrence of at least 25 benign fibroadenomas per breast and highlights the importance of shared decision-making with patients considering future breastfeeding capabilities. This case also highlights the importance of long-term follow-up, considering the risk of hidden malignancy in extensive fibroadenomas. With minimal literature on the subject, the authors intend to establish awareness and encourage others to present similar cases regarding extensive bilateral fibroadenomas.

## Summary – Accelerating Translation

**Title: Unusually High Number of Benign Breast Tumors in a Young Woman: A Case for Conservative Management and Shared Decision-Making**

**Main Problem to Solve: Fibroadenomas** are non-cancerous (benign) lumps that often appear in the breasts of young women, especially those under 35 years of age. Usually, a woman may have one to three fibroadenomas in each breast, and it is uncommon to have more than five. Having over 20 fibroadenomas in each breast is extremely rare, with very few cases documented worldwide. When this happens, it raises important clinical and emotional questions: Should the patient undergo surgery, including mastectomy (removal of the breasts), or could a more conservative approach be safely considered?

**Aim of the Study:** The purpose of this study was to present a rare and striking case of a young woman who developed more than 25 fibroadenomas in each breast by the age of 26, and to highlight the importance of patient-centered care and long-term follow-up when managing extensive benign breast conditions.

**Methodology:** This is a case report based on a detailed medical follow-up of a female patient from age 18 to 26. Information was collected from her medical visits, imaging studies (especially breast ultrasounds), and surgical biopsies. Her clinical course, decisions, and outcomes were documented and analyzed to better understand how such rare cases can be managed without immediately resorting to aggressive treatments.

**Results:** At 18 years old, the patient discovered four lumps in her breasts. They were surgically removed and confirmed to be fibroadenomas. Over the next several years, more lumps appeared. Imaging at age 19 showed 10 new masses, and by age 20, there were 19 in total. Seven years after the first diagnosis, imaging confirmed over 25 fibroadenomas in each breast, ranging in size from small (0.5 cm) to over 2.6 cm.

Given the large number of tumors, a mastectomy was recommended by her doctors to reduce the risks of recurrence, growth, and the small but possible chance of undetected cancer. However, the patient was concerned about losing the ability to breastfeed in the future. After detailed discussions with her care team, she chose a conservative management approach: no surgery, but regular monitoring through imaging and self-exams.

After giving birth, the patient breastfed successfully and without complications. Some of the lumps became slightly larger, likely due to natural hormonal changes during pregnancy, but no signs of cancer or other complications were noted at the time of writing this report.

**Conclusion:** This case shows that, even in rare and extreme cases of multiple benign breast tumors, aggressive surgery is not always the only option. With proper monitoring, good communication between the patient and medical team, and consideration of the patient's values and future plans (such as breastfeeding), a conservative approach can be both safe and appropriate. It also shows how important it is to report rare cases like this to help doctors and patients make better-informed decisions in the future. By sharing this experience, we hope to raise awareness and encourage healthcare providers to consider individualized care that respects both medical risks and personal preferences.

## References

1. Salati SA. Breast fibroadenomas: a review in the light of current literature. Pol Przegl Chir. 2020;93(1):40–8.
2. Santen RJ, Mansel R. Benign breast disorders. N Engl J Med. 2005;353(3):275–85.
3. Nassar A, Visscher DW, Degnim AC, Frank RD, Vierkant RA, Frost M, et al. Complex fibroadenoma and breast cancer risk: a Mayo Clinic Benign Breast Disease Cohort Study. Breast Cancer Res Treat. 2015;153(2):397–405.
4. Román M, Louro J, Posso M, Vidal C, Bargalló X, Vázquez I, et al. Long-term risk of breast cancer after diagnosis of benign breast disease by screening mammography. Int J Environ Res Public Health. 2022;19(5):2625.
5. Williamson ME, Lyons K, Hughes LE. Multiple fibroadenomas of the breast: a problem of uncertain incidence and management. Br J Surg. 1993;75(3):161–3.
6. Balakrishnan A, Yang J, Beattie CW, Gupta TKD, Nandi S. Estrogen receptor in dissociated and cultured human breast fibroadenoma epithelial cells. Cancer Lett. 1987;34(3):233–42.
7. Ramala SR, Chandak S, Chandak MS, Annareddy S. A comprehensive review of breast fibroadenoma: correlating clinical and pathological findings. Cureus. 2023;15(12):e49948.
8. Im CJ, Miller A, Balassanian R, Mukhtar RA. Early onset, multiple, bilateral fibroadenomas of the breast: a case report. BMC Womens Health. 2021;21(1):178.
9. Panda SK, Patro B, Mishra J, Dora RK, Subudhi BSK. Multiple fibroadenomas in bilateral breasts of a 46-year-old Indian woman – a case report. Int J Surg Case Rep. 2014;5(5):262–4.
10. Zhang RR, Bevan S, Sun P, Lu JZ, Peng Y. Unusual presentation of multiple fibroadenomas in bilateral breasts and axillary accessory breast. Breast Cancer (Auckl). 2012;6:13–6.

11. Shibata J, Fujii M, Kato T. Multiple fibroadenomas of the breasts: a cause of monthly chest pain. Postgrad Med J. 2022;98(1166):e28.
12. Aga MB, Mishra AA, G. Multiple bilateral giant juvenile fibroadenomas of breast. Eur J Surg. 2000;166(10):828–30

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Case Report

# The Impact of Social Determinants of Health on the Diagnosis of Anaplastic Oligodendroglioma: A Case Report

Meghan E. Acheson,[1] Brendan H. Pulsifer,[2] Jorge I. Peña Garcia.[3]

## Abstract

**Background:**Anaplastic oligodendroglioma is a rare brain tumor (0.5% of primary brain tumors) usually found in the frontal lobes. Its non-specific symptoms often lead to delayed diagnosis. In bilingual patients, expressive aphasia may be mistaken for limited English proficiency, further delaying care. Recognizing social determinants of health is essential to avoid such delays. **The Case:** A 75-year-old bilingual woman presented to a routine Cardiology appointment and reported word finding difficulties that worsened over the past 6 months. Five months later at her visit with Geriatrics, she reported more recent issues with expressive aphasia in both English and Spanish and difficulty speaking that started 1-2 years prior. A brain MRI revealed a left frontal lobe mass extending into the genu and body of the corpus callosum. Patient underwent a brain biopsy, which identified an IDH-mutant, 1p/19p co-deleted WHO-III anaplastic oligodendroglioma. **Conclusion:** Assessing social determinants of health such as language can help physicians diagnose medical conditions presenting with non-specific symptoms. In this case, the diagnosis of expressive aphasia was delayed likely because patient's symptoms were attributed to limited English proficiency. After careful examination and identifying her symptoms as aphasia in a bilingual patient, a work-up led to the diagnosis of anaplastic oligodendroglioma. Physicians should be aware of the social determinants of health and how they affect individual patients to avoid diagnostic biases, as delays in care such as this one have been shown to result in worsened outcomes, including increased length of hospital stay and mortality.

## Introduction

Oligodendrogliomas (OD) are brain tumors originating from the white matter of the brain.[1] According to the World Health Organization (WHO), they are classified as diffuse gliomas characterized by a mutation in isocitrate dehydrogenase type 1 (IDH1) or type 2 (IDH2). It is estimated that 1000 new cases of oligodendroglioma are diagnosed in the United States annually. These neuroepithelial tumors can be divided between low grade (about 75% of cases) and anaplastic oligodendrogliomas.[2] Approximately 55% of all cases occur in individuals aged 40 to 64.3 Notably, older adults have a markedly decreased relative 5-year survival rate.[4]

Among its manifestations, aphasia can be elusive, particularly in bilingual patients. As delays in diagnosis and missed signs and symptoms such as expressive aphasia can lead to tumor identification at a later stage, prompt diagnosis is critical to achieve the best clinical outcomes. As studies have shown that SDOH such as race, sex, education, and economic status have been associated with significantly increased hospital length of stay (p = 0.0036) and 90-day mortality (OR 2.82) in neuro-oncology patients, early identification of these factors is essential to reducing morbidity and mortality.[5] This case underscores the importance of identifying social determinants of health (SDOH) disparities to establish a proper diagnosis and start the recommended treatment.

**Highlights:**

- Anaplastic oligodendroglioma is a rare CNS neoplasm characterized by elusive clinical manifestations that may lead to delays in diagnosis
- A careful evaluation needs to be performed particularly in bilingual patients presenting with expressive aphasia, since it can be mistaken for limited English proficiency
- Patients with expressive aphasia have difficulty producing words in any language, while patients with limited English proficiency have difficulty producing words in a specific language

## The Case

A 75-year-old woman with relevant past medical history of insulin-dependent type 2 diabetes, coronary artery disease, generalized anxiety disorder, and essential hypertension came to the Geriatric Clinic to establish care and complaining about speech difficulties ***(Figure 1).*** The patient first noticed symptoms 1-2 years before her visit, with significant worsening in the last 6

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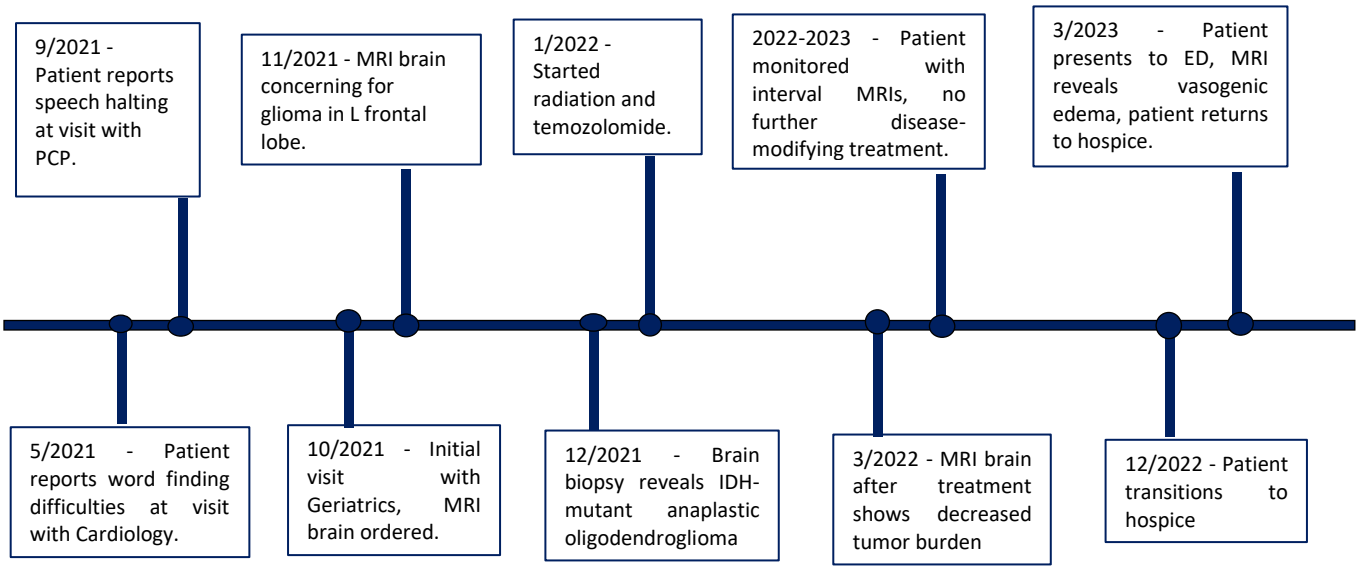
***Figure 1***. Timeline of Key Events in the Case's Disease Course.

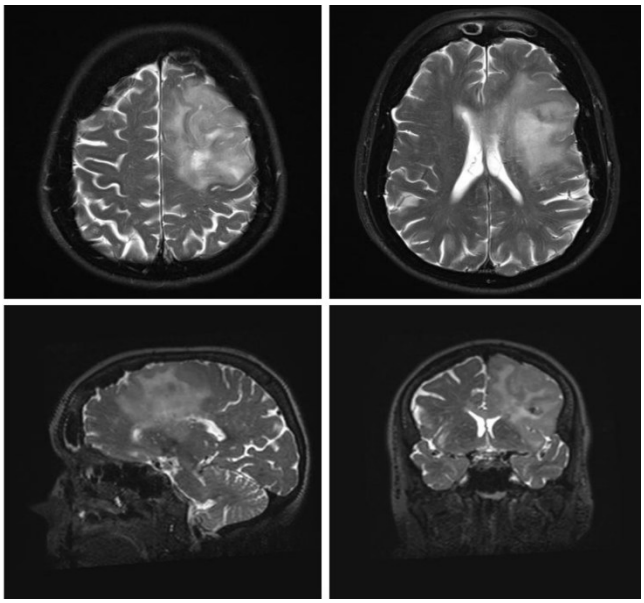



months. Spanish was her primary language, but she spoke both Spanish and English and was having trouble with naming and forming words in both languages. Other associated symptoms included mild writing difficulties and mild headaches. She denied any problems with reading and any cognitive changes. She noted that she experienced significant social isolation as she lived alone, her closest family member lived one hour away, and her closest friend passed away recently. This social isolation worsened around the start of the COVID-19 pandemic. She had reported these symptoms to previous health care providers. Her last appointment with a primary care provider was thirty days before coming to the Geriatric Clinic. Her mother was diagnosed with Alzheimer's disease in her 60s.

The physical exam showed a blood pressure of 114/62, heart rate of 96, respiratory rate of 15, oxygen saturation of 97%, and body mass index of 30.5. The patient was right-handed and had a hand grip of 21kg on both hands. The neurological exam was characterized by word finding difficulties, mild dysarthria and halting on prolonged speech, and 5/5 strength in both the upper and lower extremities. She was able to obey complex commands correctly and successfully perform finger to nose testing. Her gait was slow and hesitant, and she was unable to perform heel-toe testing. Cranial nerves I-XII were intact, and she had a negative Romberg sign. Laboratory studies were unremarkable. Geriatric assessment included a mini-cog score of 4/5 (normal), patient health questionnaire (PHQ-2) of 0 (normal), Katz index of independence in activities of daily living of 6 (fully independent), and Lawton-Brody scale for instrumental activities of daily living of 8 (high function, independent).

Magnetic Resonance Imaging (MRI) performed 1 month after her visit with Geriatrics showed a T2/FLAIR signal abnormality in the left frontal lobe, involving the white matter and extending into the genu and body of the corpus callosum, concerning for a

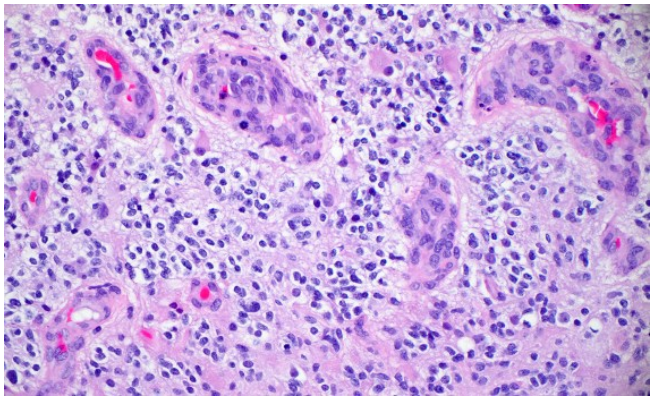
***Figure 2.*** Brain MRI with Contrast, Showing Mildly Expansile White Matter on T2 Sequence in the Left Frontal Lobe with Extension Into Genu and Corpus Callosum.



primary brain tumor ***(Figure 2).*** A stereotactic biopsy was performed, and the diagnosis of Grade 3 Anaplastic Oligodendroglioma, IDH1 mutant R132H, 1p/19q co-deleted was made ***(Figure 3).*** Due to the tumor's location and extent as well as the patient's baseline health and shared decision-making, surgery was not performed. Instead, the patient received temozolomide because it is standard of care, easy to administer, and usually has better patient tolerance than alternatives.7 However, temozolomide was stopped after 4 weeks due to the adverse effect of severe thrombocytopenia. She then received radiation therapy, consisting of six weeks of treatment to 59.4 Gy in 33 fractions, which is again standard of care.6 The patient

reported that her expressive aphasia improved to some degree after treatment. Unfortunately, the patient passed away 2.5 years after the diagnosis due to worsening extensive vasogenic edema and worsening mass effect.

***Figure 3.*** Brain Biopsy on H&E Stain, Showing an Infiltrating Glioma with an Oligodendroglial Morphology. Focal Necrosis and Microvascular Proliferation are Also Present.



## Discussion

The clinical manifestations of oligodendrogliomas (OD) are diverse and largely depend on the tumor's location and grade, with symptoms ranging from focal seizures to cognitive dysfunction. Frontal, parietal, and temporal lobe OD present with focal or generalized seizures. Frontal tumors tend to cause executive dysfunction, hemiparesis, or personality changes. Parietal tumors can lead to visuospatial impairment or hemisensory loss. On the other hand, occipital tumors may present with visual field deficits. On rare occasions, OD manifests as cerebellar ataxia and increased intracranial pressure. Low-grade OD generally present with seizures. In contrast, high-grade OD may present with increased intracranial pressure, focal deficits, and cognitive deficits.[1] Cognitive symptoms are a prominent clinical feature in central nervous system (CNS) tumors, such as lymphoma or gliomatosis cerebri, and are not seen as frequently with OD.7 These symptoms include changes in memory, attention, orientation, personality, executive function, language, and activities of daily living. Tumors originating in dominant hemispheres are more likely to be associated with cognitive dysfunction.[8]

While cognitive symptoms such as those seen in oligodendrogliomas (OD) can complicate diagnosis, aphasia—particularly in bilingual patients—adds an additional layer of complexity, often leading to misinterpretation of symptoms and delays in care. It is estimated that 41% of Hispanic individuals have low health literacy in their second language.[9] In this case, expressive aphasia was initially misinterpreted as limited English language proficiency. Even though there is strong evidence to assess language proficiency in bilingual individuals with post-stroke aphasia, very few standardized approaches have been developed to evaluate patients with aphasia due to oncologic conditions.[10] This may be related to the fact that aphasic patients speaking multiple languages exhibit a variety of patterns of impairment across their languages.[11] At present, the best way to assess for bilingual aphasia is perhaps the Bilingual Aphasic Test (BAT), which was created for the purpose of assessing the language skills of multilingual individuals with aphasia in an equivalent way. Yet not all physicians are aware of its existence, and it is not always utilized in the appropriate clinical contexts.[12] Several SDOH disparities were identified in this patient, including limited English proficiency, comorbidities, and access to bilingual physicians. Those factors have also been identified in Hispanic bilinguals with aphasia prior to stroke.[9] There are numerous studies showing the impact of having these disparities and the outcomes in patients with brain tumors.[13] A large study including 99,665 patients who underwent craniotomies secondary to a tumor showed that African American patients had a higher mortality and were less likely to be discharged directly to home compared to patients of other ethnicities in all types of tumors.[14] Similar outcomes were obtained from a study including non-black minority race. A more recent study involving 2,519 brain tumor patients who underwent resection and had at least one SDOH disparity, including race and socioeconomic status, predicted a prolonged hospital length of stay, greater odds of a nonroutine discharge, and increased 90-day mortality.[5] These and many other studies make it clear that patients with SDOH disparities often have worse outcomes than their peers without the same SDOH disparities. In the present case, the patient's bilingualism and lack of access to providers who could parse out differences between language proficiency and expressive contributed to delays in diagnosis, possibly limiting the quality and amount of care that she was able to receive.

### Conclusions

The diagnosis and treatment of rare conditions like OD can be delayed, particularly in bilingual patients presenting with aphasia. Incorporating the consideration of SDOH, such as language, into diagnostic workflows for aphasia may help clinicians avoid diagnostic biases and ensure accurate identification of underlying conditions. This case highlights the importance of recognizing SDOH as a valuable tool in enhancing the quality of care for older adults who are non-native English speakers.

## References

1. Santosh V, Rao S. A review of adult-type diffuse gliomas in the WHO CNS5 classification with special reference to astrocytoma, IDH-mutant and oligodendroglioma, IDH-mutant and 1p/19q codeleted. Indian J Pathol Microbiol. 2022;65(Suppl 1):S1–S10.
2. Bou Zerdan M, Assi HI. Oligodendroglioma: a review of management and pathways. Front Mol Neurosci. 2021;14:722396.

3. Velnar T, Smrdel U, Popovic M, Bunc G. Genetic markers in oligodendroglial tumours. Radiol Oncol. 2010;44(1):13–8.
4. Furst T, Hoffman H, Chin LS. All-cause and tumor-specific mortality trends in geriatric oligodendroglioma (OG) patients: a surveillance, epidemiology, and end results (SEER) analysis. J Clin Neurosci. 2020;73:94–100.
5. Jimenez AE, Cicalese KV, Chakravarti S, Porras JL, Azad TD, Jackson CM, et al. Social determinants of health and the prediction of 90-day mortality among brain tumor patients. J Neurosurg. 2022;137(5):1338–46.
6. Wick W, Roth P, Hartmann C, Hau P, Nakamura M, Stockhammer F, et al. Long-term analysis of the NOA-04 randomized phase III trial of sequential radiochemotherapy of anaplastic glioma with PCV or temozolomide. Neuro Oncol. 2016;18(11):1529–37.
7. Alther B, Mylius V, Weller M, Gantenbein AR. From first symptoms to diagnosis: initial clinical presentation of primary brain tumors. Clin Transl Neurosci. 2020;4(2):2514183X20968368.
8. Behrens M, Thakur N, Lortz I, Seifert V, Kell CA, Forster MT. Neurocognitive deficits in patients suffering from glioma in speech-relevant areas of the left hemisphere. Clin Neurol Neurosurg. 2021;207:106816.
9. Scimeca M, Abdollahi F, Penaloza C, Kiran S. Clinical perspectives and strategies for confronting disparities in social determinants of health for Hispanic bilinguals with aphasia. J Commun Disord. 2022;98:106231.
10. Lekoubou A, Gleichgerrcht E, McGrattan K, Bachman DL, Adams RJ, Bonilha L. Aphasia in multilingual individuals: the importance of bedside premorbid language proficiency assessment. eNeurolSci. 2015;1(1):1–2.
11. Goral M, Hejazi Z. Aphasia in multilingual patients. Curr Neurol Neurosci Rep. 2021;21(11):60.
12. Paradis M. Principles underlying the Bilingual Aphasia Test (BAT) and its uses. Clin Linguist Phon. 2011;25(6–7):427–43.
13. Rivera Perla KM, Tang OY, Durfey SNM, Vivas-Buitrago T, Sherman WJ, Parney I, et al. Predicting access to postoperative treatment after glioblastoma resection: an analysis of neighborhood-level disadvantage using the Area Deprivation Index (ADI). J Neurooncol. 2022;158(3):349–57.
14. Curry WT Jr, Carter BS, Barker FG 2nd. Racial, ethnic, and socioeconomic disparities in patient outcomes after craniotomy for tumor in adult patients in the United States, 1988–2004. Neurosurgery. 2010;66(3):427–38.

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Experience

# Public Health Experience Creating a Nature Space for Undergraduate Students

Eron J. Powell,[1] Mckay Muhlestein,[2] Jeremiah Tuchyner,[3] Jeremy R. Ellis.[4]

## Introduction

Our group of individuals came together from various backgrounds including architecture, urban planning, biology, and medicine. We all came together with the same goal, to improve the welfare of the environment and the people that live therein. We formed a nonprofit to promote walkability, nature in urban spaces and activism in our community. A few of us were familiar with the SCIF (Sustainable Campus Initiative Fund) Grant on campus at the University of Utah and wanted to take advantage of the funding available to realize our goals. There was an already existing native plant garden on campus, and we wanted to expand on that idea. We ran across the Friends of Monarchs Utah and thought it would be a great idea to add a monarch waystation on campus. These habitats provide a place for the butterflies to rest, feed, and even lay eggs as they undertake one of the largest insect migrations in North America.[1] Sadly, since the 1980s, the numbers of migrating butterflies have fallen by over 90% in the west.[2] Given our interest in promoting wellness through greenspaces, we joined forces with the goal of creating a monarch waystation on our campus.

The effect of having nature integrated into our living spaces has generous effects on the health of humans. This type of integration of nature into the built environment is termed 'biophilic design' and we aimed to promote as much real nature as we could in our surroundings on campus. Because we focused on restoring habitat for Monarch Butterflies, we chose milkweed as our signature species, selecting five varieties native to Utah—showy, narrowleaf, swamp, horsetail, and butterfly. We also planted other native flowering species that bloom at staggered times and in a range of hues, creating vivid color throughout the year. This would benefit both native pollinators and students and faculty. Results from a comprehensive review of the benefits of biophilic design found that having nature integrated into our living spaces has ample benefits on mental and physical health, including reducing stress levels, and even improving cognition.[3]

## Project

The first major step towards starting the project was finding funding and getting the project approved. It quickly became apparent that we would need approval from a variety of interconnected departments at the University. We would meet with someone from the landscaping department and hammer out a tentative plan, then take said plan to the real estate office to have them point out things they needed and a new plan was created. All the while, we had to work to create a solid proposal for the office of sustainability to fund and promote our project. In total, it took 9 months from conception to the final approval of our project.

Despite the bureaucratic hurdles, the enthusiasm from faculty and community members kept us motivated. The project was financed entirely by a $3,000 SCIF grant; following a nine-month planning phase (late summer 2023 through spring 2024) devoted to site assessments, design revisions, permitting, and plant procurement, we completed the planting itself in a single workday, with the grant covering all materials and installation expenses. (Figure 1).

As the planting day approached, our focus shifted to two main areas- finding together volunteers and purchasing and cataloguing the plants. In a fortunate turn of events, Friends of Monarchs Utah had recently received a large donation of milkweed plants, which we supplemented with 60 additional plants from community donors. This allowed us to allocate funding to other aspects of the project.

On planting day, 11 volunteers ranging from current students, former students, and community members show up to help. Altogether, we planted 125 plants (Pictures 1-4). The work was demanding, requiring frequent breaks, but seeing the waystation come to life made it all worth it. The work was overseen by a representative from Friends of Monarchs Utah who had overseen several other waystation installations throughout Utah.

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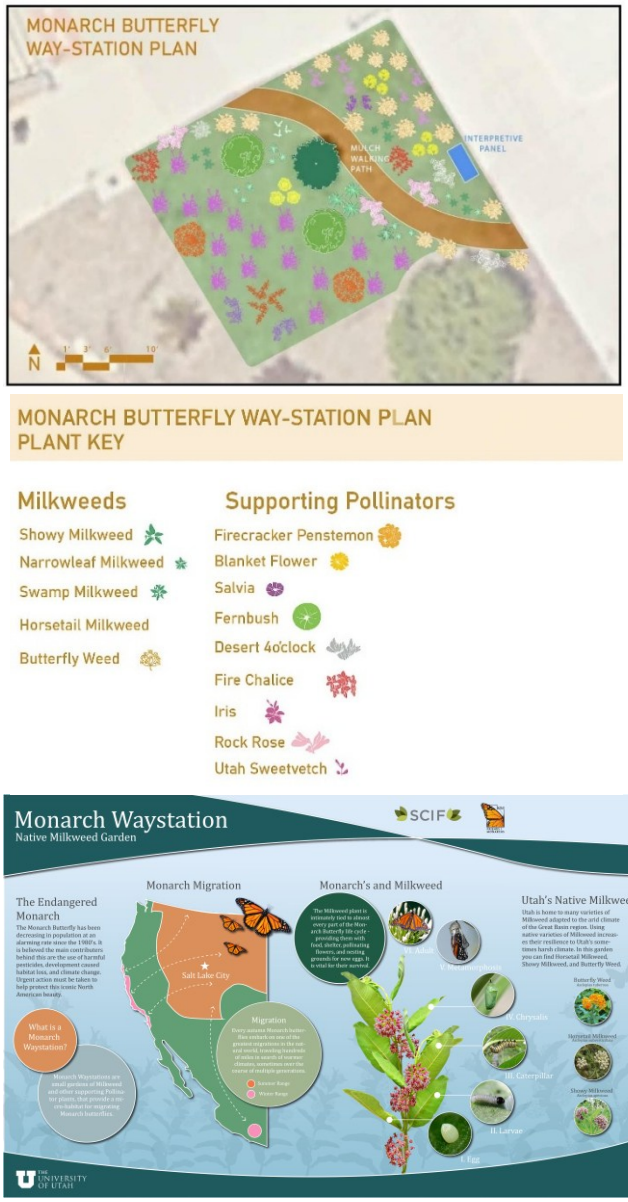
The rest of the year was spent watering, weeding, and providing further care for the plants. Monthly during the non-winter season, a weeding day is held where volunteers come to assist in upkeep and maintenance. Watering is automatically done daily by sprinkler. A walking path was installed, making the space accessible for students and staff. Almost immediately, students began using it as a quiet reprieve between classes, pausing to observe the flowers and hoping to spot a monarch butterfly.

***Figure 1.*** Map of the Waystation (Top) with Key (Bottom Left) and our Interpretive Panel (Bottom Right).




While we did not conduct a formal survey, anecdotal observations suggest that the waystation has already had a positive impact. During peak class hours, students were frequently seen pausing along the walking path, resting on nearby benches, or observing the plants. Faculty and staff also commented on the calming presence of the garden. These consistent patterns of engagement point to the space's value as a restorative microenvironment. Future student groups may consider formal surveys or usage tracking to further quantify these benefits.

***Figure 2.*** Pictures 1 and 2: Volunteers on Planting Day.

Looking ahead, the next year will be particularly exciting as the plants reach full maturity, further enriching the space. Some plants may need to be replaced, and we are in discussions to expand the waystation and install an educational panel about monarch conservation and the health benefits of green spaces. We have additional funding from the SCIF grant that covers replacement plants and other funding costs as the project continues. The Bloom Collective, along with the landscaping department, will monitor and continue plant care and maintenance in the future. This also includes any potential expansion of the area, subject to further approval from the school. No ethics approval was needed, as the project did not involve human or animal subjects.

## Reflections

This project was an invaluable experience in collaboration, grant writing, and project management. It reinforced how small-scale conservation efforts can have meaningful public health benefits. The waystation serves as both a habitat for an endangered species and a wellness-promoting space for students. We are especially grateful to SCIF for supporting our vision, as well as the various University of Utah departments, Friends of Monarchs Utah, and community members who contributed their expertise, volunteer time, and generous plant donations.

***Figure 3.*** Pictures 3 and 4: Blooming Blanket Flower (left) and Firecracker Penstemon (right) in bloom.

Before its creation, the area was an unused, mulch-covered hill, frequently trampled by students rushing to class. Now, people walk more slowly, taking in the blooming flowers and pausing for a moment of peace. This transformation shows the potential of integrating nature into urban spaces, not only just for ecological reasons, but for the well-being of the community as a whole.

The lengthy approval process often left us wondering if we would ever reach the finish line, and moments of discouragement were common. Yet those setbacks forged our tenacity. Long meetings, repeated revisions, and hard-won compromises taught us the perseverance required for work of this scale. Ultimately, we proved to ourselves that we can deliver on a project of this magnitude. It has become our flagship, an achievement we'll reference for years to come as the first entry in a growing list of successes. We hope this initiative inspires similar projects that demonstrate how urban environments can be designed to benefit both people and nature.

## Summary – Accelerating Translation

**Public Health Experience Creating a Nature Space for Undergraduate Students**

Monarch butterfly populations in the western United States have declined by more than 90% since the 1980s, while college students are facing increasing levels of stress and disconnection from nature. Our project set out to address both issues by transforming an unused hillside on the University of Utah campus into a monarch butterfly waystation and student greenspace. With support from a $3,000 Sustainable Campus Initiative Fund grant, our student team from different disciplines, architecture, city planning, biology, and medicine, collaborated with university departments and the nonprofit Friends of Monarchs Utah to design, fund, and implement the project. After nine months of planning and approvals, we organized a volunteer planting day, installing 125 native plants including five species of Utah milkweed along with other flowering species that provide food and shelter for pollinators year-round. The site was completed with an accessible walking path and is maintained through automated watering and monthly volunteer weeding days. Since its creation, students and faculty have been observed using the area as a place of rest and reflection, often pausing to enjoy the flowers or search for monarchs. While we did not conduct formal surveys, consistent engagement suggests that the space functions as both a pollinator habitat and a restorative environment that supports mental well-being. This project demonstrates how small-scale, student-led conservation can connect ecological sustainability with public health.

## References

1. Davis AK, Herkenhoff B, Vu C, Barriga PA, Hassanalian M. How the monarch got its spots: Long-distance migration selects for larger white spots on monarch butterfly wings. PloS One. 2023;18(6):e0286921.
2. Pelton E, Jepson S, Shultz C, Fallon C, Black SH. State of the Monarch Butterfly Overwintering Sites in California. The Xerces Society for Invertebrate Conservation; 2016 p. 40.
3. Hung SH, Chang CY. Health benefits of evidence-based biophilic-designed environments: A review. J People Plants Environ. 2021 Feb 28;24(1):1–16.

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Experience

# The Power of Perseverance: My 31-Year Journey to Finish Medical School

Samuel Dyer.[1]

## Abstract

This experience-based narrative recounts the author's return to medical school after a 31-year hiatus, highlighting the unique challenges and personal growth associated with completing a medical degree later in life. The aim of this reflection was to illustrate how nontraditional pathways can still lead to meaningful academic achievement and professional development. The author withdrew from medical school due to financial hardship and a family tragedy. Over the following decades, they built a successful global career in the pharmaceutical industry, eventually leading a professional organization dedicated to the Medical Science Liaison profession. The onset of the COVID-19 pandemic created an unprecedented opportunity to resume medical education through virtual instruction. At the age of 48, the author re-enrolled and began medical school from the beginning, all while continuing to manage their responsibilities as a Chief Executive Officer. The narrative follows the integration of academic demands with ongoing executive leadership, the emotional and intellectual challenges of returning to school at a later stage in life, and the insights gained from unique clinical rotations, including those at internationally recognized institutions. The story culminates in graduation at age 51 with top academic honors. This account aims to inspire readers by demonstrating that persistence, adaptability, and discipline can overcome nontraditional barriers to completing a medical degree.

## The Experience

I first started medical school thirty-one years ago with the goal of becoming a physician. Unfortunately, due to financial hardship and a family tragedy involving my mother's illness and her subsequent death, I had no choice but to withdraw. It was a painful decision, one that changed the course of my life. My desire to pursue a career in medicine was inspired in part by the physicians who treated my mother during her illness. However, given the circumstances and the financial challenges that followed, continuing medical school was no longer possible. At the time, I realized I needed to find a new career, although I had no idea what that would be.

Over time, I pursued further education, earning a master's degree in Biology and a PhD in Health Science, both of which established the foundation for my eventual career.

Professionally, I discovered the pharmaceutical industry and specifically the Medical Science Liaison (MSL) role. I began my career as an MSL and advanced into MSL leadership, followed by executive positions in Medical Affairs. These roles enabled me to live and work in 11 countries and lead MSL operations across 60 countries. Eventually, I transitioned out of the pharmaceutical industry to lead the Medical Science Liaison Society (MSL Society), the only professional association dedicated to advancing the global MSL profession. While leading the MSL Society, I have trained MSL teams for more than 75 companies. I also authored two books,[1,,2] including "The Medical Science Liaison Career Guide: How to Break Into Your First Role," which became an Amazon #1 best-seller and received multiple international awards, along with numerous other publications, awards, and industry recognitions.

Over the past 25 years, I have built a successful global career in Medical Affairs, earned advanced degrees, contributed meaningfully to the MSL profession, collaborated closely with physicians, contributed to scientific knowledge, and influenced patient care strategies worldwide. However, despite all this success, not finishing the MD remained a deeply personal regret.

I never stopped thinking about going back to finish the degree. It was never about career advancement or professional validation; it was about personal fulfillment. I did not want to look back one day and wonder, "What if?"

### A Pandemic, a Turning Point, and a Once-in-a-Lifetime Opportunity

The decision to return to medical school came as a result of an extraordinary and unpredictable moment in history: the COVID-19 pandemic. It disrupted nearly every aspect of life, including education. When I learned that, for the first time, the basic sciences of medical school would be offered entirely through virtual instruction, it was an immediate epiphany.[3,4] I realized immediately that attending medical school virtually was a once-

[1] PhD. Touro University, MD. Washington University (Health and Science) School of Medicine, USA.

**About the Author:** *Dr. Samuel Dyer graduated with Distinguished Honors in 2024 from Washington University (Health & Science) School of Medicine, ranking in the top 5% of his class. He is a recognized leader in the Medical Science Liaison profession and the author of the multi-award-winning and Amazon #1 Best Seller, The Medical Science Liaison Career Guide: How to Break into Your First Role, which has received multiple prestigious awards.*

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in-a-lifetime opportunity, and likely the only realistic chance I would ever have to return and complete my degree.

Although I have always been very driven and persistent, after three decades, the idea of returning to medical school had seemed unrealistic. The traditional demands of medical education, including attending classes on campus, relocating, pausing my professional responsibilities, and stepping away from the life I had built, always made it seem out of reach.

But when I learned that it was possible to attend medical school temporarily online, I realized that every previous limitation had been eliminated. Suddenly, what had once felt completely impossible now seemed achievable.

Despite this rare and unexpected opportunity, the decision to pursue it was not easy. During the application process, I was informed that I would not receive credit for any of my previous coursework due to how much time had passed, which meant I would need to retake all the basic sciences. At 48 years old, the thought of starting over from day one after a 31-year gap was daunting. I questioned whether I still possessed the cognitive stamina, discipline, or bandwidth to succeed in such a demanding environment while continuing to lead the MSL Society and manage a global schedule.

In fact, I was so unsure that I would be able to complete the degree that I decided not to tell anyone except my wife and one close friend. I did not tell any other family members, colleagues, or even the staff at the MSL Society. For the first two years during the basic sciences, no one knew. At times, I was almost certain I would fail. I did not publicly share my decision until I began clinical rotations and was confident I would complete the degree.

From the beginning, I was very clear about one point: I was not returning to medical school with the intention of practicing medicine, but rather to achieve a long-held personal goal. During the initial application process and throughout every clinical rotation, I communicated my intent to each supervising physician. I was there purely for self-satisfaction, to complete what I began more than thirty years ago.

**Balancing Medical School and Global Leadership**

Medical school is a demanding experience for any student, but balancing it with the ongoing responsibilities of leading a global organization presents unique challenges that most medical students will never encounter. Throughout all four years, I continued to serve as the CEO of the Medical Science Liaison Society (MSL Society), conducting international MSL training programs, managing a team, speaking at numerous conferences and events, and overseeing numerous other responsibilities.

The demands of medical school had to coexist with the equally high pressures of leading a global organization. One particularly surreal moment occurred during my very last final exam of the basic sciences. I was traveling in Antarctica and had to complete the exam aboard a ship, relying on limited satellite Wi-Fi. I remember chuckling to myself at the absurdity of the situation, hoping the connection would hold just long enough to click "submit." It was less of a struggle and more of a vivid reminder of how unconventional my journey had become. This path required unwavering commitment, creative problem-solving, and daily determination to keep moving forward. Ultimately, success in this nontraditional journey depended on a unique combination of seven key factors (Figure 1): perseverance, adaptability, unwavering self-discipline, a strong personal support network, professional flexibility, carefully selected and flexible clinical rotations, the availability of virtual instruction, the guidance of supportive faculty, and professional colleagues who understood the demands of a nontraditional path.

**Memorable Clinical Rotations**

Although I had no plans to practice medicine, I was determined to pursue unique and meaningful elective rotations. However, my circumstances required that the clinicians I worked with be highly flexible and understand the dual responsibilities I was managing. Before each clinical rotation, I was very direct in communicating my situation to the supervising physicians. I explained my ongoing professional obligations and the dual commitment I was managing. All the physicians I rotated with were incredibly supportive. They appreciated the level of dedication it took to return to medical school while simultaneously leading an international organization, and they worked with me to ensure I could meet the requirements of both. During medical school, I was fortunate to complete several outstanding and unique clinical rotations that left a lasting impact:

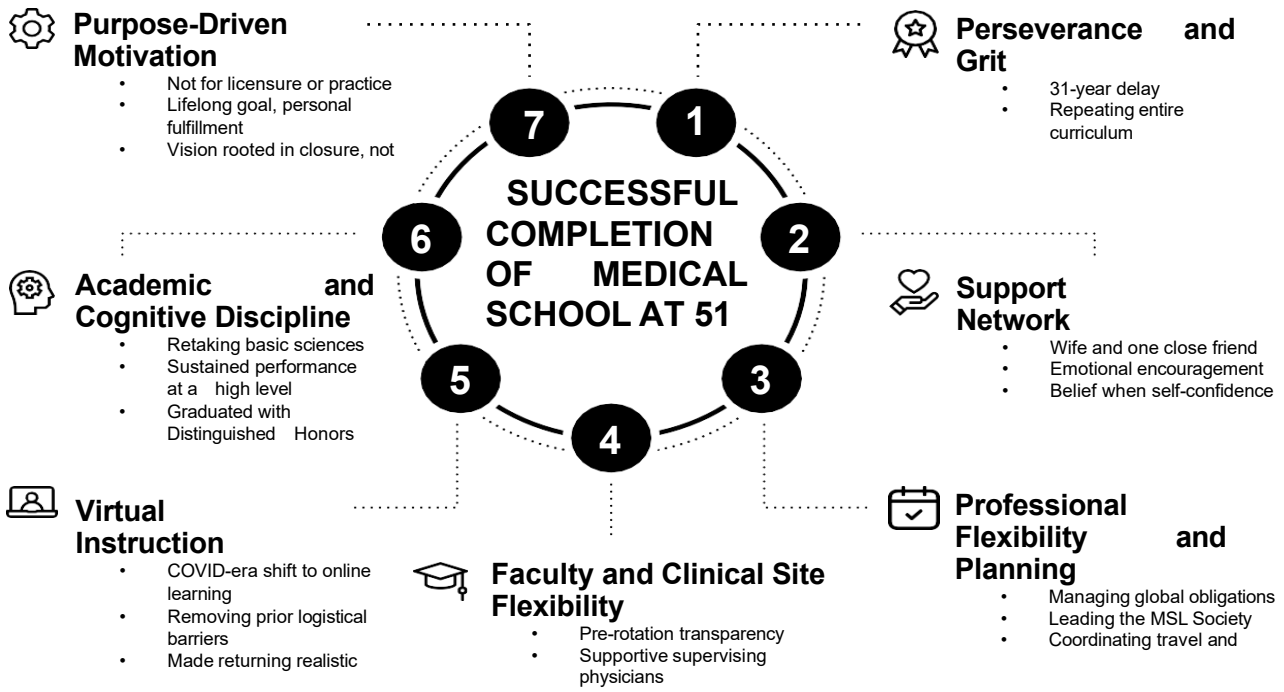
**12-Week Surgery Rotation at Harvard Medical School**: An intense and high-pressure environment that instilled in me a profound respect for surgical precision, endurance, and collaboration. I developed a strong relationship with the Program Director of the Residency Training Programs, and I co-authored and published a peer-reviewed systematic review with him.

**2-Week Wilderness Medicine Rotation in Switzerland (University of Utah School of Medicine):** One of the most physically and mentally demanding experiences. I trained in alpine emergency medicine, remote rescue techniques, and survival-based care high in the Swiss Alps.

**10-Week Sports Medicine Rotation with the Miami Dolphins:** This unique opportunity provided an insider's perspective of athlete management and rehabilitation. I observed the crucial interactions among medical teams, trainers, and coaching staff aimed at optimizing performance and promoting long-term health.

Each of these experiences deepened my appreciation for medicine and confirmed that, despite my unconventional journey, they were all rewarding learning opportunities.

***Figure 1.*** 7 Key Factors for Nontraditional Medical Student Success: A Personal Framework.




**Reflections on My Age and Personal Growth**

As a medical student significantly older than most of my peers, I found that my age and professional background seemed to allow me to connect with many of the physicians I worked with during clinical rotations on a different level. I sensed that our shared stages of life, age, and career experience often led to more candid conversations, deeper mentorship, and mutual respect. This dynamic enriched my learning and helped me gain additional insight into clinical practice and leadership in healthcare. It also became a source of personal growth, as I navigated the unique challenges of returning to medical school later in life.

**Graduation at 51**

In August 2024, I finally graduated from Washington University (Health and Science) School of Medicine at the age of 51. I received Distinguished Honors, ranking in the top 5% of my class, and was selected to deliver a part of the commencement address. It was not just a celebration of academic achievement; it was the culmination of a deeply personal, 31-year journey.

Earning the MD represented fulfilling a lifelong goal and a promise I made to myself that I refused to give up on. Beyond personal satisfaction, the degree also provided scientific and academic credibility that has strengthened my role as the CEO of the MSL Society. It further enhanced the scientific and academic foundation of my responsibilities, lending greater credibility to the training programs, publications, and initiatives I lead within the organization.

**Final Reflections**

My story is certainly not typical. It does not follow the conventional timeline or path that many associate with medical education.5 Yet it conveys a powerful reminder that many students and professionals relate to: it is never too late to pursue a goal that has deep personal meaning.

I hope my experience inspires others, especially nontraditional students or those facing setbacks, to reconsider what is possible. Often, the journey forward is not linear. At times, it is interrupted, postponed, or entirely reimagined.

To anyone reading this who has ever had to step away from a dream, I offer this: it's never too late. You are never too old, and your goals are always worth pursuing and achieving.

For over 25 years, one quote has inspired me through the challenges of my career and motivated me to complete a master's degree, earn a PhD, and successfully return to and finish medical school:

> *"The difference between a successful person and others is not a lack of strength, not a lack of knowledge, but merely a lack of will." Author: Unknown*

Perseverance, discipline, and willpower are essential for success. My journey demonstrates what is possible.

Regardless of how long it takes, never ever give up!.

## Summary – Accelerating Translation

This article shares the deeply personal and inspiring story of returning to medical school after a 31-year gap. Dr. Samuel Dyer originally began medical school in the early 1990s but had to withdraw due to financial hardship and a family tragedy. Over the next three decades, he built a successful global career in the pharmaceutical industry, becoming a leading expert in the Medical Science Liaison (MSL) profession. Despite his professional accomplishments, completing the MD remained a personal goal. The COVID-19 pandemic opened a rare opportunity for virtual medical education, which made it possible for him to return. This article explores the unique challenges and growth of completing medical school later in life while simultaneously leading a global organization. It is a story of perseverance, adaptability, and the belief that it is never too late to pursue a dream.

## References

1. Dyer SJ. The medical science liaison career guide: how to break into your first role. 2nd ed. Medical Science Liaison Corp; 2023
2. Dyer SJ. Medical science liaison job application tracking & interview self-evaluation journal. Medical Science Liaison Corp; 2024
3. Tabatabai S. Simulations and virtual learning supporting clinical education during the COVID-19 pandemic. Adv Med Educ Pract. 2020;11:513-6
4. Berberoglu I, Tang SYQ, Kozlow JH, Sezgin B, Sandhu G, Cederna PS. Integration of virtual and traditional medical education: scholarship pivots from the COVID-19 pandemic. Plast Reconstr Surg Glob Open. 2024;12(6):e5910
5. Fedorchenko Y, Zimba O, Gulov MK, Yessirkepov M, Fedorchenko M. Medical education challenges in the era of internationalization and digitization. J Korean Med Sci. 2024;39(39):e299

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Letter

# Mental Health of Medical Students

Varshinee Sathyanarayanan.[1]

## Abstract

In this Letter to the Editor, I respond to the article "A Cross-Sectional Institutional Survey of Depression, Suicidal Ideation, and Stigma in Medical Students" published in the IJMS. I appreciate how the authors have brought out the often-unspoken reality of mental health challenges within the medical student community. I discuss how medical school marks a significant turning point, not only in terms of academic rigor but also in the emotional and personal demands placed upon students. I call upon medical educators, administrators, and students to work together and create a more supportive and nurturing environment in medical education.

Dear Editor,

I am writing in response to the insightful article "A Cross-Sectional Institutional Survey of Depression, Suicidal Ideation, and Stigma in Medical Students"[1] published in the IJMS. The authors bravely address the often-unspoken reality of mental health challenges within the medical student community, a topic that deserves significantly more attention and open dialogue.

The journey to becoming a physician is typically paved with years of dedication, sacrifice, and unwavering passion. Entry into medical school marks a significant turning point, not only in terms of academic rigor but also in the emotional and personal demands placed upon students. The complex medical knowledge to be mastered can feel overwhelming, and the competitive environment can foster feelings of isolation and a constant need to prove oneself. Gruzmark and Reinders[1] provide compelling evidence of the high prevalence of depression and suicidal ideation among medical students. Their findings reveal that 22% of respondents reported moderate-to-severe depression, and a disturbing 7% endorsed suicidal ideation. These figures are significantly higher than those observed in the general population, underscoring the unique and intense stressors that medical students face. This growing trend is further supported by Peng et al.[4], who, in their meta-analysis, found a 41% prevalence of depression and a 15% prevalence of suicidal ideation among medical students, particularly during the challenging period of the COVID-19 pandemic.

Perhaps the most striking finding of Gruzmark and Reinders[1] is the persistence of stigma surrounding mental health in medical education. Despite growing awareness and efforts to destigmatize mental illness, a staggering 94% of respondents in their study believed that disclosing their struggles with depression on a residency application would be a risky endeavor. This deeply ingrained fear of jeopardizing their future careers prevents students from seeking the help they desperately need. The consequences of this stigma include academic difficulties, burnout, social isolation, and even tragic outcomes.

The recommendations put forth by Gruzmark and Reinders[1] offer a roadmap for addressing this crisis. By providing medical students with access to a diverse range of mental health providers, promoting self-care practices, and encouraging the development of personal well-being goals, we can begin to create a more supportive and nurturing environment. Furthermore, we must actively challenge the prevailing culture of stoicism and perfectionism that often permeates medical training. As Rotenstein et al.[5] highlight, medical education often lacks adequate focus on self-care, stress management, and coping strategies. By integrating these essential skills into the curriculum, we can equip future physicians with the tools they need to thrive both personally and professionally. We must foster a culture of openness and support, where seeking help is seen as a sign of strength, not weakness. Peer support programs, as highlighted by Goldberg et al.[2], can play a crucial role in reducing stigma and promoting help-seeking behaviors among medical students. By creating safe spaces for students to connect, share their experiences, and support one another, we can develop a sense of community and belonging.

The authors of this important study deserve our gratitude for bringing this critical issue to the forefront. Their work serves as a powerful call to action for medical educators, administrators, and students alike. We must work together to create a culture that prioritizes mental health and supports the well-being of those who dedicate their lives to healing others. Only then can we ensure that future generations of physicians are equipped to provide compassionate and effective care, both to their patients and to themselves.

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## References

1. Gruzmark F, Reinders A. A cross-sectional institutional survey of depression, suicidal ideation, and stigma in medical students. Int J Med Students. 2024;12(4):389-402
2. Goldberg A, Haglund M, Haywood A, et al. "It's good to know I'm not alone": a qualitative study of peer support for medical student mental health. Med Educ. 2017;51(11):1162-71
3. Dyrbye LN, West CP, Satele D, Shanafelt TD. Burnout and suicidal ideation among US medical students. Ann Intern Med. 2016;164(5):334-41
4. Peng Y, Zhang Y, Li S, et al. Prevalence and predictors of depression and anxiety among medical students during the COVID-19 pandemic: a systematic review and meta-analysis. J Affect Disord. 2023;298:161-73
5. Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. JAMA. 2016;316(21):2214-36

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