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INTERNATIONAL JOURNAL *of* MEDICAL STUDENTS

IJMS

INTERNATIONAL JOURNAL *of* MEDICAL STUDENTS

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Empowering Global Collaborative Research

Réka Sebestyén-Dósa,[1] Praveen Bharath Saravanan,[2] Mihnea-Alexandru Găman,[3] Juan C. Puyana,[4] Francisco J. Bonilla-Escobar.[5]

The hidden problem of toxic research culture looming over today's evidence synthesis was highlighted in our previous issue.[1] As a young researcher, if you felt heard after reading that, this article is for you. The intense pressure to publish for career prospects among younger researchers is helping propagate the prevalent toxic research culture. Some of the strategies that were discussed include;

- Increasing standardized workshops that are hands-on and emphasize the harm done by falsification and poor integrity among medical researchers due to poor ethics. The utilization of the skills taught in these workshops can be rewarded with ease of publication and mentor support and penalized if otherwise.

- New researchers are to be measured qualitatively by their interest in niche topics and encouraged to try different research fields within their discipline of interest. However, adequate exposure in both clinical and laboratory setups is required to spark interest in certain fields, which may not be available in low-resource regions.

- The order of authorship must reflect efforts in the research. Seasoned researchers shouldn't feel required to include their names in research of early-career principal investigators (PIs), as the criteria shouldn't measure the same at their senior cadre. This comes with a caution that published researchers with 'n' number of publications may feel their efforts are made equivalent to an early career researcher with their first few papers if the criteria still measure the number of publications.

Think Global, Act Local
By surpassing a few of these challenges, global student research initiatives have facilitated a better research environment. New platforms and societies have been on the rise since the pandemic. Research collaborations have been associated with better productivity.[2] Now who do we look for to collaborate as a student? Academic social networks are a good lead for future research collaborations. It can start from your institution, fellows through a conference dinner, mutuals through an online platform and what have you. The Cancer Research UK funded the international collaboration CanTest in 2017, which helped in capacity building to gear research toward the early detection of cancers. It made a pipeline that helped academic centers from different continents and care levels to interact and mentor new early-career researchers.[3] It was also found that research collaborations were at a slower steady pace among junior researchers compared to senior researchers who had an easier time publishing co-authored papers.[3] Now what are other benefits one may wonder.

Exchange of Talents and Resources
Current literature suggests that individuals who pursue studies or research abroad often stimulate future collaborative efforts in their home countries and play a key role in facilitating knowledge transfer.[4] The rapid development and widespread adoption of remote and online tools in recent years have significantly enhanced access to global partnerships.[5] However, research infrastructure remains underdeveloped in low- and middle-income countries (LMICs). Implementing these technologies could be advantageous for fostering international collaborations between high-income countries (HICs) and LMICs, thereby boosting research capacity and improving prospects for health equity.[6]

Innovation
Building a collaborative team involves allowing ideas to confluence and consensus to arise from discussions. People have different lived experiences and students have different exposures. Research questions can be answered more efficiently from different standpoints. It becomes more valid when thoughts are shared between similar resources but different backgrounds, as they come together to discuss possible avenues. Through this exercise, students from lower resource settings will have access to better mentors, instruments, and methodologies. Students from high-resource settings will have access to a varied clinical set-up and constraints that have led to innovative uses of existing infrastructure.

Better Researchers
Conflict resolution and troubleshooting are essential for research collaborators and principal investigators together. However, this isn't something one learns in classrooms but rather through

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Editorial

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experiencing them via projects. The more chaos in the beginning, the better clarity arrives at the end of that exercise. Exposing global and communal collaborations, to early-career researchers and medical students will allow them to learn the 'know-how' of these skills. The more trans-continental relationships they develop, the more seasoned they tackle future issues and become better in both their professional and personal lives.

Drawbacks

These cons aren't listed to drive away collaborations, but rather to plan future issues accordingly in an earlier phase of the collaborations and to curate a troubleshooting manual.

The online nature of collaborations often disrupts the collegiality among the researchers. Matching appropriate tasks, meeting deadlines, and writing skills frequently determine the student's character. Delayed responses, poor communication skills, and time zone mismanagement often put down the morale of the organizers.

Mentoring medical students online with little exposure to research involves a head phase of capacity building for them to learn the techniques and get familiar with the research field. The students in turn should have goals of learning the methodology with their first few projects when they observe and seek authorship when they meet the International Committee of Medical Journal Editors (ICMJE) standards. If the goal happens to be receiving a publication through the collaboration, often they are disappointed by the time it takes to reach conclusions following their career timelines and worried if the findings will assist in leveraging their career prospects.

The absence of an institution to provide the students with accountability adds to the attrition of collaborators as the project progresses. Since students involved often are chosen from different institutions, it requires a central source of funding from a source that is accepting of the nature of the collaboration. Frequently difficult to find, added to the fact that these students aren't full-time researchers.

With the flow of the project, it is also important that the roles and contributions of the collaborators to the project are determined. As long as the order of authorship still regards the position of different values, the contributions will have to reflect the order. Measured scoring systems are available and should be informed beforehand.[7] The occurrence of this practice isn't widespread among student researchers.

Call for Action

As virtual conferences and classes have become widespread due to COVID-19, it's time to rethink the traditional model of medical research mentoring, which has been limited to local settings. One important step in aiding global collaboration is embracing the power of virtual mentoring, as it can encourage active participation in international research. This has been demonstrated by initiatives like the Cardiovascular Analytics Group, which includes 63 active members from 14 different countries.

Table 1. **Global Research Exchange Opportunities for Students.**

Global research opportunities	Description
Fulbright Program	Scholarships and opportunities for diverse institutions and regions across the United States and the world to share expertise, and collaborate on research with international partners.[5,9]
IFMSA Research Exchange	The largest medical student exchange platform globally, providing a structured exchange experience.[10]
ERASMUS +	The leading study abroad program for higher education in Europe[11]
Danish-American Research Exchange (DARE) program	Binational collaboration between the United States and Denmark, focusing on clinical research[12]

Table 2. **Organizations Offering Benefits to Support Student Researchers.**

International Organizations	Benefits	Student Membership
European Association for the Study of Liver	Schools and Masterclasses Fellowships and Mentorships Online access to the Journal of Hepatology	Free for undergraduate students: https://easl.eu/join-the-community/#undergraduate studentseur0
European Society of Medical Oncology	Educational Resources Fee Reductions for ESMO Meetings Community and Collaboration	Free for undergraduate students: https://www.esmo.org/membership/membership-categories-annual-fees
European Society of Pathology	Professional development and networking opportunities Free access to the online ESP Educational portal Access to the "Virchows Archiv" Journal	Free for undergraduate students: https://www.esp-pathology.org/membership-benefits/
Society for Neuroscience	Reduced registration rates for the SfN annual meeting Getting involved in a variety of SfN Initiative Programs	Reduced fee for undergraduate students: https://www.sfn.org/membership/membership-fees
International Society for Infectious Diseases (ISID)	Access to Career Connections Discounted rates on ISID meetings Exclusive ICID travel awards	Reduced fee for undergraduate students https://membervillage.isid.org/general/register_member_type.asp
European Hematology Association	Educational Resources, Junior membership is available for med students at reduced costs, Dedicated training opportunities for med students interested in hematology (Lighting the Flame program)	https://ehaweb.org/education/lighting-the-flame/ https://ehaweb.org/membership/eha-member/
International Society on Thrombosis and Hemostasis	Education Resources, Free membership for med students/trainees	https://www.isth.org/page/Membership
Society of Hematologic Oncology (SOHO)	Educational Resources, Free membership for med students, non-oncology residents, members in training	https://sohoonline.org/SOHO/SOHO/Membership/Membership.aspx

Serving as a model, it shows that online space can provide various opportunities, especially for mentees from less developed countries who may have limited access to research and

international networking.[8] We encourage establishing such research groups as they can foster diversity, equity, and inclusion, values that we, as a journal are committed to.

Exchange Projects

Another step medical students can take toward global collaborative research is participating in various exchange projects. Several grants provide funding for students interested in international research or even international fellowships. **_Table 1_** illustrates some of the most popular options. These programs not only help build networks but also enhance research quality, promote cultural competence, and address shared global health challenges.

Last but not least, early career researchers and medical students with similar interests can engage in professional organizations that offer reduced or even free membership fees to facilitate student involvement in specific fields. See **_Table 2_**. These organizations not only provide valuable educational resources, including courses, workshops, and symposia, but many of these have online platforms, enabling a global exchange of ideas, research, and experiences. They also support academic and career development by providing bursaries for members.

Role of IJMS

The International Journal of Medical Students (IJMS) strives to amplify contributions from diverse regions in medical research. A recent cross-sectional study analyzing 22 medical student journals' editorial boards' adherence to the principles of diversity, equity, and inclusion (DEI) highlighted IJMS's commitment to these values. Remarkably, IJMS was the only journal to achieve the maximum score in the geographic diversity domain, emphasizing its dedication to ensuring global representation in its community.[13]

Through initiatives like the World Conference of Medical Students' Research, IJMS fosters an inclusive environment that connects students from diverse regions. Its virtual format ensures that participants from regions with limited access to international academic events can still engage in global discussions, share research findings, and form collaborative networks. By removing the barriers of physical travel, this year's conference allowed 40 students and early-career researchers from 20 different countries to connect and learn from each other regardless of their location.

Conclusion

The world is becoming a global village. Talents and resources can be shared now better than at any time in history. The rightly organized brains with aligned resources can work wonders.

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Enhancing Medical Education: The Impact of Deliberate Practice on Learning Human Physiology

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Abstract

Background: Simulation-Based Learning (SBL) has potential in health education, yet it remains underutilized at the undergraduate level. Active teaching methodologies, such as deliberate practice, are known to enhance skills like leadership, self-confidence, and teamwork. This study aimed to evaluate the medical students' perception of deliberate practice in learning Human Physiology at a private medical school in Brazil. **Methods**: An observational qualitative and quantitative study was conducted in 2022 and 2023 using an online questionnaire, including 198 participants. An inferential statistical analysis was conducted, using Fisher's exact test at a 0.05 level of significance, to assess the association between categorical variables. **Results:** Overall, students had a positive perception of deliberate practice. A significant proportion (66.8%) strongly agreed that they developed teamwork skills through the scenarios. Additionally, 83.7% strongly agreed that access to realistic simulation environments enhanced their learning. In terms of emotions, 67.9% felt motivated, while 37.8% experienced anxiety during the scenarios. The statistical analysis revealed a significant association between the sum scores of each section and the binary response ("yes" or "no") to the question "Do you like the practical classes of Human Physiology?" ($p < 0.05$), with the exception of the Negative Emotions sum. This indicates that higher section scores are associated with a greater likelihood of students liking the practical classes. **Conclusion:** The integration of deliberate practice into the Human Physiology curriculum has positively impacted students' learning and skill development. However, enhancements are needed to create a safer emotional environment for students.

Introduction

Simulation based learning (SBL) consists of an initial session, in which students begin to familiarize themselves with the equipment and are informed of the scenario (e.g., clinical case) and learning objectives. The second session is the realistic simulation itself, where students are presented with a problem and become directly involved in the search for its solution.[1] Finally, this is followed by a debriefing session, during which the scenario is discussed. It is believed that simulation will become an obligatory step for professionals before patient contact, demonstrating its great potential for training more prepared professionals.[2]

The debriefing session is not only the source of greatest learning but also it is the most critical component contributing to the success of SBL, as it provides a moment for reflection on the scenario and possible performance improvements. Additionally, it allows students to incorporate new information alongside their previous knowledge.[3] A successful debriefing must encourage an interactive exchange between students and the teacher, as studies have indicated that guided reflection improves the critical thinking and communication skills of students in training.[4, 5, 6, 7]

Deliberate practice, a type of SBL, is distinguished by the constant monitoring of student performance by the teacher. This approach allows for a broader view of progress over time, more effective feedback to address possible failures, and the adaptation of practices to improve learning. It is important that the teacher conducts the scenario with the role of sharing knowledge, while positioning the student as the main actor in their learning.[8, 9, 10] Likewise, during the debriefing, the facilitator must encourage discussion about mistakes and successes in the scenario. By answering these questions, students are led to use reasoning and reflect on their own performance.[11]

One of the main advantages of this methodology is its ability to place students in circumstances that closely reflect real-world work environments. This helps them develop skills such as quick decision-making, resilience under stress, emotional intelligence, applied reasoning, and teamwork, resulting in enhanced performance.[12] Moreover, the use of resources such as high-fidelity mannequins facilitates this process without exposing patients to the risks associated with medical errors made during the learning process.

Furthermore, it is known that both SBL and deliberate practice are activities that stimulate students' emotional involvement. Emotions can either inhibit (e.g., fear, anxiety, stress) or reinforce learning, and they are strongly associated with training long-term memory, motivational process, thinking strategies and cognitive

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sources.[13] As it has been previously reported that emotional instability and stress are the main factors affecting the learning process,[14] it becomes essential that the teaching environment in practice is stable, safe, and conducive to the development of positive emotions such as curiosity and interest.

The Medical Physiology course, taught during the first semesters of the program, is essential for a comprehensive understanding of the functioning of the human body. A study conducted by the undergraduate Nursing program at the University of São Paulo (USP)[15] demonstrated that adopting a more dynamic teaching style, such as realistic simulation and deliberate practice, enables the integration of physiological knowledge into clinical practice in a productive and enjoyable way for students. However, this methodology is mostly applied in specialized contexts, and its potential is not fully explored in basic disciplines such as Human Physiology.

Therefore, the benefits of SBL for the learning and skill development of medical students are evident, highlighting the need for research that objectively evaluates these benefits in Human Physiology classes. Since there is a scarcity of reports and research in this discipline at the undergraduate level, this existing gap in the literature is detrimental to the development of teaching technics such as SBL. It is essential to conduct more studies on the subject, to enrich the literature. The broad objective of this project was to investigate students' perception of SBL and how it affects the learning process, their emotional wellbeing, and the skills developed. Additionally, the specific objectives included verifying the engagement of undergraduate students in the scenarios and establishing the advantages and disadvantages of implementing deliberate practice from the beginning of medical education.

Methods
Study Design
This is an observational, cross-sectional, mixed-methods study conducted at a private medical school in Belo Horizonte, Brazil, with the participation of volunteer medical students from nine different semesters. All the participants had practical classes involving delibarate practice in the Realistic Simulation Laboratory during Human Physiology I or II courses. The study was approved in advance by the ethics board (CEP - Comitê de Ética em Pesquisa) of aforementioned medical school.

Participants
The study's pool was obtained from undergraduate medical students of a traditional private college, based on Belo Horizonte, the capital of a southeast state in Brazil. The students' profile in this college is mostly young (below the age of 25), with a middle to high class background and with a former high-quality education. In this research, students from all semesters, except the first, could participate, as they would be having or already had Human Physiology classes. The experience with this subject rendered this sample relevant for the research. Students' gender was not observed, which is a limitation of this study.

The inclusion criteria to participate were: participants must be medical students enrolled at the medical school where the research occurred at the time of the study, participants must have completed at least one practical class in Human Physiology I or II in the Realistic Simulation Laboratory, participants must be 18 years of age or older and participants must have responded the questionnaire in its entirety. The exclusion criteria were: medical students who have not participated in any practical classes in Human Physiology I or II in the Realistic Simulation Laboratory, individuals under 18 years of age, students who are enrolled in other medical schools and participants who did not provide complete responses on the research form.

The total number of students at the private medical school where the study was conducted was approximately 2,000 students at the time. Therefore, the calculated sample size was 196 participants, roughly 10% of the total number, considering 5% significance level, 7% margin of error and a conservative approach (assuming a proportion of 50%). The sample size calculation was carried out using the following formula:[16]

$$n = (za/2)^2 \, p(1-p)/E^2$$

α: significance level
$z\alpha/2$: quantile of the Standard Normal distribution referring to the level of significance
p: estimated proportion
E: maximum error allowed

Instruments
A questionnaire was created regarding deliberate practice in the Human Physiology I and II discipline. The questionnaire was divided into five blocks: General Questions, Emotions, Skills, Debriefing and Personal Opinion. The fifth block consisted of open-ended questions for students to identify aspects to be improved. The Likert scale was chosen as the evaluation method for the questions in the first four sections, with responses ranging from 1 to 5 (1 being "Strongly disagree", 2 being "Disagree", 3 being "Indifferent" (or "Neutral"), 4 being "Agree", and 5 being "Strongly Agree").

In developing the questions, scientific papers on the topic were consulted, which included qualitative assessments and personal experiences related to SBL. The works of Fukamizu et al. (2021), Teixeira et al. (2015) and Dourado and Giannella (2014), provided insights into factors that contribute to learning in the context of SBL, such as the difficulties encountered during practice, the most frequently trained skills, the identification of errors, and the importance of an adequate debriefing session.[9,17,18] Consequently, the questions in the General Questions and Skills sections were created by authors and based on these studies, as there were not validated questionnaires about these topics. The articles contributed to identify key aspects that contribute to the effectiveness of the questionnaire.

Moreover, according to Madsgaard et al. (2021), the emotions experienced during simulations have a direct impact on student learning.[11] Thus, a section of questions was added to address the

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emotions experienced, allowing for correlation with learning outcomes and interpreting their impact. The questions about emotions were also created by the authors and based on the important highlights of Madsgaard et al. (2021).[11] Finally, the questions in the Debriefing section were adapted from the standardized Debriefing Assessment for Simulation in Healthcare (DASH) Student Version (DASH-SV),[19] a validated questionnaire, which is designed for deliberate practice participants to evaluate their instructors. However, since instructor evaluation was not the objective of this research, the questionnaire was used only as a basis for formulating the debriefing questions.

The questionnaire also included the Free and Informed Consent Form (TCLE) on the first page, and all participants agreed to participate before proceeding with the research. Additionally, the students were asked in the questionnaire whether they had participated in deliberate practice classes in the Human Physiology course, as this was an inclusion criterion for the project. For older cohorts at the college, the SBL method had not yet been applied.

Data Collection and Analysis

The questionnaire was distributed to medical students via Google Forms to facilitate access. It remained open for 10 months, from November 2022 to August 2023. After data collection, the authors conducted a qualitative analysis of the responses, categorizing them according to the Likert scale and organizing the results into figures and tables to identify patterns and highlight the most relevant responses.

A quantitative analysis was also performed, using Fisher's exact test at a 0.05 level of significance to assess the association between categorical variables. To categorize these variables, responses from each section were summed according to their corresponding values on the Likert scale. For example, in the first section, titled General Questions, which included five statements about the students' learning experience, the total possible score ranged from 5 to 25. Based on this range, the scores were divided into three categories: 5-15, 16-20, and 21-25.

Since this is an original questionnaire created by the authors, these categories have not been previously defined in the literature. Therefore, the categories were developed by the authors to best represent the distribution of responses. The first category (5-15) represents mostly disagreement or indifferent responses, the second category (16-20) represents mostly neutral ("indifferent") or simple agreement responses ("agree"), and the last category (21-25) represents agreement and strong agreement responses ("agree' and 'strongly agree"). This method of summing responses was applied similarly across other sections. The Debriefing section used the same categories as the General Questions section, while the Skills section had different categories due to its six questions instead of five. Here, the minimum score was 6 and the maximum was 30, leading to four categories: 6-15 (mostly disagreement responses such as

"strongly disagree" and "disagree"), 16-20 (mostly "indifferent" responses), 21-25 (mostly "indifferent" or "agree" responses), and 26-30 (mostly "strongly agree" responses).

The Emotions section required a different approach because it contained both positive and negative statements, such as self-confidence and anxiety. Summing all the statements together would have been inappropriate, so the responses were divided into two blocks. The first block, called Positive Emotions, included motivation, interest, and self-confidence. The second block, called Negative Emotions, included nervousness, anxiety, and stress. In both blocks, the minimum possible score was 3 and the maximum was 15. Therefore, three categories were created: 3-7 (mostly "strongly disagree"and "disagree" responses), 8-11 (mostly neutral or "agree" responses), and 12-15 (mostly "strongly agree" responses). Each of the categories from these sections was then compared using Fisher's exact test with the variable *Do you like the practical classes of Human Physiology?* which had a binary "yes" or "no" response. The results of the analysis were then organized into tables to demonstrate the findings.

Results

A total of 198 responses were obtained. All the answers were adequate, considering the inclusion and exclusion criteria. Therefore, 198 responses were analyzed.

Firstly, it is necessary to understand the profile of the students who participated in the research. At the medical school where the research took place, the disciplines of Human Physiology I and II are taught in the second and third semesters, respectively, out of the twelve semesters in the medical program in Brazil. The main focus was on students who had recently completed Human Physiology I and II courses, where the implementation of deliberate practice wasmore established. **_Figure 1_** shows the distribution of student's responses by semester, considering the second semester of 2023. Students from the third semester had the highest participation rate with 29.9% of the total responses, followed by students of the fourth and sixth semester, both with 26.9%.

The statements used in the questionnaire have been abbreviated for visual clarity in the figures. In **_Figure 2_**, the results for the general questions about learning are presented. The statements "The scenarios added to your learning in physiology" and "Access to realistic simulation facilities contributes to your learning of Human Physiology" received the highest levels of agreement ("strongly agree") with 76.6% and 83.7%, respectively. In contrast, the statement "You can apply the knowledge learned in the classroom during practice" had the lowest agreement rate ("strongly agree") with only 54.1%, followed by 33.2% of "agree" responses. Regarding neutral responses ("indifferent"), the previously mentioned statement had the highest percentage at 10.7%, followed by the statement "You consider that there has been an evolution of your performance from your first practical class to your last", at 9.7%. This latter statement also received the highest number of negative responses ("disagree" and "strongly disagree"), totaling 4.1%.

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Figure 1. Percentage of Student Participation by Semester in Deliberate Practice Sessions for Human Physiology.
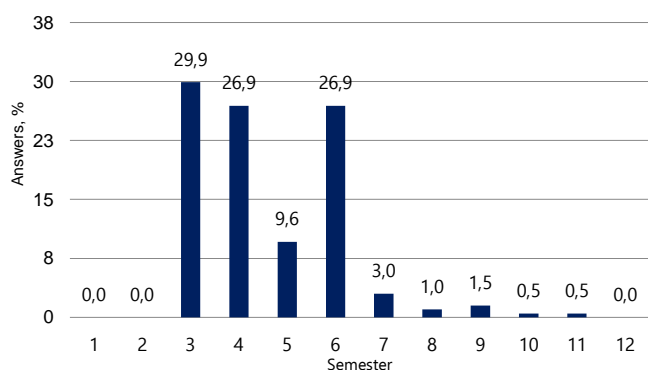
Figure 2. Student Responses on the Impact of Deliberate Practice on Learning and Knowledge Application in Human Physiology.
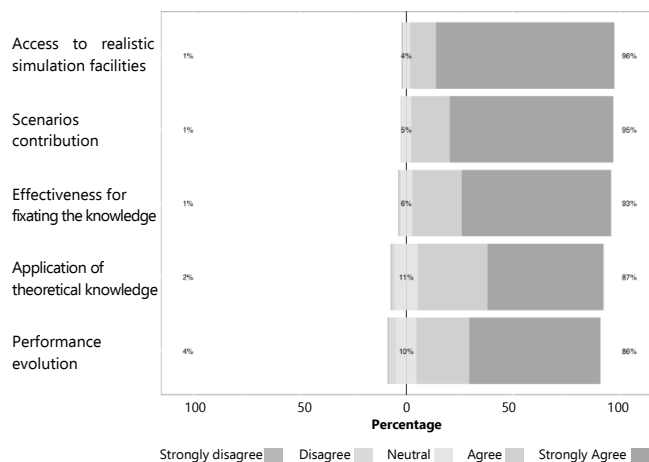
Figure 3. Student Emotional Responses During Deliberate Practice in Human Physiology Sessions.
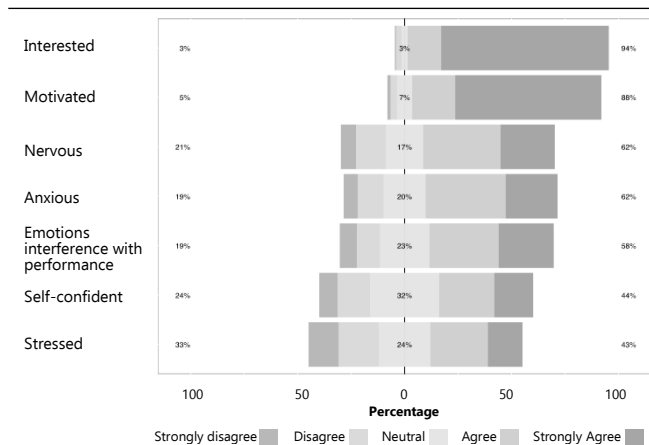
Figure 4 addresses the questions about skills development during SBL. The statements "You developed teamwork with the practical classes" and "You developed applied rationale with the practical classes" had higher agreement rates ("strongly agree") with 66.8% and 65.8%, respectively. Conversely, the statement

about developing security in performing medical techniques had the highest neutral response rate, at 20.4%. The statement regarding developing resilience under stress followed, with 17.9% of "indifferent" responses. The statements with the highest disagreement rates ("disagree" and "strongly disagree") were "The practical classes aid you in developing security to perform the techniques" and "You develop professional leadership skills with the practical classes", with a combined 7.7% for both statements.

The statements "The mistakes made during the scenario contribute to your learning" and "The explanation given by the teacher during the debriefing is beneficial for learning" had the highest agreement rates ("strongly agree"), with 83.7% and 79.6%, respectively. The statement "The discussion among students during the debriefing stimulates learning" had the highest neutral response rate ("indifferent"), at 10.2%. In this section, the disagreement rates ("disagree" and "strongly disagree") were lower than in other sections, ranging from 2% to 0.5%.

In the opinion section: 86.7% voted yes to the question "Do you like physiology classes?" and 13.3% voted no. 95.4% voted yes to the question "Do you like practical physiology classes?" and 4.6% voted no. The last question "Would you change anything in the application of the scenarios?" was open-ended and optional.

Figure 4. Student Perceptions of Skill Development During Deliberate Practice in Human Physiology Sessions.
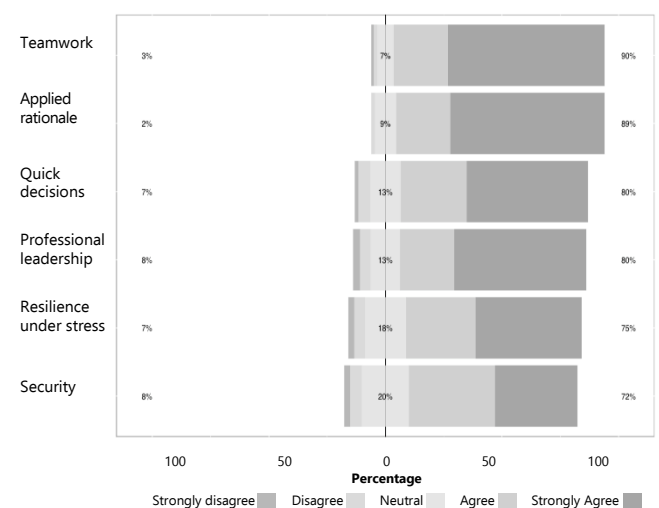
Out of the participants, 126 students chose not to respond, while 33 students indicated satisfaction with the deliberate practice sessions, stating that they would not change anything. However, other students provided various suggestions for improvement. Twenty students expressed a desire for more frequent or longer deliberate practice sessions, with one suggesting, "More scenarios and application in other subjects in more advanced periods. There are few scenarios and opportunities; I think if there were more, we could do better and have more security in practice." Four students proposed better integration between

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theoretical and practical classes, recommending that scenarios should align with topics currently being covered in lectures, as reflected in the comment, "Choose topics that are being studied in theoretical classes when carrying out the scenario." Regarding the debriefing process, four students requested longer or more thorough sessions, with one noting, "Teachers could prepare material so that the debriefing is not just in the oral dimension." Conversely, one student preferred shorter, less in-depth debriefings. Additionally, four students recommended expanding deliberate practice to other subjects within the medical curriculum, with one student specifically suggesting, "I would place the scenarios in all periods." Concerns about emotional preparation were also mentioned, with one student highlighting the need for such preparation to reduce anxiety before scenarios: "Emotional preparation to avoid exacerbated anxiety before the scenarios." Finally, two students suggested that practice scenarios should not be graded, as this would alleviate the pressure associated with these sessions, as one student expressed, "Everything, I would make it a class instead of a test." **Table 1** presents the key points divided into themes for better understanding and clarity.

There was a statistically significant association between the sum of the General Questions scores and the variable: Do you like the practical classes of Human Physiology? (p-value = 0.022), as presented in **Table 2**. The majority of participants (84%) selected "strongly agree" and "agree" (scores 21-25) regarding their positive learning experience in practical classes. This proportion is even higher among those who answered "Yes" to the question "Do you like the practical classes of Human Physiology?" (85% vs. 67% of those who answered "No"). Notably, there is a more pronounced discrepancy at lower levels of the *General Questions sum.* Among those with scores of 5–15, the proportion of dislikers was considerably higher than that of likers (22% vs. 1.6%). These results suggest that a higher sum score (predominantly positive answers, such as "strongly agree" and "agree") is associated with a higher likelihood of liking the practical classes in question. Conversely, a lower *General Questions sum* appears to be associated with a lower likelihood of liking the classes.

In the Emotions section, the sum of *Negative Emotions* and *Positive Emotions* was calculated separately. A significant association (p-value < 0.001) was found between the sum of *Positive Emotions* and participants' preference for the class. Those who reported feeling emotions such as motivation, interest, and self-confidence with "strongly agree" and "agree" tend to like the classes better than those who responded with "strongly disagree" and "disagree."

Among those who answered "yes" to the class preference, 79% had scores of 12-15, 17% had scores of 8-11, and 3.7% had scores of 3-7. Conversely, the sum of *Negative Emotions* did not show a significant association with students' preference for the class (p-value = 0.4). This result indicates that high scores in the sum of negative emotions, such as nervousness, anxiety, and stress, are not related to a higher preference for the deliberate practice classes.

Table 1. **Summary of Key Themes, Number of Responses and Example Quotations from the Open-Ended Question: "Would you change anything in the application of the scenarios?".**

Theme	n	Example Quotation(s)
No changes suggested	33	"No. They're great. That's where I learned the most in Physiology."
Request for more deliberate practice	20	"I would create more scenarios and put fewer people in each scenario."
Integration with theorical classes	4	"Choose topics that are being studied in theoretical classes when carrying out the scenario."
Longer or more complete debriefing	4	"Teachers could prepare material so that the debriefing is not just in the oral dimension."
Faster and less in-depth debriefing	1	"The teacher could spend less time explaining in the debriefing, making the class more dynamic and less tiring"
Application in other subjects	4	"Add them to DIC (Curriculum Integration Discipline) and have it every semester."
Application in advanced semesters	1	"I would place the scenarios in all periods."
Need for emotional preparation	1	"Emotional preparation to avoid exacerbated anxiety before the scenarios."
Reduced pressure by not grading	2	"Everything, I would make it a class instead of a test."

Table 2. **Association Between Student Perception Scores and Preference for Practical Human Physiology Classes.**

Characteristic	Overall n=198 [1]	No n=9 [1]	Yes n=189 [1]	p-value [2]
General Questions Sum				0.022
5 - 15	5 (2.5%)	2 (22%)	3 (1.6%)	
16 - 20	27 (14%)	1 (11%)	26 (14%)	
21 - 25	166 (84%)	6 (67%)	160 (85%)	
Skills Sum				<0.001
6 - 15	7 (3.5%)	3 (33%)	4 (2.1%)	
16 - 20	16 (8.1%)	3 (33%)	13 (6.9%)	
21 - 25	61 (31%)	2 (22%)	59 (31%)	
26 - 30	114 (58%)	1 (11%)	113 (60%)	
Debriefing Sum				<0.001
5 - 15	4 (2.0%)	2 (22%)	2 (1.1%)	
16 - 20	23 (12%)	3 (33%)	20 (11%)	
21 - 25	171 (86%)	4 (44%)	167 (88%)	
Positive Emotions Sum				<0.001
3 - 7	10 (5.1%)	3 (33%)	7 (3.7%)	
8 - 11	38 (19%)	5 (56%)	33 (17%)	
12 - 15	150 (76%)	1 (11%)	149 (79%)	
Negative Emotions Sum				0.4
3 - 7	40 (20%)	1 (11%)	39 (21%)	
8 - 11	73 (37%)	2 (22%)	71 (38%)	
12 - 15	85 (43%)	6 (67%)	79 (42%)	

Legend: [1]. n (%). [2]. Fisher's exact test

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Furthermore, a significant association was found between the variable *Do you like the practical classes of Human Physiology?* and the *Skills sum*, indicating a significant association (p-value < 0.001) between higher skill development and a greater preference for the deliberate practices. Participants who mostly selected "strongly agree" and "agree" tended to like the classes more, while those who selected "strongly disagree" and "disagree" tended not to like them as much.

Lastly, there is a statistically significant association between the *Debriefing sum* and the variable *Do you like the practical classes of Human Physiology?* (p-value < 0.001). The majority of participants (86%) selected "strongly agree" and "agree" (scores 21-25) regarding their positive learning experience in practical classes. This proportion is even higher among those who answered "Yes" to the question "Do you like the practical classes of Human Physiology?" (88% vs. 44% of those who answered "No"). Notably, there is a more pronounced discrepancy at lower levels of the *Debriefing sum*. Among those with scores of 5–15, the proportion of dislikers was considerably higher than that of likers (22% vs. 1.1%). These results suggest that a higher sum score (predominantly positive answers, such as "strongly agree" and "agree") is associated with a higher likelihood of liking the practical classes in question. Conversely, a lower *Debriefing sum* appears to be associated with a lower likelihood of liking the classes.

Discussion

In general, the statements had a predominance of responses "strongly agree" and "agree", showing that students have a positive perception of the impact of deliberate practice in teaching Human Physiology. In the block addressing emotions, a greater variability in the responses was observed, demonstrating that students have different emotional responses to the scenarios. The questions addressing the debriefing had positive results as well, indicating the students' satisfaction regarding this moment of final reflection.

In the block of general questions, "strongly agree" responses predominated, followed by "agree", across all statements. This demonstrates that students have a satisfactory self-perception of this methodology and its effects on learning both in establishing theoretical knowledge and in performance improvement, corroborating Ferreira (2015) findings, in which 98% of their sample affirmed liking simulation as a teaching methodology.[8] Also, the statistically significant finding (p-value = 0.022) comparing the *General Question Sum* and students' preference suggests a notable association. Higher scores on the *General Question Sum,* which reflects participants' evaluations of their learning experience, are linked to greater overall satisfaction and enjoyment of practical physiology classes. Although this study cannot determine causality, it raises the possibility that enhancing lower-scoring aspects, such as perceived knowledge gained, could potentially increase students' enjoyment of the class.

Further research in this area would be beneficial to explore potential causal relationships.

In the block referring to skills, there was also a concentration of "strongly agree" and "agree" responses, but with more balance between them, particularly in the questions addressing safety when performing the technique (34.7% and 37.2%, respectively) and development of resilience under stress (44.9% and 30.1%, respectively). This indicates a possible relationship between challenging emotions (insecurity and stress) and performance. The other statements in this section had a higher percentage of "strongly agree" responses, confirming students' positive perception of developing valuable skills. This result corroborates studies presented by Ferreira (2015), Madsgaards et al. (2021), and Yamane et al. (2019), which discuss how involving students in a faithful environment fosters the development of cognition, behavior, and technique in critical situations.[8, 11, 20]

When discussing the *Skills Sum* and students' preference for practical classes, the statistically significant association (p-value < 0.001) suggests several possible interpretations. One possibility is that students who enjoy the classes more may be inclined to dedicate additional effort, thereby improving their skills. Alternatively, students who develop higher skill levels may find the classes more enjoyable. While Fisher's exact test does not establish causality, it opens a discussion on how one variable might be associated with the other, which could inform strategies to enhance skill development and make practical sessions more effective and valuable. Understanding this connection could be crucial for refining the implementation of Simulation-Based Learning (SBL) in Human Physiology education.

In the Debriefing section, all statements received "strongly agree" responses in more than 70% of the cases, showing that the majority of students feel that this model is beneficial for their knowledge. Studies, such as Nascimento et al. (2020), demonstrate the importance of debriefing in cognitive and psychomotor skills' development, as the presence of more benefits than challenges.[5] This result demonstrates the importance of this moment and the role of the teacher as a facilitator of the learning process. Given the context in which the research was conducted (beginning of the medical course), these data may indicate that deliberate practice is more appropriate for this audience than SBL, as students are still inexperienced and require closer monitoring by a teacher. However, there is still a lack of studies comparing both methods in this environment.

Other data corroborate findings described in the literature, such as the observation that 83.7% of students fully agreed that errors made during the scenarios contributed to learning, as described by Dourado and Giannella (2014).[18] Furthermore, 79.6% of students fully agreed that the explanation provided by the teacher/facilitator during the debriefing was beneficial for learning, which is consistent with what Fukamizu et al. (2021) described.[9] Moreover, the debriefing may have a role of

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developing independence within the students, teaching them how to use their time and resources, how to be more efficient, and "how to learn", as mentioned by Duvivier et al. (2011).[21]

Regarding the inferential statistics between the *Debriefing Sum* and students' preferences for the class, the significant association (p-value < 0.001) suggests a potential dependence between these variables. One possible interpretation is that students may tend to prefer the class more if they perceive debriefing sessions as helpful in addressing their doubts, correcting mistakes, and enhancing their knowledge. Therefore, it could be hypothesized that improving the students' experience with debriefing sessions might increase their overall satisfaction and enjoyment of the classes.

The emotions block had the most diverse responses, mainly dealing with feelings such as nervousness, anxiety, and stress. It is possible to say that there was a great variety in the feelings experienced during the scenarios. The study by Madsgaard et al. (2021) corroborates these findings, explaining that SBL is a learning environment that can lead to the activation of emotions before, during and after the practice.[11] Observing the emotions considered positive for learning, such as motivation and interest, there is a high predominance of "strongly agree" responses. Regarding feeling motivated, 88.3% answered "strongly agree" or "agree". In regard to interest, 93.9% answered "strongly agree" and "agree", demonstrating that deliberate practice awakens students' desire to learn more about Human Physiology.

Positive emotions were significantly associated with students' preferences for the class (p-value < 0.001), indicating a relationship between the positive feelings students experienced and their enjoyment of the practical sessions, which aligns with expectations. It is already established that emotions affect cognition and memory and that they can be effective in learning self-regulation and clinical reasoning for medical students.[22] The positive perception of students' emotions is a factor that contributes to learning the subject, as demonstrated by Madsgaard et al. (2021),[11] and potentially influences joy and their preferences for the class.

In regards to challenging emotions, it was initially anticipated that the proportion of participants experiencing nervousness, anxiety, and stress would be higher than what was actually observed, given the complex scenarios and the typical inexperience of first-year medical students. Although the predominant response was "agree," with percentages of 36.7%, 37.8%, and 27.0%, respectively, these figures were still lower compared to responses in other sections, such as debriefing. The majority of participants' responses ranged from 'disagree' to "strongly agree." For those who experienced these emotions, this suggests that deliberate practice involves challenging contexts that push students out of their comfort zones, leading to discomfort for many participants. The variety in responses, as stated by Córdova et al. (2023),[14] may vary depending on the emotions' quality and intensity in each

situation, as well as the person's subjective evaluation. Therefore, factors such as personality, preference for active learning methods, confidence level, or previous experience with medical practice outside of simulation, may influence the responses. However, this study did not explore these potential variables, which presents a limitation and an opportunity for future research to investigate.

Negative emotions were not significantly related to students' preferences (p-value = 0.4), suggesting that an increase in negative feelings does not correspond to greater enjoyment of the class. This finding is also expected, as emotions such as stress and anxiety are typically uncomfortable and not conducive to enjoyment. Madsgaard et al. (2021) report that anxiety and excessive stress can limit students' ability to focus and accomplish tasks.[11] While these feelings may heighten attention and potentially enhance the learning process, they could also be linked to a reduction in students' well-being.[23] These emotions could also potentially result in a more negative perception of the class, as they may associate it with the uncomfortable experiences they encountered. However, this remains speculative, as it is not possible to establish causality.

Toufan N et al. (2023) describe emotions in education as a double-edged sword, with 'activating' feelings, such as curiosity and motivation, being allies in the process of acquiring knowledge, while 'inactivating' feelings, such as stress and anxiety, are harmful.[22] The research corroborates these findings, demonstrating that positive or 'activating' emotions are associated with class enjoyment and, consequently, with the learning experience and development of abilities. In contrast, negative or 'inactivating' emotions are not linked to class preference, being the only variable not associated statistically. An emotionally safe environment must be created so that feelings considered more challenging do not lead to blockage in learning, as it is known that emotions such as stress and nervousness can be harmful for students' performance and emotional wellbeing, according to Schaefer et al. (2017). Currently, achieving this balance represents a challenge when conducting the scenarios. SBL values an environment of safety, trust, and stimulation for learning even more than the skills and abilities developed, focusing on a comfortable learning process for students.[25]

Furthermore, responses related to students' self-confidence reflect the same pattern of challenging feelings during the scenarios. Less than half of the students feel self-confident (43.9%), having answered "agree" or "strongly agree" in the questionnaire. 32.1% are neutral, and 27% feel insecure when participating in the scenarios, having answered "strongly disagree" or "disagree". It can be said that, because the disciplines of Human Physiology I and II are in the second and third semesters, respectively, students are still very inexperienced in practice, and a lack of confidence in oneself is expected, increasing as one progresses in the course, as described by Yu et al. (2021).[23] One of the students addressed this point in the

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questionnaire's open-ended question: "As I had physiology in the first period, I feel that we are still very immature. Therefore, I would modify the period in which they are applied."

This study indicates that the implementation of deliberate practice from the beginning of the course could possibly serve as a tool to encourage the development of self-confidence and maturity in students early, as it is during practical experience that these qualities develop. It is essential to stimulate this progress through experience, as students with high self-confidence also improve their clinical skills and overall competence, according to Yu et al. (2021).[23] Moreover, in studies such as Keskitalo et al. (2021), SBL invoked mainly positive emotions, while negative emotions decreased to a mild degree during the educational course, and in Yu et al. (2021), after a simulation experience, students had less anxiety and more confidence before the second time compared to those without experience.[22, 26] These studies corroborate the hypothesis that SBL can be a tool for developing emotional balance from the beginning of the course, an essential characteristic for health professionals.

The similarities between the findings of this study and other studies in the medical literature, as mentioned above, demonstrate a pattern in students' perception regarding emotional response, skill development, and learning during the application of SBL. These consistencies contribute to confirming the veracity and applicability of previous results and to a possible generalization of new results to be confirmed with future studies in a broader context.

Despite the positive responses collected by the questionnaire on the use of deliberate practice in the Human Physiology discipline, other evaluation measures are necessary, in addition to the students' self-perception, to determine the effectiveness of this teaching method. Despite this limitation, the findings in this research, such as student interest and motivation, skill development, and perception of learning, are valuable. This positive perception of students undoubtedly contributes to better academic performance and better professional training, in addition to encouraging the continued use of SBL in this area, being seen as a useful and attractive tool for students.

Limitations and Strengths

This study has some limitations, including the lack of detailed demographic characterization of the participants and a restricted study population, as the research was conducted with a small sample that included only students from one college. To mitigate this limitation, a sample size was calculated based on the total number of students enrolled in the college, allowing for the possibility of generalizing the findings to the rest of the student body at that institution. However, future studies would benefit from analyzing larger and more diverse samples. There are also limitations in the variables used for the inferential statistical analysis. The variable *Do you like the practical classes of Human Physiology?* had 189 positive responses and only 9 negative,

which reduces the reliability and generalizability of the findings. The other variables used (*General Question Sum, Skills Sum, Debriefing Sum, Positive Emotions Sum, and Negative Emotions Sum*) also have limitations, as the categories used to classify the scores in each section were defined by the authors.

The strengths of this study encompass the inferential analysis with statistical significance in all sections of the study, except in the Negative Emotions block. They also include the research's focus on an innovative subject that requires further scientific development, as evidenced by the existing literature gap. Additionally, the study addresses the application of deliberate practice in Human Physiology, a potential tool for improving students' learning during their undergraduate studies. Finally, this study explores Simulation-Based Learning (SBL) from a new perspective, highlighting its impact on the emotional well-being of medical students, as well as on skills progression and learning.

Conclusion

The application of this methodology in teaching Human Physiology during the medical course at a private school in Belo Horizonte showed positive results in terms of student perception. Regarding skill development, most students felt that deliberate practice facilitated the development of quick decision-making, teamwork, applied reasoning and professional leadership. Furthermore, they reported feeling motivated and interested during the scenarios, in addition to feeling that they learn from the debriefing and from their mistakes during the scenarios.

Its application in disciplines in the beginning of the medical program, such as Human Physiology, is beneficial, as it makes the teaching experience more dynamic and engaging for students, arising interest and curiosity, and creating opportunities for the development of essential skills for the daily lives of healthcare professionals. Finally, creating scenarios that evoke a wide variety of emotions is positive for learning, but it is necessary to ensure that students feel emotionally safe, in order to prevent feelings, such as stress and anxiety from occurring in excess, which constitutes a challenge to be addressed.

Summary – Accelerating Translation

A Aplicação de Prática Deliberada no Ensino de Fisiologia Humana Durante o Curso de Medicina: Um Estudo Qualitativo Observacional
O ensino baseado em simulação (SBL) é um tipo de metodologia ativa de ensino, em que os estudantes são inseridos em cenários práticos que mimetizam a sua realidade profissional. Muitos estudos científicos já abordaram a importância da simulação no ensino em saúde, principalmente devido a seus inúmeros benefícios para a consolidação do conteúdo aprendido em sala de aula, além da contribuição para o desenvolvimento de habilidades valiosas como trabalho em equipe, proatividade, liderança, raciocínio aplicado, entre outras. Ademais, as aulas de simulação são importantes, principalmente no contexto de saúde, pois permitem que os alunos treinem as técnicas e habilidades e as aprimorem antes de realmente intervir em pacientes, diminuindo a exposição dos indivíduos a riscos e aos erros médicos. Porém, a prática deliberada, um tipo de ensino baseado em simulação, ainda é pouco utilizada no contexto da educação em saúde, e se concentra principalmente em níveis mais avançados, como na pós-graduação e nas especializações, por exemplo, abordando técnicas como cirurgias. Ainda

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existe uma carência de estudos abordando a SBL e seus efeitos no aprendizado, bem-estar emocional e desenvolvimento de habilidades, principalmente no contexto da graduação. O presente estudo pode contribuir para a diminuição dessa lacuna na literatura e para o desenvolvimento de técnicas de ensino como a SBL.

O objetivo principal deste projeto foi investigar a percepção dos alunos sobre o SBL e como isso afeta o processo de aprendizagem, além de determinar a eficácia do ensino de fisiologia médica baseado em simulação realística e métodos de prática deliberada para o aprendizado de estudantes de medicina. Os objetivos específicos foram: verificar o engajamento dos graduandos nos cenários e estabelecer as vantagens e desvantagens da implementação da SBL e da prática deliberada desde o início do curso médico.

Pensando nisso, essa pesquisa buscou avaliar a eficácia da aplicação da prática deliberada no ensino de Fisiologia Humana em um curso de medicina em uma faculdade privada de Belo Horizonte e como ela impacta o bem-estar emocional dos alunos. Essa disciplina é ministrada no ciclo básico do curso, ou seja, nos dois primeiros anos, e os cenários de simulação são um dos primeiros contatos que esses alunos têm com uma versão semelhante da prática clínica do dia a dia de um profissional da saúde. Devido ao fato de que, em sua maioria, esses alunos são jovens e ainda inexperientes, essa metodologia é uma oportunidade de estimular aspectos importantes, como responsabilidade sobre o próprio estudo, tomada rápida de decisão, resiliência sob estresse e maturidade emocional.

Diversos estudos abordando o aspecto emocional do ensino tiveram resultados demonstrando que sentimentos desafiadores como estresse e ansiedade, se em excesso, podem prejudicar a aquisição de conhecimento. Porém, pesquisas abordando a SBL especificamente mostraram que à medida em que os cenários de simulação foram sendo aplicados, os estudantes desenvolveram cada vez mais confiança e foram adquirindo equilíbrio emocional mesmo sob situações desafiadoras. Para entender mais sobre o impacto dessa metodologia, foi desenvolvido um questionário abordando a prática deliberada de acordo com a Escala de Likert, em que se apresenta uma afirmação e os participantes respondem de 1 a 5, sendo: 1 Discordo totalmente; 2 Discordo; 3 Indiferent (ou neutro); 4 Concordo e 5 Concordo totalmente.

O questionário foi dividido em 5 áreas principais: perguntas gerais, habilidades, emoções, debriefing e opinião pessoal. A pesquisa foi aprovada pelo CEP (Conselho de Ética em Pesquisa) da faculdade antes de ser iniciada. O questionário foi aplicado em estudantes de uma faculdade de medicina de Belo Horizonte que se encaixavam nos critérios de inclusão da pesquisa: terem mais de 18 anos, serem alunos da faculdade estudada, terem tido aulas de prática deliberada na disciplina de fisiologia Humana I ou II e responderem o questionário de forma completa. O total de alunos da faculdade em questão era de aproximadamente 2.000 alunos e o questionário recebeu 198 respostas, sendo aproximadamente 10%. Todas as respostas foram analisadas.

Foi realizada uma análise estatística inferencial, utilizando o Teste Exato de Fischer em um nível de significância 0.05, para avaliar a associação entre as variáveis categoricas. As respostas de cada seção foram organizadas de acordo com os seus valores correspondentes na escala de Likert. A primeira sessão, por exemplo, incluia 5 perguntas, entao o score total varia de 5 a 25, e as categorias utilizadas foram: 5 – 15 (em sua maioria discordando da afimativa), 16 – 20 (em sua maioria respostas indiferentes ou pouco concordantes) e 21 – 25 (respostas concordando com a afirmativa). Esse modelo foi aplicado em todas as sessões, menos na sessão das Emoções, que foi subdividida em Emoções Positivas (motivação, interesse, autoconfiança) e Emoções Negativas (nervosismo, ansiedade e estresse). O Score dessas subsessões varia de 3 – 15 e ele foi subdividido em 3 – 7 (respostas discordantes), 8 – 11 (respostas neutras)

e 12 – 15 (respostas concordando com a afirmativa). Cada uma das categorias dessas seções foi então comparada usando o teste exato de Fisher com a variável *Você gosta das aulas práticas de Fisiologia Humana?* que teve uma resposta binária "sim" ou "não". Os resultados da análise foram então organizados em tabelas para demonstrar os achados.

Em 4 das 5 perguntas do bloco de perguntas gerais houve mais de 60% de respostas número 5 (concordo totalmente). 83,7% dos alunos concordam totalmente com a afirmativa: "O acesso a simulação realística contribui para o seu aprendizado de Fisiologia Humana".

Em relação ao bloco de perguntas abordando as emoções, 78,1% dos alunos concordam totalmente com a afirmativa de que se sentem interessados durante os cenários. 25% dos alunos concordam totalmente que se sentem nervosos e 26% concordam totalmente que as emoções interferem na performance durante a prática.

Na sessão de perguntas sobre habilidades, 66,8% concordam totalmente com a afirmativa "você desenvolve trabalho em equipe com os cenários" e 65,8% concordam totalmente que eles desenvolvem raciocínio aplicado durante as aulas práticas.

O debriefing é o momento final da prática deliberada, em que o professor se reúne com os alunos depois dos cenários e procura instigar uma reflexão sobre os erros e os acertos, além de oferecer feedback útil e individualizado sobre possíveis pontos de melhoria para futuras práticas. No bloco de perguntas sobre o debriefing, 79,6% dos alunos concordaram totalmente com a afirmativa: "A explicação provida pelo professor durante o debriefing é benéfico para o aprendizado" e 83,7% concordam totalmente que "Os erros cometidos durante os cenários contribuem para o aprendizado".

E, por fim, a última parte do questionário foi sobre opiniões pessoais. 86,7% votaram sim para a afirmação "Você gosta das aulas de fisiologia?" e 13,3% votaram não. 95,4% votaram sim na afirmativa "Você gosta das aulas práticas de fisiologia?" e 4,6% votaram não. A última pergunta "Você mudaria alguma coisa na aplicação dos cenários?" foi discursiva e opcional, recebendo 72 respostas. A maioria dos participantes sugeriram mudanças para intensificar a aplicação dos cenários, inclusive aplicando-os em outras disciplinas.

Este estudo apresenta algumas limitações que incluem a falta de melhor caracterização demográfica dos participantes e a ausência de estatísticas inferenciais. Além disso, a pesquisa foi feita com uma amostra pequena, que incluiu apenas alunos de uma faculdade. Estudos futuros podem se beneficiar da análise de amostras maiores e mais variadas. Os pontos fortes englobam a análise inferencial com significância estatística em todas as seções do estudo, exceto no bloco Emoções Negativas. Além disso, este projeto aborda um tema inovador que precisa ser mais desenvolvido cientificamente, como visto pela lacuna da literatura ainda existente em torno desse tema. Além disso, este estudo aborda a SBL em uma nova perspectiva, lançando luz sobre seu impacto no bem-estar emocional de estudantes de medicina, bem como na progressão de habilidades e aprendizagem.

A aplicação dessa metodologia no ensino de Fisiologia Humana durante o curso de medicina em uma faculdade de Belo Horizonte apresentou resultados positivos em termos de percepção dos alunos. Em relação ao desenvolvimento de habilidades, a maioria dos estudantes sentiram que a prática deliberada proporcionou o desenvolvimento de tomada rápida de decisão, trabalho em equipe, raciocínio aplicado e liderança profissional. Além disso, eles relatam se sentirem motivados e interessados durante os cenários, além de sentirem que aprendem com o debriefing e com seus erros durante os cenários. Houve significância estatística em todas as seções do estudo, exceto na seção de Emoções Negativas.

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Sua aplicação em disciplinas do ciclo básico da graduação em medicina, como a de Fisiologia Humana, pode ser benéfica, pois torna a experiência de ensino mais dinâmica e proveitosa para os alunos, despertando interesse e curiosidade, criando oportunidades para o desenvolvimento de habilidades essenciais para o dia a dia dos profissionais de saúde. Por

fim, criar cenários que despertem uma ampla variedade de emoções é positivo para a aprendizagem, porém é necessário garantir que eles se sintam seguros emocionalmente, a fim de não permitir que os sentimentos, como estresse e ansiedade, ocorram em excesso, constituindo um desafio a ser enfrentado para a manutenção da saúde mental dos alunos.

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A Cross-Sectional Institutional Survey of Depression, Suicidal Ideation, and Stigma in Medical Students

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Abstract

Background: Due to high rates of depression and suicidal ideation among medical students, interventions, such as Pass/Fail grading systems and peer-mentorship, have been implemented, but their effects not reported. The purpose of this study was to explore variations in depression severity among medical students and to better understand the related stigma in healthcare over the past decade, with the aim of enhancing medical education. **Methods:** A cross-sectional survey was conducted on REDCap across students at the University of Illinois College of Medicine. The severity of depression was measured by the PHQ-9. Stigma was assessed utilizing Likert scale responses. Demographics of students who are most likely to experience depression were collected. Additionally, clinical diagnoses of depression, treatment modalities, and alcohol use were compared. **Results:** There were 178 respondents with a 15% response rate. Thirty-nine (22%) respondents were classified in the moderate-to-severe depression group. Thirteen students, all female, endorsed suicidal ideation. A majority of respondents reported that depressed medical students would provide inferior patient care (n=71, 58%), their application to residency would be less competitive (n=76, 54%), they would feel embarrassed (n=88, 61%), and that it would be risky to reveal they have depression on a residency application (n=153, 94%). **Conclusions:** Depression, suicidal ideation, and stigmatization remain prevalent in medical students and may have worsened since 2010. New, multi-faceted approaches such as giving medical students the choice of mental health providers, providing clear information about documentation, and implementing personal, well-being goals are needed to reduce depression and stigma experienced by medical students.

Introduction

The culture of medicine is one of selflessness and invincibility,[1] where physicians dedicate their careers to treating the community. This culture, however, may exact a somber price with astonishingly high rates of mental illness. Medical education represents the first exposure to a challenging professional culture for many physicians where the confluence of academic medicine, accreditation organizations, and collaborative healthcare systems have been described as "indifferent to personal wellness."[2] Suicide is the second leading cause of death in individuals between ages 25 and 34 and the third leading cause of death between ages 15 and 24 in the U.S.[3] The average age of medical students (MSs) is 24,[4] in the highest risk group, at a time when they enter a field with prevalent burnout and suicide.[5] The physician suicide completion rate is almost two times greater than the general public.[5] Although the rate of suicide completion in MSs is less known,[6] they have higher rates of mood and anxiety disorders, as well as suicidal ideation (SI).

One systematic review using 24 cross-sectional studies reported a SI rate of 11% (range of 7% to 24%) in MSs.[7] In addition to fearing stigmatization from authority figures and society,[8] MSs avoid seeking medical attention, preferring to seek support from friends, family, and peers instead.[1] Untreated mental illness not only affects quality of life, but it may also put patients at risk due to decreased quality of care delivery.[5] Mental illness in this cohort contributes to public health concerns, as these are chronic illnesses, with comorbid conditions, that create an economic burden in the U.S.[9]

Stigma, or the feelings of blame and exclusion due to a person's distinct attributes or identification with a group, may be partially responsible for the alarmingly high rates of mental illness in MSs.[1] Students may experience stigmatization in the form of self-stigma, internal feelings of inadequacy, or from the result of socially misplaced external labels garnered from public stigma. In either scenario, little research has been conducted about possible interventions that might reduce stigma in medical education. Medical schools have responded to the mental health crisis with efforts to improve MS well-being during training. Some of these measures include transitioning to a Pass/Fail grading system, more collaborative curriculums, self-care workshops, resilience and mindfulness training, and peer-mentoring, among others.[10] Interestingly, the COVID-19 pandemic seems to have reduced some of the stigma associated with mental illness.[11]

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Figure 1. **Reported Types of (a) Treatment for Depression, (b) Impression of Peers' Depression, and (c) Impression of Therapy/Counseling in Medical Students at the University of Illinois College of Medicine.**

a)

b)

c)
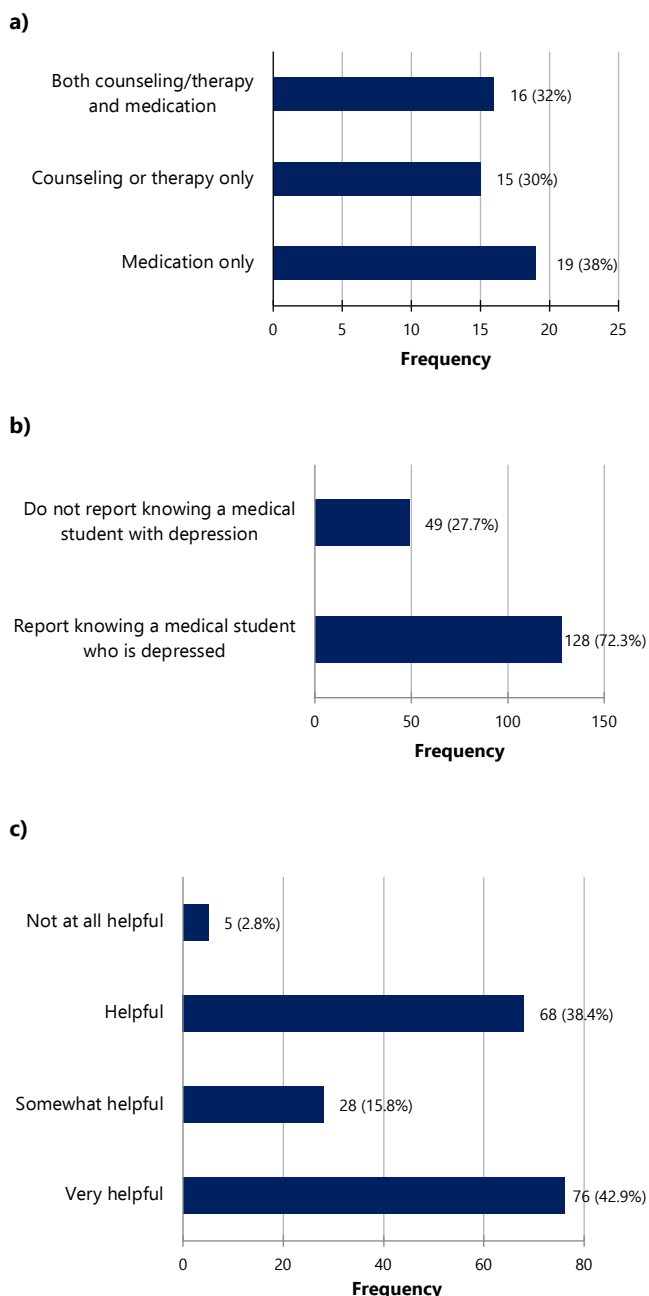
Legend: Figure 1a demonstrates that most medical students report not being depressed, and thus, are not receiving any treatment. The most common type of treatment was reported to be medication only (n=19, 10.7%) followed by counseling/therapy only (n=16, 9.0%). Fifteen students (8.5%) reported both taking medication and attending counseling/therapy for depression. Figure 1b illustrates that most students (n=128, 72.3%) reported knowing another medical student with depression. Figure 1c demonstrates most respondents reported that they believe counseling/therapy would be very helpful (n=76, 42.9%) or helpful (n=68, 38.4%) for those who are clinically depressed. Twenty-eight students (15.8%) reported they believe counseling/therapy would be somewhat helpful, and only 5 students reported they did not believe counseling/therapy would be helpful for those who are clinically depressed.

The primary objective of this study was to analyze the rates of depression, SI, and their associated stigma at one institution. Another objective of this study was to identify differences between individuals experiencing various levels of depression based on MS demographics. This study offers an opportunity to suggest additional improvements in medical education to reduce student depression and stigma.

Methods

Study Design and Ethical Approval

The methodology from a 2010 University of Michigan study entitled *Depression, stigma, and suicidal ideation in medical students* served as a template.[12] From February 2023 to November 2023, we conducted a cross-sectional survey (following STROBE protocol) at the University of Illinois College of Medicine's (UICOM) three campuses - Chicago, Peoria, and Rockford. More specifically, the survey was open from February 2nd to November 20th and data analysis was performed in early December 2023. We adapted the previously validated University of Michigan survey and added questions to gather information about gender identity, sexual orientation, and relationship status. Our study was approved by the UICOM Peoria Institutional Review Board ID 1984299-2. Prior to administration, we piloted the survey with three MSs at the Lewis Katz School of Medicine. To maximize the data gathered, we invited all MSs (n = 1186) from the three UICOM campuses to participate in the survey. The study population is a diverse range of students attending UICOM, a large, public, state-supported medical school. We solicited participation by email invitation and class social media channels. We used REDCap to obtain informed consent, complete the survey, and manage data collection. Completion of the survey was voluntary, but a financial lottery was used to recognize participation. Participants interested in being eligible for the lottery voluntarily provided an email, which was blinded to the study, and was only used to cross-check participation and to notify lottery winners. Emails were assigned a number, and three winning numbers were selected using a random number generator. Winners received gift cards of $50, $100, or $300 at the conclusion of the study. The responses to our survey were entirely anonymous, so specific resources could not be provided to high-risk participants. However, we provided all participants with a list of available mental health services on their respective campuses.

Survey Instrument

Our survey consisted of 84 questions/statements, which can be found in the ***Supplementary Material***. We asked general intake questions to identify the demographics of MSs who were most likely to experience depression. Responses were analyzed to detect differences of depression prevalence between classes and race, among others. We used the Patient Health Questionnaire-9 (PHQ-9), a brief, reliable and validated measure, endorsed by the National Institute for Health and Clinical Excellence,[13,14] to assess the severity of depression in participants with the following predetermined, validated cut-off scores: 0-4 for no/minimal

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Table 1. **Demographics of Medical Student Respondents at the University of Illinois College of Medicine (n=190).**

Variables	n (%)
Age	
18-20 years	1 (0.5)
21-25 years	100 (52.6)
26-30 years	70 (36.8)
>30 years	19 (10.0)
Sex	
Female	121 (63.7)
Male	69 (36.3)
Gender identity	
Cisgender Female	114 (60.0)
Cisgender Male	65 (34.2)
Non-Binary	6 (3.2)
Transgender Female	1 (0.5)
Other	4 (2.1)
Sexual orientation	
Heterosexual	138 (72.6)
Bisexual	27 (14.2)
Homosexual	12 (6.3)
Race	
Caucasian or White	103 (54.2)
Asian	43 (22.6)
African American or Black	24 (12.6)
Native Hawaiian or Other Pacific Islander	1 (0.5)
Some Other Race	14 (7.4)
Are you of Hispanic or Latino or Spanish Origin?	
No	163 (85.8)
Yes	27 (14.2)
Which religion or belief system do you identify with?	
Christianity	62 (32.6%)
Atheism	29 (15.3%)
Agnosticism	23 (12.1%)
I would prefer not to answer	21 (11.1%)
Agnosticism; Christianity	10 (5.3%)
Islam	8 (4.2%)
Judaism	8 (4.2%)
Other	8 (4.2%)
Relationship status	
Single	86 (45.3)
In a committed relationship/Married	101 (53.1)
Separated/Divorced	3 (1.6)
Children	
None	184 (96.8)
One-Two	6 (3.2)
Is your biological mother or father a physician?	
One is a physician	17 (8.9)
Both are physicians	9 (4.7)
Neither are physicians	164 (86.3)
Which campus do you attend?	
Chicago	90 (47.4)
Peoria	70 (36.8)
Rockford	30 (15.8)
Year in medical school	
M1	73 (38.4)
M2	52 (27.4)
M3	34 (17.9)
M4	31 (16.3)
Intended medical specialty	
Hospital-based discipline (i.e. radiology; pathology, etc.)	24 (12.6)
Medical or pediatric specialty (i.e. pediatric cardiology, etc.)	37 (19.5)
Primary care (i.e; family medicine; internal medicine, etc.)	55 (28.9)
Surgical specialty (i.e. surgery; obstetrics/gynecology, etc.)	37 (19.5)
Undecided	34 (17.9)
Other	3 (1.6)

Table 2. **Likert Scale Responses of Medical Students' Anecdotal Experiences Throughout Medical School (n=190).**

Variables	n (%)
Q16. The stress of medical school depends mostly on my current sequence/rotation	
Strongly disagree	3 (1.6)
Disagree	22 (11.6)
Neither agree nor disagree	41 (21.6)
Agree	96 (50.5)
Strongly agree	28 (14.7)
Q17. My financial situation is a source of significant stress	
Strongly disagree	10 (5.6)
Disagree	29 (16.4)
Neither agree nor disagree	28 (15.8)
Agree	75 (42.4)
Strongly agree	35 (19.8)
Missing	13
Q18. Do you get the help and support you need from your family members and friends	
Strongly disagree	1 (0.6)
Disagree	15 (8.5)
Neither agree nor disagree	16 (9.0)
Agree	77 (43.5)
Strongly agree	68 (38.4)
Missing	13
Q19. Do you get the help and support you need from your fellow medical students	
Strongly disagree	8 (4.5)
Disagree	16 (9.0)
Neither agree nor disagree	39 (22.0)
Agree	81 (45.8)
Strongly agree	33 (18.6)
Missing	13
Q20. Do you get the help and support you need from the University of Illinois Medical School	
Strongly disagree	9 (5.1)
Disagree	41 (23.2)
Neither agree nor disagree	50 (28.2)
Agree	65 (36.7)
Strongly agree	12 (6.8)
Missing	13
Q21. Too much of my happiness has been sacrificed to attend medical school	
Strongly disagree	29 (16.4)
Disagree	63 (35.6)
Neither agree nor disagree	35 (19.8)
Agree	36 (20.3)
Strongly agree	14 (7.9)
Missing	13
Q22. I feel alone	
Strongly disagree	41 (23.2)
Disagree	41 (23.2)
Neither agree nor disagree	33 (18.6)
Agree	46 (26.0)
Strongly agree	16 (9.0)
Missing	13

depression, 5-9 for mild depression, 10-14 for moderate depression, 15-19 for moderately severe depression, and 20-27 for severe depression. We grouped the students into three categories: no/minimal depression (0-4), mild depression (5-9), and moderate-to-severe depression (10-27).

To assess stigma, we used a Likert scale, a common method of measurement in psychology that offers the advantage of

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assessing subjective emotions across a continuum.[15] The Likert responses ranged from 1 (very strongly disagree) to 9 (very strongly agree). We asked additional questions to assess clinical diagnoses of depression, treatment modalities, alcohol use, and coping skills. We employed a cross-sectional survey because it is a cost-effective and efficient means of gathering data from a potentially large pool of subjects while allowing for various comparisons and outcomes.

Statistical Analysis

The data was blinded prior to statistical analysis. We calculated frequencies and percentages for all variables of interest. The prevalence of mild and moderate-to-severe depression is reported with 95% confidence intervals. We examined the association between depression severity and SI and respondent characteristics by using a Chi-Square test or exact Chi-square test. We also investigated the association of depression severity and SI by diagnosis and treatment history using a Chi-Square test or exact Chi-square test. Additionally, we compared stigma responses among the three depression severity groups using a Chi-Square test or exact Chi-square test. We used the Bonferroni method as an adjustment for multiple comparisons. We considered results with a P-value of less than 0.05 as statistically significant, except for **Table 5**, where a P-value less than 0.002 was considered statistically significant. We performed all statistical analyses using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

While percentages and frequencies were collected for all 84 variables of interest, only significant results are reported. Of the 191 responses received, 178 participants (n=178) completed the entire survey, resulting in a participant response rate of 15%. The demographics of participant respondents can be found in **Table 1**. Notable findings include that most respondents were female, first-year students, and 21-25 years old **Table 1**. **Table 2** illustrates participant opinion data collected on medical school experience. **Figure 1** demonstrates medical students' impression of their peers' depression and the effect of counseling. **Table 3** displays depression PHQ-9 scores by respondent characteristics. Importantly, there was a statistically significant difference between PHQ-9 scores and self-reported respondent race (95% CI for difference, 6.8-31.4; p = 0.029) **Table 3**. Also, there was a statistically significant difference between SI in males and females (p = 0.010). Of those who responded, thirteen (7%) students endorsed SI, and 7 (4%) students endorsed having a plan of suicide during medical school. All 13 students who endorsed SI were female.

Table 4 illustrates the rates of diagnosis and treatment for major depressive disorder (MDD) based on PHQ-9 scores. Interestingly, respondents who reported mild depression and have been diagnosed with MDD in the past were more likely than the respondents with moderate-severe depression to receive treatment for their depression in the present (95% CI for difference, -1.9-22.9; p < 0.001) and in the past (95% CI for difference, -5.1-25.1; p = 0.002) **Table 4**. **Table 5** displays a comparison of responses regarding the stigma associated with depression in MSs based on the severity of respondent depression.

Table 3. Depression PHQ-9 Scores by Medical Student Demographic Characteristics at the University of Illinois College of Medicine School.

Variables	Total n=177(%)	None to minimal n=81(%)	Mild n=57(%)	Moderate to severe n=39(%)	P Value	95% CI [a]	
Year in medical school					0.659*		
M1	69 (100)	34 (49.3)	24 (34.8)	11 (15.9)		-5.8	21.0 [b]
M2	49 (100)	22 (44.9)	15 (30.6)	12 (24.5)			
M3	32 (100)	12 (37.5)	12 (37.5)	8 (25.0)			
M4	27 (100)	13 (48.1)	6 (22.2)	8 (29.6)			
Sex					0.105*		
Female	111 (100)	44 (39.6)	40 (36.0)	27 (24.3)		-18.4	6.1
Male	66 (100)	37 (56.1)	17 (25.8)	12 (18.2)			
Race					0.029*+		
African American or Black	21 (100)	8 (38.1)	8 (38.1)	5 (23.8)		6.8	31.4 [c]
Asian	40 (100)	16 (40.0)	12 (30.0)	12 (30.0)			
Caucasian or White	97 (100)	52 (53.6)	32 (33.0)	13 (13.4)			
Some Other Race	19 (100)	5 (26.3)	5 (26.3)	9 (47.4)			
Are you of Hispanic or Latino or Spanish Origin?					0.584*		
No	150 (100)	70 (46.7)	46 (30.7)	34 (22.7)		-20.3	12.0
Yes	27 (100)	11 (40.7)	11 (40.7)	5 (18.5)			
Seriously considered committing suicide					0.007*+		
No	164 (100)	79 (48.2)	53 (32.3)	32 (19.5)		6.6	62.1
Yes	13 (100)	2 (15.4)	4 (30.8)	7 (53.8)			
Considered dropping out of medical school					<0.001*		
No	129 (100)	72 (55.8)	38 (29.5)	19 (14.7)		11.7	42.2
Yes	48 (100)	9 (18.8)	19 (39.6)	20 (41.7)			

Legend: a: 95% CIs for differences in the proportion of moderately or severely depressed individuals between subgroups characterized by the respective row categories, b: Comparison by year in medical school, coded 1 for first or second year and 2 for third or fourth year, c: Results shown for comparison by race, coded 1 for white and 2 for Other. +Exact test, *Chi-square test.

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Table 4. Rates of Diagnosis and Treatment for Major Depressive Disorder Amongst University of Illinois College of Medicine Students Based on PHQ-9 Scores.

Variables	Total n=177(%)	None to minimal n=81(%)	Mild n=57(%)	Moderate to severe n=39(%)	P Value	95% CI [a]	
Q33 Have you ever been diagnosed with MDD which is informally referred to as depression?					0.008*		
No	139 (100)	72 (51.8)	39 (28.1)	28 (20.1)		-7.1	24.7
Yes	38 (100)	9 (23.7)	18 (47.4)	11 (28.9)			
Q34 Are you currently diagnosed with MDD/depression?					0.009*		
No	149 (100)	75 (50.3)	46 (30.9)	28 (18.8)		1.4	39.6
Yes	28 (100)	6 (21.4)	11 (39.3)	11 (39.3)			
Q35 Have you ever felt you were seriously depressed even if not diagnosed?					<0.001*		
No	76 (100)	48 (63.2)	17 (22.4)	11 (14.5)		1.5	25.0
Yes	101 (100)	33 (32.7)	40 (39.6)	28 (27.7)			
Q36 Have you sought prior treatment for depression?					<0.001*		
No	98 (100)	62 (63.3)	19 (19.4)	17 (17.3)		-1.9	22.9
Yes	79 (100)	19 (24.1)	38 (48.1)	22 (27.8)			
Q38 Are you currently receiving treatment for depression?					0.002*		
No	133 (100)	71 (53.4)	36 (27.1)	26 (19.5)		-5.1	25.1
Yes	44 (100)	10 (22.7)	21 (47.7)	13 (29.5)			

Legend: a: 95% CIs for the difference in the proportion of moderately or severely depressed individuals between subgroups characterized by the respective row categories, +Exact test, *Chi-square test.

There was a statistically significant difference across the three groups of depression severity with regard to stigma in Q79 (95% CI for difference, 19.17-55.75; p < .001). Hence, people who had higher rates of depression were more likely to agree that those who were depressed were less able to cope **Table 5**.

Another statistically significant difference was found between respondents who identified as male and female for Q82, "Medical students with depression are dangerous to their patients" (p = 0.01). Respondent males agreed more often (n=7, 14%) than females (n=2, 2%), **Table 5**.

As shown in the **Supplementary Material**, participants were offered four options about the state of depression during medical school with "I am not depressed," the most common answer. The other three options were that their depression had become "Better," "Worse," or "Neither better nor worse." Nearly a third (n=56, 32%) of respondents answered that their depression had worsened since the start of medical school. Notably, over half of participants (n=93, 53%) reported alcohol binge drinking in the month before the survey. Binge drinking was defined as greater or equal to four drinks for women and five drinks for men.[16] Forty-three (24%) respondents endorsed binge drinking on more than or equal to three occasions in the prior month.

Discussion
Depression
One significant insight from our study is the overwhelming number of MSs with depression. According to the National Survey on Drug Use and Health, from 2015-2020, the prevalence of depression in the general U.S. population (≥12 years old) is 9% and for those between ages 18 and 25, it is 17%.[17] By comparison, our survey involving mostly participants aged 21 to 25 shows an absolute mild depression rate of 33% and a moderate-to-severe

depression rate of 22% **Table 3**. The much higher rates of depression, possibly caused by stress from intense academic rigor,[18] reported by MSs deserve attention because of potentially serious consequences, such as dropping out, suicide,[2] and suboptimal patient care.[19] Notably, nearly one-third (n=56, 32%) of student participants answered that their depression had worsened after they began medical school. The exact cause for this worsening is unknown, but Cook and Aurora theorized that student mistreatment may play a role. Mistreatment includes racial and gender discrimination, and humiliation, perpetrated by attendings, residents, auxiliary staff, and other MSs.[20] Other contributing causes and associations, such as student personality traits, curricular changes, and changing perceptions of success, have been considered but the results are mixed.[21]

Stigma
Our study offers important insight into MS stigma around depression. Most student respondents reported that depressed MSs would provide inferior treatment (n=71, 58%), their application to residency would be less competitive than their peers (n=76, 54%), they would feel embarrassed/ashamed (n=88, 61%), and that it would be risky to reveal they have depression on a residency application (n=153, 94%). In contrast, 167 (99%) participants disagreed that depression is a sign of personal weakness. That is, while students do not believe that depression is a weakness, they nevertheless view it as a significant barrier. Such contrast between internalized feelings and externalized expectations likely propagates the already established stigma of mental illness in medical schools.[22] The stigma around mental illness remains prevalent in medical schools. The effect of this stigma may discourage students from receiving treatment.[23] According to Suwalska, MSs believed that receiving treatment for depression would be risky and identified self-stigmatization itself as a barrier.[24] Interestingly, 33 (21%) student respondents in our

Table 5. University of Illinois College of Medicine Students' Likert Scale Responses Regarding Stigma Associated with Mental Health.

Variables	Total n [c] (%)	None to minimal n (%)	Mild n (%)	Moderate to severe n (%)	P Value[a]	95% CI [b]	
Q58 Telling a counselor I am depressed would be risky.					0.152 [*]		
Disagree	122 (78.7)	63 (85.1)	34 (70.8)	25 (75.8)		-7.34	26.1
Agree	33 (21.3)	11 (14.9)	14 (29.2)	8 (24.2)			
Q59 My teachers would not ignore me or take me any less seriously if I were depressed.					0.092 [*]		
Disagree	57 (41.6)	22 (32.4)	20 (50.0)	15 (51.7)		-40.69	1.95
Agree	80 (58.4)	46 (67.6)	20 (50.0)	14 (48.3)			
Q60 Medical students with depression could snap out of it if they wanted to do so.					0.500 [* +]		
Disagree	168 (98.8)	78 (100.0)	56 (98.2)	34 (97.1)		-2.66	8.38
Agree	2 (1.2)	0 (0.0)	1 (1.8)	1 (2.9)			
Q61 Most people believe that depressed medical students would provide inferior treatment to their patients.					0.348 [*]		
Disagree	51 (41.8)	23 (45.1)	20 (45.5)	8 (29.6)		-6.51	37.45
Agree	71 (58.2)	28 (54.9)	24 (54.5)	19 (70.4)			
Q62 Other students would stop including me in social activities if they discovered that I was depressed.					0.201 [* +]		
Disagree	141 (88.7)	70 (90.9)	43 (91.5)	28 (80.0)		-3.82	25.63
Agree	18 (11.3)	7 (9.1)	4 (8.5)	7 (20.0)			
Q63 If I were depressed, I would tell my medical school friends.					0.276 [*]		
Disagree	69 (46.9)	25 (40.3)	24 (48.0)	20 (57.1)		-37.26	3.62
Agree	78 (53.1)	37 (59.7)	26 (52.0)	15 (42.9)			
Q64 If I were depressed and asked for help, I would be admitting that my coping skills are inadequate.					0.068 [*]		
Disagree	109 (74.7)	54 (83.1)	30 (63.8)	25 (73.5)		-7.86	26.95
Agree	37 (25.3)	11 (16.9)	17 (36.2)	9 (26.5)			
Q65 If I were depressed, I would worry that I would miss out on educational opportunities.					0.921 [*]		
Disagree	36 (23.1)	16 (22.5)	12 (22.2)	8 (25.8)		-21.48	14.94
Agree	120 (76.9)	55 (77.5)	42 (77.8)	23 (74.2)			
Q66 Depression is a real medical illness.					0.599 [* +]		
Disagree	3 (1.7)	2 (2.5)	0 (0.0)	1 (2.6)		-6.09	5.96
Agree	173 (98.3)	78 (97.5)	57 (100.0)	38 (97.4)			
Q67 A medical student who sees a counselor is admitting that he/she is unable to handle the stress of medical school.					0.056 [* +]		
Disagree	158 (95.8)	75 (98.7)	50 (96.2)	33 (89.2)		-0.83	19.82
Agree	7 (4.2)	1 (1.3)	2 (3.8)	4 (10.8)			
Q68 Medical students with depression are not worth the time and resources for medical school teaching.					0.010 [* +]		
Disagree	173 (98.3)	80 (100.0)	57 (100.0)	36 (92.3)		-0.67	16.06
Agree	3 (1.7)	0 (0.0)	0 (0.0)	3 (7.7)			
Q69 Most medical students would not want to work with a medical student who is depressed.					0.503 [* +]		
Disagree	136 (88.9)	62 (88.6)	48 (92.3)	26 (83.9)		-10.24	19.64
Agree	17 (11.1)	8 (11.4)	4 (7.7)	5 (16.1)			
Q70 If I were depressed and applying to a residency, my application would be less competitive than that of a student who does not have depression.					0.033 [*]		
Disagree	66 (46.5)	36 (52.9)	22 (51.2)	8 (25.8)		7.69	46.58
Agree	76 (53.5)	32 (47.1)	21 (48.8)	23 (74.2)			
Q71 If I were depressed, I would not feel embarrassed or ashamed.					0.380 [*]		

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Disagree	88 (61.1)	38 (60.3)	32 (68.1)	18 (52.9)		-13.3	28.05
Agree	56 (38.9)	25 (39.7)	15 (31.9)	16 (47.1)			
Q72 If I were depressed, I would worry that my medical student friends who knew would tell other students or faculty.					0.042 *		
Disagree	105 (68.2)	54 (77.1)	33 (66.0)	18 (52.9)		4.75	43.65
Agree	49 (31.8)	16 (22.9)	17 (34.0)	16 (47.1)			
Q73 Depression is a sign of personal weakness.					0.047 * +		
Disagree	167 (98.8)	77 (100.0)	55 (100.0)	35 (94.6)		-1.88	12.69
Agree	2 (1.2)	0 (0.0)	0 (0.0)	2 (5.4)			
Q74 Medical students with depression are NOT to blame for their problems.					0.286 * +		
Disagree	7 (4.5)	3 (4.4)	4 (7.4)	0 (0.0)		-0.47	9.29
Agree	148 (95.5)	65 (95.6)	50 (92.6)	33 (100.0)			
Q75 A depressed medical student is worth the investment of medical school teaching time and effort.					0.702 * +		
Disagree	2 (1.2)	1 (1.3)	0 (0.0)	1 (2.6)		-7.02	4.35
Agree	170 (98.8)	76 (98.7)	57 (100.0)	37 (97.4)			
Q76 Medical students and faculty members believe that a student who has depression is just as intelligent as other students.					0.022 * +		
Disagree	16 (11.3)	5 (7.4)	3 (7.1)	8 (25.0)		-33.88	-1.41
Agree	126 (88.7)	63 (92.6)	39 (92.9)	24 (75.0)			
Q77 If I were depressed it would be risky to reveal my depression on my residency application.					0.905 * +		
Disagree	9 (5.6)	5 (6.8)	2 (3.8)	2 (5.6)		-8.17	10.76
Agree	153 (94.4)	68 (93.2)	51 (96.2)	34 (94.4)			
Q78 If I were depressed, I would seek treatment.					0.181 * +		
Disagree	15 (10.6)	4 (5.9)	6 (12.8)	5 (18.5)		-28.32	3.05
Agree	127 (89.4)	64 (94.1)	41 (87.2)	22 (81.5)			
Q79 If I were depressed, I would be blamed for being unable to cope.					<.001 *		
Disagree	111 (75.5)	56 (88.9)	37 (75.5)	18 (51.4)		19.17	55.75
Agree	36 (24.5)	7 (11.1)	12 (24.5)	17 (48.6)			
Q80 Seeking help for depression would make me feel less intelligent as a medical student.					0.082 *		
Disagree	125 (79.6)	61 (84.7)	40 (81.6)	24 (66.7)		0.56	35.55
Agree	32 (20.4)	11 (15.3)	9 (18.4)	12 (33.3)			
Q81 Other students and faculty members would view me as unable to handle my responsibilities if I were depressed.					0.067 *		
Disagree	86 (59.7)	45 (68.2)	26 (59.1)	15 (44.1)		3.94	44.18
Agree	58 (40.3)	21 (31.8)	18 (40.9)	19 (55.9)			
Q82 Medical students with depression are dangerous to their patients.					0.148 * +		
Disagree	138 (93.9)	59 (89.4)	50 (98.0)	29 (96.7)		-17.09	2.55
Agree	9 (6.1)	7 (10.6)	1 (2.0)	1 (3.3)			
Q83 If I were depressed, I would be unable to complete medical school tasks and responsibilities as					0.456 *		
Disagree	57 (38.8)	22 (34.4)	22 (45.8)	13 (37.1)		-22.56	17.02
Agree	90 (61.2)	42 (65.6)	26 (54.2)	22 (62.9)			
Q84 If I were depressed, fellow medical students would respect my opinions less.					0.013 * +		
Disagree	124 (85.5)	59 (90.8)	42 (89.4)	23 (69.7)		3.89	38.26
Agree	21 (14.5)	6 (9.2)	5 (10.6)	10 (30.3)			

Legend: a: Significant using the Bonferroni adjustment for multiple comparisons (P < .002), b: 95% CIs for difference in the rate of agreement between moderately or severely depressed and no or minimally depressed individuals, c: Responses of "strongly agree" and "agree" were recoded as "agree," and responses of "strongly disagree" and "disagree" were recoded as "disagree." Responses of "neither disagree nor agree" were excluded from the analysis, +Exact test, *Chi-square test

study reported that telling a counselor they are depressed would be risky, similar to the 22% of student respondents in the Michigan study.[12] Moreover, while 101 (57%) student respondents reported that they have felt seriously depressed in

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the past, only 79 (44%) student participants have sought prior treatment, even when 82% reported that treatment for depression would be either helpful or very helpful (*Figure 1*). This supports the aforementioned disparity of treatment of mental illness in MSs. A corollary involves reduced quality of care in the context of stigma about mental illness.[25] One study assessed why MSs were undertreated for their depression. The reasons included lack of time, inadequate resources, fear of negative impact on career, fear that treatment would be noted in their academic record, and fear that treatment would not help.[26]

Comparison to Previous Studies

The absolute rate of depression, SI, and stigma in UICOM's MS population echoes the findings of other studies, including the Michigan study, which found that 14% of respondents had moderate-to-severe depression, and 22 (4%) respondents reported SI.[12] In our study, 39 (22%) student respondents had moderate-to-severe depression, and 13 (7%) reported SI. These findings suggest that well-intended efforts to reduce depression and SI in MSs may be less successful than hoped. For example, in efforts to address student well-being, UICOM employs a Pass/Fail grading system during the first two years, offers an integrated curriculum with workshops about mindfulness training, peer-mentoring, and self-care, and shifted from lecture-based to collaborative learning in 2017.[9,19] Nair et al. discuss that tools learned through such programs and workshops are insufficient. She proposes systemwide changes that enhance efficiency and balanced workloads, thereby preventing "moral injury."[18]

A comparison of the overall SI rate in our and the University of Michigan study shows similar rates. The two studies are more than a decade apart, so the persistence of such high rates is concerning. However, direct comparisons of the results must be approached with caution as several covariates and confounding variables cannot be accounted for between two different institutions at two different times. Suicide risk factors in the medical student environment include both static and dynamic risk factors.[27] Yet, efforts to reduce depression, as noted, may not be as effective as intended. An additional stressor might be the COVID-19 pandemic. It is well known that the pandemic had a negative effect on the general population's mental health, but the impact was even greater on MSs.[28] A meta-analysis of 201 studies demonstrated that during the pandemic, the prevalence of depression and SI was reported to be 41% and 15%, respectively; 81 of the studies showed a high moderate-severe depression prevalence of 27%.[28] COVID-19 is likely to have had lasting negative effects on mental illness and may explain why MS SI rates have remained persistently high.

Coping Mechanisms

Our study revealed another important finding – MSs reported an unhealthy coping mechanism, binge drinking, at high rates. Numerous studies report greater rates of binge drinking among MSs compared to the general population.[29,30] We report that 93 (53%) participants reporting binge drinking within a month of taking the survey. Binge drinking may be linked with depression,

although which is causative of the other is uncertain.[30] Other reasons MSs have higher rates of binge drinking may include stress from academic pressure, social issues, and financial problems.[30–32]

Efforts to Reduce Depression

Although prior efforts to reduce the rate and severity of MS depression have had mixed results, the need remains. According to Moir et al., student participation in the creation and implementation of exercises such as self-care diaries, well-being goals, and reflective writing may be necessary to be effective. Other suggestions include the use of mindfulness, self-management, and self-awareness strategies that may help MSs with high emotional intelligence. Moir's group also suggests giving students a choice of mental health providers or services and open transparency in the documentation.[33] Resilience leads to lower rates of burnout, so this, too, should be promoted in MSs while recognizing that internal coping mechanisms alone may be inadequate.[18] Ways to enhance resilience in MSs include employing a variety of self-care practices.[34] Some academic institutions have implemented psychoeducation and contact-based interventions to reduce the stigma associated with mental illness. Policy-maker involvement may also help combat stigma in academic institutions.[34,35]

Limitations and Future Directions

Our study offers information about MS depression, stigma, and coping mechanisms, among other data. Our cross-sectional study does come with the toll of the reduced ability to make causal inferences, susceptibility of report, sampling, and other biases, and the limitations in determining trends, among others. The use of a survey inevitably introduces bias, including the potential for response bias, non-response bias, selection bias, confirmation bias, social desirability bias, and sampling bias. To mitigate these unavoidable biases, we omitted or reframed questions that were leading, loaded, absolute, or unclear. Additionally, the effect of depression on the study cohort is unknown. Some of the potential participants may have been unmotivated to participate due to depressive symptoms, whereas others may have felt compelled to volunteer for the study to combat their own depression or others.' An additional limitation of the cross-sectional study design is its inability to capture longitudinal changes over time or indicate causality. Another limitation is the small 15% response rate, although this is not too different from other MS survey rates and the absolute sample size is relatively large (n=178). Because the pool of potential participants was drawn from a single institution, the data is not likely to be generalizable to other academic centers, which adds additional bias. Since the students represented three distinct campuses, however, may mitigate this limitation.

Further studies are needed to confirm our results. There are two data sets from two samples more than a decade apart, both of which raise concerns about MS depression and the stigma around mental illness. Future studies should continue to assess trends while gathering data about effective interventions for improving MS well-being. Other studies should assess how different medical

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school interventions, such as offering medical students the choice of mental health providers, providing clear information about expectations, managing relationships, promoting resilience and help-seeking, and implementing personal well-being goals, among others, are effective in improving the medical school experience.[33]

Final Thoughts

Depression, SI, and their stigmatization remain prevalent in the MS population. New, effective approaches are needed to reduce this prevalence, especially because current methods may be less impactful than presumed. Reduction of stigma, specifically, may promote greater access to mental health resources, including preventative measures, that would, in turn, reduce the prevalence and severity of depression and its negative sequelae.

Disclosures

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Summary – Accelerating Translation

A cross-sectional institutional survey of depression, suicidal ideation and stigma in medical students

Depression and suicidal ideation (SI) are not only serious threats to public health in the general population, but they also remain very prevalent in the Medical Student (MS) body. The aim of our study is to identify differences in depression and suicide among MSs of different demographics and to better understand the stigma associated with mental illness among MSs. In addition, we comment on whether changes to the MS curriculum have improved MS well-being in the last decade.

A survey of MSs was conducted in 2023 at three University of Illinois College of Medicine campuses. There were 178 respondents. The survey integrated the PHQ-9, a validated measure of depression severity. Data was also gathered about suicidal ideation, stigma and perception of mental illness, demographics, clinical diagnoses, treatment, and alcohol use.

The survey results show that 22% of MS respondents were in the moderate-to-severe depression group and 13, all female, endorsed SI. A majority of students reported that depressed MSs would provide inferior treatment to their patients, their application to residency would be less competitive than their peers if they were depressed, they would feel embarrassed or ashamed if they were depressed, and that it would be risky to reveal they have depression on a residency application. In addition, MSs with higher levels of depression were more likely to agree with the statement that a depressed MS would be blamed for being unable to cope. Although it is uncertain whether depression, SI, and stigmatization have worsened since 2010, the high prevalence in MSs supports the need for new, multi-faceted approaches to address them.

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Supplementary Material

GENERAL INTAKE QUESTIONS: These questions will be used to assess if there are differences in perceptions of mental health depending on differences in demographics.

1) What is your email address?

*Please note this will only be used to contact you if you win the prize.

*If you click "Choose not to Answer" you will be unable to win the prize.

2) How old are you?
a. 18-20 years
b. 21-25 years
c. 26-30 years
d. 31-35 years
e. Greater than 35 years

3) What is your biological sex?
a. Female
b. Male

4) What is your gender identity?
a. Cisgender Female
b. Cisgender Male
c. Transgender Female
d. Transgender Male
e. Non-Binary
f. Other (please specify)
g. I would prefer not to answer

5) What is your sexual orientation?
a. Asexual
b. Bisexual
c. Heterosexual
d. Homosexual
e. Pansexual
f. Other (please specify)
g. I would prefer not to answer

6) What is your race? (Select all that apply.)
a. African American or Black
b. Alaska Native/American Indian
c. Asian
d. Caucasian or White
e. Native Hawaiian or Other Pacific Islander
f. Some Other Race

7) Are you of Hispanic or Latino or Spanish Origin?
a. Yes
b. No

8) Which of the following religions/belief systems/beliefs do you identify with?
a. Agnosticism
b. Atheism
c. Buddhism
d. Christianity
e. Hinduism
f. Islam
g. Judaism
h. Sikhism
i. Other (please specify)
j. I would prefer not to answer

9) How would you characterize your relationship status currently?
a. Single
b. In a committed relationship
c. Married
d. Divorced
e. Widowed
f. Separated

10) If you are currently single, (including previously divorced, widowed, and separated individuals) do you feel like medical school has impeded your ability to be in a relationship?
a. Yes
b. No
c. I am in a relationship

11) How many children do you have?
a. None
b. One
c. Two or More

12) Is your biological mother or father a physician?
a. Yes, one is a physician
b. Yes, both are physicians
c. No, neither are physicians

13) Which campus do you attend?
a. Chicago
b. Peoria
c. Rockford

14) In what year of medical school are you?
a. M1
b. M2
c. M3
d. M4

15) What is your intended medical specialty?
a. Primary care (i.e, family medicine, general internal medicine, general pediatrics)
b. Surgical specialty (i.e. general surgery, obstetrics/gynecology, urology)
c. Medical or pediatric specialty (i.e. pediatric cardiology, adult gastroenterology, neurology)
d. Hospital-based discipline (i.e. radiology, pathology, anesthesiology, emergency medicine)
e. Undecided
f. Other (please specify)

16) The stress of medical school depends mostly on my current sequence/rotation.
a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

QUESTIONS REGARDING OPINIONS ON MEDICAL SCHOOL EXPERIENCE: These questions will be used to assess medical students' feelings on their experiences in school and how it has affected them.

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17) My financial situation is a source of significant stress.
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

18) In thinking about all types of help and support for medical school (i.e. emotional, financial), do you get the help and support you need from your FAMILY MEMBERS AND FRIENDS?
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

19) In thinking about all types of help and support for medical school (i.e. emotional, financial), do you get the help and support you need from your FELLOW MEDICAL STUDENTS?
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

20) In thinking about all types of help and support for medical school, do you get the help and support you need from the UNIVERSITY OF ILLINOIS MEDICAL SCHOOL?
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

21) Too much of my happiness has been sacrificed to attend medical school.
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

22) I feel alone.
a.   Strongly disagree
b.   Disagree
c.   Neither agree nor disagree
d.   Agree
e.   Strongly agree

23-32) Over the last 2 WEEKS, how often have you been bothered by any of the following problems?
0 = not at all   1= several days   2= more than half the days   3= nearly every day

23) Little interest or pleasure in doing things.
24) Feeling down, depressed, or hopeless.
25) Trouble falling or staying asleep, or sleeping too much.
26) Feeling tired or having little energy.
27) Poor appetite or overeating.
28) Feeling bad about yourself—or that you are a failure or have let yourself or your family down.
29) Trouble concentrating on things, such as reading the newspaper or watching television.

30) Moving or speaking so slowly that other people could have noticed. Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual.
31) Thoughts that you would be better off dead, or of hurting yourself in some way.
32) How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?
a.   Not difficult at all
b.   Somewhat difficult
c.   Very Difficult
d.   Extremely Difficult

33) Have you ever been diagnosed with Major Depressive Disorder (MDD) which is informally referred to as depression?
a.   Yes
b.   No

34) Are you currently diagnosed with MDD/depression?
a.   Yes
b.   No

35) Have you ever felt you were seriously depressed even if not diagnosed?
a.   Yes
b.   No

36) Have you sought prior treatment for depression?
a.   Yes
b.   No

37) What type of treatment?
a.   Counseling or therapy only
b.   Medication only
c.   Both counseling/therapy and medication
d.   Other treatment
e.   N/A

38) Are you currently receiving treatment for depression?
a.   Yes
b.   No

39) What type of treatment are you currently receiving?
a.   Counseling or therapy only
b.   Medication only
c.   Both counseling/therapy and medication
d.   Other treatment
e.   I am not depressed and am not receiving any treatment

40) Since enrolling in medical school has your depression been?
a.   Better
b.   Worse
c.   Neither better nor worse
d.   I am not depressed

41) Since enrolling in medical school, have you ever seriously considered committing suicide?
a.   Yes
b.   No

42) Since enrolling in medical school, have you ever made a plan on how you would commit suicide?
c.   Yes
d.   No

43) Do you know any medical students who are depressed?
a.   Yes
b.   No

44) Do you know any medical students whose education, training, or advancement has suffered because of their depression?
a.   Yes
b.   No

45) Have you considered dropping out of medical school?
a.   Yes
b.   No

46) Over the past month, how STRONGLY have you considered dropping out of medical school?
a.   I have not considered dropping out of medical school
b.   Not at all strongly
c.   Somewhat strongly
d.   Strongly
e.   Very strongly

47) What are your main reasons for considering dropping out of medical school? (Select all that apply.)
a.   I have not considered dropping out of medical school.
b.   I am unhappy
c.   I am too stressed
d.   I do not feel academically prepared
e.   I am too homesick
f.   I no longer have time to do the things I enjoyed
g.   My depression has gotten too severe
h.   It seems like there is no end in sight/It seems as if it will never get better
i.   I want to do something besides become a physician
j.   Other (please specify)
k.   I don't know

48) If you have considered dropping out of medical school before, what were your main reasons for NOT dropping out? (Select all that apply.)
l.   I have not considered dropping out of medical school.
m.   I would be more unhappy if I dropped out
n.   I would be more stressed if I dropped out
o.   There are no jobs I could get with my undergraduate degree
p.   My family would be disappointed in me
q.   I would be too ashamed
r.   I would feel like a failure
s.   I would be too in debt
t.   I know it will get better after medical school itself (ie. in residency or as am attending physician)
u.   Other (please specify)
v.   I don't know

49) Knowing what you know now, would you choose to attend medical school again if you had the chance?
a.   Yes
b.   Probably
c.   Probably Not
d.   No

50) How would you rate the level of academic competitiveness at your medical school?
a.   Not at all competitive
b.   Somewhat competitive
c.   Competitive
d.   Very Competitive
e.   Extremely competitive

51) Relative to the average person in my class, my overall academic performance is
a.   Far below average
b.   Somewhat below average
c.   Average
d.   Somewhat above average
e.   Far above average

52) How helpful on average do you think THERAPY or COUNSELING is, when provided competently, for medical students who are clinically depressed?
a.   Not at all helpful
b.   Somewhat helpful
c.   Helpful
d.   Very helpful

53) How helpful on average do you think MEDICATION is, when appropriately prescribed, for medical students who are clinically depressed?
a.   Not at all helpful
b.   Somewhat helpful
c.   Helpful
d.   Very helpful

54) Do you believe that depression develops in medical students due to...?
a.   Inability to cope, either with the stress of medical school or with other issues
b.   Neurotransmitter abnormality or Imbalance
c.   Illness or other medical problems
d.   Substance Use
e.   A combination of two or more of these
f.   None of these

55) When you are stressed or depressed, what methods do you use for coping? (Select all that apply)
a.   Exercise more
b.   Smoke more cigarettes/tobacco
c.   Physically harm yourself
d.   Contact therapist/counselor
e.   Eat less than usual
f.   Eat more than usual
g.   Talk to or spend more time with friends
h.   Seek support from my church or spiritual advisor (i.e. pastor, minister)
i.   Talk to or spend more time with family members
j.   Study more
k.   Use recreational drugs
l.   Drink more alcohol
m.   Take a break from Peoria, Chicago, or Rockford (i.e. leave the city)
n.   Isolate yourself
o.   Other (please specify)
p.   None of the above

56) Over the past month, about how many HOURS PER WEEK did you spend exercising? (Include any exercise of moderate or higher intensity, where "moderate" intensity would be roughly equivalent to brisk walking or bicycling)
a.   Zero
b.   Less than 1
c.   1-2
d.   3-4
e.   5 or more

57) Over the past month, on how many occasions have you had 4 (for women) or 5 (for men) ALCOHOLIC DRINKS at one sitting?
a.   None
b.   Once
c.   Twice
d.   3 to 5 times
e.   6 to 9 times
f.   10 or more times
g.   Don't know
h.   I refuse to answer

The following statements address your beliefs about depression. Please respond to each item according to how much you agree or disagree.
59-85) To what extent do you agree or disagree that... ?
a.   Strongly Disagree
b.   Disagree
c.   Neither Disagree nor Agree
d.   Agree
e.   Strongly Agree

58) Telling a counselor I am depressed would be risky.
59) My teachers would not ignore me or take me any less seriously if I were depressed.
60) Medical students with depression could snap out of it if they wanted to do so.
61) Most people believe that depressed medical students would provide inferior treatment to their patients.
62) Other students would stop including me in social activities if they discovered that I was depressed.
63) If I were depressed, I would tell my medical school friends.

64) If I were depressed and asked for help, I would be admitting that my coping skills are inadequate.
65) If I were depressed, I would worry that I would miss out on educational opportunities.
66) Depression is a real medical illness.
67) A medical student who sees a counselor is admitting that he/she is unable to handle the stress of medical school.
68) Medical students with depression are not worth the time and resources for medical school teaching.
69) Most medical students would not want to work with a medical student who is depressed.
70) If I were depressed and applying to a residency, my application would be less competitive than that of a student who does not have depression.
71) If I were depressed, I would not feel embarrassed or ashamed.
72) If I were depressed, I would worry that my medical student friends who knew would tell other students or faculty.
73) Depression is a sign of personal weakness.
74) Medical students with depression are NOT to blame for their problems.
75) A depressed medical student is worth the investment of medical school teaching time and effort.
76) Medical students and faculty members believe that a student who has depression is just as intelligent as other students.
77) If I were depressed it would be risky to reveal my depression on my residency application.
78) If I were depressed, I would seek treatment.
79) If I were depressed, I would be blamed for being unable to cope.
80) Seeking help for depression would make me feel less intelligent as a medical student.
81) Other students and faculty members would view me as unable to handle my responsibilities if I were depressed.
82) Medical students with depression are dangerous to their patients.
83) If I were depressed, I would be unable to complete medical school tasks and responsibilities as well as other students.
84) If I were depressed, fellow medical students would respect my opinions less.

Magnitude of Psychological Distress Among Medical and Non-Medical Students During the Late Phase of the COVID-19 Pandemic in West Bengal: A Cross-Sectional Study

Udisa Das,[1] Arunima Ganguly,[1] Dibakar Haldar,[2] Asish Mukhopadhyay.[3]

Abstract

Background: COVID-19 pandemic led to drastic changes worldwide affecting mental health of students. This study aimed to assess psychological distress due to COVID-19 in students during the late phase of pandemic and to establish correlation of academic course, socio-demographics, and knowledge-attitude-practices (KAP) with depression and anxiety. **Methods:** A cross-sectional study was conducted in Kolkata, from March to April 2022 among undergraduate medical students and undergraduate students from engineering and general science colleges, via purposive and snowball sampling. Survey questionnaire was circulated via Google forms through social media. It included Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, Fear of COVID-19 scale 2020, KAP regarding COVID-19 and socio-demographics. Data were analyzed using SPSS(Version 22.0) by estimating mean, standard deviation, median, interquartile range, and displayed by charts and tables. Mann-Whitney U test/non-parametric ANOVA and Chi-square tests were used for drawing statistical inferences. P-value of <0.05 was considered significant. **Results:** A total of 421 responses were included: 219 medical and 202 non-medical students. Most participants were male (58.67%). Prevalence of depression was 58.42% among non-medical students and 81.73% among medical students. Prevalence of anxiety was 50.99% among non-medical students and 76.25% among medical students. Medical students had significantly better scores for knowledge and attitude (p=0.001 in both). Anxiety was influenced by residence (p=0.018), mode of travel (p=0.012), and having relatives or friends affected by COVID-19 (p=0.03). **Conclusion:** High prevalence of depression and anxiety among college students, especially medical students, highlights the need for student wellness activities and better mental health services in colleges across India.

Introduction

COVID-19 began as an epidemic in China in December 2019 and was declared a pandemic by World Health Organization in March 11, 2020.[1] Due to severe transmissibility of the SARS-COV2 virus and its adverse outcomes in some cases, the main focus had been on physical effects of pandemic. This led to drastic lockdowns and strict quarantine measures worldwide. India implemented its lockdown in four phases from 25th March, 2020 to 31st May, 2020.[2] Since its discovery, fear of the virus had greatly affected mental health of individuals.[3] Studies conducted among general population identified huge rise in symptoms of depression and anxiety.[4] Meanwhile, medical students are already more prone to develop psychological distress because of highly demanding medical curriculum and other factors.[5] By March 2022, due to widely successful vaccination drive in India, 70% of the population had received at least one dose of vaccine. Thus, gradual resumption of normal activity was followed.[6] Schools, colleges and offices returned to physical mode. Public transport, restaurants and tourist attractions opened up. Given the current

situation being greatly different from that during lockdown, factors determining mental health of the student population are also expected to change.

There are a few studies conducted in India regarding impact of COVID-19 on mental health. Most of them focus on the initial phase of pandemic during early lockdown period and show different results for prevalence of depression and anxiety. In a study conducted in Karnataka,[7] depression in girls was found to be more than that in boys and anxiety did not differ between genders whereas, in a study conducted in Chennai,[8] depression increased in males and anxiety increased in females due to COVID-19. Another study conducted in West Bengal showed a significantly different prevalence of anxiety.[9] But there are few to no existing studies in this area to the best of knowledge of the authors which compared mental distress among undergraduate medical and non-medical students (engineering and general stream) in the late phase of the pandemic, when resumption of daily activities were being followed after the second wave of

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COVID-19. After withdrawal of lockdown, COVID-19 infection was still rampant, and medical students were eager to join college activities including the encounter with patients in their ward clinics, which was lagging for a long time. This type of hands-on practical training was also long due for engineering and Bachelor of Science (non-medical) students of different colleges in Kolkata. The undergraduate students of these streams were a sizable section of the student fraternity in Kolkata, West Bengal, India. Psychological morbidity during and after lockdown, has some obvious bearing on the well-being and learning among these students. A systematic reliable and authentic database was desperately needed in formulating strategy to tackle this type of dire condition in exigency like COVID-19 pandemic.

The objectives of this study were to estimate the prevalence of Depression and Generalized Anxiety Disorder (GAD) and their correlates, assess the Knowledge, Attitude, and Practice (KAP) regarding COVID-19, and to determine the relationship between these factors among medical and non-medical students during the late phase of the COVID-19 pandemic, to inform strategies to improve their mental well-being and learning ability.

Methods

Study Design and Setting
This was a cross-sectional study conducted among medical and non-medical students (Bachelor of Science and engineering) of Kolkata, during the late phase of the pandemic. The study was conducted in Department of Community Medicine and Department of Psychiatry of Nilratan Sircar Medical College and Hospital, Kolkata.

Sampling Method
Study participants included third year undergraduate medical students (having clinical ward classes) and third year undergraduate non-medical students from four medical colleges, four engineering and eight science colleges out of various colleges in Kolkata. Purposive sampling was employed to choose the study participants with the above-mentioned specific characteristics for fair comparison. Snowball sampling was used to enable greater reach, as during the pandemic phase visiting each college for data collection seemed to be risky and many students were yet to attend colleges regularly. As mental health problems are still stigmatized in India, the affected students may remain hidden during any probability sampling and a bias might creep into the results in the form of under-representation of these groups. On the other hand, in snowball sampling, different students shared the questionnaire to those with similar mindset and behavior. Thus, although statistically inferior, purposive and snowball sampling enabled in ensuring representative study samples.

Sample Size Calculation
Using the prevalence (35.5%) explored by relevant research as 'P',[8] sample size has been calculated using formula n= $[Z^2PQ]/L^2$, where Z=1.96 (two-tailed) at 95% confidence interval (CI),

Q=complement of P =100-P and L=7, absolute error around the reported prevalence. The sample size for the study has been estimated to be $(3.84*35.5*64.5)/7^2$=180. Being an online survey, after adding 20% non-response rate the sample size was 216. Thus, 220 medical students along with 220 non-medical students were considered adequate for the study.

Study period
Data collection was conducted from March 8th, 2022, until April 6th, 2022.

Data Collection
After obtaining informed digital consent, participants were asked to fill online Google forms distributed by social media platforms like, WhatsApp and Facebook. The online questionnaire was administered in English as English is the primary mode of education in most colleges of Kolkata including the ones considered for this study. Forms were accepted until responses reached 220 for both study groups. A total of 442 responses were received. After excluding incomplete and inappropriate responses, the final sample comprised 421 participants of whom 219 were medical and 202 were non-medical students.

Study tools
A validated and pretested questionnaire containing information pertaining to socio-demographics was used.

To assess depressive symptoms, participants completed the nine-item Patient Health Questionnaire (PHQ-9).[10] PHQ-9 is a self-reported scale used to diagnose major and sub-threshold depression. Participants indicated how frequently they experienced depressive symptoms over the past two weeks on a four-point Likert scale, from 0 "not at all" to 3 "nearly every day". The total score range is 0–27 which determines the severity of depression. It is interpreted as normal (0–4), mild (5–9), moderate (10–14), moderately severe (15-19), and severe (20-27) depression.

The seven-item Generalized Anxiety Disorder (GAD-7) was used to assess anxiety symptoms.[11] Participants indicated how frequently they experienced symptoms of anxiety over the last two weeks on a four-point Likert scale from 0 "not at all" to 3 "nearly every day". Total score of the participants ranges from 0-21. The severity of symptoms of anxiety is interpreted as normal (0–4), mild (5–9), moderate (10–14), and severe (15–21) anxiety.

PHQ-9 and GAD-7 scales have sound psychometric properties and have good validity and reliability. Both these scales have been used in similar settings, both in India and other countries, to establish the prevalence of depression and anxiety. A study, conducted to measure invariance of the scales in Indian population, by De Man J et al., found that the psychometric properties were comparable to studies in western settings.[12]

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To assess Fear of COVID-19, Fear of COVID-19 Scale, 2020 (FCV-19S) was used.[13] This is a reliable, valid self-report scale developed recently to assess fear of COVID-19 pandemic. A study conducted by Ahorsu et al.,[13] reported internal consistency (alpha = 0.82) and test-retest reliability (ICC = 0.72) for this scale which were acceptable reliability. The participants indicated their level of agreement with the statements using a seven- item questionnaire on a five-point Likert scale, from 1 to 5. Answers included "strongly disagree," "disagree," "neutral", "agree" and "strongly agree". Total score was calculated by adding up each item score (ranging from 7 to 35). Higher score (score >18) corresponded to greater fear, according to a similar study conducted in India using this scale.[14]

The predesigned and pre-validated Knowledge, Attitude and Practices regarding COVID-19 questionnaire adopted from relevant study,[15] was modified by faculty of the Department of Community Medicine as the subject matter experts (SMEs) to suit the local context. The Knowledge section consisted of six questions related to mode of transmission, symptoms, management options and preventive strategies. The questions had answers as "Yes", "No" and "Do not know". Participants, who answered 50%, two-third or more and less than 50% of the questions correctly, were respectively graded as "Average", "Good" and "Poor". The Attitude section had four questions related to possibility, severity of infection, attitude towards practicing personal hygiene and avoiding crowded places. These were graded by five-point Likert scale. Those who attained median Attitude score of 11, more than 11, and less than 11 were respectively, graded as "Average", "Good" and "Poor". The Practice section had three questions related to exercising preventive strategies which were graded by four-point Likert scale. Participants who attained median Practice score of ten, more than ten, and less than ten were graded as "Average", "Good" and "Poor", respectively.

Data Analysis
Collected data was compiled in Microsoft Excel. Continuous data was described by mean, median, standard deviation (SD), and interquartile range (IQR); and categorical data by proportion and percentage. Normality of dataset was checked by charts like histogram, stem-leaf, P-P and Q-Q plot and Shapiro-Wilk normality test. Results were displayed using charts and tables. Inferential statistical tests like 'Unpaired t' test, Pearson correlation coefficient (r) (for normally distributed data) and Mann-Whitney U test (for skewed data) were used for continuous variables. Chi-square test was used for categorical variables. The Statistical Package for Social Science (SPSS Version 22.0) was used for analysis. P-value of less than 0.05 was considered as significant.

Ethical Approval
The study was carried out after obtaining approval of the Institutional Ethics Committee of Nilratan Sircar Medical College and Hospital, Kolkata on February 23rd, 2022, with Memo no: NRSMC/IEC/03/2022 and conducted according to the World Medical Association Declaration of Helsinki on Ethical Principles

for Medical Research Involving Humans. Informed online consent was obtained from each study participant after explanation of the study and confirming confidentiality.

Table 1. Distribution of Participants According to Socio-demographic Characteristics, West Bengal, 2022.

Variable	Attribute	Number	%
Gender	Male	247	58.67
	Female	174	41.33
Age in years (Mean±SD)		22.42±0.99	
Course	MBBS	219	52.02
	Non-MBBS	202	47.98
Residence during Late Phase of Pandemic	Home	203	48.22
	Hostel	162	38.48
	Paying Guest	56	13.3
Mode of Travel to College	Hostel-boarder	162	38.48
	Public Transport	204	48.46
	Hired Car	27	6.41
	Own Car	28	6.65
History of Addiction	Alcohol	6	1.43
	Tobacco	28	6.65
Previous History of Psychiatric Illness	Depression	5	1.19
	Anxiety neurosis	3	0.71
	Obsessive Compulsive Disorder	4	0.95
Presence of comorbidities	Yes	81	19.23
	No	340	80.76
If any family member/ close relative or friend, suffered/died from COVID-19	Yes	250	59.38
	No	171	40.62
If any family member is working in health care system	Yes	93	22.09
	No	328	77.91

Legend: Significant results have been marked in bold. IQR= Interquartile range

Results

A total of 442 responses were received. After excluding incomplete and inappropriate responses, the final sample comprised 421 participants, of whom 219 were medical students and 202 were non-medical students. The majority of the participants were male (58.67%), with an average (mean±SD) age of 22.42±0.99 years. Other socio-demographic characteristics are depicted in **Table 1**.

The overall prevalence of depression (PHQ-9 score >4) was 81.73% among medical students and 58.42% among non-medical students. The overall prevalence of anxiety (GAD-7 score >4) was 76.25% among medical students and 50.99% among non-medical students. The mean PHQ-9 score was 8.37±5.16 for medical students and 7.62±5.86 for non-medical students, with a statistically significant difference (p=0.017, Mann-Whitney U: 19136.000, **Figure 1**. The mean GAD-7 score was 7.96±4.65 for medical students and 7.20±5.63 for non-medical students, also showing a significant difference (p=0.008, Mann-Whitney U: 18801.000) **Figure 2**. Overall prevalence of depression (PHQ-9 score >4) was 67.21% in males and 75.29% in females whereas, overall prevalence of anxiety (GAD-7 score >4) was 57.89% in

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males and 72.98% in females. However, both depression and anxiety did not vary significantly with the genders (p=0.135 and p=0.065, respectively).

Figure 1. Distribution of Participants According to Academic Course and Grades of Depression (PHQ-9), West Bengal, 2022.
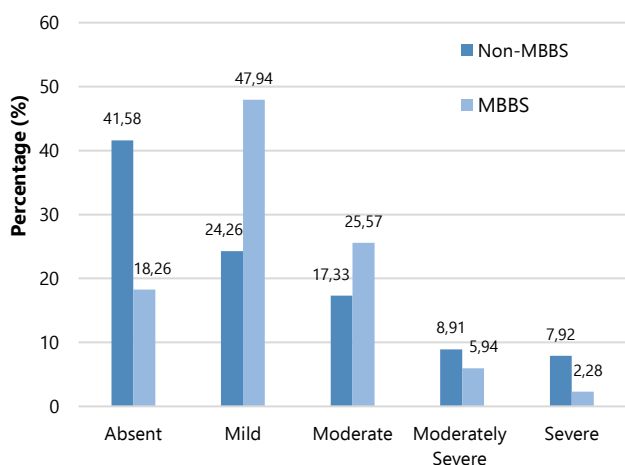
Figure 2. Distribution of Participants According to Academic Course and Grades of Anxiety (GAD-7), West Bengal, 2022.
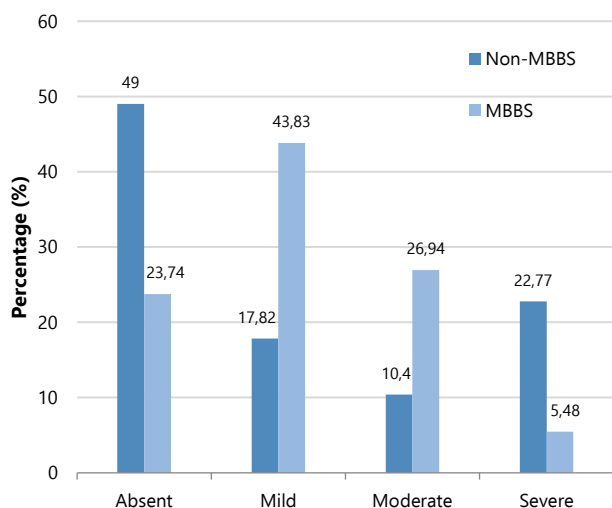
According to the Fear of COVID-19 Scale (FCV-19S), non-medical students had scores of 12.00 (8.00) [median (IQR)], while medical students had scores of 13.00 (5.00) [median (IQR)]. Medical students had higher knowledge scores regarding COVID-19 than non-medical students, with mean scores of 4.24±1.04 and 3.80±1.28, respectively (p=0.001, Mann-Whitney U: 16396.00). Attitude scores were significantly different between non-medical and medical students, with means of 10.64±2.26 and 11.63±1.93, respectively (p=0.001, Mann-Whitney U: 15207.500). Practice scores for non-medical and medical students were 9.85±1.92 and

9.44±1.74, respectively, showing no statistical significance (p=0.147, Mann-Whitney U: 19714.00, **_Table 2_**).

Grades of Attitude were found to significantly influence Depression scores (p=0.033). Participants with an average attitude towards COVID-19 had a higher mean depression score

Table 2. Distribution of Participants according to Academic Course and Knowledge, Attitude and Practices regarding COVID-19, West Bengal, 2022.

	Course	Median (IQR)	Mann-Whitney U	P-value	Adjusted P values*
Knowledge	Non-MBBS	4.0 (1.0)	16396.00	**<0.0001**	**0.001**
	MBBS	5.0 (2.0)			
Attitude	Non-MBBS	10.0 (3.0)	15207.50	**<0.0001**	**0.001**
	MBBS	12.0 (3.0)			
Practice	Non-MBBS	9.50 (3.0)	19714.00	0.049	0.147
	MBBS	10.0 (3.0)			

Legend: Significant results have been marked in bold. IQR= Interquartile range. *By Bonferroni method [p'i={pi×m,1} (1≤i≤m)

than those with poor or good attitudes, as shown by Post-Hoc analysis with p-values of 0.009 and 0.036, respectively. However, attitude grades did not have influence on GAD-7 scores (p=0.135), **_Table 3_**.

Depression did not vary significantly in participants with a previous history of psychiatric illness (p=0.09). Anxiety varied significantly based on residence (p=0.018), mode of travel to college (p=0.012), and having a family member, close relative, or friend who suffered or died from COVID-19 (p=0.03). Participants who travelled in their own car had a higher mean anxiety score than those using public transport, according to Post-Hoc analysis. No significant relationship was found between fear of COVID-19 and the aforementioned factors **_Table 4_**.

Discussion

The present study found an overall prevalence of depression (PHQ-9 score >4) of 81.73% and 58.42% among medical and non-medical students, respectively. Overall prevalence of anxiety (GAD-7 score >4) was 76.25% and 50.99% among medical and non-medical students, respectively. In an online survey conducted on Indian medical students in 2020; mild, moderate,

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and severe anxiety were found in 27%, 24%, and 16% students.[16] In this study, prevalence of mild to severe symptoms of depression and anxiety in MBBS students was observed to be higher as compared to other studies.[17] This variation might be due to methodological and socio-cultural differences. Comparable values of prevalence of depression but a higher prevalence of anxiety among non-MBBS students was found in a study conducted among university students in India.[14]

Table 3. Distribution of Participants as per Knowledge, Attitude and Practices along with their Depression, GAD and Fear of COVID-19 Scores, West Bengal, 2022.

	PHQ-9 Score (mean±SD)	H (Kruskal Wallis ANOVA), p/p' values	GAD-7 Score (mean±SD)	H (Kruskal Wallis ANOVA), p/p' values	Fear of COVID-19 Score (mean±SD)	H (Kruskal Wallis ANOVA), p/p' values
Knowledge						
Poor	6.98±0.85		7.57±0.77		13.66±0.96	
Average	8.08±0.74	2.753, 0.253*	7.53±0.71	0.159, 0.923*	14.89±0.89	0.780, 0.677*
Good	8.14±0.31		7.62±0.29		14.21±0.34	
Attitude						
Poor	7.56±0.39		6.98±0.36		14.02±0.42	
Average	9.75±0.71	8.984, **0.011/0.033***	8.27±0.57	6.185, **0.045***/0.135	13.62±0.75	0.227, 0.893*
Good	7.94±0.43		8.03±0.42		14.69±0.52	
Practice						
Poor	7.76±0.37		7.60±0.36		13.97±0.42	
Average	8.81±0.61	2.797, 0.247*	8.02±0.50	2.804, 0.246*	13.20±0.57	2.909, 0.234*
Good	7.89±0.50		7.34±0.48		15.31±0.62	

Legend: *df=2. Significant results have been marked in bold. p'=By Bonferroni Adjustment only in cases of significant independent variables

Table 4. Distribution of Participants according to Depression, Generalised Anxiety Disorder, Fear of COVID-19 and Socio-demographics, West Bengal, 2022.

Variable	Attributes	PHQ-9 Score (mean±SD)	p/p' values	GAD-7 Score (mean±SD)	p/p' values	Fear of COVID-19 Score (mean±SD)	p/p' values
Gender	Male	7.72(5.42)	0.135*	7.26(5.08)	0.065*	14.10(6.23)	0.524*
	Female	8.38(5.64)		8.03(5.19)		14.46(6.35)	
Place of Residence	Home	7.98(5.67)	0.116†	7.53(5.29)	**0.003†/0.018**	14.19(6.59)	0.546†
	Hostel	8.41(5.38)		8.34(5.09)		14.42(6.04)	
	Paying/Guest	7.00(5.37)		5.79(4.37)		13.93(5.83)	
Mode of Travel to College	Hostel-boarder	8.30(5.31)	0.329‡	8.33(5.05)	**0.002‡/0.012**	14.48(6.09)	0.108‡
	Public Transport	7.58(5.56)		6.81(5.11)		13.83(6.24)	
	Hired Car	8.56(4.88)		6.85(4.39)		13.52(5.44)	
	Own Car	8.96(6.84)		9.82(5.65)		16.79(7.72)	
Previous History of Psychiatric Illness	No	7.90(5.50)	**0.015***/0.090	7.57(5.14)	0.522*	14.31(6.29)	0.331*
	Yes	11.07(5.28)		8.47(5.55)		12.87(5.58)	
If any family member/ close relative or friend, suffered/died from COVID-19	Not suffered/died	7.59(5.42)	0.134*	6.75(4.92)	**0.005***/0.030	14.02(5.92)	0.771*
	Suffered/died	8.30(5.57)		8.18(5.23)		14.42(6.51)	
If any family member is working in health care system	No	7.76(5.37)	0.073*	7.45(5.15)	0.193*	14.11(6.26)	0.207*
	Yes	8.89 (5.95)		8.12(5.15)		14.76(6.31)	

Legend: *According to Mann-Whitney U test, †According to Kruskal Wallis ANOVA at df=2,‡According to Kruskal Wallis ANOVA at df=3, Significant results have been marked in bold, p'=By Bonferroni Adjustment only in cases of significant independent variables.

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The mean PHQ-9 and GAD-7 scores for non-MBBS participants were significantly lower than that of MBBS participants. This could be due to physical mode of classes, encounters with patients in wards, and examinations, which had already started for MBBS students during the study period. Also, the presence of higher prevalence of psychological distress in the medical students might be because they are typically subjected to various challenges such as a demanding curriculum, long study hours, fear of failure, as reported in an 18 month follow-up study conducted among medical students in Kerala.[5] However, in an online survey was conducted in 2020 among 486 non-medical and 468 medical students from three universities of Shandong Province, non-medical college students had higher prevalence of depression (53.9 vs. 46.4%; p=0.020) and insomnia (28.0 vs. 22.4%, p=0.049), as well as higher total scores on PHQ-9 (p = 0.03) and Insomnia Severity Index (p <0.01) compared to the medical counterpart.[18] These variations might be due to methodological, socio-cultural differences, force of COVID-19 infection, implementation of COVID-19 containment measures, and compliance of the people towards COVID-19 prevention.

The 2016 National Mental Health Survey reported 2.7% prevalence of depressive disorder and 3.1% prevalence of anxiety in Indian population.[19] Prevalence of depression and anxiety were found to be 27.2% and 33.8% respectively, among medical students before the onset of COVID-19 pandemic.[20,21]

A study conducted during lockdown in India among non-medical students found that 85.51% and 62% of students had symptoms of depression and anxiety.[22] Similar findings were reported among university students in Bangladesh.[23] In another online study conducted among university students in USA with recruitment of participants through email, text messaging, and snowball sampling, 71% indicated increased stress and anxiety due to COVID-19 pandemic.[24] An online survey reported a prevalence of 20.6% of perceived stress during the pandemic which was significantly higher (p=0.001) than pre-pandemic period (11.6%) having positive correlation with worries regarding the possible disruption of education/examinations, excessive news exposure, apprehension of COVID-19 infection, effects of strict isolation and social distancing.[25]

In our study, prevalence of both depression and anxiety were found to be lower than that during lockdown for non-MBBS students, whereas among medical students, depression was found to be lower than that during lockdown.[22] This decline in distress is supported by other studies conducted after first lockdown in India.[14,17] The progressive decline in prevalence of distress is in accordance with another longitudinal study.[26] However, levels of anxiety and depression were still higher than that before the pandemic among both MBBS and non-MBBS students, which is compliant with a similar study by Imran N et al.[3]

At the time of study, the pandemic was ongoing and there still was an apprehension about the chance of COVID-19 infection. Many students and their relatives may have been suffering from long-Covid. For medical students, the apprehension might be more due to their exposure to patients during ward clinics which was resumed after a long gap with a huge backlog. Non-medical students did not have such an apprehension due to no encounters with patients.

MBBS students had higher knowledge scores (p=0.001) than their non-MBBS counterparts. This may be because COVID-19 has lately been incorporated in the MBBS curriculum in India, leading to greater awareness.

Non-MBBS students had a lower mean score of attitudes than their MBBS counterparts (p=0.001). The knowledge of the non-MBBS participants was based on mass-media which, at the time of this study, showed decreased number of COVID-19 cases. Moreover, they had no clinical ward exposure. Thus, less perceived possibility and severity of infection might have led to lesser mean scores of attitudes.

Although, mean score of practice was slightly higher among the non-MBBS participants, it was not statistically significant (p=0.147). This might be because practices such as, wearing masks, physical distancing, and handwashing had been integrated into the daily lives of the population for two years since the start of the pandemic. Social demand and legal enforcement might be the likely explanations of similar practice scores among both study groups.

At the start of the pandemic, little was known about transmission, pathogenesis, complications of COVID-19 and there was high amount of unverified information, leading to uncertainty that may have led to strict protective measures and thus, higher attitudes and practices despite poor knowledge, as found in a study conducted in Indonesia during early stages of the pandemic.[27] During this study, conducted in late phase of the pandemic, extensive research followed by mass media campaigning led to increased knowledge scores. The difference in attitude and practice with earlier studies might be due to a decrease in hospitalization and deaths due to COVID-19 and the pan-India vaccination drive, reducing associated fear. Two years had passed since the start of the pandemic and people have become complacent with their practices, leading to relatively lower practice scores, supported by another study.[28]

Participants having average attitude towards COVID-19 had greater mean score of depression than those having good attitude. This could be because most of the participants having good attitude also showed average to good practices thereby having less perceived risk of contracting COVID-19, leading to lower depression scores. Positive attitude towards COVID-19 has been found to negatively correlate with psychological distress.[29] However, poor attitude during the late phase of pandemic also had significantly lower mean scores of depression. This is most probably because those participants were reckless regarding the pandemic and so experienced a false sense of wellbeing and denial and hence, less symptoms of depression.

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In this study, depression was not found to be higher in those having prior history of psychiatric illness, contrary to a study conducted in Pakistan.[3]

Participants staying in hostels had significantly higher mean scores of anxiety. This might be because of the lack of proper attention to the maintenance of hygiene and sanitation in hostels. Moreover, it was not expected that all hostel-boarders would follow COVID-19 appropriate behavior. Social distancing is impractical in hostels, where three or four boarders have to share rooms. Staying away from home may also have added to their distress. Therefore, hostel-boarders were at an increased perceived risk of COVID-19 infection and hence their increased anxiety, corroborating with a study conducted in China.[30]

The current study also found that participants travelling to their colleges in their own car had significantly greater scores for anxiety than those commuting by public transport. Those travelling in their own cars were probably following avoidant coping mechanism- avoiding the crowd of public transport. However, those commuting by public transport were more accepting of the 'new normal' and were likely following acceptant coping mechanism. This is consistent with a study which found that psychological burden was higher with students having avoidant coping styles.[17,31]

GAD-7 scores were significantly higher in participants who had themselves suffered or had experienced their family members or relatives suffering or dying from COVID-19.[14,26] It might be partly due to the apprehension of re-infection as well as some of them or their relatives might have been suffering from long-COVID.

Substance use and presence of comorbidities were not significantly associated with psychological distress, contradicted by earlier studies.[17,32] Present study found no significant difference in symptoms of depression and anxiety among males and females, similar to a study conducted in Bangladesh.[23] However, some studies have found females to be more prone to psychological distress.[3] These differences might be due to difference in characteristics of the study population based on country and culture.

The mean FCV-19S score for both study groups were lower as compared to a study conducted in India one month post lockdown.[14] Fear of COVID-19 was neither significantly impacted by any of the socio-demographic correlates nor by academic course, compliant with other studies.[31] This is most likely because of the time elapsed since start of the pandemic. The decrease in number of hospitalizations, deaths due to COVID-19 and pan-India vaccination may have helped in allaying fear of getting infected. However, raised levels of depression and anxiety can be attributed to the indirect effects of COVID-19 or long-Covid.[33] The pandemic had led to several drastic changes. Students were subjected to uncertainties regarding academics and even their household economic condition.[29] With gradual resumption of offline mode of teaching, the shift from their quiet life at home to hectic life at campus was hard to bear for many.[34] This might have led students to face other sources of mental distress or amplified their existing problems. Student wellness activities, interpersonal support groups, and specific policy interventions are therefore, the need of the hour.

Limitations and Recommendations

Since this study employed a cross-sectional study design, trends of mental distress in the student population due to COVID-19 could not be assessed. Cause and effect relationships could not be established due to lack of an analytical study design. Being a web-based, self-reported survey there could have been response bias. Non-probability sampling methods like, purposive and snowball sampling were used in this study to locate a specific student sample for comparison. However, these techniques are subjective and might have led to community bias and limited generalizability. Although standardized questionnaires were used, full diagnostic interviews were not conducted. PHQ-9 and GAD-7 questionnaires from the pre-COVID era were used to assess distress during the pandemic. Information about COVID-19 vaccination was not collected. As the study was conducted among university students, its results cannot be extrapolated to the general population and healthcare professionals. Additionally, while the questions asked about COVID-19 worries were based on the clinical, academic and health concerns, they were not exhaustive. Therefore, a broader impact of the pandemic on the minds of students might have been missed. Future studies should employ better analytical study design and aim for better generalizability of the sample by using probability sampling. A more detailed questionnaire including other stressors and relieving factors of the pandemic can be employed to further enhance the understanding of the effect of the pandemic on mental health.

Conclusion

Although direct harm caused by COVID-19 on mental health has been shown to improve over time,[26] the present study has found higher prevalence of depression and anxiety than that before the pandemic in students, especially among medical students. This is likely attributed to the indirect and long-term consequences of the pandemic.[33] This calls for adequate awareness and intervention as psychological distress has been shown to affect academic performance apart from the general wellbeing of the students.[35] Student wellness activities like regular sleep, balanced diet, time-management, yoga, and recreational activities should be advocated in colleges across India.[36] Positive family support is also beneficial.[37] As students benefit most by discussing their distress with their colleagues and teammates, colleges can conduct interpersonal support groups. Student mentoring programs by faculty has also shown reduced relative prevalence of depression and anxiety in a study conducted among Indian medical students.[17]

As per the directives of National Medical Commission (NMC), India, yoga classes were arranged in two weeks of Foundation course at the starting of MBBS course and sports are to be conducted on regular basis. Each college may develop mentoring policy towards students, faculty, and physicians. As second line of defense, each faculty member may be allocated a certain number mentees and interact with them at regular intervals for

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monitoring their mental wellbeing, encouraging to adapt to coping mechanisms such as planning, acceptance, humor, active coping, adequate sleep, use of instrumental and emotional social support instead of gambling, substance use, avoidant coping, and behavioral disengagement, which were all found to be helpful in maintaining well-being.[31] Strict implementation of policy interventions such as anti-ragging, regular mental health checkups, and student grievance cells can also help address the problem. Around the world and especially in India, seeking help from mental health professionals is met with a lot of stigma.[21] Provision of confidential and affordable access to psychiatrists and psychologists either online or on campus, may help in mitigating this problem.

Summary – Accelerating Translation

Title: Magnitude of Psychological Distress among Medical and Non-medical Students during the Late Phase of COVID-19 Pandemic in West Bengal: A Cross-sectional Study

Main Problem to Solve: COVID-19 led to drastic changes worldwide which has affected mental health especially, of the vulnerable student population. Only a couple of studies have been conducted to assess mental health of university students during the pandemic. To the best of our knowledge, studies comparing mental distress among medical and non-medical students in the late phase of the pandemic in West Bengal have not been conducted.

Aim of Study: This study aimed to assess psychological distress due to COVID-19 in students during the late phase of pandemic and to establish correlation of academic course, socio-demographics and knowledge-attitude-practices (KAP) with depression and anxiety. It would also help assess any long-term psychological burden of the pandemic and help college authorities to develop strategies to improve the mental well-being and thereby, the learning ability of students.

Methodology: Survey questionnaire was circulated via Google forms through social media. It included Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, Fear of COVID-19 scale 2020, KAP regarding COVID-19 and socio-demographics. Data were analyzed using appropriate statistical methods in Statistical Package for Social Science (Version 22.0). P value of less than 0.05 was considered significant. P values were adjusted by Bonferroni method to take into consideration any Type-1 error that might occur due to testing of multiple comparisons.

Results: Overall prevalence of depression (PHQ-9 score>4) was 58.42% in non-MBBS and 81.73% in MBBS students. Whereas the overall prevalence of anxiety (GAD-7 score >4) was 50.99% in non-MBBS and 76.25% in MBBS students. Prevalence of depression and anxiety were found to be lower than that during the first lockdown however, these were still higher than that before the pandemic. Medical students had significantly better scores for knowledge and attitude towards the pandemic. Anxiety was influenced by residence, mode of travel to college, history of relatives or friends affected by COVID-19.

Conclusion: Prevalence of depression and anxiety in college students, especially among medical students, was higher in present study mainly due to long-term indirect effects of the pandemic. This calls for employing student wellness activities like building interpersonal support groups, practicing yoga and other hobbies;and provision of better, cheap, and confidential mental health services across colleges in India.

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Supplementary Material

Study Questionnaire

Consent: The nature and purpose of the study and its potential risks/benefits and other relevant details of the study have been suitably explained to me in detail by the investigators. All the personal information provided by me will be kept confidential. Anonymity will be maintained. My name and email-id will not be collected. After analysis, if the result of the study be published in any article, under any circumstances, my name and identity will not be disclosed. My digital consent form indicates that I agree to participate in the study.

　　Yes, I agree.

A.　Socio-demographic Characteristics

1. What is your age? (　　　) years

2. What gender do you identify as?
   - Male
   - Female
   - Other

3. What is your family size (total family members)?　　_____

4. Which of these describes your current residence?
   - Home
   - Hostel
   - PG (paying guest)

5. Mention your course
   - MBBS
   - Other courses (mention:_____)

6. What is the name of your college?　　_____

7. Mention your year of study　　_____

8. How do you travel to your college?
   - Public transport
   - Hired car
   - Own car
   - Not applicable (hostel-boarder)

9. Mention what addiction do you have?
   - Tobacco
   - Alcohol
   - Other (specify.........)

10. Do you have any prior history of psychiatric illness?
   - No
   - Yes

11. Please specify the disease, if you answered 'Yes' regarding prior history of psychiatric illness. If not, type 'No'.　　_____

12. Have you/any family member/close relative or friend, suffered from COVID-19/died of it?
   - Yes (suffered/died)
   - No

13. Do you have any family member who is working in health care system?
   - Yes
   - No

14. What morbidity do you have? (May choose more than one)
   - Endocrinal/metabolic e.g. Diabetes mellitus/ thyroid dysfunction
   - Cardiovascular
   - Respiratory e.g. Asthma
   - Cancers for which you are taking treatment/medicines
   - Kidney/liver diseases
   - Others (specify........)
   - Nil

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B. Specific Information:
1. Baseline [Knowledge, Attitude and Practice relating to COVID-19]

	Knowledge items	Yes	No	Do not know
Sl No.	**Are the following facts correct?**			
K1	The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia (muscle pain).	1	2	3
K2	There currently is no effective cure for COVID-2019, but early symptomatic and supportive treatment can help most patients recover from infection.	1	2	3
K3	Not all persons with COVID-2019 will develop severe cases. Only those who are elderly have chronic illnesses are more likely to be in severe cases.	1	2	3
K4	Eating or contacting wild animals would result in infection by the COVID-19 virus.	1	2	3
K5	The COVID-19 virus spreads via respiratory droplets of infected individuals.	1	2	3
K6	Ordinary residents can wear general medical masks to prevent infection by the COVID-19 virus.	1	2	3

[Attitudes]

	Perceived Risk of COVID-19 infection Items	Very low		Neither low nor high		Very high
A1	What do you think is the possibility of your COVID-19 infection?	1	2	3	4	5
A2	What do you think will be the severity if COVID-19 infects you?	1	2	3	4	5

	Efficacy beliefs Items	Not at all			Extremely
	To what extent do you think the precautionary behaviour is an effective way to reduce the risk of COVID-19 infection?				
A3	Practicing personal hygiene such as wearing facial masks and hand hygiene'	1	2	3	4
A4	Social distancing such as avoiding crowded places.	1	2	3	4

[Practices]

	Practices of preventive behavior	Never	Sometime	Often	Always
	In the last week, how often did you practice the following?				
P1	Wearing face shield/facial masks	1	2	3	4
P2	Washing hands frequently and or using hand sanitizer	1	2	3	4
P3	Avoiding visit to crowded places	1	2	3	4

2. FEAR OF COVID-19 SCALE, 2020

Please respond to each item by ticking (√) one of the five (5) responses that reflects how you feel, think or act toward COVID-19.

	Fear of COVID-19 Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I am most afraid of Corona					
2	It makes me uncomfortable to think about Corona					
3	My hands become clammy when I think about Corona					
4	I am afraid of losing my life because of Corona					
5	When I watch news and stories about Corona on Social media, I become nervous or anxious.					
6	I cannot sleep because I'm worrying about getting Corona.					
7	My heart races or palpitates when I think about getting Corona.					

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3. PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? (Use '√'eto indicate your answer)

S.no		Not at all	Several days	More than half the days	Nearly every day
1	Little interest or pleasure in doing things	0	1	2	3
2	Feeling down, depressed, or hopeless	0	1	2	3
3	Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4	Feeling tired or having little energy	0	1	2	3
5	Poor appetite or overeating	0	1	2	3
6	Feeling bad about yourself- or that you are a failure or have let yourself or your family down	0	1	2	3
7	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8	Moving or speaking so slowly that other people could have noticed. Or the opposite- being so fidgety or restless that you have been moving a lot more than usual	0	1	2	3
9	Thoughts that you would be better off dead, or hurting yourself	0	1	2	3

10. If you have checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all   Somewhat difficult   Very difficult   Extremely difficult

4. GENERALIZED ANXIETY DISORDER SCALE (GAD-7)

Over the <u>last two weeks</u>, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

 If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all   Somewhat difficult   Very difficult   Extremely difficult

Prevalence and Associated Factors of Psychological Distress of Patients with Stroke Attending a Neurology Clinic – An Analytical Cross-sectional Study

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Abstract

Background: A vast range of factors lead to psychological distress among stroke patients, causing poor outcomes. This study aimed to assess the prevalence of psychological distress and identify the associated factors among stroke patients attending the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo. **Methods**: A descriptive cross-sectional study with an analytical component was conducted among 177 patients with stroke attending the Neurology Clinics of the NHSL, Colombo, who were sampled by multistage random sampling. Psychological distress was assessed using the Kessler Psychological Distress Scale (K-10). Data collected under 6 domains underwent initial bivariate analysis using Chi-square and Fisher's Exact Tests, followed by multivariate analysis via binary logistic regression. **Results**: The mean age of the participants with stroke was 59.7 (SD:12.3) years. The prevalence of psychological distress among stroke patients was found to be 23.3% (95% CI:16.1–31.9). During bivariate analysis, six factors ($p<0.05$) were significant. The regression analysis identified five independent predictors: younger age ($OR =0.87$, *95% CI*=0.79–0.97, $p<0.05$), female gender (OR=70.94, *95% CI*=3.73–1348.89, p=0.05), patient being the sole source of income (OR=24.71, *95% CI*=1.67–362.01, $p<0.05$), increased level of disability (OR=13.05, *95% CI*=3.59–47.36, $p<0.001$), and past personal history of psychiatric disorders (OR=172.59, *95% CI*=3.64–8174.42, $p<0.05$) with a R^2 of 0.772. **Conclusion**: The prevalence of psychological distress among patients with stroke attending the Neurology Clinics of the NHSL, Colombo, is considerably high and is associated with multiple health and non-health related factors.

Introduction

Stroke is one major cause of quality-of-life reduction. According to the American Heart Association, stroke is described as brain, spinal cord or retinal cell death from ischemia or hemorrhage based on symptoms persisting for >24 hours/death or pathological, radiological or objective evidence that is not attributable to trauma.[1] Stroke is the second most common cause of death and the third most common cause of disability-adjusted life years lost worldwide.[2] Regarding Sri Lanka, stroke is the sixth leading cause of death and the fifth leading cause of disability-adjusted life years lost.[3]

Stress can be defined as an actual or perceived perturbation to an organism's psychological, resulting in the activation of coping mechanisms such as behavioral changes, activation of the sympathetic nervous system and adrenal medulla and secretion of stress hormones. Thus, distress denotes a negative state in which the coping mechanisms and adaptation processes have failed to return the organism to its normal state.[4]

Approximately one-third of post-stroke patients suffer from psychological distress (PsyD) worldwide.[5] A multitude of factors affect the prognosis of PsyD among post-stroke patients and, in the end, lead to poor outcomes such as limitation of daily activities, poor rehabilitation outcomes, social isolation, poor functional recovery, vascular events, and recurrent episodes of stroke.[6]

Most research found in the literature was found to be focused on the effect of either depression or anxiety on stroke patients rather than assessing the combined effect.[7] Added to that was the use of specific rating scales to assess either the level of PSD (Post-stroke depression) or PSA (Post-stroke anxiety), which was rather more sensitive in measuring the overall level of distress rather than an isolated condition. The conclusions of Schramke *et al.* (1998) state that "these results suggest the need for caution in using rating scales of depression and anxiety in neurologic patients and support the notion that these scales are sensitive to distress rather than specific for identifying depressive and anxiety disorders" supporting the validatory importance of a general approach to PsyD to avoid misinterpretations and inequity

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towards different groups within the same study population.[8] Furthermore, stroke-induced PsyD carries a greater risk of mortality, social impairment, and poor drug compliance, imposing detrimental effects on the quality of life of the patient and posing a long-lasting effect on the rest of the family as well.[7]

Hence, we believe that the psychiatric consequences of stroke are significant, especially in low-income settings comparable to those in developed countries, and we aim to have a holistic approach in this regard through the assessment of PsyD. The conduction of these studies can be used to identify the potential factors that can have possible implications beneficial in the local setting, as it allows future researchers to correlate local and international research evidence to improve the practical applications of findings. The conclusions thus derived can be used in Sri Lanka as well as in other lower middle-income countries to channel their limited resources for early detection and prevention, which is of higher feasibility than the medical management that follows progressed severe clinical depression. Furthermore, it is applicable in the busy clinic and ward schedules commonly seen, as clinicians will only be required to direct their specific psychiatric concerns towards a selected group of people with a potential tendency.

Methods

Study Design

A descriptive cross-sectional study with an analytical component was conducted in the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo, the largest tertiary care hospital in the country. The analytical component was incorporated to assess the prevalence of psychological distress amongst adult post-stroke patients and, thereon, evaluate the factors influencing it in order to apply them, particularly in resource-poor clinical settings, pragmatically. The study period extended from April 2021 to December 2021 and data collection was carried out in September 2021. The study population was based on the adult post-stroke patients attending the Neurology Clinics of the study setting since long-term management of stroke is mainly based on an outpatient basis in the local context. Patients diagnosed with stroke who were above 18 years of age and had been diagnosed at least one month prior were included in the study. We excluded patients with significant language and cognitive impairment that will hinder the fidelity of the data, other severe disabilities unrelated to the stroke, such as loss of a limb and those severe mental illnesses (preceding the stroke) and confusion that impairs the capacity to give consent.

Sampling and Data Collection

A probability-based systematic sampling method was initially decided to be used in this research. The first five stroke patients attending each clinic fulfilling the inclusion and exclusion criteria were given sequential numbers and one number to be selected via a random number generator as the first participant to be recruited from that clinic.

After that, every other patient satisfying the inclusion and exclusion criteria was to be recruited into the study until the required sample size was completed. However, due to the COVID-19 pandemic situation in the country during the period of data collection and practical difficulties imposed by the pandemic lockdown, the sampling method was switched to multistage random sampling. Accordingly, two of the four consultants holding Neurology Clinics, NHSL, Colombo, were randomly selected. After that, the clinic records of all the post-stroke patients attending their clinics were accessed. A list of patients with contact numbers conferring to the inclusion and exclusion criteria was formed under sequential numbers. After that, 180 patients were randomly selected using a random number generator (allocating 144 participants for entry and 36 patients considering a non-response rate of 20%). These patients were contacted via phone at a convenient time for the patient, and study instruments were administered upon the acquisition of informed consent.

Figure 1. Conceptual Framework for Psychological Distress Among Stroke Patients.
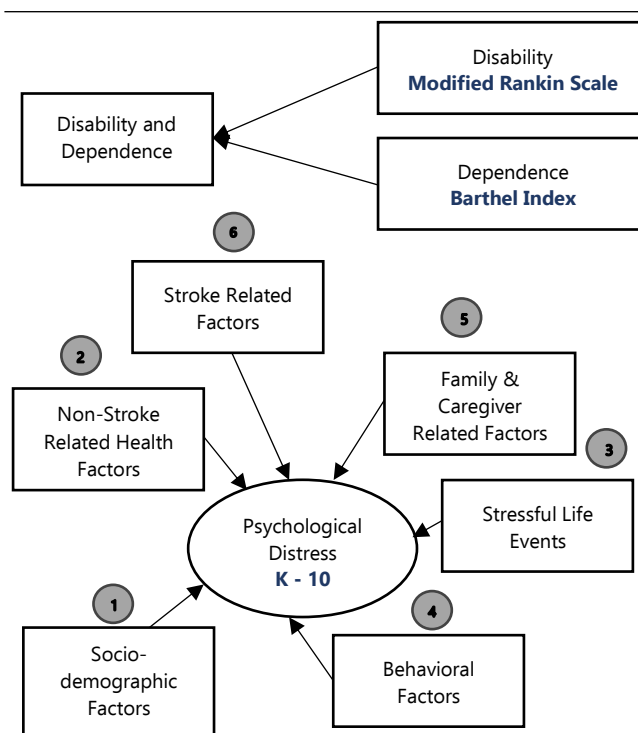
Legend: The presence of psychological distress assessed via K–10 was hypothesized to be influenced by factors under 6 domains (stroke and non-stroke-related health factors considered collectively as health factors). Blocks refer to the clusters of variables; solid arrows refer to expected causal effects; dashed arrows refer to components of a cluster; and text in bold refers to study instruments used. Data regarding the content numbered 1 – 6 were obtained from Section A of the questionnaire.

Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo (MFC/AL/2017/1290), administrative clearance was acquired from

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the director of the National Hospital of Sri Lanka, Colombo, and permission was obtained from the consultants of all four neurology clinics.

Study Instruments

The study instrument used comprised three sections, all of which were interviewer-administered to the participants. *Figure 1* None of the three sections involved any manuals requiring investigator training. However, the investigators discussed consistency, and advice was obtained from a consultant psychiatrist to gain insight regarding this process.

- Section A – A questionnaire developed by the investigators under the supervision of a consultant psychiatrist to identify the various factors listed under the socio-demographic, health-related, stroke-related, behavioral, stressful life event, and family and caregiver factorial domains.
- Section B – Interviewer-administered Kessler's psychological distress scale (K- 10), standardized and validated for the Sri Lankan population.[9]
- Section C – Interviewer-administered 10-item Barthel Index, standardized and validated for the Sri Lankan population by Lekamwasam et al. (2011) and the modified Rankin scale.[10]

Data Analysis

Dichotomization of the Dependent Variable

Data was analyzed descriptively and analytically by the SPSS statistical software version 26. The validation of the K-10 to the Sinhala-speaking population of Sri Lanka by Wijerathne et al. (2005), presented a cutoff of ≥22 to categorize patients as 'distressed' or 'non-distressed', which was used to differentiate the distressed patients from the non-distressed patients.[9]

Descriptive Analysis

The descriptive analysis of results was done using frequency distributions for basic sociodemographic and stroke-related details. Numerical variables were described via means and SDs, and categorical variables via proportions.

Statistical Analysis

Factors affecting PsyD were evaluated under several domains *Table 1*. Four domains that were not directly related to the patient's health were first analyzed, followed by two health-related domains (stroke-related and other health-related factors). Accordingly, two main statistical methods were used: bivariate analysis using chi-square tests and simple logistic regression, followed by multivariate analysis by multiple logistic regression. For each domain, categorical variables were subjected to initial bivariate analysis using Chi-square tests (and Fisher's exact tests when necessary) to identify the association between the factors of each domain on the level of PsyD. P-values of < 0.05 were considered statistically significant in all associations.

Bivariate Analysis

The bivariate analysis of continuous independent variables (age, number of stroke events, time since last stroke event, level of dependence on Activities of Daily Living, and level of disability) was carried out using simple logistic regression, where the results

Table 1. Classification of Variables Included in the Main Domains Assessed.

Socio-Demographic	Health Related	Stroke Related
Gender	Hypertension	Number of stroke events
Age	Dyslipidemia	Time since the last stroke event
Ethnicity	Diabetes Mellitus	Type of stroke
Highest Level of Education	History of Psychiatric Disorders prior to stroke	Dominance of the side affected
Monthly Household Income	Family History of Psychiatric Disorders	Follow-up care received
Employment Status		Membership of the stroke support group
Behavioral	**Family and Caregiver**	**Stroke related Disability**
Status of smoking	Marital status	Barthel Index
Frequency of smoking	Sole source of income	Modified Rankin Scale
Effect of stroke on frequency of smoking	Number of children	
Status of alcohol consumption	Presence of caregiver	
Frequency of alcohol consumption	Association with the caregiver	
Effect of stroke on alcohol consumption	Time spent with the caregiver	
Status of engagement in physical/leisure activities		
Frequency of engagement in physical/leisure activities		
Effect of engagement in physical/leisure activities		
Status of religious activities		
Frequency of religious activities		
Effect of stroke on religious activities		

were presented in the form of odds ratio (OR) with 95% confidence intervals (95%CI) while considering *p* values <0.05 as significant. The level of PsyD persisted in becoming the dependent variable in all analyses.

Multivariate Analysis

Under multivariate analysis, a hierarchical binary logistic regression analysis was carried out. Initially, age, gender, and history of psychiatric disorders were entered into the model since they were repeatedly identified in the literature as strong

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confounders.[11] After that, the other independent predictors identified as significant using bivariate analysis were included in the second block, with the rest of the predictors in the third block to assess for confounding amongst variables in bivariate analysis. Predictors in the second and third blocks were added stepwise into the analysis process. Accordingly, after assessing multicollinearity and excluding any outliers, a final single model was formed by isolating the factors that are proven to be significant even after undergoing multivariate analysis ($p < 0.05$). The goodness-of-fit of the model was assessed using the Hosmer-Lemeshow test.

Results

Study Sample

The study included 177 subjects, with a response rate of 67.8 %. The participants' ages ranged from 27 to 91, with a mean age of 59.7 years, a standard deviation of 12.3 years, and a normal distribution. 27.5 % (n = 33) of the patients were employed, and 93.3% (n = 112) of the total sample had received formal secondary education. The majority of the participants had an ischemic stroke (85%, n = 102). The K-10 scores of the study sample ranged from 10 to 47 (the total range of the scale is 10 – 50), with a mean score of 16.7 and a standard deviation of 8.4, indicating an acceptably wide distribution. Based on the cut-off, 23.3% (n = 28) of the study sample was distressed.

Results of Bivariate Analysis

Socio-demographic factors, the presence of at least one stressful life event, and family and caregiver-related factors did not possess statistically significant associations with PsyD according to the results of the bivariate analysis using chi-square tests and simple logistic regression (all p values > 0.05). The chi-square analysis revealed that history of psychiatric disease (p-value = 0.003), first-degree relatives with psychiatric diseases (p-value = 0.034) (under health-related factors), the frequency of engaging in physical/leisure activities prior to stroke (p-value < 0.05) (under lifestyle-related factors) to be significantly associated with PsyD. Under stroke-related factors, namely time since the last stroke event (p-value = 0.036, level of disability (p-value < 0.000), and level of dependence (p-value = 0.021) were significantly associated with PsyD during simple logistic regression (*Table 2*).

Table 2. Three Continuous Variables (Time Since the Last Stroke Event, Level of Dependence and Level of Disability) Associated with Psychological Distress Of Stroke Patients (N = 120).

Predictor	p	OR	95% CI
Time since last stroke event[a]	*0.036*	0.74	0.56 – 0.98
Level of Dependence[b]	0.021	0.99	0.97 – 1.00
Level of Disability[c]	p < 0.000	2.01	1.46 – 2.78

Legend: OR = Odds Ratio; CI = Confidence Interval; [a] Omnibus χ^2 (1) = 10.95, p < 0.05, R^2 = 0.124 (Negelkerke); [b] Omnibus χ^2 (1) = 5.189, p < 0.05, R^2 = 0.065 (Negelkerke), level of dependence regarding activities of daily living was assessed using the Barthel Index Score; [c] Omnibus χ^2 (1) = 21.195, p < 0.05, R^2 = 0.248 (Negelkerke), level of disability was assessed based on the Modified Rankin Scale.

Results of Multivariate Analysis

The multivariate logistic regression analysis showed a statistically significant influence of younger age (p-value = 0.010), female gender (p-value = 0.005), presence of a history of psychiatric disease (p-value = 0.009), being the sole source of income to the family (p-value = 0.019) and increasing level of disability (p-value < 0.001) on the presence of PsyD (χ^2 (5) = 68.0, p < 0.001). The model was checked and cleared of potentially significant outliers. The variance inflation factors of the five predictors during the collinearity statistics were 1.045, 1.166, 1.064, 1.159 and 1.094, respectively, well below the standard cutoff for significant correlation between predictors. (1: no correlation, 1 – 5 moderate correlation with no significant impact on the model, >5: severe correlation with imprecise model) The Hosmer-Lemeshow Goodness-of-fit test for the model displayed a χ^2 (8) = 4.1 and p = 0.852, and the Omnibus Chi-square value was χ^2 (5)= 68.0 with a p-value < 0.001. The overall prediction percentage of the model was 92.6%, well above the standard cutoff of 80%. The model explained 77.2% of the variance (Negelkerke R^2) with a sensitivity of 73.3% and specificity of 96.6% (*Table 3*).

Table 3. Results of the Multivariate Regression Analysis (n = 112) on Predictors of Psychological Distress.

Predictor	p	Unadjusted OR	Adjusted OR	95% CI
History of Psychiatric Disorders[a], Yes	0.009	5.15	172.59	3.64-8174.42
Age	0.01	-0.13	0.87	0.79-0.97
mRS	*<0.001*	2.57	13.05	3.59-47.36
Gender[b], Female	0.005	4.26	70.94	3.73-1348.89
Sole Source of Income[c], Yes	0.019	3.21	24.70	1.67-362.01
Constant	0.045	-4.77	0.008	

Legend: OR = Odds Ratio; CI = Confidence Interval; mRS = modified Rankin Scale; Omnibus χ^2 (5) = 68.022, p < 0.001, R^2 = 0.772 (Negelkerke). Reference levels of the independent categorical levels. [a] absence of a history of psychiatric diseases; [b] male gender; [c] Not the sole source of income

Discussion

This study was carried out to assess the prevalence and the associated factors of PsyD among the post-stroke patients attending the Neurology Clinics of the NHSL, Colombo. The cross-sectional study design facilitated the investigators to compare distressed and non-distressed patients and the strength of each factor in its influence on the presence of psychological.
The prevalence of PsyD in the current study is comparable to that reported in other local and international studies. The differences could be attributed to the differences in the sample sizes, age

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ranges of participants and other restrictions in inclusion criteria.[8,12,13]

Under the different variables, factors like age and gender were frequently discussed in past studies with contrastingly different results, with some presenting young age as a risk factor and others as a protective factor or as insignificant. However, in the present study, age was recognized as statistically significant in the final binary logistic regression model (OR = 0.87: 95% CI: 0.79 – 0.97; p = 0.010). This might confirm the findings of the systematic review by Hackett and Anderson (2005), where age is considered a crucial demographic factor that is to be mandatorily included in multivariate analysis.[11] Thus, the contrasting findings in different studies might be due to the confinement to bivariate analysis in most studies and not including multivariate analyses.

In the current study, gender was not found to have a statistically significant influence on PsyD in the initial bivariate analysis. In contrast, female gender was found to be significant in multivariate analysis. Similarly, 13 out of 21 studies reviewed by Robinson and Jorge, 2016, did not find gender as a significant predictor of PSD in their initial analyses.[14]

Studies by Ferro et al., 2016 and Mirolovics et al., 2020, indicate higher educational levels as a protective factor for PsyD, which was not identified by this study either in bivariate or multivariate analysis.[15,16] This could be attributed to differences in the study samples, precisely due to lower proportions of participants with lower educational levels, which could have affected the findings (the proportion of participants with an educational level less than Grade 5 was 6.7%).

The current study did not identify income level as a significant predictor of PsyD, which differed from studies conducted by Mirolovics et al., 2020, which recognized higher economic status as associated with lower PsyD.[15] This association could have been due to the costs of medication and the acquisition of health facilities, which play a significant role in the long-term management of stroke. However, this might not be relevant in the local setting due to the presence of a free health care service in the country, which indicates the non-significant results.

Furthermore, a study conducted in China identified hypertension to be significantly associated with PsyD in both bivariate and multivariate analyses. However, none of these factors were found to have a statistically significant association with PsyD in the present study. In the Chinese study, only young patients in the age range of 20 to 44 years were considered, which could have had a significant influence on the results, as the presence of other chronic conditions will significantly impact younger patients, being an economically driving force in all societies in addition to the stroke itself. This is further gratified by the absence of age adjustment in none of the regression models where hypertension was statistically significant (model for the Symptom Checklist 90 Revised and the model for anxiety).

A meta-analysis carried out by Mitchell et al., 2017, identified both past personal and family history of depression as crucial risk factors for post-stroke depression, adjustment disorder and anxiety.[17] Even though a family history of psychiatric disorders was statistically significantly associated with PsyD only in the initial bivariate analysis in this study, significant results were found regarding past personal history of psychiatric disorders in both bivariate and multivariate analyses.

When considering behavioural factors, a Norwegian study exploring the association between pre-stroke physical activity with symptoms of anxiety and depression three months post-stroke identified higher activity levels prior to the stroke event to be protective against post-stroke depression in their multivariate analysis despite 41.5% of the study population, not having a significant reduction or increase in the level of physical activity following the stroke event. This contrasts with the present study, which found no significant association between engagement in physical activities prior to the stroke event and the presence of PsyD. However, the frequency of physical activities prior to the stroke event was significantly associated with PsyD in the bivariate model (it was not included in the final regression model due to the effects of multicollinearity). Here, higher frequencies of physical activity prior to the stroke event were associated with the presence of distress, which could be associated with mental stress in such patients due to the limitation of activity following the disabilities imposed on them by the cerebrovascular accident. However, other factors under this domain specifically included to suit the local cultural setting but not openly discussed in the literature, such as religious activities, were insignificant in their results.

Under family and caregiver factors, although specific studies state the importance of family members and friends in relieving the internal isolation experienced by patients, a quantitative analysis of this using the marital status, number of family members and dependents was insignificant.[18]

Stroke-related factors were considered to be among the most highly debated in the literature. For example, regarding the time since the last stroke event, some studies presented that depressive symptoms decreased with the time since the stroke, while others expressed otherwise. In the initial bivariate analysis of this study via simple logistic regression, an increase in the time since the last stroke event (in years) was associated with a reduction in PsyD (OR = 0.74; 95% CI:0.56 – 1).

Unlike other factors of the same domain, stroke-related disability and dependence on Activities of Daily Living (ADL) were both consistently associated with higher levels of distress and depression in post-stroke patients. The systematic review by Hackett and Anderson (2005) identifies disability status to be a factor that both researchers and clinicians should prioritize in the detection of depression among post-stroke patients.[11] Similarly, disability status assessed by the modified Rankin scale was identified to be a statistically significant predictor of PsyD in both bivariate and multivariate analysis in the current study (p < 0.001).

Accordingly, these factors identified can be utilized at the point of discharge in the early rapid recognition of patients for referrals

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and during follow-up care so that limited psychiatric resources could be efficiently channeled to prioritize patients at a comparatively high level of risk.

Throughout the interpretation of the results of the final logistic regression model, the wide confidence intervals obtained for the different predictors, particularly for the presence of a history of psychiatric disorders, female gender, and the being the sole source of income, even after assessments for multicollinearity and outliers should be given due significance. While it is in congruence with the similar findings in the literature discussed above with powerful associations established with the dependent variable, imprecision due to small size should always be considered and noted.

Notably, there were several limitations in the study with relevance to (1) the inability to obtain an adequate sample size due to pragmatic issues from the pandemic situation which could potentially have had a significant impact on the statistical analysis as well, (2) low response rate of 67.79%, (3) absence of temporal associations between the predictors and outcomes due to the study design, (4) inability to generalize findings outside the study setting due to the absence of multiple center involvement in the study setting, (5) inability to assess the added impact of the CoVID-19 pandemic on patients, (6) change in the sampling method to multistage random sampling and data collection via phone calls over direct face-to-face interviews due to the pandemic. Hence, further research should be encouraged, particularly by incorporating clinical assessment into the screening tools in assessing PsyD and by including details regarding stroke subtype classifications and stroke severity assessments via radiological and clinical data. Furthermore, such studies should be expanded to a multicenter level and incorporate direct investigator-participant interactions to reduce bias and expand generalizability. Moreover, it will be essential to explore the challenges faced by post-stroke patients who are not psychologically distressed and the factors that influence poor outcomes in them as well.

Conclusion.

In conclusion, this study conducted to make a holistic approach to the psychological consequences of stroke on patients revealed a significant prevalence of PsyD amongst post-stroke patients in the outpatient setting and was associated with several health and non-health related factors. These findings, comparable with international studies, shed light on the Sri Lankan perspective and have a multitude of clinical implications in the long-term care of these patients, especially in low-income settings. However, several limitations, owing to the pandemic situation in which the study was conducted and the inherent characteristics of the design itself, direct potential for further research on this topic. Nevertheless, this study landmarked as potentially the first of its kind in Sri Lanka, for the best of our knowledge can direct the course of neuropsychiatric care of post-stroke patients by transcending beyond clinical and sociodemographic characteristics to include caregiver as well as family-related data to identify patients at risk.

Summary – Accelerating Translation

Prevalence and Associated Factors of Psychological Distress of Patients with Stroke Attending a Neurology Clinic – A Descriptive Cross-sectional Study

Aims: To assess the prevalence of psychological distress and identify its associated factors among the post-stroke patients attending the Neurology Clinics of the National Hospital of Sri Lanka (NHSL), Colombo. Background – A multitude of factors affect the prognosis of psychological distress among post-stroke patients. Existing studies have primarily focused on post-stroke anxiety or depression using non-specific scales. These scales may not fully represent the outcomes. Even though many factors are known to be associated with psychological distress, there are many controversies regarding many factors. Very few studies have accounted for the effects of confounding in their analysis in identifying potential predictors.

Outcomes of the Study – Psychological distress is a significant issue in the current context, accounting for approximately ¼ of the post-stroke patients. Age, gender, being the sole source of income, history of psychiatric disorders and the level of disability assessed by the modified Rankin Scale were identified as statistically significant predictors of psychological distress via binary logistic regression analysis.

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Healthcare Workers' Perceptions of Patient Safety Culture in United States Hospitals: A Systematic Review and Meta-Analysis

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Abstract

Background: Despite leading in healthcare spending, the United States sees only marginal improvements in patient outcomes among developed nations. Assessing patient safety culture (PSC) through the Hospital Survey on Patient Safety Culture (HSOPSC) provides insights into overall patient safety and attitudes toward medical errors. This study aims to examine PSC in U.S. hospitals across professional categories via a systematic review and meta-analysis of published literature. **Methods:** Embase, PubMed (Medline), Web of Science, Scopus, and AHRQ's Bibliography were consulted for identifying studies. A total of 31 articles met the eligibility criteria for inclusion, which garnered 608,443 survey participants in a national population of hospital healthcare professionals. For each professional category of PSC, a fixed and random-effects meta-analysis was performed, and a subgroup analysis was also conducted to measure differences in perceptions of PSC based on type of healthcare professional. **Results:** The HSOPSC composite average across all the studies was 61.3% positive responsiveness, indicating a need for improvement in patient safety. "Teamwork within units" had the highest positive PSC perception while "nonpunitive response to error" and "handoffs and transitions" scored the lowest. Furthermore, healthcare trainees and physicians seemed to have overall worse perceptions of patient safety culture compared to other professional subgroups, indicating the potential impacts of inexperience and a culpability culture on patient safety and medical error in hospitals. **Discussion:** To strengthen weak aspects of patient safety culture, hospitals should implement interventions such as teamwork training and error-reporting systems, thereby enhancing patient safety measures and reducing medical errors.

Introduction

According to the World Health Organization, patient safety refers to "the prevention of errors and adverse effects to patients associated with health care" and "to do no harm".[1] Threats toward patient safety can be attributed to medical errors both at the individual and organizational levels.[2-3] "To Err is Human" reported that as many as 98,000 people die of hospital medical errors,[3] and substantial efforts have been made recently to identify sources of error, develop safety measures, and create harm-prevention policies in United States hospitals.[4-5] Hospital errors and treating patients due to these errors account for more than 15% of healthcare spending in developed countries, including the US.[6] Furthermore, around 1 in every 10 patients is harmed in healthcare due to safety lapses, an indicator of low-quality healthcare, leading to a global figure of 3 million deaths annually.[7-8] As a result, addressing patient safety in health systems, like private hospitals and hospital networks, has become a crucial aspect of improving the quality of patient care.

Enhancing safety culture in healthcare settings has been recognized as an element for improving patient safety, treatment outcomes, and overall quality of health.[9-11, 36] Patient safety culture (PSC) refers to the shared perceptions of healthcare professionals around the procedures, norms, values, and attitudes relating to a culture of preventable errors.[12] As such, health organizations with strong PSC—characterized by trust and teamwork amongst staff, effective communication between members, and shared perceptions about the importance of patient safety—are associated with having more favorable outcomes and lower frequency of medical errors.[13-15]

The Hospital Survey on Patient Safety Culture (HSOPSC) created by the Agency for Healthcare Research and Quality (AHRQ) in the USA is a multi-dimensional, psychometrically-sound tool that measures patient safety culture in the hospital setting.[16-17] Currently, two versions of the HSOPSC exist, and both versions 1.0 (created in 2014) and 2.0 (developed in 2019) are available. Considering its development in the United States, the HSOPSC has been adopted and utilized by hundreds of hospitals nationwide.[18] Assessing health institutions in the United States is educationally necessitated for two primary reasons: economics and patient outcomes. First of all, the US has one of the highest

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spending rates for medical care, potentially twice as much as the other developed nations; some of these costs are due to medical errors and preventable administrative issues.[19-21] Secondly, the United States population has a lower average life expectancy and a higher *avoidable* mortality rate than other middle- or high-income countries.[22] In other words, despite having the greatest healthcare spending rate, the United States of America is seeing marginal overall impacts on patient outcomes within the developed world. Studying PSC in hospitals can provide insights into the status of patient safety and the culture of medical/avoidable errors in the United States. In this context, the purpose of this study is to examine patient safety culture in US hospitals across professional categories through a systemic review and meta-analysis of published literature.

Methods

Study Aims and Protocol

This review aims to identify studies that have used HSOPSC to measure PSC at United States hospitals and to describe their main findings relating to specific safety culture composites. Additionally, the present study sought to summarize the HSOPSC surveys by means of systematic review and meta-analysis. This study, utilizing a living systematic review and meta-analysis,[23-24] was prepared and implemented by both authors. The literature search was conducted according to protocols set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[25] This study is registered to PROSPERO with the following registration number: CRD42024543348.

Table 1. Patient Safety Culture Measures and Definitions.

Composites	Items	Definitions
Teamwork Within Units	4	Staff support each other, treat each other with respect, and work together as a team.
Supervisor & Manager Expectations and Actions Promoting Patient Safety	4	Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems.
Organizational Learning—Continuous Improvement	3	Mistakes have led to positive changes and changes are evaluated for effectiveness.
Management Support for Patient Safety	3	Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority.
Overall Perceptions of patient safety	4	Procedures and systems are good at preventing errors and there is a lack of patient safety problems.
Feedback & Communication about error	3	Staff are informed about errors that happen, are given feedback about changes implemented, and discuss ways to prevent errors.
Communication Openness	3	Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority.
Frequency of Events reported	3	Mistakes of the following types are reported: (1) mistakes caught and corrected before affecting the patient, (2) mistakes with no potential to harm the patient, and (3) mistakes that could harm the patient but do not.
Teamwork across units	4	Hospital units cooperate and coordinate with one another to provide the best care for patients.
Staffing	4	There are enough staff to handle the workload and work hours are appropriate to provide the best care for patients.
Handoffs & Transitions	4	Important patient care information is transferred across hospital units and during shift changes.
Nonpunitive Response to Error	3	Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their personnel file.
HSOPSC Composite Average	42	Average of the 12 composite scores

Search Strategies

The following databases were consulted for identifying studies: Embase, PubMed (Medline), Web of Science, and Scopus. The search strategy involved implementing a combination of the following keywords using the Boolean operators 'OR' and 'AND': "Patient safety culture", "HSOPSC", and "SOPS". To maximize inclusion of relevant studies, the AHRQ Reference Bibliography List was consulted. Importantly, the AHRQ reference bibliography includes articles that are not limited to the four databases mentioned above. The search strategies for each database are given in ***Supplemental Table 1***. 57 studies from the AHRQ bibliography were incorporated in the screening phase.

Eligibility Criteria and Study Selection

There is much variety in the instruments that are used to assess patient safety culture perceptions amongst healthcare professionals.[26-27] As a result, the authors selected articles that meet the following inclusion criteria: (i) studies used Hospital

SOPS Version 1.0 to measure dimensions of PSC; (ii) studies show data from US healthcare systems; (iii) studies are full-text and available in English. Furthermore, the following articles were excluded: (i) studies in the form of letters, conferences, commentaries, and patient reports; (ii) studies performed outside of hospital setting; (iii) studies using benchmark data without mentioning sampling/eligibility criteria; (iv) studies with data from already-identified articles; (v) studies duplicated across databases. Previous reviews done in developing countries and European countries also followed similar inclusion and exclusion criteria.[12-17] Some of these reviews excluded studies that only included one unit of a hospital or one professional category.[13-14] However, the authors decided to include such studies, agreeing that every unit and staff category plays a role in representing a US hospital and its safety culture. Two authors independently screened the title/abstract to determine eligibility for full-text review. Then, these selected studies were comprehensively evaluated based on the aforementioned criteria by both

reviewers. Disagreements for inclusion were resolved by additional, collaborative full-text analysis and consensus; if consensus could not be attained, an impartial third-party reviewer was consulted to make a final decision. The reviewers/authors involved in this study have no conflicting interests.

Data Extraction

Two reviewers summarized data from the included studies using a standardized data extraction sheet in Microsoft Excel. The minimum information was extracted from each study: citation, publication year, study site, number of hospitals included (N), sample size of survey respondents (n), and professional categories. Most importantly, all data relating to the 12 dimensions evaluated by the hospital SOPS 1.0 were extracted for qualitative and quantitative analysis. Any additional information regarding interventions or safety culture improvement programs was qualitatively described.

Considering the purpose of this study is to assess safety culture in the US using the HSOPSC, an understanding of the survey is crucial. The HSOPSC measures 12 dimensions of patient safety culture, with three to four questions to assess each dimension, totaling 42 items. The dimensions are measured using a 5-point Likert scale, ranging from 'never' to 'always' and 'strongly disagree' to 'strongly agree', for both negatively and positively worded items.[16] Following the Likert scale, many studies evaluate PSC by calculating mean scores, ranging from 0 to 5, for each dimension. A score closer to 5.0 denotes more positive perceptions of safety culture amongst hospital staff, allowing for extrapolation and conversion.[28] The AHRQ and the majority of literature in the field recommend using the percentage of positive responses obtained in each composite dimension by the survey participants as a measure of safety culture status. While both methods of presenting PSC data are valid, this systematic review specifically uses percentage of positive responses as the quantitative measure of safety culture. A high percentage of positive responses (>75%) indicates a general strength for the PSC dimension within the surveyed population. Lower positive response scores (<50%) are considered weak dimensions needing further study and improvement.[28] The 12 dimensions measured by the HSOPSC 1.0 and their respective definitions are given in **_Table 1_**.

Risk of Bias

The selected articles were assessed for risk of bias (i.e. the quality score) using the JBI critical appraisal toolkit.[29] This 10-item checklist assesses (i) sample representativeness, (ii) appropriate recruitment of participants, (iii) sample size adequacy, (iv) description of sample and study site, (v) data analysis, (vi) presence of objective, standard criteria for measurement, (vii) reliable measurement, (viii) appropriate statistical analysis, (ix) accounting for confounding factors/subgroups/differences, and (x) identification/analysis of subpopulations.[30] Both reviewers rated each article in this review using the JBI critical appraisal checklist, and scores were averaged, culminating in the quality scores shown in **_Table 2_**.

Statistical Analysis

Data extracted from the studies were organized, analyzed, and graphed using Microsoft Excel and RStudio. For each HSOPSC dimension, statistical analysis was performed by calculating mean positive scores, standard deviation, standard error, and 95% confidence intervals.[31] Meta-analysis was performed using a comparison of results using both a fixed and random-effect analysis, a conservative approach for the meta-analysis of systematic studies.[32-33] A random-effect analysis was done because of the number of studies included in this review (31 total articles) and the understanding that studies utilizing HSOPSC yield high heterogeneity in the results. Heterogeneity was assessed by deriving the inverse variance in a fixed-effects model, expressed as the I^2 statistic percentage.[34] Then, two subgroup analyses were done to measure potential differences in PSC based on the sample composition of studies.[31] For the first subgroup analysis, studies were grouped into two categories: those that assessed healthcare trainees (residents, fellows, trainee nurses, etc) vs those that surveyed permanent staff members. The second subgroup analysis regrouped the studies based on three professional categories: nurses, physicians, and a mix of professions. Importantly, a few individual studies provided separate HSOPSC data for each subgroups; the reviewers extracted all subgrouped data to include in the meta-analysis. For example, Bump et al., 2017 provided separate results for trainees vs staff members, and both categories of data were collected in Excel and included in the statistical comparison. Statistical analysis included two-tailed tests of statistical probability, and P-values < 0.05 were deemed significant.[33]

Results

The database searches identified 658 papers for screening. An additional 57 papers from the AHRQ reference bibliography were added to this screening pool.[34] Initial screening for language, location, and removal of duplicates eliminated 406 articles, leaving 309 studies for title/abstract screening. Two reviewers assessed the abstracts/titles of the papers to identify 77 articles total for the full-text review phase. A total of 31 articles met the eligibility criteria for inclusion. **_Figure 1_** shows a PRISMA flowchart for the literature selection process.

For the purpose of this review, all 31 studies were conducted in the United States, ranging from nationwide to single hospital samples. The articles were all published within the last 15 years and used the Hospital SOPS 1.0 to assess PSC. The 31 studies totaled (at least) 608,443 participants, ranging from 42 participants at a specialized hospital unit to 196,462 participants in a national population of healthcare professionals. Most studies included a mix of professional categories, but a small number of studies provided compartmentalized HSOPSC results focused exclusively on nurses (8 papers) and physicians (5 papers). Moreover, only four studies included HSOPSC results that specifically denoted trainee professionals vs permanent staff members. **_Table 2_** provides an overview and qualitative descriptions of all 31 studies.

Table 2. **Overview and Qualitative Descriptions of Selected Studies.**

N°	Author /Study	Study Site(s)	Number of Hospitals/ Medical Centers (N)	Number of Participants (n)	Main Findings	Professional Category	Quality Score
1	Jasti, 2009 [37]	Pittsburgh, PA - UPMC Presbyterian Hospital	1	58	"Supervisor/Manager Expectations & Actions Promoting Patient Safety" and "Teamwork within units" were the highest scored HSOPSC dimensions (75% and 69% positive response rate, respectively). "Handoffs & Transitions" and "Feedback & Communication About Error" scored the lowest (19% and 27% positive response rate, respectively). Internal medicine house staff at earlier stages in their residency training scored higher in 11 out of 12 dimensions.	Physicians (residents)	8
2	Profit, 2016 [38]	Neonatal Intensive Care Units in Californian hospitals	44	2073	"Teamwork Within Units" was the highest scored HSOPSC dimension (74% positive response rate). "Communication Openness" and "Feedback & Communication About Error" scored the lowest (49.3% and 49.2% positive response rate, respectively). Patient safety culture ratings generally decreased as the number of admissions, beds, and staff experiences levels increased across the sample of NICUs.	Mix of Professions	9
3	Bump, 2015 [39]	Pennsylvania - UPMC	10	955	"Teamwork Within Units" and "Supervisor/Manager Expectations & Actions Promoting Patient Safety" were the highest scored dimensions (72% and 80% positive response rate, respectively). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (39% and 42% positive response rate, respectively). Compared to practicing providers, resident and fellow doctors seemed to have lower overall perceptions of PSC.	Physicians (residents + fellows)	7
4	Blegen, 2010 [40]	California - UCSF, El Camino Hospital, Kaiser Permanente SF Hospital	3	368	"Teamwork Within Units" and "Organizational Learning—Continuous Improvement" scored the highest positive response rates (76.6% and 76%, respectively). "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (57.4% and 57.6% positive response rate, respectively). The TOPS project, involving multidisciplinary team training programs and communication interventions, seemed to improve PSC in hospital medical units.	Mix of Professions	9
5	Campbell, 2010 [41]	Boston, MA - Massachusetts General Hospital	1	2163	"Teamwork Within Units" was the highest scored HSOPSC dimension (85% positive response rate). "Handoffs & Transitions", "Frequency of Events Reporting", and "Feedback & Communication About Error" scored the lowest (45%, 49%, and 51% positive response rate, respectively). At this hospital, patient safety climate varied drastically across units and unit types; furthermore, physicians offered more negative PSC ratings.	Physicians, Nurses	10
6	DuPree, 2011 [42]	NYC, NY - Mount Sinai Medical Center	1	325	At the time of study, "Organization Learning—Continuous Improvement" scored the highest at 68% positive response, but "Teamwork Within Units" was consistently rated around 65% positive response. "Frequency of Events Reporting" was scored the lowest at 54% positive responsiveness. Implementing a multidisciplinary Code of Professionalism for staff members to follow showed significant improvements in safety culture in this hospital.	Mix of Professions	10

7	Jones, 2013 [43]	Small Rural Hospitals in Central America	Intervention Hospitals: 24 Static Hospitals: 13	Intervention Hospitals: 2137 Static Hospitals: 1328	"Teamwork Within Units" and "Management Support for Patient Safety" were the highest scoring dimensions (82% and 81% positive response rate, respectively). "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (both 54% positive response rate). TeamSTEPPS intervention, a training program teaching the knowledge and skills that comprise effective teamwork, was associated with greater positive PSC scores.	Mix of Professions 10
8	Mardon, 2010 [44]	Nationwide	179	56480	"Teamwork Within Units" and "Supervisor/Manager Expectations & Actions Promoting Patient Safety" were the highest scored dimensions (79% and 74% positive response rate, respectively). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (44% and 42% positive response rate, respectively).	Mix of Professions 10
9	Ulrich & Kear, 2014 [45]	Nationwide	--	929	Among nephrology nurses: "Teamwork" items received a high positive PSC score (80.7%) while "Handoffs & Transitions" scored the lowest in HSOPSC rating (32.75%).	Nurses 10
10	Wagner, 2013 [46]	Nationwide	622	196462	"Teamwork Within Units" and "Supervisor/Manager Expectations & Actions Promoting Patient Safety" were the highest scored dimensions (79% and 75% positive response rate, respectively). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (both 44% positive response rate,).	Mix of Professions 8
11	Wu, 2013 [47]	Nationwide	884	106710	"Teamwork Within Units" was the highest positively scored dimension (78.2%). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (both approximately 62% positive responsiveness). Nurses with long working hours/shifts had lower PSC ratings for the "Teamwork Within Units" and "Staffing" Dimensions.	Nurses 9
12	Gampetro, 2021 [48]	Nationwide - Pediatric Units	287	6682	"Teamwork Within Units" was the highest positively scored dimension (82.8%). Meanwhile, "Staffing", "Handoffs & Transitions", and "Nonpunitive Response to Error" scored the lowest (53.2%, 52.8%, and 54.2%, respectively). There are significant differences regarding perceptions of safety culture between hospitals/specialty units as well as between pediatric physicians and nurses	Mix of Professions 10
13	Nourel din, 2021 [49]	Nationwide - Hospital Pharmacies	--	7,671	"Teamwork Within Units" and "Supervisor/Manager Expectations & Actions Promoting Patient Safety" scored relatively high positive responsiveness ratings with 78.7% and 77.6%, respectively. Meanwhile, pharmacists scored "Staffing" lower at 55.2% positive responsiveness. More experienced pharmacists were more likely to report errors in the workplace. Furthermore, pharmacists at larger hospitals were less likely to report errors and had lower percent positive scores across all the PSC domains.	Pharmacists 9
14	Lozito, 2018 [50]	Pennsylvania	1	71	After implementing the Good Catch Campaign (an educational intervention associated with the implementation of a standardized electronic reporting and debriefing system), staff members reported higher positive responsiveness in all five tested PSC domains: "Communication Openness", "Feedback & Communication about Error", "Frequency of Event Reporting", "Nonpunitive Response to Error", and "Organization Learning—Continuous Improvement". "Nonpunitive Response to Error" scored the lowest at 57% positive response rate.	Mix of Professions 9

15	Smith, 2017 [51]	Nationwide	164	140,316	"Teamwork Within Units" was the highest positively scored dimension (81%). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (43% and 44% positive responsiveness, respectively). Hospitals where staff have more positive perceptions of PSC are associated with higher Consumer Reports hospital safety scores.	Mix of Professions	10
16	Sorra, 2012 [52]	Nationwide	73	26791	"Teamwork Within Units" was the highest positively scored dimension (77%). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (both 40% positive response rate). Hospitals where staff have more positive PSC perceptions were associated with patients having more positive care experiences, even after controlling for hospital size and ownership.	Mix of Professions	10
17	Mackay, 2023 [53]	Southeast US - Children's Hospital	1	Intervention Unit: 44 Comparison Unit: 42	Implementing a Daily Safety Huddle improve the positive PSC perception in one dimension: Communication Openness, which also had the highest positive responsiveness at 68.42%. In this study, "Frequency of Events Reported" had the lowest positive response rate at 41.07%. Further research is needed to elucidate the impact of daily safety huddles in nursing.	Nurses	9
18	Campione & Famolaro, 2018 [54]	Nationwide - Acute Care Hospitals	536	1608	"Teamwork Within Units" was the highest positively scored dimension (81.1%). Meanwhile, "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (46.6% and 44.7% positive responsiveness, respectively). Improvement in PSC perceptions were associated with goal setting, action planning, implementation of multifaceted programs, and consistent measurement of hospital culture across all levels of staff.	Mix of Professions	10
19	Lee & Dahinten, 2020 [55]	Nationwide	535	34514	"Teamwork Within Units" was the highest scored HSOPSC dimension (80.6% positive response rate). Meanwhile, "Staffing", "Handoffs & Transitions", and "Nonpunitive Response to Error" scored the lowest (64.8%, 63%, and 65%, respectively). In regression analysis, "Staffing" and "Management Support for Patient Safety" were the two strongest predictors of patient safety perception.	Nurses	9
20	Jones, 2008 [56]	Central America - Critical Access Hospitals	21	1374	"Teamwork Within Units" was the highest scoring dimensions (81% positive response rate). "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (58% and 52% positive response rate, respectively). Simply raising organizational awareness of patient safety and implementing a voluntary error-reporting program were associated with improved perceptions of PSC.	Mix of Professions	10
21	Hefner, 2017 [57]	Midwest US - OSUWMC Hospitals	3	667	"Teamwork Within Units" was the highest scoring dimension at 78% positive responsiveness while "Nonpunitive Response to Error" scored the lowest at 35%. Crew resource management (CRM) training significantly improved positive perceptions of PSC, especially in teamwork and management domains.	Mix of Professions	10
22	Klingner, 2009 [58]	Tennessee Rural Hospitals	8	835	"Teamwork within units" and "Supervisor/Manager Expectations & Actions Promoting Patient Safety" were the highest scored HSOPSC dimensions (83% and 80% positive response rate, respectively). "Staffing", "Nonpunitive Response to Error", and "Handoffs & Transitions" scored the lowest (52%, 50%, and 49%, respectively).	Mix of Professions	9
23	Lin, 2018 [59]	Hawaii - Surgical Units	12	--	"Teamwork Within Units" received the highest positive response of 75% while "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest at 39% and 40%, respectively. Implementing the AHRQ Safety	Mix of Professions	8

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Program for Surgery was associated with reduced surgical site infection rate and increased perceptions of PSC.

24	Hook, 2016 [60]	Midwest US	4	2011	Higher ratings of hospital culture humility are associated with higher positive perceptions of PSC.	Mix of Professions	10
25	Pimentel, 2021 [61]	Boston, MA - Brigham and Women's Hospital (perioperative staff)	1	431	"Teamwork Within Units" received the highest positive response of 69% while "Frequency of Event Reporting", "Feedback & Communication About Error", and "Handoffs & Transitions" scored the lowest at 35%, 34%, and 30%, respectively. In general, surgery attending physicians perceived the highest PSC while nurses and technicians had the lowest positive PSC ratings.	Physicians (attendings + residents), Nurses, Technicians	10
26	Bump, 2017 [62]	Pennsylvania - UPMC	10	12941	"Supervisor/Manager Expectations & Actions Promoting Patient Safety" and "Teamwork Across Units" were the highest scored HSOPSC dimensions (80%/70% and 77%/75% positive response rate, respectively [MD trainees/Other Staff]). "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest positive responsiveness (41%/46% and 35%/45%, respectively [MD trainees/Other Staff]). Overall, in this integrated health system, MD trainees and other staff report similar positive rates of PSC; however, there are slight differences between domains.	Physicians (residents + fellows), Mix of Professions	8
27	F Jones, 2013 [63]	Memphis, TN - large hospital system's emergency departments	2	47	"Supervisor/Manager Expectations & Actions Promoting Patient Safety" and "Management Support for Patient Safety" were the highest scored HSOPSC dimensions (both 72% positive response rate). "Nonpunitive Response to Error" had the lowest positive responsiveness at 28%. TeamSTEPPS intervention, a training program teaching the knowledge and skills that comprise effective teamwork, was associated with greater positive PSC scores.	Mix of Professions	8
28	Armellino, 2010 [64]	New York - Acute Critical Care Unit at a large tertiary hospital	1	98	"Teamwork Within Units" received the highest positive response of 74.4% while "Nonpunitive Response to Error" scored the lowest at 21.09%. Nurses from more empowered backgrounds seemed to have more positive ratings of PSC, indicating systemic social disparities in safety culture perceptions.	Nurses	9
29	Legg, 2013 [65]	Nationwide - Vascular Interventional Technology Units	--	437	Perceptions of PSC were relatively positive (>50% positive responsiveness) with "Teamwork Within Units" scoring the highest positive response rate at 78.3%. "Handoffs & Transitions" and "Nonpunitive Response to Error" scored the lowest (61.7% and 64.87% positive response rate, respectively).	Technicians	9
30	Hannah, 2008 [66]	West Virginia	26	1,717	"Teamwork Within Units" was the HSOPSC dimension with the highest positive response at 78.7% while "Handoffs & Transitions" and "Nonpunitive Response to Errors" scored the lowest at 41.3% and 38.6%, respectively. There was a significant difference between perceptions of PSC between clinicians and nonclinical staff; overall, clinical staff (i.e. nurses) had more negative ratings of PSC.	Nurses, Administration	10
31	Marstellar, 2015 [67]	Nationwide - Cardiac Surgical Units	5	158	In a sample of cardiac surgical units: "Teamwork Within Units" was the HSOPSC dimension with the highest positive response at 73.5% while "Handoffs & Transitions" and "Nonpunitive Response to Errors" scored the lowest at 39.9% and 37.7%, respectively.	Mix of Professions	10

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The studies demonstrated good methodological quality scores with an average quality score of 9 points out of 10, with 15 studies achieving a maximum score. The studies that lost points were mainly due to errors in participant recruitment or sample/site reporting.

"Teamwork within units" dimension was reported to be the highest or one of the highest-rated composites in the majority of the studies, 26 of 31 studies. Meanwhile, "handoffs & transitions" and "nonpunitive response to error" consistently had the lowest or one of the lowest PSC ratings, 22 of 31 studies each. The meta-analysis of the 12 dimensions of safety culture also corroborated these qualitative findings. Only "teamwork within units" yielded a positive response rate above seventy-five percent, at 75.9%. "Handoffs & transitions" and "nonpunitive response to error" produced positive responsiveness below fifty percent, at 46.6% and 47.7%, respectively. The meta-analysis revealed high heterogeneity values across the survey dimensions and composite average *Table 3*. The HSOPSC composite average across all the studies was 61.3% positive responsiveness, indicating a perception of patient safety culture that requires improvement. A forest plot of studies with a positive PSC composite average by workplace status (trainee vs staff member) is shown in *Figure 2*.

Figure 1. PRISMA 2020 Flowchart for Systematic Study Selection.

Table 3. **Meta-Analysis of HSOPSC Dimensions and Heterogeneity.**

Dimension	Positive Response, % (95% CI)	I² (%)
Teamwork Within Units	75.9 (73.5-78.3)	93.7
Supervisor & Manager Expectations and Actions Promoting Patient Safety	72.7 (70.6-74.9)	90.1
Organizational Learning—Continuous Improvement	71.4 (69.2-73.7)	89.9
Management Support for Patient Safety	66.9 (63.9-70.0)	95.4
Overall perceptions of patient safety	62.0 (59.2-64.8)	95.5
Feedback & Communication about error	60.6 (56.3-64.8)	97.4
Communication Openness	61.6 (58.3-65.0)	96.1
Frequency of Events reported	58.5 (54.3-62.7)	97.7
Teamwork across units	59.3 (55.8-62.8)	96.1
Staffing	57.4 (54.5-60.2)	95.9
Handoffs & Transitions	46.6 (42.9-50.4)	97.5
Nonpunitive Response to Error	47.7 (43.7-51.6)	97.7
HSOPSC Composite Average	**61.3 (58.4-64.1)**	**93.9**

Four studies provided HSOPSC results for trainee participants specifically. Two studies provided multiple HSOPSC results to demarcate potential differences between trainees and permanent staff, so both studies were included in each subgroup.[61-62] The trainee subgroup had a positive composite average of 53.9% while the staff subgroup reported a positive composite average of 62.8%, leading to an overall composite average of 61.3%. The difference in HSOPSC composite averages between trainees and staff (~9%) was found to be statistically significant with a p-value of 0.0111, indicating that trainees seem to have worse perceptions of patient safety than permanent hospital staff.

Five studies provided HSOPSC results for physicians while eight studies reported data from nurse participants. Two studies provided separate data sets for physicians and nurses; both were included in the subgroup analysis.[41, 61] One study denoted individual results for physicians and a mix of professions, so both of these datasets were also included in the respective subgroups.[62] Physicians were the group with the lowest PSC perception with an HSOPSC composite average of 54.8%, followed by nurses with an average of 58.7%, and studies with a mix of professions had the highest composite average of 64.1%. The meta-analysis showed that physicians and a mix of professions had a statistical difference in safety culture perceptions for multiple dimensions: organizational learning–continuous improvement, overall perceptions of patient safety, feedback and communication about error, frequency of events reported, handoffs and transitions, nonpunitive response to error, and overall HSOPSC composite average. Physicians always seemed to report lower PSC perceptions. Additionally, physicians reported a statistically significant lower PSC rating than nurses for one dimension: feedback and communication about error. A bar graph showing differences in HSOPSC dimension between physicians, nurses, and a mix of professions is provided in *Figure 3*.
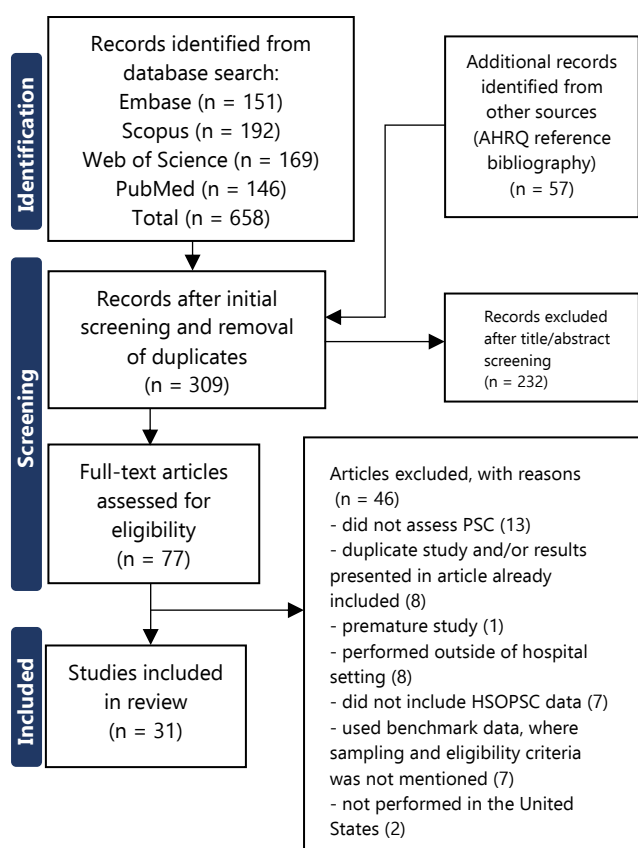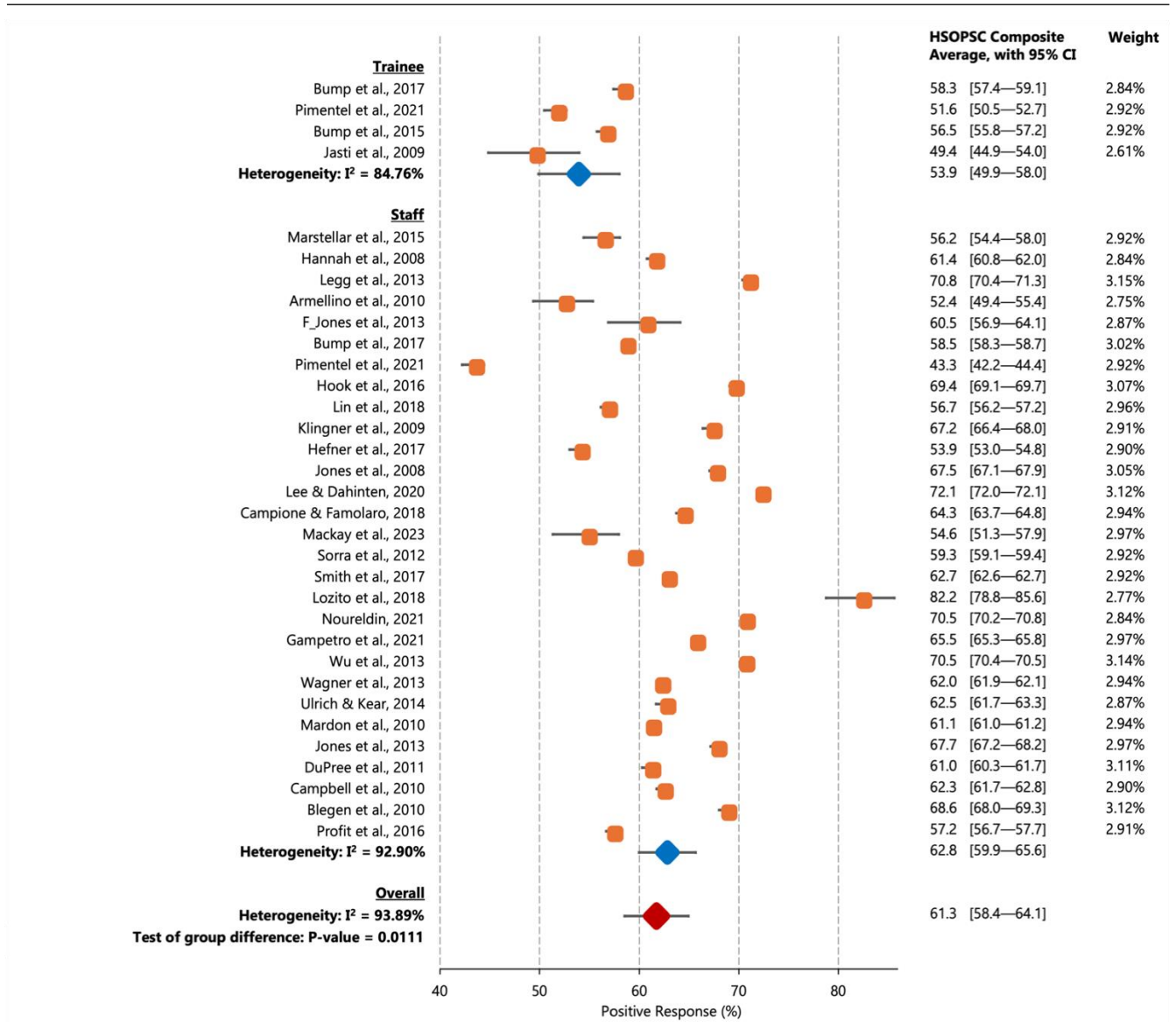
Figure 2. **Forest Plot of HSOPSC Composite Average for all Studies (n = 31) by Workplace Status, Trainees vs Staff Members.**

	HSOPSC Composite Average, with 95% CI	Weight
Trainee		
Bump et al., 2017	58.3 [57.4—59.1]	2.84%
Pimentel et al., 2021	51.6 [50.5—52.7]	2.92%
Bump et al., 2015	56.5 [55.8—57.2]	2.92%
Jasti et al., 2009	49.4 [44.9—54.0]	2.61%
Heterogeneity: I² = 84.76%	53.9 [49.9—58.0]	
Staff		
Marstellar et al., 2015	56.2 [54.4—58.0]	2.92%
Hannah et al., 2008	61.4 [60.8—62.0]	2.84%
Legg et al., 2013	70.8 [70.4—71.3]	3.15%
Armellino et al., 2010	52.4 [49.4—55.4]	2.75%
F_Jones et al., 2013	60.5 [56.9—64.1]	2.87%
Bump et al., 2017	58.5 [58.3—58.7]	3.02%
Pimentel et al., 2021	43.3 [42.2—44.4]	2.92%
Hook et al., 2016	69.4 [69.1—69.7]	3.07%
Lin et al., 2018	56.7 [56.2—57.2]	2.96%
Klingner et al., 2009	67.2 [66.4—68.0]	2.91%
Hefner et al., 2017	53.9 [53.0—54.8]	2.90%
Jones et al., 2008	67.5 [67.1—67.9]	3.05%
Lee & Dahinten, 2020	72.1 [72.0—72.1]	3.12%
Campione & Famolaro, 2018	64.3 [63.7—64.8]	2.94%
Mackay et al., 2023	54.6 [51.3—57.9]	2.97%
Sorra et al., 2012	59.3 [59.1—59.4]	2.92%
Smith et al., 2017	62.7 [62.6—62.7]	2.92%
Lozito et al., 2018	82.2 [78.8—85.6]	2.77%
Noureldin, 2021	70.5 [70.2—70.8]	2.84%
Gampetro et al., 2021	65.5 [65.3—65.8]	2.97%
Wu et al., 2013	70.5 [70.4—70.5]	3.14%
Wagner et al., 2013	62.0 [61.9—62.1]	2.94%
Ulrich & Kear, 2014	62.5 [61.7—63.3]	2.87%
Mardon et al., 2010	61.1 [61.0—61.2]	2.94%
Jones et al., 2013	67.7 [67.2—68.2]	2.97%
DuPree et al., 2011	61.0 [60.3—61.7]	3.11%
Campbell et al., 2010	62.3 [61.7—62.8]	2.90%
Blegen et al., 2010	68.6 [68.0—69.3]	3.12%
Profit et al., 2016	57.2 [56.7—57.7]	2.91%
Heterogeneity: I² = 92.90%	62.8 [59.9—65.6]	
Overall		
Heterogeneity: I² = 93.89%	61.3 [58.4—64.1]	
Test of group difference: P-value = 0.0111		

Positive Response (%)

Discussion

The present review used the PRISMA protocol to find studies that used the HSOPSC to assess PSC in United States hospitals. The meta-analysis found both strengths and weaknesses in perceptions of patient safety among and between professional categories. In the included studies, HSOPSC was answered by physicians, nurses, technicians, pharmacists, and administrators. Some of the studies provided survey results for specific subgroups of healthcare professionals (such as trainees vs permanent staff), but the majority of studies (27 papers) showed integrated results for a mix of hospital professions. The overall HSOPSC composite average calculated from all 31 studies was 61.3%, indicating an overall need for improvement in US hospitals. Hospitals that used teamwork and collaboration training interventions showed statistically significant improvements in patient safety culture.[40, 43, 54, 57, 63] It is possible

that adopting programs such as the TOPS project and Team STEPPS in the context of specific hospitals/medical centers may result in higher perceptions of PSC.[68-69] Improving PSC may decrease the rate of medical errors and improve overall patient safety in US hospitals.[70]

"Teamwork within units" had the greatest positive responsiveness in terms of patient safety culture. Similar results were found in systematic reviews and meta-analyses of HSOPSC in other areas of the world including Latin America, the Middle East, Europe, and international studies.[13-14, 71-73] This suggests the presence of global strengths in teamwork within hospital units, potentially due to the collaboration and communication that develops between closely working healthcare professionals. Meanwhile, in the United States and global communities, "nonpunitive response to error" and "handoffs and transitions" were the lowest-rated PSC dimensions. Weak perceptions of nonpunitive response to

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error may reflect a culture of culpability in the US healthcare system. Healthcare professionals may fear negative consequences for making mistakes, leading to a failure to report mistakes and fix said errors. Brattebø and colleagues recommend a participating system for the improvement of patient safety errors as opposed to a punishment system.[76] Furthermore, one study in this review looked at hospitals using a voluntary error-reporting system,[56] which used a standardized taxonomy in patient files to support a reporting culture. This procedure, in conjunction with safety briefings about communicating about and learning from errors, resulted in significant improvements in hospital PSC and overall safety measures. The authors

recommend implementing similar error-reporting systems to enhance patient safety practices and prevent avoidable medical errors. Other systems such as chart reviews, trigger tools, etc. are also beneficial for capturing adverse events and errors. Finally, the weak dimension of "handoffs and transitions" refers to the transfer of information across hospital units and shift changes. There seems to be a deficit in how hospitals standardize effective handoffs and transitions for the benefit of patients. Recent studies recommend using an I-PASS system in a limited-interruption location to facilitate the proper transfer of information between professional units and shifts.[74-75]

Figure 3. Bar graph on Dimensions of HSOPSC Positive Responsiveness by Professional Category.
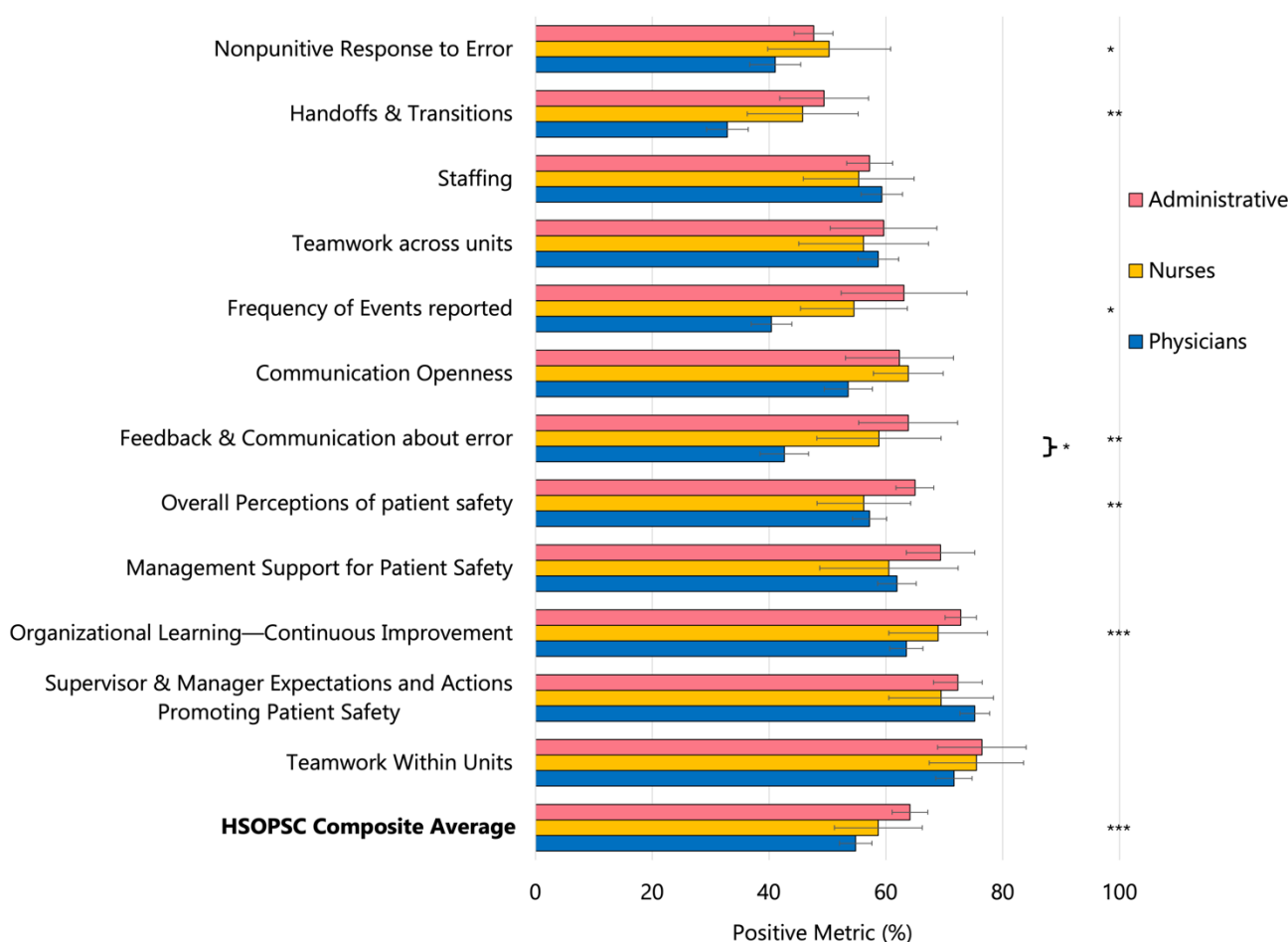
Legend: 95% CI. (* p-value ≤ 0.05 , ** p-value ≤ 0.01 , *** p-value ≤ 0.001)

Evaluating perceptions of PSC assumes the consideration of many factors that make US hospitals unique. One factor is the differences between varying stages of career, specifically hospital trainees versus permanent staff members. Trainees include residents, fellows, students, and healthcare prospects while permanent staff are healthcare workers who are established full-time or by contract in their hospitals. There was a statistically significant difference in HSOPSC composite averages between trainees and staff (~9%), indicating that trainees seem to have

worse perceptions of PSC than established staff in the US. The most likely explanation for lower PSC ratings among trainees is inexperience and lack of confidence, especially regarding patient safety measures and performance of medical errors.[77] Additional studies indicate that trainees have greater fears about bad outcomes, reprimands, and communication, all of which contribute to worse PSC responses.[78-79] Another likely explanation is that seasoned employees are affected by an acceptance or normalization of deviance. Based on these findings, the authors

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recommend hospitals include patient safety measures in their trainee and staff curriculums; addition of patient safety into graduate school curriculums also warrants consideration. Furthermore, staff should facilitate a collaborative integration of trainees into their medical teams. These practices may improve perceptions of some PSC dimensions among trainees in order to prevent/report errors and uphold patient safety.[61-62]

There is much variability in PSC perceptions between and within professional categories. In this particular review of United States HSOPSC studies, safety culture was rated lower for physicians compared to nurses and a mix of professions in the hospital setting. While physicians scored lower PSC ratings for many dimensions, the most significant category was "feedback and communication about error." The meta-analysis revealed that more physicians feel like errors are not reported or discussed compared to nurses and other medical professionals. Once again, this points to a negative culture of culpability amongst healthcare professionals,[14, 83-84] which is preventing the maintenance of patient safety. Another interesting note is that recent studies found a relatively strong association between professional/personal burnout and lower perceptions of safety culture as well as greater risks in patient safety and medical error.[80-82]

The authors acknowledge that this review is open to some limitations. First of all, articles were searched using four databases, which were believed to be effective for collecting eligible studies. Some articles may have been missed, so to maximize the inclusion of eligible studies, the authors also consulted the AHRQ Bibliography, adding 57 additional records for the screening. Moreover, the studies demonstrated good methodological quality scores, indicating the presence of well-conducted evaluation of PSC in United States hospitals. Regardless of quality scores, all the studies exhibited high heterogeneity of results similar to other reviews, which may make

any outlined recommendations more challenging to implement.[13-14, 71-73] Heterogeneity was possible due to the wide-ranging sample sizes of included studies, multiple professional categories, and nationwide locations. Small study effects and publication bias may have also impacted results. Moreover, HSOPSC is a survey tool with good psychometric properties,[28] but based on implementation and sampling, the results are open to inconsistencies, which may have also contributed to increased variability during meta-analysis. Despite these limitations, this review provides a combined analysis of patient safety culture perceptions amongst nationwide US healthcare workers with a high sample of responses. As a result, the findings in this study provide generalizable insights on potential obstacles to achieving safer healthcare standards and better medical error reporting practices in the United States. Future research on practical interventions (at the clinical, administrative, and educational levels) addressing weaknesses in patient safety culture would be beneficial for improving patient safety and reducing healthcare errors in the hospital.

Summary – Accelerating Translation

Assessing patient safety culture across hospitals in the United States allows researchers and policy administrators to identify areas of strength and weakness with regard to upholding patient safety and reducing medical error. The United States spends a lot of funding on healthcare with marginal improvements in patient safety, so improving the culture of patient safety may be a vital step in improving the overall healthcare quality for staff and patients in hospitals. There is much variability in perceptions of safety culture amongst different healthcare professionals, but trainees and leadership positions (i.e. physicians) seemed to report lower PSC, potentially due to the impact of inexperience, lack of deviance from regulation, and a culture of culpability. Quality improvement strategies, such as teamwork training and error-reporting systems, should facilitate effective communication, feedback about medical errors, and a culture of learning—all of which foster a safer environment for patients and staff in the hospital setting.

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Supplementary Material

Table 1. Search Strategies for Each Database Consulted for Study Selection.

Database	Search Query
Scopus	TITLE-ABS-KEY ("Patient Safety Culture" AND ("hsopsc" OR "sops")) AND (LIMIT-TO (LANGUAGE , "English"))
Embase	SEARCH: 'patient safety culture' AND ('hsopsc' OR 'sops') AND [english]/lim
Web of Science	TS=(Patient safety culture AND (hsopsc OR sops)) Refine by Languages: English
PubMed (Medline)	("Patient safety culture"[All Fields] AND ("hsopsc"[All Fields] OR "sops"[All Fields])) AND (english[Filter])
AHRQ	Browse bibliography for relevant articles according to the inclusion and exclusion criteria. Filters can be applied to limit bibliography to the United States and hospital settings. Articles in the AHRQ SOPS bibliography are accessible with but NOT limited to the four databases mentioned above.

Breastfeeding Policies of Otolaryngology Residency Programs

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Abstract

Background: Women entering surgical residencies must determine which programs best fit their career and family goals. The purpose of this study was to determine if breastfeeding policies are available on otolaryngology residency program websites. **Methods:** A total of 122 publicly available otolaryngology residency program websites were reviewed for the presence of a breastfeeding policy and lactation information. The percentage of residents and faculty that are women in each program as well as the program's region, size, and affiliation with a top 50 hospital for ear, nose, and throat care were determined. Frequencies and nonparametric analyses were calculated when appropriate. **Results:** None of the otolaryngology residency programs had a breastfeeding policy posted directly on their website. A link to a Graduate Medical Education (GME) website that contained a breastfeeding policy was present on 20 (16.4%) program websites, and 31 websites (25.4%) had information about lactation facilities on the GME website or another page that could be found through the search bar; 17 (23.0%) of the large residency programs contained the link to the GME website, whereas only 3 (6.25%) of the small programs did ($p = 0.015$). Residency programs that were affiliated with a top 50 hospital for ear, nose, and throat care were more likely to have a link to the GME website with a breastfeeding policy than those not affiliated (13 [29.5%] vs. 7 [8.9%], respectively; $p = 0.003$). **Conclusion:** Otolaryngology residency programs do not provide breastfeeding policies directly on their websites.

Introduction

The number of women choosing to have children during residency is on the rise as the timing of residency overlaps prime childbearing years. Residency programs present unique challenges to these women as a result of the established power dynamic rendering them unable to advocate for themselves and their family. The Accreditation Council for Graduate Medical Education (ACGME) has mandated lactation facilities be established in accredited training hospitals,[1] but there is concern regarding compliance with this mandate and the accessibility of the lactation rooms created.

To assess the issues surrounding breastfeeding in residency, a national survey was conducted among current and recently graduated residents. This study revealed many barriers to lactation. Although nearly all training hospitals have lactation rooms according to residents, a majority of the lactation rooms are not usable due to location or availability.[2] Overall, more than two-thirds of respondents reported that residency work obligations limited their ability to lactate.[2]

Within surgical fields similar to otolaryngology, there is a lack of information and resources for breastfeeding available to residents. A recent study found that only 2.8% of the websites for orthopedic surgery residency programs had information about breastfeeding support, with only 1.7% mentioning dedicated lactation facilities.[3] A cross-sectional study of obstetrics and gynecology residents similarly found that only 7% believed their program had a breastfeeding policy, even though it was important to 85% of this population of residents.[4] In addition, two-thirds of breastfeeding residents struggled with low milk supply and stopped breastfeeding early.

Pregnant and postpartum women in surgical residencies continue to face a number of barriers, including access to lactation facilities. Many prospective otolaryngology residents determine which programs will best fit their career and family goals by investigating otolaryngology residency websites. The purpose of this study was to determine if breastfeeding policies are available on otolaryngology residency program websites and identify any associations between the presence or lack of policies based on program characteristics.

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Methods

Subject selection

A list of 125 otolaryngology residency programs in the United States was accessed through the American Medical Association Fellowship and Residency Electronic Interactive Database. Three programs were excluded because they did not have a website linked on the database or they had no information on their webpage. Therefore, 122 publicly available otolaryngology residency program websites were reviewed for the presence of a breastfeeding policy and lactation facility information. This study was considered non-human subject research and exempt from University at Buffalo Institutional Review Board approval.

Data Collection

Five of the authors (AR, LD, MD, KP, and NF) searched for a total of seven different criteria on the websites: presence of a written breastfeeding policy on the otolaryngology residency website, presence of a link to an institutional Graduate Medical Education (GME) website which discussed the lactation policy, presence of information on lactation facility availability, number of residents in the program that are women, total number of residents in the program, number of surgeon faculty that are women, and total number of faculty. The gender identity of the surgeon faculty and residents was ascertained based on appearance in posted photos.

Program size was determined based on the number of otolaryngology residents accepted into each program per year. Programs were considered "large" if they accepted 3 or more residents and "small" if they accepted 2 or fewer residents per year; those accepting two to three residents per year were classified as small. The US News and World Report also aided in the classification of each program based on its association, or lack of association, with one of the top 50 ranked hospitals for ear, nose, and throat (ENT) care; only 2 of the 50 hospitals did not have an associated residency program. The location of each program was categorized as Northeast, Midwest, West, or South according to the US Census Bureau classification.[6]

Data Analysis

Frequencies and nonparametric comparisons were calculated when appropriate with SPSS version 27 (IBM Corporation, Armonk, NY). The methods of this study were based on a prior study that evaluated breastfeeding criteria on orthopedic residency program websites.[3] A p value of <0.05 was considered statistically significant.

Results

Information on the residency program region, size, and affiliation with a top 50 otolaryngology hospital (according to US News and World Report[5]) can be found in *Table 1*. The mean number of residents per year was three. *Table 2* shows the gender distribution of residents and surgeons at the residency programs analyzed. Based on photos provided on the majority of the otolaryngology residency program websites, a mean of 38.3% of the residents at each program were women and a mean of 25.2% of the otolaryngologist faculty were women.

Table 1. **Characteristics of the 122 Otolaryngology Residency Programs in the US.**

Characteristic	N (%)
Region	
Northeast	32 (26.2)
South	36 (29.5)
West	33 (27.0)
Midwest	21 (17.2)
Program size	
Large (>3 residents/year)	74 (60.7)
Small (<3 residents/year)	48 (39.3)
Affiliated with a top 50 USNWR-ranked hospital for ENT care	
Yes	44 (36.1)
No	78 (63.9)

Legend: [a]ENT, ear, nose, and throat; UNSWR, United States News & World Report.

Information on breastfeeding policies was not directly available on any of the otolaryngology residency program websites. A link to a GME website that contained a breastfeeding policy was present on 20 websites (16.4%), and 31 websites (25.4%) had information about lactation facilities on the GME website or another page that could be found through the search bar on the residency program website. No statistically significant relationship was found between the number of residents and otolaryngologists that were women and the presence of breastfeeding or lactation policies on the otolaryngology residency program websites ($p > 0.05$).

Table 2. **Representation of Women at Residency Program Institutions in the US.**

Category	Mean value
Otolaryngology residents per year at each institution (*n*)	3.0
Residents in the otolaryngology residency program that are women (*n* [%])	6.0 (38.3)
Attending otolaryngologists at the institution that are women (*n* [%])	5.5 (25.2)

The number of otolaryngology residency programs characterized by region, large or small program, and affiliation with a top 50 hospital can be found in *Table 3*. Large residency programs were significantly more likely to contain the link to a GME website with breastfeeding policy information ($p = 0.015$). There were 17 (23.0%) large programs that contained the link compared to 3 (6.25%) of the small programs. Residency programs that were classified as a top 50 hospital for ENT care were also statistically more likely to have the link to the GME website ($p = 0.003$). There were 13 (29.5%) top 50 hospitals that had the link compared to 7 (9.0%) of the programs that were not in the top 50. There was no significant relationship between the residency program's region and the presence of a link to breastfeeding and lactation facility information ($p > 0.05$).

Table 3. **Otolaryngology Residency Programs with Lactation Policies or a Link to a Graduate Medical Education Website with Breastfeeding Policies in the US.**

Characteristic	Lactation Policy Present	
	On website or by search tab n (%)	Via link to institutional GME website n (%)
Region		
Northeast	7 (21.9)	3 (9.4)
South	11 (30.6)	9 (25)
Midwest	6 (18.2)	5 (15.2)
West	7 (33.3)	3 (14.3)
Program size		
Small (<3 residents/year)	14 (31.82)	13 (29.5)
Large (≥3 residents/year)	17 (21.8)	7 (8.9)
Affiliated with a top 50 USNWR-ranked hospital for ENT care		
Yes	20 (27.0)	17 (23.0)
No	11 (22.9)	3 (6.3)

Legend: [a]ENT, ear, nose, and throat; UNSWR, United States News & World Report.

Discussion

Women in surgical residencies continue to face a number of barriers, including sufficient time for parental leave, access to lactation facilities, and difficulty finding childcare.[7] A 2020 survey of 312 female residents found that only 21% reported access to usable lactation rooms and 73% indicated that residency activities limited their ability to lactate.[1] Thus, to determine whether otolaryngology residency programs have addressed this lack of support, this study sought to determine if breastfeeding policies are available on otolaryngology residency program websites.

Not a single one of the 122 otolaryngology residency program websites that were analyzed in this study contained a breastfeeding policy directly on their website. This suggests that applicants and residency program directors do not believe that breastfeeding policies are relevant to the interview process. Kraus et al.[8] recently highlighted the clear disconnect between what residency program directors believe applicants want to see during the recruitment process and what applicants actually want: 37% of residency program directors believed that parental leave policies were not relevant, whereas 92% of residency applicant respondents reported that they would prefer parental leave policies to be formally addressed during their interview. Our data suggest that this disconnect extends to the desire to see breastfeeding policies on residency websites.

It is important to note that the majority of the residency program directors included in the aforementioned study were male, and the results may have differed if more residency program directors that are women were surveyed. Wynn et al.[3] found that the odds of having a written breastfeeding policy on orthopedic surgery residency websites increased with the number of female attendings (odds ratio, 1.1, $p = 0.01$). However, our study found no statistically significant relationship between the presence of breastfeeding policies and the number of otolaryngology residents and faculty members that were women. This may be due to the fact that the number of otolaryngology and orthopedic surgery faculty and residents that are women still does not match the number of residents and faculty that are men in both specialties.

Wynn et al.[3] found an average of two female attendings per program (range 0–19). In this study, women made up a mean of only 25.2% of otolaryngologist faculty members and a mean of 38.3% of otolaryngology residents at each institution. A cross-sectional analysis of otolaryngology data in 2019 revealed that 34.7% of residents and 24.5% of faculty were female and only 5 (4.2%) department chairs and 31 (26.5%) residency program directors were female.[9] Thus, the differences in outcomes between our study and those of the study of orthopedic surgery residency websites by Wynn et al.[3] may be attributed to the low number of faculty and residents that are women in these programs that makes it difficult to find a precise and accurate statistical relationship between breastfeeding information and number of attendings and residents that are women.

Notably, the websites for larger otolaryngology residency programs as well as those affiliated with a hospital listed among the top 50 for ENT care were more likely to have a link to a GME website with breastfeeding policy information. This may reflect the extra resources and greater attention to educational policies at larger and more well-known hospitals. Moreover, larger programs have more residents and thus a greater likelihood for pregnant residents. A qualitative study of three female otolaryngology residents who had given birth within the past 12 months at a single institution found that all residents reported mild dissatisfaction regarding privacy and facilities for breastfeeding.[10] Additionally, these residents reported that they did not attempt to remedy the situation until after the postpartum period; however, once it was brought to the program director's attention, a private, secure lactation room was provided.[10] This suggests that advocacy plays a critical role in policy changes. Therefore, the first step residency programs can take is to openly advertise breastfeeding policies on a publicly available platform. Next, establishing a strong foundation of open communication at the start of residency training can lead to a positive environment for trainees seeking breastfeeding accommodations. Lastly, the findings of this study suggest that amplifying the concerns of pregnant otolaryngology residents through the support of female otolaryngologist faculty could positively impact the expansion and visibility of breastfeeding policies on otolaryngology residency program websites.

Limitations

The format of each otolaryngology residency program website varied, and this study only looked for criteria available directly on the program website or through a search tab or GME website link. Thus, breastfeeding policies may have been present elsewhere on the hospital website. The number of surgeons and residents that were women was determined solely on the basis of their

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appearance, which can be biased and inaccurate. Additionally, an individual's physical presentation as a woman does not always align with one's ability or desire to breastfeed or carry a child. Thus, the authors acknowledge that this is a main limitation of the study and the number of women in each program may be an overestimate of individuals interested in breastfeeding their children. Future studies that assess gender as well as a desire to breastfeed a child in a more accurate way, potentially through a cross-sectional survey, should be considered. This study also did not look at residency program websites of specialties other than otolaryngology. While similar themes may exist across surgical specialties, this can not be ascertained from the present study.

Conclusion

Otolaryngology residency programs do not provide breastfeeding policies directly on their websites. Program support for breastfeeding and resident success in breastfeeding in otolaryngology programs is unknown. Additional research is necessary to see if applicants desire to have these policies on program websites.

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Gender Trends in Dermatology Research: Shifting Authorship Landscape in Indian Journals

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Abstract

Background: Historically, research authorship has been male dominated, particularly in dermatology. Gender equity in medical research is vital for diverse perspectives and rigorous science. In India, gender trends in dermatology research among first authors remain understudied, limiting our understanding of gender inequalities in the field. **Methods**: This study analyzed Original Articles, Review Articles, and Case Reports in three prominent Indian Dermatology journals from January 2017 to May 2023. The first authors' genders were determined using Namsor V.2, cross-verified with social media profiles, and authors with undetermined genders were excluded. The authors' countries were identified based on their affiliated institutions. The data was analyzed using Microsoft Excel, with a predictive analysis using the FORECAST function. **Results**: Among 1,600 authors, 840 were female and 760 male. Male authors outnumbered female authors only in 2017. Female authors surpassed male authors in original articles and case reports, while fewer appeared in review articles. Predictive analysis revealed an increasing trend in female authors from 2023 to 2028, indicating evolving gender dynamics in dermatology research. **Conclusion**: While the rise in female representation in medical research is promising, concerns arise when fields become predominantly female, raising questions about their perceived value. Gender disparities in compensation further underscore these concerns, as male dermatologists earn more. Addressing such disparities is crucial and recognizing these issues and actively pursuing gender equality is essential for a more inclusive and equitable future in medicine.

Introduction

Gender equality in medical research and academia ensures diverse perspectives, scientific progress and improved health outcomes for the community. Historically, research has often focused on male subjects, leading to a limited understanding of how health conditions, treatments, and interventions impact women differently.[1] Furthermore, authorship in research has also always been male dominated, with a very small proportion of women serving as first authors for research papers.

While the number of women practicing in medicine is improving, there are still significant disparities such as equality in leadership positions and in research. In research, the significance of authorship in a paper may vary based on discipline, culture norms, and field of research. But, the first and last authorship positions are generally considered to be most significant. The first authorship position is generally occupied by the one who contributes the most to the paper, while the last authorship is reserved for senior or principal investigator of the project, and signifies the researcher's seniority, leadership role, and responsibility for overseeing the research project. Studies by Bernardi et al., which examined papers from 2000-2107, and

Baobeid et al., which examined papers from 2014-2016, found a higher percentage of men in both first and last authorship positions.[2,3]

However, there is minimal research regarding gender trends in dermatology research in India. Furthermore, given that in many research fields, it is common practice for the first author to be typically regarded as the individual who made the most significant contributions to the research project in many research fields and represents early-career researchers, serving as an indicator of their scientific productivity and potential.[2] Thus, the present paper aims to identify the gender trends among the first authors in dermatology research published in 3 Indian journals, from 2017 to 2023, to identify any gender inequality and offer a predictive analysis of these trends.

Aims and Objectives

The aim of this study was to analyze gender trends among first authors in dermatology research published in three prominent Indian dermatology journals from 2017 to 2023 and identify any gender inequality and offer a predictive analysis of these trends. The paper also aims to determine the gender distribution among first authors of dermatology research published in three Indian

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dermatology journals from 2017 to 2023, and analyze the trends in gender representation based on the year of publication and the type of articles (original articles, review articles, and case reports), and to conduct a predictive analysis to identify anticipated gender trends in dermatology research publishing from 2023 to 2028.

Methods

Initial Compilation of Articles

Articles published in 3 Indian dermatology journals, i.e., Indian Journal of Dermatology, Venereology and Leprology (IJDVL), Indian Dermatology Online Journal (IDOJ) and Indian Journal of Dermatology (IJD), which were chosen based on their prominence, wide readership, and reputation for publishing high-quality research in the field of dermatology. These journals have a significant impact on shaping the knowledge and practice of dermatology in India and serve as important platforms for scientific communication and collaboration among dermatologists and researchers and were analyzed with the following criteria:

- Articles published from January 2017 to May 2023, including ahead of print articles available on the journal websites.
- Only Original Research Articles, Review Articles and Case Reports were included in the study.
- Only First Authors of each article were analyzed.
- Country of the first authors was also collected, based on their affiliated institutes.

A total of 1,628 articles and their authors were thus compiled in Google Sheets and then transferred to Microsoft Excel for analysis. Basic statistical techniques were applied to examine various aspects of the dataset, such as determining the total number of occurrences and calculation of percentage ratios.

In addition to descriptive statistics, Excel's 'FORECAST' function was utilized to generate predictive analysis of the gender trends for the years 2023 to 2028. The year 2023 was also predicted, as the current data collected was only for the months from January to May. This function is used to calculate expected future y-values for a specific x- value, based on linear regression of the dataset and allows for the identification of potential future patterns and trends in gender representation among first authors, offering valuable insights into the trajectory of gender equality in the field.[4]

Gender Assignment of the Authors using Namsor V.2

The genders of the authors were analyzed using Namsor V.2, which is an application programming interface (API) that defines the gender of the authors as a binary variable (i.e., either man or woman) and considers the country of origin, ethnicity, both first and last names, and draws on linguistic and cultural information to determine gender.[3] This API has been previously used in studies such as those by Baobeid et al. and Morgan et al., with satisfactory results.[3, 5]

Quality Check of the Gender Assignment

Namsor assigns genders to the given names in terms of binary variables and also offers probability of likelihood of the assigned gender (from 0 to 1). The authors whose gender probability was less than 0.7 were manually rechecked using their institutional web pages and professional social media (ResearchGate, LinkedIn, etc.), and re-corrected. After the quality check, the genders of 28 authors remained unidentified, and were excluded. Thus, the total number of authors analyzed from 2017-2023 were 1,600.

Results

A total of 1,600 first authors were analyzed, of which 840 were found to be female and 760 found to be male. Further analysis was done based on the year of publication, type of article and country of author.

Table 1. Gender Distribution of First Authors According to Year of Publication.

Year of Publication (n)	Male Authors (%)	Female Authors (%)
2017 (175)	91 (52)	84 (48)
2018 (196)	95 (48)	101 (52)
2019 (244)	112 (45.9)	132 (54.1)
2020 (246)	119 (48.3)	127 (51.7)
2021 (249)	124 (49.7)	125 (50.3)
2022 (313)	135 (43.1)	178 (56.9)
2023 (Jan-May) (177)	82 (46.3)	95 (53.7)

Gender Distribution According to Year of Publication

Table 1 shows the gender distribution of male and female first authors in each year. 2017 is the only year where the number of male first authors is greater than their female counterparts. The years from 2018 to 2023 have a slightly higher percentage of female authors.

Gender Distribution According to Type of Article

Of the types of articles analyzed, original articles were highest in number, followed by case reports and then review articles.
Review articles had a higher number of male first authors than females. Original articles and case reports had a higher percentage of female authors than males; however, in the latter, the difference is minimal *Table 2*.

Table 2. Gender Distribution of First Authors According to Type of Article.

Type of Article (n)	Male Authors (%)	Female Authors (%)
Original Article (891)	399 (44.7)	492 (45.3)
Review Article (177)	96 (54.3)	81 (45.7)
Case Report (532)	263 (49.4)	269 (50.6)

Analysis of the Trends - Both Current and Future

Based on gender distribution over the years, a line chart was made to plot and analyze the trends. **_Figure 1_** shows the gender trend from 2017-2022. Both genders have an increasing number over the years, with a greater number of female than male authors. Furthermore, the number of male authors has a steady increase, while the number of female authors appears to be fluctuating.

Table 3 shows the number of male and female authors per year, and also the numbers predicted for the years 2023 to 2028 (decimals were rounded to the nearest whole number). **_Figure 2_** shows the line chart depicting gender trends from 2017 to 2028. In the predictive analysis, a similar trend of increasing number of authors, but greater number of female authors, is observed.

Discussion

The present study aimed to analyze the gender trends among the first authors in dermatology research published from 2017 to 2023 in 3 Indian Dermatology Journals, while also offering a predictive analysis of future trends in the gender ratios.

A total of 1,600 authors were taken into consideration, of which 840 (52.5%) were found to be female and 760 (47.5%) male. This slightly higher ratio of female authors is similar to the findings of Zheng et al., Mitello et al., and Bernardi et al.[2,6,7] This shift may be attributed to several factors, such as the growing emphasis on gender equality and diversity in academia, increased opportunities for female researchers, and the empowerment of women in the field of dermatology.

When examining the gender distribution by article type, it was found that overall, the study found that the number of female authors is more than males in original articles, less than males in review articles and almost equal for case reports. One hypothesis is that review papers, which often involve synthesizing information and collaboration between multiple authors, might favor male authors due to findings from studies such as Piper et al., suggesting a significant tendency for female physicians to publish with female senior physicians and for male physicians to publish with male senior physicians.[8] This preference for same-gender collaborations may contribute to the observed higher male representation in review articles.

When analyzing the gender ratio according to the year of publication, female authors were found to be higher than males in all the years except 2017. The year 2021 had an almost equal number of publications, with male authors being 124 in number, and female authors being 125 in number. This positive shift over time suggests an evolving landscape in dermatology research, with increasing opportunities and recognition for female researchers.

A predictive analysis was done to determine the future trends from the years 2023 to 2028. 2023 was also included as the number of publications taken into consideration from the year 2023

Table 3. Predictive Analysis of Gender Distribution until 2028.

Year of Publication	Male Authors (n)	Female Authors (n)
2017	91	84
2018	95	101
2019	112	132
2020	119	127
2021	124	125
2022	135	178
2023	144	178
2024	153	194
2025	162	209
2026	171	224
2027	180	240
2028	189	255

Figure 1. Gender Distribution of First Authors by Type of Article.
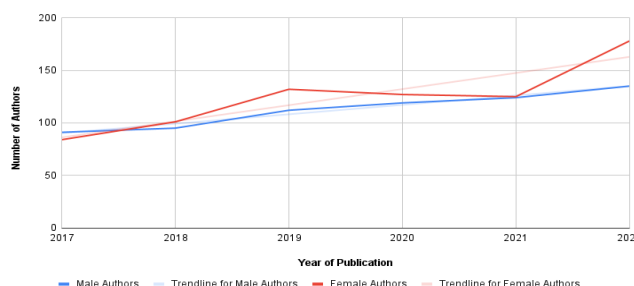
Figure 2. Predictive Analysis of Gender Trends until 2028.
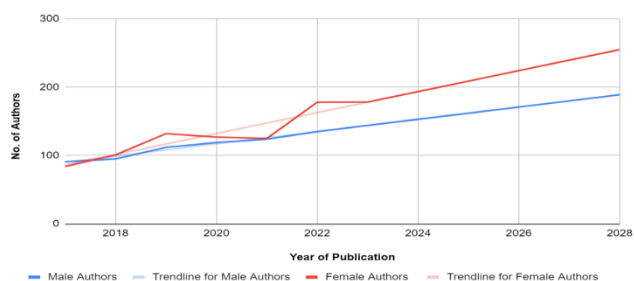
was only from January to May. The analysis found an increasing proportion of submissions from female authors than males. This is consistent with the observations made in the paper by Feramisco et al., which analyzed trends from 1976 to 2006 and found a steady increase in female authors.[9] Our finding is slightly different from the observation by Bernardi et al., however, who observed that the gender gap will be narrowed and likely further reduced in the future.[2]

While it's reassuring to see more women in medical research, societal biases can lead to the devaluation of fields that become female-dominated. Historically, such professions have been

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undervalued and often receive lower pay. C. Miller highlighted in The New York Times that significant pay gaps exist in fields with increasing female participation.[9] Dermatology exemplifies this issue: despite 61% of U.S. dermatologists being female in 2019, female dermatologists earned less than their male counterparts.[11,12] This underscores the need to address gender-based disparities and ensure all medical fields are valued equally, regardless of gender composition.

The variations among article types could reflect the differences in research interests, career preferences, or the influence of mentorship and collaborative networks within specific areas of dermatology. Further research is thus warranted to explore these factors in more depth and gain a better understanding of the dynamics behind gender disparities across different article types.

Limitations

The present study has several limitations. First, gender trends were analyzed only from 2017 to 2023, with 2017 being the only year where male authors were more prevalent. By extending the analysis further back in time, we might have gained better insight into when and how the gender gap began to shift from a higher proportion of male authors to a higher proportion of female authors. Second, we only analyzed original articles, review articles, and case reports; however, all three journals had a significant number of Letters to the Editor, and including these could have provided additional insight into gender trends. Third, we considered only first authors, and by also analyzing last authors, we could have offered an analysis regarding senior and leadership positions in dermatology. Lastly, only three Indian journals were included in the study, limiting our ability to offer a more inclusive analysis regarding geographical gender trends.

Conclusion

The observed increase in female authorship in dermatology research is a positive development, suggesting progress in promoting diversity and gender equality. This shift may be attributed to several factors, including supportive institutional policies, mentorship programs, increased visibility of successful female role models, and the recognition of the importance of diverse perspectives in advancing scientific knowledge. However, it is essential to challenge and overcome biases to ensure that all fields within medicine receive equal recognition, resources, and opportunities.

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Navigating Barriers: Healthcare Anchor Institutions and Population Health Advancement

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Abstract

Background: Many United States hospitals explicitly pursue "anchor missions" by committing to intentionally apply place-based economic power and human capital in partnership with the community. Little is known about how hospital-community partnerships are implemented or whether they impact social determinants of health (SDOH) and population health. We qualitatively analyzed healthcare institutions from a national network to understand barriers and facilitators while implementing hospital-community partnerships that aim to improve population health. **Methods**: We used qualitative analysis of responses to open-ended items on a cross-sectional survey to explore how hospitals with anchor missions address SDOH. We administered the survey to healthcare systems participating in the Healthcare Anchor Network (HAN), a national network of hospitals with explicit goals to address SDOH and improve population health. **Results**: Responses were from 16 organizations. Two themes emerged: 1) healthcare systems faced many demands (i.e., COVID-19, financial stability), which competed with prioritization of the anchor mission, and 2) senior leadership engagement was critical for impact of the anchor mission and efforts to address SDOH and population health. Strategies to engage leadership included peer networking and providing repetitive education on community health inequities to hospital leaders. **Conclusions**: Although health systems show enthusiasm for population health, competing priorities often constrain anchor mission efforts to improve SDOH and population health outcomes. With external encouragement, such as changes to federal or state quality metrics reporting, payment incentives to address community health, or other policy changes, health systems will engage more with communities and be able to address SDOH.

Introduction

United States hospitals recognize the importance of addressing social determinants of health (SDOH) that influence their communities.[1–3] The Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recognize that the SDOH includes non-medical factors like where people live, their environment, education, food stability, working life conditions, and structural barriers influencing health outcomes.[4,5] Hospitals that have prioritized SDOH and attempted to connect with their communities through invested capital, population health initiatives, and relationships with consumers, employees, and vendors[6–9] have been labeled "anchor institutions" pursuing "anchor missions." The Democracy Collaborative defines an anchor mission as "a commitment to intentionally apply an institution's place-based economic power and human capital in partnership with community."[10] In other words, an anchor mission grounds a healthcare institution to support its local community beyond providing medical care. However, little is known about how hospital-community partnerships are developed and implemented or whether they genuinely impact SDOH and population health. Our study uniquely addresses this gap in the existing literature by sampling member organizations of the Healthcare Anchor Network (HAN) and exploring hospital-

community partnerships. HAN is a multi-institution, membership-based network comprising health systems with stated goals to bring together champions from health systems across the country, facilitate shared learning, and support collaborative initiatives to accelerate the adoption of practices that will narrow inequities for low-income families and communities of color.[11] We qualitatively analyzed anchor mission leads from health system members of this network to understand barriers and facilitators while implementing hospital-community partnerships to improve population health.

Methods

Study Population

We used qualitative analysis of responses to open-ended items on an electronic, cross-sectional survey to explore how hospitals with anchor missions address SDOH. All study activities were reviewed and approved by Northwestern University's Institutional Review Board. We administered the survey to all 60 member organizations in the Healthcare Anchor Network in June 2021.

Deployment and Data Collection

We recruited individuals listed as their healthcare organization's point of contact for the HAN's Anchor Mission Leads Group; these

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individuals are responsible for advancing their organization's goal to adopt and implement an anchor mission. Administration at the HAN aided recruitment by distributing a link to the online survey and study risks and benefits via email. Participation was confidential, with no monetary incentive. The data collection period lasted three weeks in total in June 2021. The goal of the current study is to report our qualitative analysis of answers to seven open-ended questions ***Supplementary Material*** about the following topics: the role of a hospital in addressing economic and racial inequities in community conditions; ways that anchor mission strategy does or does not align with other population health efforts; and questions about the challenges faced as part of the anchor mission journey. See the complete questions as supplemental material.

Data Analysis

We exported and de-identified responses to the open-ended survey questions for hand coding to categorize and analyze responses to see patterns and themes. Three study team members who were trained in qualitative analysis independently reviewed the data. An initial draft of the codebook was developed from a literature search that included relevant peer-reviewed publications and white papers about healthcare organizations' community health initiatives, engagement, and anchor missions, and themes that emerged directly from the data. The literature used to help develop the survey questions was also used to create the codebook. After applying the initial set of predefined codes, we compared and discussed each code and revised the codebook to include emerging codes and themes. The team continued an iterative coding and analysis process until a consensus was reached on disagreements in the codes and final themes. To ensure data integrity, we created an analysis audit trail to document decisions and adhered to the Standards for Reporting Qualitative Research (SRQR).[12]

Results

Sample Characteristics

Sixteen organizations ***Table 1*** completed the open-ended questions. These included nine academic health systems, six children's hospitals, five multi-state systems, and four safety net systems. Eight organizations reported urban settings, three reported rural settings, and five did not report a practice setting.

Themes

Two predominant themes ***Table 2*** emerged in our analysis of building hospital-community partnerships about anchor missions: 1) healthcare systems faced many demands, which competed with prioritization of the anchor mission, and 2) engagement of senior leadership was critical for the impact of the anchor mission and efforts to address SDOH and population health.

Competing Priorities

Across the data, respondents noted the potential value of their organizations as anchor institutions. One leader stated, "as an anchor institution we could have a significant role in addressing economic and racial inequities."[7] They were committed to advancing an anchor mission to positively impact their communities and address SDOH. Still, respondents described difficulty prioritizing the work necessary to implement anchor missions in their health systems. One respondent said, "[there are] too many other immediate and pressing priorities."[13] While another organization actively implementing anchor work exemplified these struggles with a quote: "although the various leaders understood and bought into the anchor mission framework, they did not prioritize this work".[3] Most respondents described competing priorities for leadership (e.g., battling a pandemic, meeting quality metrics, and financial stability) that got in the way of championing anchor mission work.

Table 1. Characteristics of Participating Healthcare Systems.

Organization ID	Characteristics
2	Multi-State System
3	Urban and Rural Academic Health System and Children's Hospital
4	Urban Children's Hospital
6	Multi-State System
7	Academic Health System
9	Urban Academic Health System and Children's Hospital
10	Urban and Rural Academic, Multi-State System and Children's Hospital
11	Urban and Rural Children's Hospital
12	Academic Health System
13	Safety Net System
14	Safety Net System
16	Academic Health System
17	Urban Academic and Safety Net System
19	Urban Multi-State System
20	Urban Academic and Multi-State System
22	Academic, Safety Net Health System and Children's Hospital

Prioritization Issues Due to COVID-19

This survey was administered amid the COVID-19 pandemic. Multiple respondents described the pandemic as a competing priority for focusing on anchor mission work. One respondent exemplified this by stating, "[challenging] attention to anchor strategies while battling a pandemic".[12] Another mentioned, "I anticipate we will have challenges getting sufficient financial support to move the work forward, especially due to the financial costs incurred as a result of COVID".[7]

Business Constraints

Despite many institutions' intention to implement strategies that advance an anchor mission, a shared competing priority in the data was the bureaucratic challenges of running a hospital. These challenges include the financial responsibilities that healthcare

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organizations have to remain functional. One respondent described this challenge: "The dollar flow. Budgeting for long term and keeping with the commitment when [times are] lean".[10] Similarly, providing the necessary staffing required for implementing anchor strategies was commonly mentioned by participants. Supporting comments include one participant who said, "Our biggest challenge at the moment is staff to support the work".[14] Another respondent mentioned difficulty with "identifying personnel resources and assigning responsibilities early".[4]

Leadership

The most common and notable theme to emerge from the data was that the ceiling for community benefit activities depended on the strength of leadership investment in advancing an anchor mission. One respondent with a fully resourced anchor mission stated, "Without leadership support, the remaining efforts don't get the traction needed for success".[6]

Table 2. **Themes and Subthemes Supported by Participant Responses.**

Theme	Exemplary Quotes
Competing Priorities	(13) Many, many believe [anchor missions] to be important, but higher priorities persist. (3) Although the various leaders understood and bought into the anchor mission framework, they did not prioritize this work (13) Too many other immediate and pressing priorities. (2) Some organizations are more resistant to change than others
Leadership	(6) Without leadership support, the remaining efforts don't get the traction needed for success (7) Leadership support - this is essential to ensuring that time and money are allocated towards collecting baseline data and moving forward anchor strategies (17) There are elements of anchor mission that can be accomplished without strong high-level support, but without it, there will be a limitation on achievement. (12) Conceptual leadership support at the highest levels. You won't make progress without that
Subthemes	
Prioritization Issues Due to COVID-19	(7) I anticipate we will have challenges getting sufficient financial support to move the work forward, especially due to the financial costs incurred as a result of COVID. (12) [Challenging] attention to anchor strategies while battling a pandemic.
Business Constraints	(10) The dollar flow. Budgeting for long term and keeping with the commitment when [times are] lean. (14) Our biggest challenge at the moment is staff to support the work. (17) Changing entrenched business patterns and routines. To avoid them, new incentives need to be in place.
Strategies to Engage Leadership	(7) awareness in leadership that as an Anchor Institution we could have a significant role in addressing economic and racial inequities (16) our CEO and Senior leadership team is really beginning to see the next steps of success involve our organization moving into the communities we serve (3) We were successful in engaging senior leaders and board members by helping them understand the health inequities that exist in our communities. In particular, looking at life span differences across our metro area as well as the demographic and other indicators in those neighborhoods. (7) It seems that senior leaders are most receptive to hearing from other senior leaders about anchor mission. (17) Peer pressure is effective, as is the motivation to show corporate leadership in our city. (19) Competitive analysis (what our peers are doing) has also proved compelling (19) Data that the strategies work, don't cost much, is critical

Legend: * The number in parentheses identifies a unique respondent.

Strategies to Engage Leadership

Given the significance of leadership, multiple strategies to engage leadership in anchor mission work were identified. Several respondents discussed the value of peer networking for motivating and engaging leaders in learning about anchor work, including three who specifically noted the potential to activate leadership through peer connections. One respondent stated: "Senior leaders are most receptive to hearing from other senior leaders about anchor mission",[7] while another shared: "Using examples of other health systems and tying the anchor work to [the] mission".[6] Anchor mission leads found it beneficial to provide leadership with successful examples of others completing this work. One respondent put it bluntly when referring to how to engage leadership successfully, "Peer pressure is effective".[17] As discussed by several respondents, another strategy employed to engage leadership was providing repetitive education on community health inequities to leaders. Organizations were successful in educating leadership about the role they could have in addressing social and health inequities. An Urban/Rural health system noted, "We were successful in engaging senior leaders and board members by helping them understand the health inequities that exist in our communities".[3] Finally, the implementation of data collection protocols was discussed as a strategy because it can provide evidence for the value of an anchor mission. One respondent said, "Data that the strategies work and don't cost much is critical".[19] Health system leadership must ensure their decisions benefit the community and their organization's well-being. Therefore, the data to support these efforts is vital.

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Discussion

We examined the perspectives of anchor mission leads from healthcare systems whose institutions are explicitly committed to advancing their anchor mission via membership in the national Healthcare Anchor Network (HAN) and found that, although there is enthusiasm about population health and addressing social determinants generally, even health systems committed to the mission are constrained by competing priorities. This limits the implementation of strategies to address SDOH and the impact these institutions can have on population health. We also found that healthcare system leaders are essential in implementing anchor missions.

Previous quality and safety literature studies have examined the success of complex, successful organizational change and described a requirement for top-down leadership engagement and organizational culture buy-in.[13,14] Mullin et al. also concluded that healthcare leaders committed to the principles of DEI enhance organizational performance and are more successful in attracting and retaining employees who are likeminded in contributing to accountability within the broader healthcare ecosystem.[15] Similarly, our findings suggest that strong leadership engagement is required if anchor institutions commit resources and time to initiatives to improve community health. However, leaders struggled to stay engaged and often were distracted by competing (urgent) demands, including the COVID-19 public health emergency. Many still feel the impact of the COVID-19 pandemic, and its toll on hospitals across the United States is enormous. For example, in the first year of the pandemic, the hospitals in the state of Pennsylvania experienced an estimated loss of more than $5 billion.[16] As discussed by many participants in this study, it is more difficult for health systems to prioritize initiatives that address SDOH without financial stability. Conversely, the pandemic disproportionately harmed minority communities, which highlighted the importance of investing in initiatives that address SDOH.

Many competing priorities highlighted by respondents involve continuously monitored activities that create a heightened sense of accountability. Examples include the need to comply with regulatory, accreditation, and quality metrics required by the Centers for Medicare and Medicaid Services, Health and Human Services, and the Joint Commission on Accreditation of Healthcare. This suggests that one way to increase the prioritization of community engagement and population health would be to include these activities in quality measurement or accreditation standards.[17,18] In a recently published study by Brown et al. examining the relationships between health and social sector organizations, the authors conclude that the more the health sector engages at the policy level, the stronger the adoption and sustainability of community-driven socioeconomic initiatives will be.[19] Furthermore, looking at lobbying disclosures of healthcare organizations, a 2021 study found that from 2015 to 2019, very little lobbying was done by the ten healthcare organizations that spent the most on federal lobbying related to the social determinants of health.[20] More substantial or deliberately structured requirements for community-focused metrics could enable more health organizations to distribute resources effectively.

Our study has several strengths, as well as some notable limitations. To our knowledge, we sampled the largest known national network of anchor healthcare organizations. However, sampling a group of hospitals that had already committed publicly to an anchor mission may be missing essential barriers that non-participants encountered. This may have created a response bias. Further, social desirability bias may lead respondents to appear more engaged in anchor activities than they are. Although we found similar themes across respondents, the small sample size creates the potential for thematic saturation that can affect our study results. Finally, because participation was confidential and was intended to encourage complete and honest responses, we did not collect demographic data from individual survey respondents, preventing any specific follow-up with participants. Still, our findings introduce new information about hospital participation in population health efforts, an essential addition to the literature. This data provides evidence for further investigating barriers and facilitators for hospital-community partnerships.

In conclusion, even among a subset of health systems committed to population health, competing priorities and variable engagement from leadership influenced the potential impact of anchor mission activities. It is possible that without external encouragement (in the form of quality metrics, payment incentives, or other policy changes), health systems will continue to have limited engagement with communities and limited ability to address social determinants of health.

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Short Communication

Wagner D, et al.   Navigating Barriers: Healthcare Anchor Institutions and Population Health Advancement

Supplementary Material

The following indicators have previously been identified as useful for implementing an anchor mission:

- Leadership support, both conceptual and financial, at the highest level

- Incorporation of the Anchor Mission into your organization's strategic plan

- Appointment of Anchor committees and internal relationship building

- Implementation of data collection protocols to evaluate the impact of your Anchor Mission

- Building relationships with external partners

Which indicator do you believe is the most important and why?

Which indicator do you believe is the least important and why?

What does your organization believe is the role of a hospital in addressing economic and racial inequities in community conditions that create poor health?

How does an anchor mission strategy align with your work related to community health, population health, and/or the social determinants of health (i.e., the built environment, economic stability, housing, education)?

If you've been successful at engaging senior leaders or board members as champions of the anchor mission approach, what strategies did you find to be most successful?

If senior leadership at your institution has bought into an anchor mission approach, what are they trying to solve by advancing an anchor mission?

What were some of the biggest challenges for your organization during your anchor mission journey so far and, if possible, how would you suggest others avoid them?

A Blueprint for High Altitude Acclimatization Prior to High Altitude Competition for Professional Athletes

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Abstract

Introduction: Among professional athletes, high altitude training is a popular technique due to its documented success on improving cardiovascular health and athletic performance. Nevertheless, there is little consensus on the guidelines for high altitude training and competition. This review sought to summarize existing literature for acclimatization recommendations for competing at high altitudes and suggests a blueprint that could be followed by athletes and trainers. **Methods**: This paper is part of the Altitude Nondifferentiated ECG Study (ANDES) project. A non-systematic search was conducted using Pubmed, EMBASE and MEDLINE databases. **Results**: Six studies were included, all of which recommended a gradual ascent before competition. The duration of acclimatization ranged from 4 days to 2 weeks depending on the magnitude of ascent. Athletes are encouraged to have pre-ascent assessments of ferritin, transferrin, hemoglobin mass, ECG, and weight with close monitoring of adverse altitude-induced complications. **Conclusion**: This study provides insight on key recommendations for athletes and trainers to consider when training and competing at high altitudes. These strategies can optimize athletic performance and mitigate deleterious altitude effects that can hinder functionality and training.

Introduction

High altitude training is a popular approach among athletes to enhance their endurance and competitive performance.[1] However, studies show that high altitude training can impact short and long-term cardiovascular health.[1] A recent systematic review by Ramchandani et al., explored electrocardiographic changes in individuals temporarily ascending to high altitudes finding notable changes in T wave inversion in the precordial leads, and significant rightward deviation of the QRS complex in the inferior leads.[2] Limited consensus among sports regulatory bodies and a lack of recent, large-scale investigations adds confusion for athletes and coaches regarding optimal high altitude training guidelines.[2-3] Acclimatization time is a crucial consideration for athletes and coaches, as it directly impacts performance at high altitudes. Unlike other factors, like diet and training intensity, which can also affect performance but may be more challenging to control, acclimatization time is a variable that athletes can directly influence to optimize their overall health and athletic performance. To date, there is limited literature on ideal acclimatization times and associated considerations for sea-level athletes ascending to altitudes for competition. This paper aims

to review existing literature on acclimatization time for competing at high altitudes and suggests a blueprint for athletes and coaches to consider when ascending to high altitudes for competition.

Methods

While there is no universal classification for altitude levels, in this paper, we use the commonly followed altitude thresholds in the literature: <1500m for low altitude, 1500-2000m for moderate altitude, and >2000m for high altitude.[1] This non-systematic review is part of the Altitude Nondifferentiated ECG Study (ANDES) project that aims to uncover electrocardiographic and physiologic changes in populations at high altitudes.

An electronic non-systematic review of the published data was conducted in PubMed, EMBASE, and MEDLINE databases. For each database, representative MeSH terms were chosen for each of the four subtopic categories relating to the scope of our paper: adapting, training, altitude, and humans. MeSH terms chosen for each database and Boolean commands can be found in **Appendix 1**. Two blinded authors (EM and RA) independently

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screened the titles and abstracts of the identified papers. First, the relevance of papers based on title and abstract was determined. Selected publications were then further reviewed for relevance using the full text. Disagreement was solved by consensus

meetings where discussion between the two reviewers took place. A secondary search was conducted by reviewing the reference lists of the included papers.

Table 1. Summary of Key Findings From Studies Included in this Non-Systematic Review.

Study author (year)	Recommended acclimatization period	Pre-Ascent Considerations	Observed Side Effects
Koehle et al. (2014)	2-3 days to 1 week	Gradual altitude exposure; oxygen supplementation	AMS; HACE; HAPE
Bergeron et al. (2012)	Arrival 2-weeks prior to competition with rest for 1-2 before commencing training	Baseline serum ferritin and with appropriate correction prn	AMS
Girard, O et al. (2013)	Low altitude (<1500m): 3-7 days; Moderate altitude (1500-2500m): 1-2weeks; High altitude (>2500m): >2 weeks	Evaluation of co-morbidities, previous sports injuries, baseline electrolytes and hydration.	Cardiac arrythmias; Dehydration; Sleep fragmentation
Constantini, K et al. (2017)	Up to 14 days	History of injuries, altitude sickness, and baseline ferratin	Dehydration; Sleep quality; V/Q mismatch
Pedlar, C et al. (2011)	5 days to 4 weeks	Ferritin, Transferrin, and hemoglobin mass	AMS; HACE; HAPE; Sleep fragmentation; Dehydration; Sunburn; Weight loss
Bartsch, P et al. (2008)	Low altitude (<1500m): 3-5days; Moderate altitude (1500-2500m): 1-2weeks; High altitude (>2500m): >2 weeks	N/A	AMS

Screening identified those papers meeting the inclusion criteria, which included the following: 1) prospective or retrospective investigations for athletic training at high altitudes and pronouncements of professional associations and scientific societies; 2) English language and 3) papers referring to four inclusion themes: a) acclimatization to altitude, b) preparation for altitude training, c) recommendations for training at altitude, and d) adverse effects of high-altitude training. Studies were excluded if the full text was not accessible or if their content did not involve acclimatization to altitude, or pertained to simulated ascent, animal studies or biochemical investigations. Studies were also excluded if they were case reports, systematic reviews, case series, and clinical trials.

The focus of this paper was on consensus statements, position statements, guideline papers, pronouncements of professional associations and scientific societies. These documents are typically developed by reputable organizations and experts in the field, ensuring that the information and recommendations provided are based on current scientific evidence, expert consensus and standardized practices. Furthermore, guideline papers that reference consensus and position statements are more likely to be accepted and adopted by healthcare providers, policymakers, and other stakeholders. This acceptance can facilitate the implementation of recommended practices and improve patient care outcomes. Overall, due to the diversity of

sources, the authors opted for a non-systematic approach to provide thorough recommendations by encompassing a broader scope of the existing literature.
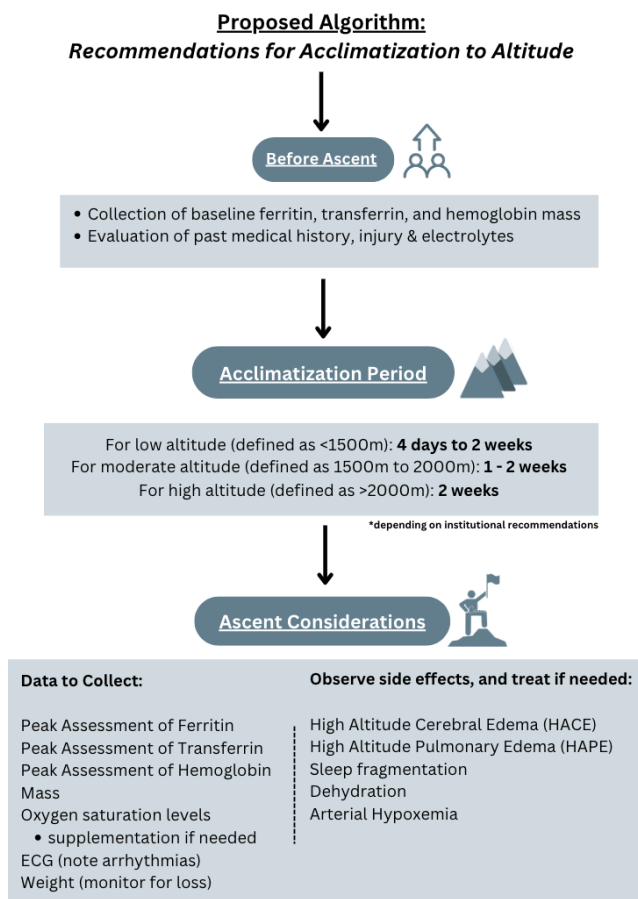
Results

From a total of 1268 references obtained in the first search, 6 documents have been considered for this non-systematic review all of which were prospective observational studies for athletic training at high altitudes and pronouncements of professional associations and scientific societies *Table 1*. Based on these recommendations, a blueprint was created for professional athletes to follow when competing at high altitudes

A key component in training and competing at high altitude is ensuring sufficient acclimatization time, defined as ascending to high altitude and either remaining sedentary or engaging in low-moderate exercise before a competition date.[4] All included studies recommended an acclimatization period, defined as a preset period of residing at altitude before beginning training or competition. The duration of this period ranged from 4 days to a maximum of 2 weeks depending on elevation above sea level as suggested in *Figure 1*. For instance, Koehle et al., recommended a no-training based acclimatization period such that athletes should reside, and not train, at the competition altitude for a minimum of 4-5 days to a maximum of one week prior to performance day.[5] Conversely, Bergeron et al. recommend

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athletes ascend 2 weeks prior to competition, rest for 1-2 days and subsequently resume low-intensity training.[6] Moreover, Girard et al. recommend a 7-day, 1-2 week and >2-week adaptation period for low, moderate, and high altitudes, respectively.[7] However, the exact values delineating these altitude classifications was not specified. Residence at high altitudes beyond 14 days was not recommended due to increased potential for harmful hypoxia-induced hematological consequences, such as excessive erythrocytosis, thrombosis, and hematological hyperviscosity[7]. In contrast, Constantini et al. suggested engaging in a competition 48-72 hours upon return to sea level, advocating benefit in having competing at sea level after acclimatization to hypoxic high altitude conditions.[8] It was hypothesized that this gives athletes sufficient time to re-establish a baseline homeostasis after a rigorous competition, making them ready for additional physiological strain that may occur during the descent.

Figure 1. **Blueprint for Pre-Ascent and Ascent Monitoring Considerations with Key Side Effects Highlighted Relevant for Athletes and Trainers.**

Proposed Algorithm:
Recommendations for Acclimatization to Altitude

Before Ascent

- Collection of baseline ferritin, transferrin, and hemoglobin mass
- Evaluation of past medical history, injury & electrolytes

Acclimatization Period

For low altitude (defined as <1500m): **4 days to 2 weeks**
For moderate altitude (defined as 1500m to 2000m): **1 - 2 weeks**
For high altitude (defined as >2000m): **2 weeks**

*depending on institutional recommendations

Ascent Considerations

Data to Collect:

Peak Assessment of Ferritin
Peak Assessment of Transferrin
Peak Assessment of Hemoglobin Mass
Oxygen saturation levels
  • supplementation if needed
ECG (note arrhythmias)
Weight (monitor for loss)

Observe side effects, and treat if needed:

High Altitude Cerebral Edema (HACE)
High Altitude Pulmonary Edema (HAPE)
Sleep fragmentation
Dehydration
Arterial Hypoxemia

To mitigate hypoxia overload, some studies investigated ascent increment. Koehle et al., recommended that for altitudes above 3000m, athletes should ascend 300-600 m/d with a rest day for every 1000m gained.[5] This was supported by Girard et al., who

cautioned altitude training above 3000m claiming that slow, incremental altitude changes are needed to control manifestations of extreme hypoxic environments, including high-altitude cerebral edema (HACE) and high-altitude pulmonary edema (HAPE).[7] It was generally supported by all studies that training and competition at low to moderate altitudes required less time for acclimatization.[1,3-6]

Studies also suggested pre-ascent considerations. Bergeron et al. suggested baseline ferritin measurement and recommended oral supplementation if levels were under 30 µg/l for women or 40 µg/l for men.[6] Baseline measurement of iron stores was supported by Constantini et al., who further suggested a thorough pre-ascent health assessment of co-morbidities and injuries that may make the altitude acclimatization more difficult, similar to the study by Garvican-Lewis et al.[8,9]

Several of the papers concurrently investigated the live high, train low (LHTL) strategy where athletes reside at high altitudes to stimulate physiological adaptations, such as increased red blood cell production, and subsequently train at lower altitudes. The combination of elevation change allows for optimized performance at sea level by supporting higher-intensity workouts and improved recovery. Koehle et al. emphasizes the effectiveness of the LHTL strategy for enhancing performance at lower altitudes but highlights limited research beyond 2000m.[5] Girard et al. suggest the potential application of LHTL approach, particularly in return-to-sport scenarios or to intensify training without imposing additional mechanical load on the musculoskeletal system.[7] Constantini et al. suggest optimal training and performance may occur between 2000-2500m and recommends low intensity training at higher altitudes, and high intensity training.[8] Such an approach would mitigate harmful effects of hypoxia on athletic performance and allow for matching of workout intensity with ambient oxygen conditions. In contrast, Bartsch et al. cautions against LHTL, particularly when playing at or near sea level or at moderate to high altitudes due to the incidence of harmful side effects.[4] Notable effects include HACE, HAPE, and polycythemia due to increased oxygen-hemoglobin demand. Other less prominent side effects noted were acute mountain sickness (AMS), sleep fragmentation, dehydration, and muscle soreness.[6] The incidence of these effects varies with altitude, with higher altitudes showing higher incidence rates. While side effects have a low overall incidence, athletes should remain vigilant for their signs and symptoms, as their onset can significantly impact performance, especially in high-stakes competitions.[6,7]

Discussion

These studies provide valuable insights into the complexities of altitude training for athletes. The published literature emphasizes the importance of a controlled ascent approach, including a sufficient acclimatization period and appropriate health assessments, to prevent adverse outcomes. In the ascent-based competition blueprint *Figure 1*, we recommend starting with a

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baseline assessment of serum ferritin, transferrin, and hemoglobin mass. Additionally, a comprehensive evaluation of an athlete's past medical history, previous injuries, and baseline electrolytes—specifically, potassium, sodium, and magnesium—is essential. These measures ensure baseline hydration, nervous system regulation, and healthy myocardial activity, all of which can be compromised in hypoxic environments during ascent. Treating abnormalities found from these investigations before ascent can improve tolerability of the altitude for athletes and minimize risk altitude-induced side effects, most notably HAPE and HACE. Importantly however, tolerability cannot be guaranteed as, even with appropriate iron supplementation, some athletes showed hematological adaptation while others do not.[10,11] Therefore, it is vital to do a comprehensive baseline evaluation prior to ascent to minimize the risk of undetected triggers.

While there is a lack of consensus regarding optimal duration of acclimatization, the suggested results from studies included in this paper ranged from 4 days to 2 weeks. The duration of the acclimatization period was found to depend on the magnitude of elevation. As such, in our blueprint we suggest low altitudes, defined as elevations <1500m, to have an acclimatization period ranging from 4-days to 2-weeks. In contrast, moderate altitudes, defined as 1500-2000m, and high altitudes, being elevations >2000m above sea level, are recommended to have an acclimatization period of 1-2 weeks. During the ascent and acclimatization period, strategies may be employed to ease the hypoxic effect of the high altitude, including exogenous oxygen supplementation, and using training altitude simulation facilities while training or sleeping, the latter of which has debated efficacy.

Finally, apart from pre-ascent testing and ensuring a sufficient acclimatization period, from the findings in the included studies we recommend conducting ongoing assessments of serum ferritin, transferrin and hemoglobin mass alongside oxygen saturation levels, ECG readings and weight monitoring.[12] These measurements at peak altitude and during descent can mitigate negative effects of training at high altitudes which include HACE, HAPE, sleep fragmentation, dehydration, and arterial hypoxia. Coaches and athletes should carefully monitor for the onset of these side effects when ascending, acclimatizing, or descending from high altitudes.

The LHTL strategy garnered attention, showcasing its potential benefits for enhancing performance at lower altitudes, but concerns were raised about limited research beyond 2000m. The LHTL approach was also explored for rehabilitation purposes and training intensity optimization with a lack of clinically significant findings and minimal consensus on its effects.

Notable side effects to high altitude exposure, mainly AMS, HACE and HAPE were highlighted, necessitating careful consideration of preventive measures and treatment options. There is debated treatment regimens for these conditions with none showing unequivocal efficacy. Some recommend the use of acetazolamide as first line therapy, or dexamethasone as second line to treat AMS, HACE and HAPE. However, both medications have been banned during competition by the world anti-doping agency and thus have significant limitations for use by competitive athletes.[13,14] Alternative treatments are sildenafil, moderate NSAID use, supplemental oxygen and incremental ascent as suggested by Bartsch et al., though these treatments lack significant evidence for their efficacy.[4,15] While the blueprint provides a structured approach, it's crucial to recognize that the incidence and severity of side effects can vary significantly among athletes due to differences in training regimens and individual characteristics. Therefore, coaches and athletes should use the blueprint as a guideline and carefully tailor their ascent acclimatization and monitoring based on the athlete's specific needs, the nature of the sport, and the magnitude of ascent. These individual needs, which may include factors such as previous altitude experience, medical history, and physiological responses to altitude, should be assessed and considered prior to ascent.[16] Therefore, while there is significant need for further prospective, randomized, and controlled research in this field to develop high-quality, evidence-based recommendations for athletes training at altitude, *Figure 1* proposes a blueprint for athletes and trainers to broadly follow based on the currently existing studies included in this review.

Limitations

Due to the scope of this paper, it is possible that some relevant papers were missed. The authors tried to be thorough in incorporating relevant references, but there may have been limitations in the capture of literature as this was a non-systematic review.

Conclusion

Evidence-based guidelines and statements for athletes engaging in altitude training consider factors such as acclimatization duration, ascent increments, and the intricate balance between training intensity and altitude. The six papers included in this non-systematic review recommend gradual and controlled ascent to high altitudes, alongside performing pre-ascent and ongoing evaluations. The findings from the included studies in this review were used to create a blueprint that shows the sequential consideration of factors for athletes or coaches wishing to compete at altitudes above sea levels. The suggested blueprint *Figure 1* can help to better prepare athletes for altitude changes during competition to minimize performance deficits and the onset of adverse side effects. Importantly, even with adopting the blueprint, coaches and athletes must be vigilant of individual athlete variability in metabolism, medical history and physiologic needs to tailor ascent regimens accordingly. Overall, the implications of these findings will help to improve clinical guidelines for high-altitude training and inform future research.

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Supplementary Material

Acronyms

ANDES: Altitude Nondifferentiated ECG Study
AMS: Acute Morning Sickness
HACE: High Altitude Cerebral Edema
HAPE: High Altitude Pulmonary Edema
LHTL: Live-high, train-low

Pubmed:

(((((((athletic performance/physiology*[MeSH Terms]) OR (sport*[MeSH Terms])) OR (human physical conditioning/physiology*[MeSH Terms])) OR (sports medicine[MeSH Terms])) OR (exercise[MeSH Terms])) OR (exercise tolerance/physiology[MeSH Terms]))))))) AND (acclimatization/physiolog*[MeSH Terms]) AND (altitude[MeSH Terms]) AND (humans[MeSH Terms] OR athletes[MeSH Terms]))))))))

Medline:

1. Acclimatization/ph [Physiology]
2. exp Athletic Performance/ph [Physiology]
3. exp Physical Conditioning, Human/
4. exp Sports Medicine/
5. exp Sports/
6. exp Exercise/ph [Physiology]
7. exp Exercise Tolerance/ph [Physiology]
8. 2 OR 3 OR 4 OR 5 OR 6 OR 7
9. exp Altitude/
10. exp Humans/
11. exp Athletes/
12. 10 OR 11
13. 1 AND 8 AND 9 AND 12
14. limit 13 to english language

Embase:

1. exp acclimatization/
2. exp adaptation/
3. 1 OR 2
4. exp competition/
5. exp exercise/
6. exp athletic performance/
7. exp sport/
8. exp exercise tolerance/
9. exp sports medicine/
10. exp training/
11. "Assessing Physical Training Modalities in Enhancing Sports Performance"/
12. "Elite Performance"/
13. exp altitude/
14. 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12
15. exp athlete/
16. exp human/
17. 15 OR 16
18. 3 AND 13 AND 14 AND 17
19. limit 18 to english language

A Narrative Review on the FSTL-1 Protein and its Current Known Impact on Cardiovascular Ischaemic Disease

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Abstract

This narrative review investigates the potential therapeutic role of FSTL-1 in addressing severe cardiac issues following myocardial infarctions (MI). Despite advances in modern medicine, MI persist as a leading global cause of death, with stem cell therapy falling short of expectations since the early 2000s. In contrast, FSTL-1, an emerging bone morphogenetic protein, demonstrates promise based on successful studies. We conducted a qualitative narrative synthesis of studies published in PubMed, Scopus, and Web of Science between January 2000 and May 2022. This research explores the intricate scientific aspects of FSTL-1's contribution to myocardial regeneration, utilizing a chronological approach to trace its progression from biological pathways to broader scenarios. It examines the mechanisms regulated by FSTL-1 and its effects on cardiac tissue and cells, highlighting its potential as a therapeutic agent emphasizing its multifaceted role in cardiac regeneration. By deepening our comprehension of FSTL-1, this study significantly contributes to knowledge advancement, offering insights into its role in addressing severe cardiac issues post-MI. By consolidating current knowledge and proposing new avenues for investigation, this work offers valuable insights into FSTL-1's significance in advancing cardiovascular health and post-MI recovery.

Introduction

In 54 countries belonging to the European Cardiology Society, there were 19.9 million new cases of cardiovascular disease (CVD) and 108.6 million individuals were found to be suffering from CVD in 2017. Ischaemic heart disease (IHD) is identified as the foremost expression of CVD, with 3.6 million new cases and 34.9 million individuals living with IHD.[1] CVD remains acknowledged as the leading cause of mortality in Europe, accounting for 4.1 million deaths annually, representing 47% of all deaths among women and 39% among men.[1]

Cardiac regenerative therapies have made significant progress over recent decades, aiming to address the limitations of traditional treatments for myocardial infarction (MI) and heart failure. Stem cell therapy has been a central focus, with various types, including embryonic, induced pluripotent, and mesenchymal stem cells, explored for their potential to replace damaged heart cells. However, challenges such as low engraftment rates, limited functional integration, and the risk of tumorigenicity have hindered widespread clinical success.[2] Cell-free therapies, such as the use of exosomes, microRNAs, and growth factors, have emerged as alternatives, targeting cardiac repair through cell signalling pathways. Tissue engineering approaches, including cardiac patches and 3D bioprinting, aim to create supportive environments for myocardial regeneration.[3]

Gene therapy, utilizing techniques like viral vectors and CRISPR/Cas9, offers another avenue for promoting heart tissue repair by targeting specific pathways.[4] Biomaterials, such as injectable hydrogels and scaffolds, provide structural support and enhance cell survival, though challenges like immune response, vascularization, and functional integration persist.[5]

Despite these advancements, the field faces ongoing hurdles that require further research and innovation. Managing immune responses, ensuring adequate blood supply to regenerated tissues, and achieving long-term efficacy and safety in humans are critical areas of focus. Emerging approaches, including the investigation of novel biomolecules like FSTL-1 and immunomodulation strategies, offer promising new directions. The ultimate goal is to develop therapies that can reliably regenerate heart tissue, restore function, and improve outcomes for patients with heart disease. While significant strides have been made, translating these innovations into widely available clinical treatments remains a complex and ongoing challenge.

This dual focus on both cell-based cardiac regeneration techniques and the potential role of FSTL-1 underscores the urgency and significance of ongoing research endeavors in addressing the formidable burden of cardiovascular disease, particularly ischemic heart disease, in contemporary healthcare

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landscapes. The proposed objective of this narrative review is to comprehensively explore the role of FSTL-1 in cardiac regeneration, particularly within the context of ischemic heart disease. The review aims to synthesize current findings on FSTL-1's mechanisms of action, its therapeutic potential in promoting cardiac repair, and the challenges and opportunities for translating these insights into clinical practice. By integrating insights from basic research, preclinical studies, and emerging clinical evidence, the review seeks to provide a nuanced understanding of how FSTL-1 could be harnessed to improve outcomes for patients with ischemic heart disease.

Ischaemic Heart Disease

As mentioned before, Ischaemic Heart Disease (IHD) has been shown to be a severe pathology with a high mortality rate. Within a simplistic approach, IHD is caused by the acute occlusion of one or multiple sizable epicardial coronary arteries for more than 20 minutes, which can lead to an acute MI.[7] Typically, necrosis spreads from the sub-endocardium to the sub-epicardium region. Depending on the territory affected by the infarction, cardiac function is typically compromised, and current treatment options are limited. Due to the minor renewal capacity of the myocardium,[8] the infarcted area heals by scar formation, and often, the heart is remodeled, characterized by dilation, segmental hypertrophy of remaining viable tissue, and cardiac dysfunction.

The initial effects of oxygen deprivation will disrupt the sarcolemma arrangement in heart muscle tissue and relaxation of myofibrils, shortly followed by alterations in mitochondrial ultrastructure. These changes will then lead to mitochondrial dysregulation, affecting energy availability. More advanced stages of prolonged ischaemia will result in liquefactive necrosis of heart tissue, especially in the myocardium. The deposition of collagen type I and type III in fibrosis is essential in the short term to stop the rupture of ventricular walls; however, this mechanism makes it increasingly difficult for the injured to maintain its functional capacity. This is due to its ill effects on the ventricle's geometry, resulting in an accentuated loss of contractile and pump function.[9] Alongside this, an inflammatory reaction will also occur by motivating the migration of macrophages to the myocardium,[10] mainly through macrophage 1 and 2. Macrophage activity will be rich in several growth factors and cytokines.[10,11]

Methods

In this narrative review, an analytical framework was adopted to synthesize and evaluate the findings from the literature, aiming to depict the chain of logic, as evidence must support possible future clinical outcomes. To refine the investigation, a comprehensive search strategy was employed to identify relevant literature sources, utilizing specific Medical Subject Headings (MeSH) terms provided by the National Library of Medicine (NLM). These terms included Myocardial Ischemia, Coronary Artery Disease, FSTL-1, Follistatin-Related Proteins, and Follistatin-Related Protein 1. The primary databases utilized for

the literature search included PubMed, Scopus, and Web of Science, with a focus on articles published between January 2000 and May 2022 to capture the most recent advancements in the field.

The inclusion criteria for this narrative review were rigorously defined to ensure a comprehensive and relevant synthesis of existing literature on FSTL-1 in cardiac regeneration. Eligible studies included peer-reviewed observational and interventional studies, reviews, meta-analyses, and both molecular and animal model studies, all published in English between January 2000 and May 2022. The focus on studies published within this timeframe was chosen to capture the most relevant and contemporary research, reflecting the significant advancements in the understanding of FSTL-1 over the past two decades. This period was selected because it encompasses the critical years during which FSTL-1 emerged as a potential therapeutic target, as well as the development of advanced molecular techniques and animal models that have provided deeper insights into its biological functions. By concentrating on this timeframe, the review aims to highlight the progression of scientific knowledge and the most current perspectives on FSTL-1's role in cardiac regeneration, ensuring that the findings are both up-to-date and aligned with the latest research trends.

Selection was based on the studies' contributions to elucidating FSTL-1's mechanisms within human physiology, with particular emphasis on research that provided clear and significant insights into its role in cardiovascular regeneration. To ensure that the included studies were of high relevance and scientific rigor, only those that adhered to established principles of biomedical research were considered. This included studies employing robust methodologies, validated models, and those that used precise and accepted scientific terminology, ensuring the findings could be interpreted accurately by medical students and professionals alike.

Additionally, studies were omitted if their methodologies were found to be flawed or if their findings did not align with the broader body of evidence on FSTL-1. Methodological flaws that led to exclusion included issues such as small sample sizes, inadequate controls, lack of reproducibility, and insufficient statistical power, all of which could compromise the validity and reliability of the findings. Studies with discrepancies or inconsistencies when compared to the established scientific consensus on FSTL-1 were also excluded. This approach was taken to ensure that the review presents a cohesive and scientifically sound narrative, grounded in evidence that is both credible and widely accepted by the research community. By filtering out studies with methodological weaknesses or conflicting results, the review aims to provide a clear and accurate synthesis of the current state of knowledge on FSTL-1, thereby offering reliable insights into its potential therapeutic applications.

The synthesis of findings followed a structured narrative approach, enabling a qualitative analysis that integrated diverse types of evidence to construct a cohesive overview of FSTL-1's role in cardiovascular regeneration. The narrative was developed chronologically, reflecting the evolution of scientific knowledge from fundamental concepts to advanced animal models and potential clinical applications, thereby providing a clear and logical progression of the field's development.

Results

FSTL-1 in the Heart

The most prominent regulation mechanism by FSTL-1 is the serine/threonine protein kinase (AKT), also known as phosphatidylinositol 3-kinase (PI3K). AKT has been identified as a key piece in myocardial growth induced by stress (Fig.1).[12,13] Investigation of AMP-activated protein kinase (AMPK) has also been conducted and discovered to safeguard cardiomyocytes from apoptosis during a MI.[14,15] This is due to the capacity of FSTL-1 to stimulate the phosphorylation of AMPK Thr172.[14] Research has proven that FSTL-1 overexpression would lead to an upregulation of both an AKT and ERK signalling in cardiac myocytes, resulting in better survival rates under hypoxic conditions and induced apoptosis.[16] This correlates with previous research, as AKT and ERK are positively correlated with cellular survival.[17,18,19] Other pro-survival factors include Pim-1, hypoxia-inducible factor-1α, and heme-oxygenase-1, which are also involved in the AKT signalling mechanism, although their relationship and function are still not understood in their entirety.[20,21] Meanwhile, ERK signalling seems to occur mainly in cardiac fibroblasts, with its central purpose being the proliferation and migration of the same cells. It is hypothesized that the controlled fibrotic reaction offered by FSTL-1 derives from an early activation and migration of cardiac fibroblasts, which in turn will lead to a greater myofibroblast build-up in the infarcted area.[22] This is believed to allow for an improved synthesis and maturing of extracellular matrix in the affected zone.[14] This reasoning is well-based, as FSTL-1 largely resembles the SPARC family, which is an initial controller of extracellular matrix maturation after MI.[23] Although alternative pathways to that proposed by Murayama et al. might also exist in relation to the activation of FSTL-1. As it has been demonstrated that fibroblasts are responsible for activating the Smad2/3 signalling route via TGF-β1 which will cause a fibrotic response.[22]

Bone morphogenic protein-4 (BMP4) has also been shown to boost the apoptosis of cardiomyocytes.[23] BMP4 is one of the commonly released proteins during an inflammatory response to MI[24,25] and is related to an enhanced phosphorylation of the previously mentioned Smad1/5/8 signalling, as shown in *Figure 1*. Reports have been conducted where they showed that FSTL-1 would bind to BPM4[26], which would inhibit further activity.[14,27]

Figure 1. Visual Representation of the Discussed FSTL-1 Stimulated Pathways.
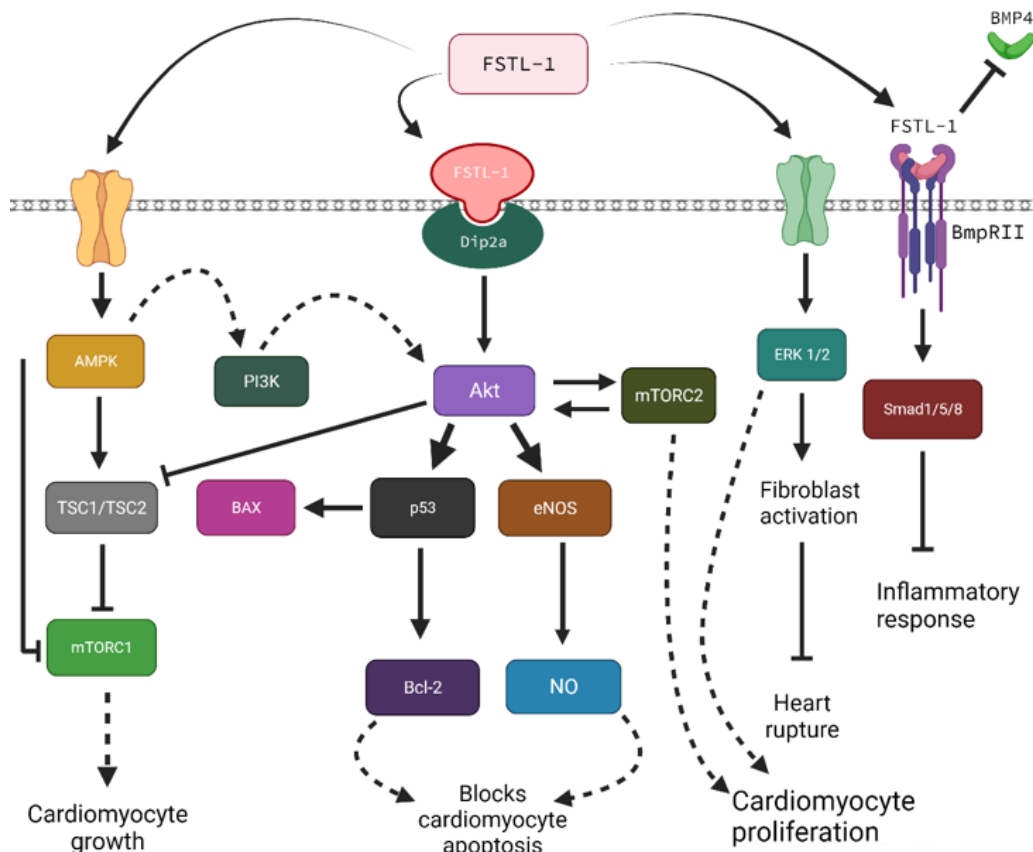
Legend: AMPK, AMP-Activated Protein Kinase; PI3K, Phosphoinositide 3-Kinase; TSC1/2, Tuberous Sclerosis Complex 1/2; mTORC1/C2, Mammalian Target of Rapamycin Complex1/2; DIP2A, Disco-Interacting Protein 2 Homolog A; Akt, Protein Kinase B; BAX, Bcl-2 Associated X-protein; eNOS, Endothelial Nitric Oxide Synthase; NO, Nitric Oxide; ERK, Extracellular Signal-Regulated Kinase; BMP-4, Bone Morphogenetic Protein-4.

Inflammatory Response

Macrophages are the main source of proinflammatory cytokines during MI.[28,29] Cytokines such as IFNγ and IL-1β will increase the secretion of FSTL-1. Other cytokines are responsible for increased levels of tumour necrosis factor-α (TNF-α) and interleukin-6 (IL-6). BMP4 is largely known for its increase in the expression of TNF-α and IL-6 after MI, resulting in an exaggerated and prejudicial inflammation of cardiac tissue. Due to the inhibition of BMP4 by FSTL-1 (Fig.1), inflammatory processes are considerably decreased, thus proving that FSTL-1 is a strong anti-inflammatory in post-MI.[14] AMPK signalling, dependent on FSTL-1, has also been linked to an inhibition of macrophage migration (Fig.1).[15] FSTL-1 also decreased lipopolysaccharide-stimulated expression of proinflammatory genes via activation of AMPK.[14]

Real-World Response

In a forerunner investigation by Wei et al., FSTL-1 was introduced to the epicardium through a nanofibrillar collagen patch.[34] It proved some different short-term effects, including reduced fibrosis and increased vascularisation beneath and surrounding the epicardial patch. Measurements showed an increase in the number and size of blood vessels. It is believed one of the processes behind revascularisation depends on a nitric-oxide process, which is most likely regulated by a paracrine mechanism.[30] Cardioprotection also occurred, as embryonic stem cell-derived cardiomyocytes did not undergo apoptosis provoked by the hypoxic environment, which is in correlation with previous studies.[16,30]

Wei et al. also proved that it could have mid-term effects, as after a 4-week period, the area beneath the patch showed striated myocytes, and in the border zones of the patch, cardiomyocytes had also undergone cell division, which proved that FSTL-1 had successfully induced cell cycle entry and cytokine release.[33] However, Chen et al. also showed that FSTL-1 can be used to incentivise the proliferation of mature adult ventricular cardiomyocytes, as it did not induce synthesisation of DNA or division as well as hypertrophy, showing some limitations in this aspect.[34] Thus, clear knowledge gaps still remain, as currently it is still unknown if these cells originate *de novo* or from pre-existing cardiomyocytes. Studies have been conducted in this regard, as fate mapping indicated that resident cardiomyocytes were the main source of regeneration in the myocardium. However, during the investigation, a small percentage of cardiomyocytes didn't undergo labelling, suggesting an alternative source of cardiomyocytes.[35] Current evidence points that this unknown source is most likely made up of ckit+ cells, as it was found that they can also contribute to the proliferation and regeneration of cardiomyocytes after MI.[36]

Probably the most pertinent issue that came from Wei et al. was the difference between FSTL-1 expression in the myocardium *vs.* the epicardium. The overexpression of myocardial FSTL-1 varied in its role in comparison to the overexpression of FSTL-1 in the epicardium. The initial idea behind this discrepancy was that there were differences in the migration rates of the cells due to differing glycosylation processes. FSTL-1 produced from different cellular sources are most likely exposed to differences in the post-translational glycosylation, which will inevitably result in varying isoforms.[37] FSTL-1 derived from the myocardium demonstrated cardioprotective functions but not cardio regenerative.[38] While FSTL-1 derived from the epicardium demonstrated a cardio regenerative capacity.[38] Other studies showed that non-glycosylated FSTL-1 increases the proliferation of cardiomyocytes, while glycosylated FSTL-1 protects cardiomyocytes from peroxidase-induced apoptosis.[38] However, other factors might also be influencing the activation processes and subsequent role of FSTL-1. Maruyama et al. in a more recent investigation, explored this topic as they evaluated the effect of glycosylation of FSTL-1 in relation to cardiac fibroblast activation.[39] For this, they used insect, mammalian, and bacteria cells. Although the glycosylation mechanisms varied substantially between the three, there were no statistically significant differences in the capacity of each FSTL-1 protein to promote activation of cardiac fibroblasts and their role.[39]

Other areas of interest revolve around the relationship of FSTL-1 with other peptides, such as thymosin β4, due to their similarities, such as the production of epicardial-derived cells and a strong driving force of angiogenesis and mobilization.[38] Thymosin β4 has already been reported as a strong pro-vasculogenic factor.[40] Following MI, thymosin β4 has been shown to induce epicardial-derived cells to form vascular precursors and prompt angiogenesis in the human heart.[41] Further investigation has established a relationship between thymosin β4 and the capacity of Wt1+ cells to undertake cardiomyogenesis.[40,42]

Alongside this, FSTL-1 has been proven to inhibit the entrance into the apoptotic mode of cardiomyocytes. Akt/GSK-3β signalling was verified in hypoxic-FSTL-1 cells, being currently held as the main mechanism behind anti-apoptosis in hypoxic conditions. More technical analyses have also shown that the heart upregulated FSTL-1 expression under mechanical stresses such as pressure.[34] Due to these cardioprotective roles, cardiac tissue, under the presence of FSTL-1, can be able to positively regulate the cardiac microenvironment and induce the importation or production of pro-regenerative substances.[34] This regulation post-MI is managed by elements such as retinoic acid, hypoxia-inducing factor-1α, fibroblast growth factors, transforming growth factor-beta (TGFβ), insulin-like growth factor, and BMP, among many others.[43]

Musculoskeletal Secretion

FSTL-1 produced outside the heart is also essential in post-MI scenarios, as skeletal muscle is the main producer of circulating FSTL-1 and has been linked to transgenic AKT-1 overexpression.[44] Circulating FSTL-1 will resemble a myokine by maintaining its previously reported cardioprotective role through an endocrine method.[45] Increased myocardium angiogenesis and an overall increase in the heart's performance were reported due to an augmented TGFβ-Smad2/3 signalling (Fig.1).[45,46] Reduced levels of FSTL-1 in the blood have also been shown to be correlated to more prominent inflammatory reactions in arterial injury.[46] FSTL-1 will also inhibit the proliferation and migration of smooth muscle cells in damaged blood vessels, which will lower the effect of neointimal hyperplasia after vascular injury.[45] This will result in the control of smooth muscle cells through the stimulation of AMPK mechanisms through an increase in phosphorylation.[45] Exercise is essential as it increases FSTL-1 expression in skeletal muscle, especially through intermittent aerobic exercise.[46] This is further emphasised as circulating FSTL-1 would increase its expression in the heart's myocardium heart, which is a strong indicator of regulation through positive feedback.[45] FSTL-1 has also been tested in conjunction with mesenchymal stem cells due to the inherent characteristics FSTL-1 possess.[30] This was an attempt at addressing some of the issues currently associated with cardiac stem cell therapy, mainly low survival percentage and difficulty in retention and engraftment of donor cells in ischemic tissue.[7] A study by Shen et al. showed promise in this hypothesis, as FSTL-1 successfully enhanced the resistance of mesenchymal stem cells to hypoxia, a reduction in fibrosis, inflammatory cell infiltration and an increase in neovascularisation.[30] The production of extracellular matrix was also considerably modulated, as tested by western blot analysis, which showed that mesenchymal stem cells injected in conjunction with FSTL-1 decreased the transcription rates of collagen type I and fibronectin in peri-infarcted zones. Other pro-fibrogenesis cytokines, such as connective tissue growth factor, decreased in ischaemic myocardium.[30]

Discussion

In evaluating the limitations of the studies encompassed within this review, several critical considerations emerge that significantly influence the interpretation of findings and the broader understanding of FSTL-1's role in cardiac regeneration. A primary concern is the diverse methodologies and experimental models employed across these studies. Animal models, such as rodents and larger mammals, have been invaluable in elucidating the molecular mechanisms underpinning cardiac regeneration. However, the translational relevance of these findings to human physiology remains a complex challenge. Differences in cardiac anatomy, physiology, and regenerative capacity between species necessitate cautious extrapolation of preclinical data. Many investigations have provided valuable insights into the molecular pathways involving FSTL-1 in cardiac regeneration, a predominant focus on mechanistic aspects without sufficient consideration of direct clinical relevance or translational

implications limits the practical utility of these findings. Additionally, the heterogeneity in experimental protocols—ranging from dosing regimens and delivery methods to the timing of interventions—introduces variability that complicates the interpretation and comparison of results across studies. This emphasis on fundamental research, though crucial for understanding underlying biological mechanisms, can often fail to address the practical challenges of translating FSTL-1-based interventions into clinically effective therapies. The absence of comprehensive preclinical studies that integrate mechanistic insights with translational endpoints—such as functional recovery and long-term safety assessments—represents a significant gap in the literature.

Furthermore, publication bias poses a significant challenge in the existing literature. Studies reporting positive outcomes or novel findings are more likely to be published, potentially leading to an overrepresentation of favorable results. Conversely, studies with neutral or negative findings may face greater difficulties in publication, resulting in an underrepresentation of valuable data. This bias can skew the overall perception of FSTL-1's therapeutic potential, either fostering unwarranted enthusiasm or undue skepticism.

In addition to the aforementioned points, the integration of FSTL-1 into complementary therapeutic approaches, such as mesenchymal stem cell therapy, holds promise for optimizing cardiac regeneration strategies. Leveraging the epicardium as a targeted cell therapy site represents a compelling avenue for enhancing the efficacy of regenerative interventions. However, to fully capitalize on this potential synergy, a comprehensive understanding of the intricate molecular networks governing cardiac regeneration is essential. These networks, characterized by intricate interplay and feedback loops, involve not only FSTL-1 but also other cardio-protective and regenerative proteins expressed in the myocardium. Despite significant progress in elucidating the mechanisms regulated by FSTL-1, gaps persist, particularly regarding the upstream activators of FSTL-1 expression. Resolving these knowledge gaps is critical for developing precise therapeutic interventions. Furthermore, while recent studies have shed light on FSTL-1's role in modulating immune responses post-MI, further research in this direction is warranted to unravel its full therapeutic potential.

Moreover, fostering interdisciplinary collaborations and aligning research efforts with emerging trends in cardiovascular science is paramount. Recent advancements in stem cell therapy, including investigations into c-kit+ cells and Wt1+ cells, present opportunities to address existing challenges, such as poor engraftment of donor cells in hypoxic environments. Exploring the secretion of FSTL-1 in skeletal muscle and its implications for cardiac rehabilitation post-MI or post-op represent another intriguing avenue for future exploration. By capitalizing on synergies between diverse therapeutic modalities and integrating novel insights from related fields, we can unlock new dimensions

in cardiac regeneration and pave the way for transformative advancements in cardiovascular medicine.

However, despite the overall agreement on FSTL-1's beneficial effects in cardiac regeneration, there are notable discrepancies and contradictions in some areas of the literature. For instance, while some studies demonstrate a clear cardioprotective role for FSTL-1[33], others suggest no significant impact on cardiac function when acting alone.[44] Additionally, discrepancies exist regarding the mechanisms underlying FSTL-1 mediated cardiomyocyte proliferation, with some studies implying activation of specific signaling pathways, such as AKT and ERK, while others propose alternative mechanisms.

Furthermore, contradictory findings are observed regarding the optimal timing and dosage of FSTL-1 administration for maximal therapeutic efficacy. Some studies suggest that early administration of FSTL-1 post-injury is more effective in promoting cardiac regeneration[33], while others advocate for delayed intervention to allow for resolution of inflammation and scar formation before initiating regenerative processes.[5] Similarly, discrepancies exist regarding the source of FSTL-1 secretion and its precise cellular targets within the myocardium, highlighting the need for further investigation to elucidate these aspects.

Despite these advances in understanding FSTL-1, it is important to note that, as of now, there are no clinical trials involving FSTL-1 in cardiac regeneration. However, the future setup of such trials could involve carefully designed, phased approaches to assess safety, dosage, timing, and efficacy. Initial trials might focus on determining the optimal delivery method of FSTL-1, such as direct injection into the myocardium or incorporation into biomaterials used in cardiac patches. These trials could also investigate the timing of administration relative to myocardial infarction or surgical intervention, as well as the integration of FSTL-1 with other therapies, such as stem cell treatments or pharmacological agents. Subsequent trials would likely expand to larger populations and longer follow-up periods to fully assess long-term outcomes and potential benefits in preventing heart failure or improving functional recovery post-MI. As research progresses and a deeper understanding of FSTL-1's role in cardiac regeneration emerges, clinical trials will play a pivotal role in translating these findings into viable therapeutic strategies.

Conclusion
The key findings from our review underscore the significant role of FSTL-1 as a stable and effective cardio-protective and regenerative factor in cardiovascular research. FSTL-1's multifaceted mechanisms demonstrate considerable potential in addressing critical clinical challenges in MI treatment, such as the clearance of necrotic tissue, restoration of lost cardiomyocytes, regeneration of electrical conductivity, and resolution of inflammation and fibrotic tissue accumulation. Notably, our review highlights the importance of optimizing FSTL-1 delivery methods—whether through intravenous administration or via a

nanofibrillar collagen patch—both of which hold promise for enhancing the efficacy of therapeutic interventions and improving the quality of engrafted cells.

In the broader context of cardiovascular therapy, FSTL-1 emerges as a highly promising therapeutic target with the potential to revolutionize clinical approaches to MI and other cardiac conditions. The elucidation of FSTL-1's molecular mechanisms provides a foundation for its integration into innovative treatment strategies, potentially transforming current practices in cardiac care. Clinically, FSTL-1 offers avenues for developing targeted therapies that could mitigate heart damage, promote tissue regeneration, and improve long-term outcomes for patients. The versatility of FSTL-1 in addressing multiple facets of cardiac injury suggests that it could be pivotal in creating personalized and precision-based treatments, particularly in high-risk patient populations.

As research continues to delve into the complexities of FSTL-1's actions and refine its delivery systems, the potential for FSTL-1 to serve as a cornerstone in cardiovascular medicine becomes increasingly evident. With further development, FSTL-1 could lead to groundbreaking therapies that significantly enhance patient recovery and survival rates, marking a substantial advancement in the clinical management of MI and related cardiac disorders.

Summary – Accelerating Translation

Follistatin-like 1 and its application in Ischaemic Heart Disease
FSTL-1 is a protein that has gained significant attention in the field of cardiac rejuvenation due to its crucial role in promoting cardiac tissue repair and regeneration. This study has as its main aim to identify, understand and summarise the molecular and immune-physiological mechanisms underpinning this molecule and how it they might apply to cardiac regeneration. Through this narrative review, the aim was to synthesise information from various sources on this topic in a descriptive and/or qualitative manner, with a more flexible and holistic overview of the existing literature.

FSTL-1 has been identified as a key player in this subject because of its ability to stimulate the growth and repair of heart muscle tissue. This is of great importance because the heart has limited regenerative capacity, and injuries or diseases can lead to irreversible damage. FSTL-1 has also been found to activate cardiac stem cells and promote their differentiation into functional cardiac muscle cells (cardiomyocytes). This process is vital for replenishing damaged or dead cells in the heart after injury, such as a heart attack. FSTL-1 exhibits anti-inflammatory properties by modulating the immune response. Inflammation is a major contributor to heart damage following cardiac events. By reducing inflammation, FSTL-1 helps create a more favorable environment for cardiac repair. Another critical aspect of cardiac regeneration is the formation of new blood vessels (angiogenesis) to supply oxygen and nutrients to regenerating tissue. FSTL-1 has been shown to promote angiogenesis in the heart, facilitating the healing process. FSTL-1 may also help reduce fibrosis, the excessive formation of scar tissue in the heart, which can impair cardiac function. By limiting fibrosis, FSTL-1 aids in preserving and restoring the heart's contractile function.

Understanding the importance of FSTL-1 in cardiac regeneration holds significant promise for the development of novel therapeutic approaches for heart disease treatment. Researchers are exploring ways to harness the regenerative potential of FSTL-1, such as through gene therapy or the development of pharmaceutical agents that mimic its effects.

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Complex Regional Pain Syndrome, an Important Differential Diagnosis in Sports Injuries: a Case Report

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Abstract

Background: Complex regional pain syndrome (CRPS) is a disproportionate and persistent, regional pain related to a minor trauma. Although CRPS is not an infrequent condition its pathophysiology remains unknown and leading to underdiagnosis or late diagnosis. The diagnosis is clinical, according to Budapest criteria of the International Association for the Study of Pain. Bone scintigram is the most effective test to support the diagnosis. The aim of this article is to discuss the importance of clinical suspicion for an early CRPS diagnosis in a sprain's young athlete clinical case. **The Case:** We present the case of a sixteen-year-old male patient with no medical history who suffered two minor ankle injuries in the right foot. The patient developed severe and persistent pain associated with vasomotor, sudomotor and trophic abnormalities. He remained undiagnosed for 10 months until CRPS diagnosis confirmation supported by a bone scintigram. He received multiple treatments until spontaneous remission in the fourth year of evolution. **Discussion:** CRPS poses a diagnostic challenge that requires early suspicion to improve treatment outcomes and prognosis. Maintaining a high index of clinical suspicion is crucial, and CRPS should be considered in the evaluation of any persistent pain sport-related injury. Despite extensive research on CRPS conducted in recent decades, this condition may still be unfamiliar to many healthcare providers. Increasing awareness of CRPS among medical professionals can facilitate timely and accurate diagnosis, which is essential for effective management.

Introduction

Complex regional pain syndrome (CRPS) is defined as an array of painful conditions characterized by a disproportionate continuing regional pain.[1] The incidence varies widely between 5 to 26 per 100,000 inhabitants.[2] It is caused mainly after a local trauma, most frequently a fracture or sprain.[3] In the last two decades, CRPS research has been largely conducted. However, the pathophysiology mechanism is not yet fully understood.[4]

The diagnosis is clinical by the modified diagnosis criteria of the International Association for the Study of Pain (IASP) or Budapest criteria, which established the CRPS as an exclusion diagnosis characterized by a continuing pain disproportionate to any incited event associated with sensory (hyperalgesia and/or allodynia), vasomotor (temperature and/or skin color asymmetry), sudomotor (edema and/or sweating) and motor/trophic changes in a limb region, that doesn't follow any specific nerve territory or dermatome.[5]

CRPS continues to be a diagnosis challenge, with a significant delay in the diagnosis, which worsened the prognosis and treatment response.[6] Considering that the precipitating event in CRPS is often represented by an injury, this condition should be relevant for athletes.[3] The aim of this article is to discuss the importance of clinical suspicion for an early CRPS diagnosis in a sprain's young athlete clinical case.

Highlights:

- CRPS is a disproportionate and persistent, regional pain related to a minor trauma.
- CRPS represents a diagnostic challenge that should always be considered in the context of a persistent pain sport-related injury.
- Despite extensive research on CRPS, it may still be unfamiliar to the medical community. Raising awareness is crucial to aiding healthcare professionals in making timely and accurate diagnoses.

The Case

We present the case of a sixteen-year-old male patient with no medical history, who suffered two consecutives grade one right ankle sprain while playing soccer. He had poor response to 15 kinesiotherapy sessions. Afterwards, he progressed with a burning pain, increased volume and red-purple erythema triggered by the heat. Physical examination *Figure 1.A* showed mild edema, erythema, allodynia, higher temperature and hair loss in the right foot, without motor alterations. A right foot ultrasound was performed, revealing a partial anterior talofibular ligament rupture and a mild peroneal tendonitis. Based on these findings, the patient continued with kinesiotherapy.

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Figure 1. **Patient's Physical Examination at Third and Tenth Month of Evolution.**
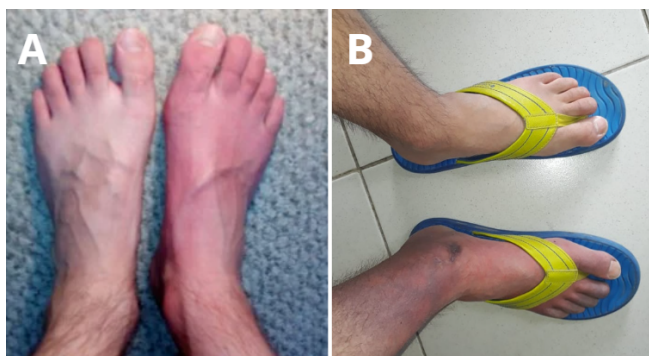
Legend: Physical examination at the third month (Figure 1.A): asymmetrical skin changes, with greater erythema in the right foot. Physical examination at the tenth month (Figure 1.B): increase of asymmetrical erythema, edema and hair loss in the right foot.

Due to pain persistence at the sixth month, the case study was complemented with vascular and rheumatological tests, which were negative. Additionally, it was performed a right ankle MRI, which reported the presence of calcaneal bone edema. Therefore, new kinesiotherapy sessions were indicated. At the tenth month, the symptoms worsened, increasing the affected area until middle leg *Figure 1.B*. Since symptoms could not be explained by the imaging findings, a lower member bone scintigram was requested *Figure 2*. The exam reported a moderate increase in arterial flow and diffuse hyper uptake in right foot and ankle, confirming the diagnosis of a CRPS.

Figure 2. **Lower Member Bone Scintigram.**
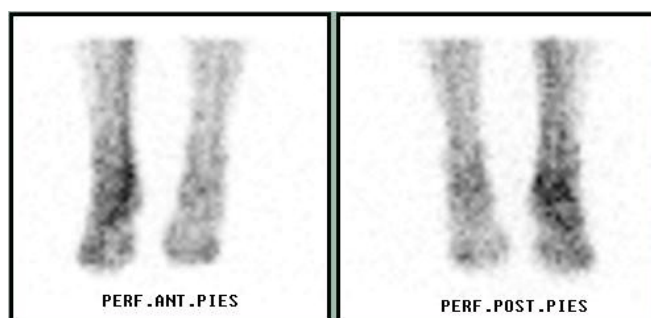
Legend: An anterior and posterior vision of a lower member bone scintigram evidence a moderate increase in arterial flow and diffuse hyperuptake in right foot and ankle. These findings correlated with the autonomic dysfunction in CRPS, leading to blood flow abnormalities

The patient began treatment with pregabalin and duloxetine in ascending doses until 75 mg every 12 hours and 60 mg per day, respectively. In addition, he received psychotherapy for pain management. Symptoms worsened after one year of treatment. Further therapeutics options were considered. The patient underwent 5 sympathetic blocks sessions, not being able to complete the 10 recommended sessions. Symptoms remained stable and the patient abandoned medical therapies in the third year. He explored alternative medicines such as acupuncture,

phytotherapy, mindfulness, among others, without significant relief. Medical follow-up continued and during the fifth year of disease there was a progressive decrease in symptoms until remission. Only mild vegetative symptoms persisted but there was an absence of pain and full recovery of functionality.

Discussion

We presented the case of a sixteen-year-old male with no medical history suffered two minor right ankle injuries. He developed severe, persistent pain with vasomotor, sudomotor and trophic abnormalities. After 10 months, CRPS was confirmed by bone scintigram. He received multiple treatments until spontaneous remission in the fourth year.

CRPS incidence has been more commonly reported in old women between 60 and 70 years and affecting upper limbs.[7] In young population incidence is still greater in women but affecting lower limbs, probably due to the higher incidence of sport-related injuries.[8] In consequence, athletes experiencing worsening conditions after common trauma should be assessed for excluding CRPS.[3] A scoping review searching for CRPS in athletes found only 20 patients reported, 15 females and 5 males between 12 and 20 years, where 50% of cases were after an ankle sprain.[9] CRPS is not a rare condition according to four population-based studies in the last two decades.[2] However, it remains unknown for many physicians and is underdiagnosed or diagnosed late, leading to a worse therapeutic response and prognosis.[10] In some studies, the mean time between the injury and diagnosis is around 2,8 to 3,9 years.[6,11] In our case, the patient pertained to a high-risk group (young athlete with lower limbs injury). Although the time from the ankle sprain until CRPS diagnosis in the presented case was 10 months, less than described in these studies, the diagnosis could have been done earlier under a greater clinical suspicion.

CRPS diagnosis is clinical according to the IASP or Budapest criteria.[5] Laboratory or imaging tests are not needed for CRPS diagnosis, but it could be used to support it or to exclude differential diagnosis.[12] Bone scintigraphy or triple-phase bone scan has shown to be the better complementary diagnosis test over MRI and radiography.[13] In our case, the imaging findings may have acted as confounding factors, since the symptoms and signs probably weren't explained by a tendonitis or bone edema.

There are multiple described treatment options for CRPS, nevertheless the quality of clinical trials remains variable.[14] Immobilization is a well-recognized possible cause and/or perpetuating factor in CRPS,[15] so in this case during the delay diagnosis process the multiple kinesiotherapy may have worked as a therapeutic tool preventing a severe early progress of disease.

In summary, we discussed the case of a late CRPS diagnosis even though it complied with all clinical features of IASP diagnosis criteria and was part of a high-risk group. Physicians should always consider this diagnosis in the context of a sport-related injury with persistent and severe pain. Clinical suspicion is key for

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an early diagnosis which improves treatment response and prognosis. Even though CRPS research has been largely conducted in the last decades, it may remain unfamiliar to the medical community. Raising awareness of this entity may help healthcare professionals to make a timely and accurate diagnosis.

Summary – Accelerating Translation

Título: Síndrome de Dolor Regional Complejo, un Caso Clínico que Resalta su Importancia como Diagnóstico Diferencial en Lesiones Deportivas.

Problema principal a resolver: El Síndrome de Dolor Regional Complejo (SDRC) abarca una variedad de condiciones dolorosas caracterizadas por dolor regional persistente y desproporcionado en relación con una lesión menor. Los jóvenes atletas enfrentan un mayor riesgo de desarrollar SDRC en el contexto de lesiones deportivas. Un diagnóstico clínico oportuno es esencial para mejorar los resultados del tratamiento y el pronóstico.

Objetivo del estudio: Este estudio tiene como objetivo discutir la importancia de la sospecha clínica para un diagnóstico temprano de SDRC en el caso clínico de un joven atleta con esguince.

Presentación del caso y conclusión: El caso presentado involucra a un paciente que experimentó un diagnóstico tardío de SDRC, a pesar de que los síntomas coincidían con los criterios diagnósticos y pertenecía a un grupo de alto riesgo (jóvenes atletas). Los médicos deben considerar constantemente el SDRC cuando se enfrentan a lesiones deportivas acompañadas de dolor persistente e intenso. Fomentar la sospecha clínica es fundamental para un diagnóstico temprano, lo que mejora la respuesta al tratamiento y el pronóstico general. A pesar de la investigación considerable sobre el SDRC en las últimas décadas, este aún puede ser desconocido para la comunidad médica. Por lo tanto, aumentar la conciencia sobre esta condición es crucial para ayudar a los profesionales de la salud a realizar diagnósticos oportunos y precisos.

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Bronchiectasis with Transmediastinal Herniation of the Left Upper Lobe in a 3-Year-Old Child: A Case Report

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Abstract

Background: Bronchiectasis is a disorder marked by the destruction of smooth muscle and elastic tissue caused by inflammation, resulting in the permanent expansion of bronchi and bronchioles. It can occur following a single severe episode or repeated episodes of pneumonia, as well as exposure to tuberculosis. **The Case:** A child reported with cough and cold for 7 days, with mild fever. He was admitted to the hospital due to breathing difficulties and facial swelling. The clinical exam showed crepitation, wheezing, and pectus carinatum. The patient has a history of multiple hospital admissions due to pneumonia, respiratory distress, and exposure to tuberculosis. His mother was diagnosed and treated for tuberculosis when he was 3 months old. The condition of the patient was evaluated using ultrasonographic examination, chest radiograph, and High-Resolution Computed Tomography of thorax. **Conclusion:** High-resolution Computed Tomography (HRCT) scanning is the preferred diagnostic test as it helps to identify the pathologic changes and the exact extent through which it has taken place. Early intervention plays a critical role in reducing severe complications like hemoptysis and cor pulmonale. The current treatment options consist of antibiotics, bronchodilators, anti-inflammatory medications, and physical therapy. The patient was treated using steroids, anti-microbials, and inhalational bronchodilators. Complete symptom resolution was noted in two weeks from date of admission. He also seemed to be doing well in the follow-up visit, one week post discharge. Severe cases may require injectable antibiotics. As a widespread condition in India, early diagnosis and treatment with suitable antimicrobials is critical for a positive outcome.

Introduction

The principal conditions associated with bronchiectasis are obstruction and infection.[1] Infections primarily originate from issues with airway clearance, which cause bronchi and bronchioles to enlarge irreversibly.[2] Vertical airways are notably affected, while distal bronchi and bronchioles are more severely affected. The bronchi and bronchioles are typically so dilated that they can be tracked to the pleural surface.[3]

Clinical signs include a strong, persistent cough, dyspnea, expectoration of foul-smelling, occasionally bloody sputum, and orthopnea in severe cases.[1] Upper respiratory tract infections and the introduction of pathogenic organisms causes episodic symptoms. As a result of improved therapeutic methods brain abscesses, amyloidosis, and cor pulmonale are less common complications.[2]

Histologic findings are influenced by the level of activity and duration of the disease.[2] In severe active cases, the lining epithelium of the bronchiolar walls are desquamated. There may be ulceration along with inflammatory exudation. The bronchiolar lumen may be entirely or partially destroyed by peribronchiolar fibrosis, bronchial, and bronchiolar wall fibrosis.[3]

Highlights:

- Only bronchiectasis is a relatively neglected problem in developing countries like India.
- Limited infrastructure and research facilities in India prevent the diagnosis of bronchiectasis and treatment with appropriate antibiotics.
- Severe bronchiectasis with complications is rarely seen in developed countries due to advent of newer antibiotics.
- What makes this case so interesting and unique is the presence of severe bronchiectasis and the resulting complications.

Treatment for bronchiectasis in India currently only involves managing symptoms, and there is no established protocol. The management of the disease is less than ideal, with over 60% of patients being treated similarly to those with obstructive airway diseases using inhaled corticosteroids, long-acting beta agonists, or both, despite the fact that only 35% of patients show an obstructive pattern on spirometry. More evidence-based treatment, like low-dose macrolides, inhaled antibiotics like tobramycin and colistin, is used in less than 10% of cases.[1]

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Case Report

Bronchiectasis was thought to be an orphan disease that seldom progressed to severe consequences, especially after the introduction of newer antimicrobials. The incidence of bronchiectasis varies widely, ranging from 67 to 566.1 per 100,000 people in Europe and North America and reaching as high as 1200 per 100,000 individuals aged 40 years or older in China. A comparison of data revealed that Indian patients with bronchiectasis exhibited notable differences from those in the developed world. Patients in India were generally younger (with a mean age of 56 years) and more commonly male (56.9%). Previous tuberculosis was identified as the most frequent underlying cause of bronchiectasis at a rate of 35·5%. Notably, bronchiectasis is emerging as one of the top three chronic airway inflammatory diseases globally, alongside chronic obstructive pulmonary disease and asthma. Understanding the disease burden is imperative for the improvement of the global management of bronchiectasis.[1]

Patients experience a highly variable clinical course which ranges from complete resolution if diagnosed early to long-term impairment of quality of life and high healthcare costs through exacerbations, hospitalizations, and premature mortality.[1] Complications include lung abscess, empyema, atelectasis, cor pulmonale, persistent bacterial bronchitis, and recurrent pleurisy.[3]

This case is noteworthy because it illustrates bronchiectasis in an Indian child that proceeded to the severe complication of transmediastinal herniation. It is relatively common albeit under-diagnosed in low- and middle-income countries.[6]

The patient's mother provided written consent for her son's situation to be discussed in a case study.

The Case

A 3.5-year-old Indian boy, weighing 11 kgs (who is underweight and falls in the 1st percentile according to WHO weight for age percentile chart),[4] presented with a 7 day history of productive cough, cold, and low-grade fever with dyspnea and respiratory distress for past 4 days. Facial swelling is present. He was admitted to the OPD. Patient was apparently well 10 days prior to discharge from the hospital where he was admitted for pneumonia. Child is developmentally normal based on fine motor skills, gross motor skill, language, and social interaction.

History

The patient's previous medical background was acquired from his mother, revealing that the patient was hospitalized at the age of one month for pneumonia and then at seven months, three years, and four months for symptoms such as coughing, colds, and respiratory distress. He has also visited the local doctor multiple times due to respiratory distress. His mother received a diagnosis of pulmonary tuberculosis (TB) using Cartridge Based Nucleic Acid Amplification Test and was treated with Isoniazid, Rifampicin, Pyrazinamide and Ethambutol when the patient was 3 months old. She discontinued breast-feeding him owing to her

tuberculosis diagnosis, and then formula milk was administered. Prenatal history of the patient includes a single mother, born at term, normal vaginal delivery weighing 3.5 kg. Patient has received bacille Calmette-Guerin (BCG) vaccine at birth and 0 and 1st dose of Oral Polio Vaccine (OPV) and Hepatitis B vaccine. He has not received further immunization. He has not received Pentavalent vaccines. This leaves him unprotected from respiratory pathogens such as Corynebacterium diptheriae, Bordetella pertussis, and Haemophilus inflenzae type b. Moreover, BCG vaccine provides immunization only against extra-pulmonary forms of tuberculosis.

Examination of the Respiratory System

Upon examination in a seated position, pectus carinatum is identified by an excessively protruding sternum and the chest having a triangular shape *Figure 1*. The right side of the chest has a unilateral depression due to bronchiectatic changes and the collapse of the basal segment of the right lung along with decreased movement on the right side of the chest.

Figure 1. **Chest Examination Shows Pectus Carinatum**

Legend: The child is orthopneic, he inhales oxygen through nasal prongs. Pectus carinatum also known as pigeon chest, is a bony deformity is which is probably present due to long standing lung infection.

Dyspnea is present. On palpation, the patient's chest has an asymmetrical movement. Dullness is heard on percussion of the chest. Vocal fremitus is diminished. Auscultation reveals characteristic breath sounds on left side of the chest but diminished breath sounds on the right side. Rhonchi and localized coarse crepitation are heard which are restricted to the right lung base. S1 and S2 heart sound are prominent. Apex beat

palpated at 4th intercostal space towards the left border of the sternum.

The patient has persistent, productive cough without blood. Clubbing of fingers and cyanosis are not seen.

Examinations

Digital chest radiograph shows bronchiectatic changes. Ultrasonogram (USG) revealed multiple sub-centric, mesenteric lymph nodes, and right-sided mild pleural effusion.

High-Resolution Computed Tomography (HRCT) of thorax revealed collapse of basal segment of right lung, trans-mediastinal space shift of the left upper lobe, and bi-lateral bronchiectatic changes. This indicates the trans-mediastinal herniation of left upper lobe of the lung or the protrusion of the lungs past the mediastinum's anatomic boundaries.

The bronchiectatic changes include an unusually enlarged and thickened airway with an uneven wall, lack of tapering and visibility of the airway in the lung's periphery, as observed in this chest radiograph **Figure 2**. They exhibit the characteristic tram track appearance due to bronchial wall thickening. Echocardiogram findings show thickened pericardium, mild pericardial collection, and trace tricuspid valve regurgitation.

Figure 2. Digital Radiograph Showing Collapse of Lower Segment of Right Lung.

Legend: Shift in the tracheal shadow to the right indicates mediastinal shift and fibrosis on the right side of the lung after consolidation and collapse. Rib crowding on the right side signifies lung collapse. A tram-track appearance is visible, characteristic of bronchial wall thickening. The hilar structures are shifted to the right, and there is crowding of the bronchus and vessels in the lower segment of the right lung.

To rule out autoimmune disorders such as systemic lupus erythematosus, an autoimmune panel test was performed, and all findings were within the normal range **Table 2**.

Table 1. Blood Investigation Results for a Pediatric Patient with Bronchiectasis and Respiratory Distress.

Investigation	Result	Normal Range
Total Bilirubin	0.5 mg/dL	<1
Direct Bilirubin	0.3 mg/dL	0-0.3
Hemoglobin	10 g/dL	11-13.7
TLC (Total leukocyte count)	5350 μL	4000-11000
Platelet	462× 10^3 /μL	$150×10^3$-$450×10^3$
Lactate Dehydrogenase (LDH)	392 U/L	60-170
Urea	16 mg/dL	5-20
Creatinine	0.5 mg/dL	0.39-0.55

Table 2. Autoimmune Panel Results for a Pediatric Patient with Bronchiectasis and Respiratory Distress.

Antigen	Intensity	Class	Interpretation
SS-A native (60kDa)	0	0	Negative
Sm (Anti-Smith antibody)`	0	0	Negative
Ro-52 Recombinant	1	0	Negative
Centromere B	0	0	Negative
dsDNA	2	0	Negative
Histones	1	0	Negative
Ribosomal-P-protein	1	0	Negative
PCNA (Proliferating Cell Nuclear Antigen)	1	0	Negative

The results of the Gastric Lavage Cartridge Based Nucleic Acid Amplification Test (GLCBNAAT) for tuberculosis and Cystic Fibrosis Transmembrane Receptor (CFTR) gene analysis were negative. These tests were done to rule out the differential diagnoses of tuberculosis and cystic fibrosis respectively.

Management

Upon admission, the patient was administered injections of meropenem and teicoplanin. Prednisolone tablets (2 mg/kg/day) were given for 2 weeks. Azithromycin syrup (100 mg per 5 ml) was administered once daily on an empty stomach for 7 days. Enalapril tablets (0.08 mg/kg/day) were administered for ten days to address concurrent malnutrition, which was causing salt and water retention and posing a risk of heart failure. The patient also received levosalbutamol (1.25 mg every 4 hours) and budesonide nebulization for 7 days. Continuous oxygen therapy was provided to maintain SpO₂ between 92% and 95% for 5 days.

Clinical Outcome and Follow-Up

Prednisolone was administered at a dosage of 1mg/kg/day for one week following discharge, after which it was discontinued. He was advised to continue budesonide (1 puff twice a day) metered dose inhaler with spacer for another 6 weeks. The patient's mother noted improvement following initiation of therapy. After two weeks from the day of admission, he was discharged following symptom resolution. At his one-week follow-up post discharge, his mother said he seemed to be doing well. His chest

radiograph revealed no new abnormalities, but his airways were dilated, and the basal portion of his right lung remained collapsed. His left upper lobe's trans-mediastinal space shift was also still present. He was advised chest physiotherapy for 8 weeks. He was also advised to come for fortnightly checkups for the next six months to look for persistent bacterial bronchitis. At three months follow-up, repeat chest radiograph showed resolution of the collapse and consolidation was present, but radiological signs of dilated bronchioles persisted. Early identification is essential to manage bronchiectasis and prevent the development of such serious consequences, considering lack of therapeutic protocols in India.[1]

Discussion

The patient presented with classic symptoms of bronchiectasis like fever, cough, and dyspnea. The presence of pectus carinatum, which is a bony deformity, in this patient points towards recurrent respiratory infections over a certain period. Pectus carinatum is a rare chest malformation with protrusion of the sternum and ribs. The cartilage grows abnormally causing unequal growth in the regions where rib connects to sternum. This patient was treated with oral and injectable antibiotics for infection. He was administered corticosteroids for symptomatic relief. Inhaled bronchodilators, such as salbutamol, were given to address the heightened resistance in the airways.

Pathogenesis

Recently, Flume et al proposed a new concept called "vicious vortex" and suggested that the interactions between each pathophysiological step are far more complex. This revised theory's primary principle was that all the components were interconnected and that no one sequence of events would apply, implying that bronchiectasis was the product of intricate interactions between the several essential components. Hence, targeting only one component of the vortex is probably insufficient to fully break the "vicious vortex" and halt the disease progression.[2] Usually originating from lung infection that injures the bronchiolar walls resulting in mucus build-up. Other morbidities that can be causally associated with bronchiectasis are cystic fibrosis, auto-immune diseases, and primary ciliary dyskinesia.[3]

Signs and Symptoms

Symptoms may not appear until months or years of repeated lung infections. From a functional point of view, patients with bronchiectasis may show a variety of patterns ranging from normal lung function to pathophysiological abnormalities, including obstructive, restrictive, isolated air trapping or mixed patterns. From a clinical point of view, some patients might be paucisymptomatic. In other patients, bronchiectasis may be detected unexpectedly through hemoptysis or pneumonia, whereas others may have daily symptoms of cough and sputum production with periodic exacerbations.[5]

Management

The use of chest imaging, laboratory tests, and microbiologic examination of airway secretions to determine the origin of non-cystic fibrosis bronchiectasis can lead to the commencement of specific therapy aimed at delaying the progression of the disease. Overtime the airways become scarred and results in collapse of affected segment which is consistent with the findings of this case. Symptoms may not appear until months or years of repeated lung infections. Thickening of pericardium is present. Digital radiography and HRCT results are consistent with the diagnosis. As per Goyal et al. Pediatric pathobiological studies are lacking, although there are recent data on the role of antibiotics in treating and preventing exacerbations.[6] The goals of bronchiectasis treatment are to improve airway clearance, minimize bacterial infection, and avoid potential exacerbations.[7] Mucolytic, antibacterial, and anti-inflammatory drugs are an urgent requirement. A stepwise strategy for treatment is suggested.

Strengths

Despite speaking in a different dialect, the patient and family were cooperative, facilitating comprehensive medical history recording, physical examination, and clinical evaluations. Because the patient and his family are below the poverty line, they were entitled to receive free treatment and investigations at government-run facilities, which serves as a motivator and reduces their likelihood of being lost to follow-up.

Limitations

The child was in extreme distress, making it difficult to carry out a comprehensive medical examination. The patient was admitted at a late stage since his mother was unaware of how serious the patient's condition was. Furthermore, his location in a remote rural region hindered follow-up efforts. Despite efforts to improve access to health care, socioeconomic, regional, and gender inequities exist in India. Physical access to preventative and curative health care remains a major barrier for India's vast rural population. The patient's mother spoke a tribal dialect that differed from the Bengali spoken in West Bengal, making communication challenging.

Recommendations

Due to a significant lack of understanding on the epidemiology, risk factors, causes, diagnosis and treatment of this previously rare illness, it is essential for government and respiratory health organizations to collaborate in raising awareness among medical practitioners. It is important to regularly develop and adjust comprehensive guidelines according to local conditions. Educational campaigns targeting both the public and healthcare professionals on bronchiectasis and its significance in continuous care and monitoring are indispensable. Public health authorities should evaluate the distribution of HRCT scanners and establish microbiological laboratories based on geographic prevalence of bronchiectasis across different regions. Once considered a rare disease, bronchiectasis is now becoming more prevalent globally partly due to increased accessibility to chest radiographs and computed tomography scans.

Summary – Accelerating Translation

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Case Report

Dasgupta A, et al.   Bronchiectasis with Transmediastinal Herniation of the Left Upper Lobe in a 3-Year-Old Child: A Case Report

This case involves a child with bronchiectasis who exhibits significant respiratory distress. He received symptomatic treatment after being diagnosed late in the disease process. This could be attributed to a number of health issues, such as societal, regional, and gender disparities, as well as unequal distribution of healthcare facilities. The increasing prevalence of bronchiectasis in India emphasizes the need for comprehensive guidelines and protocols for managing the condition. Investigations such as digital chest radiographs and ultrasonograms (USG) were performed. The diagnosis was confirmed with high-resolution computed tomography of the thorax. Due to a lack of proper treatment guidelines, this case was treated empirically with antibiotics for infection, bronchodilators, and corticosteroids for airway inflammation. To reduce the incidence and prevalence of bronchiectasis, the healthcare system should prioritize primary prevention by enhancing health, cleanliness, and education activities. Secondary preventive interventions for recurrent pneumonia or respiratory tract infections include chest radiography and a thoracic HRCT scan. Prompt diagnosis and treatment is essential for favorable prognosis.

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Impact of "Aegeus" - A Novel Research-Based Quiz for and by the Medical Undergraduate Students in India

Shirish Rao,[1] Devansh Lalwani,[2] Amey Ambike,[1] Yashika Zadage.[1]

The Experience

Activities to promote research apart from workshops and conference presentations remain limited among undergraduate students.[1] Medical students in India are generally exposed to multiple pre-clinical and clinical quizzes over the course of their undergraduate degrees which encourages them to dive deeper into their core concepts and academics. A healthy competition in the form of intercollegiate quizzes sparks the enthusiasm among students and draws their interest towards the topic.[2] Quiz-based learning has shown to encourage student discussions, deepen understanding through peer-assisted learning, and help improve examination techniques by fostering collaborative learning environments.[2] Following this idea, a team of undergraduate students embarked on creating the first ever undergraduate research quiz in India. Through this article we share our experience conceptualizing, developing and organizing the national level quiz for 3 consecutive years, 2021, 2022 and 2023.

Figura 1. **The Evolution of Aegeus and its Rounds Over the Years.**

AEGEUS 2021

EVIDENCE-BASED ROUND (6 SINGLE BEST ANSWER, MCQ TYPE QUESTIONS) → BIOSTATISTICS ROUND (6 SINGLE BEST ANSWER, MCQ TYPE QUESTIONS) → PICTORIAL ROUND (6 SINGLE BEST ANSWER, MCQ TYPE QUESTIONS) → STUDY DESIGN ROUND (6 OBJECTIVE DIRECT ANSWER QUESTIONS) → STUDY DESIGN ROUND (6 OBJECTIVE DIRECT ANSWER QUESTIONS) → CLINICIANS CHOICE ROUND (6 SUBJECTIVE QUESTIONS) → ETHICS ROUND (6 SUBJECTIVE QUESTIONS; TIEBREAKER/ BONUS ROUND)

AEGEUS 2022

ETHICS ROUND (10 SUBJECTIVE QUESTIONS; 5 MAINS, 5 BONUS) → BIOSTATISTICS ROUND (10 SINGLE BEST ANSWER, MCQ) → STUDY DESIGN ROUND (5 OBJECTIVE DIRECT ANSWER QUESTIONS) → CLINICIANS CHOICE ROUND (5 SUBJECTIVE QUESTIONS) → RAPID FIRE ROUND (30 OBJECTIVE ONE WORD ANSWER QUESTIONS; 6 FOR EACH TEAM)

AEGEUS 2023

'ETHICALLY EQUAL' (6 OBJECTIVE DIRECT ANSWER QUESTIONS) → 'PASSING THE PLOTS' (6 OBJECTIVE DIRECT ANSWER QUESTIONS) → 'BIASED FOR BIAS' (6 OBJECTIVE DIRECT ANSWER QUESTIONS) → 'BLIND BUZZER' (12 OBJECTIVE DIRECT ANSWER QUESTIONS) → 'BID TO BUILD' (12 OBJECTIVE DIRECT ANSWER QUESTIONS)

Inception and Development

"Aegeus"- The Research Quiz, was conceptualized in June 2021 who were part of institutions student research council A.S.P.I.R.E as well as the organizing team of the Annual Medical Conference, "Confluence" at Seth G. S. Medical College and K.E.M Hospital, Mumbai, India.[3] "Aegeus" was newly added to the conference programme, which already had a rich quizzing culture in the form of pre-clinical and clinicopathological correlation quizzes, which received overwhelming participation across the country. In the year 2021, under the restrictions of COVID-19 pandemic, "Confluence 2021" was organized via online platforms *Figure 1.* During the subsequent years Confluence was held in-person,

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which also led to change in format and conduct of "Aegeus",
which was inspired by learning from its previous editions.

Table 1. **Rounds and Their Rules in Each Edition of "Aegeus" – The Research Quiz.**

R. No.	Round Name	Rules
	Aegeus 2021	
1	Evidence-based Round (6 Single best answer, MCQ type questions)	• Questions were based on interpretation of statistics for choosing best diagnostic, prognostic and treatment modalities • Time per question 1 minute • Correct Answer +10 Points • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
2	Biostatistics Round (6 Single best answer, MCQ type questions)	• Questions were based on choosing statistical tests and performing calculations • Time per question 1 minute • Correct Answer +10 Points • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
3	Pictorial Round (6 Single best answer, MCQ type questions)	• Questions were based on graphs and plots • Time per question 1 minute • Correct Answer +10 Points • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
4	Study Design Round (6 Objective Direct Answer Questions)	• Questions were based on choosing the most appropriate study design for a given research scenario • Time per question 2 minutes • Correct Answer +10 Points • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
5	Critical Appraisal Round (6 Subjective Questions)	• Questions were based on Critically appraisal of a journal article provided to team; following which they presented their review to the judges. • Time per question: 5 minutes • Each judge gave score out of 10 and the final score was the sum of scores by all the judges i.e. 30.
6	Clinicians Choice Round (6 Subjective Questions)	• Questions were based on a patient case and the choices of medical therapies backed by research data. Participants had to make a choice while providing a rationale for their choice. • Time per question: 2 minutes • Judges scored the participants based on: • Rationale provided for the choice • Answers to Judges' questions • Each judge gave score out of 10 and the final score was the sum of scores by all the judges i.e. 30.
7	Ethics Round (6 Subjective Questions; Tiebreaker/Bonus Round)	• Questions were based on an ethical dilemma/violation, and choice of further course of action with regard to it. • Time per question 1.5 minutes • Correct Answer +10 Points • Incorrect Answer -10 Points • No passing was be allowed in this round
	Aegeus 2022	

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1	Ethics Round (10 Subjective Questions; 5 mains, 5 bonus)	• Questions were based on an ethical dilemma/violation, and choice of further course of action with regard to it. If the answer was adequate, the judges allowed a bonus question related to the situation in the ethics question. • Time per question 1 minute • Correct Answer +10 Points (Each judge gave score out of 10 and the final score was average of 3) • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
2	Biostatistics Round (10 Single best answer, MCQ)	• Questions were based on choosing statistical tests, performing calculations and interpretation of statistics and graphs • Time per question 2 minutes • Correct Answer +10 Points • Incorrect Answer -5 Points • Passed 0 Points • Passed Answer +5 Points
3	Study Design Round (5 Objective Direct Answer Questions)	• Questions were based on choosing the most appropriate study design for a given research scenario • Time per question 2 minutes • Correct Answer +10 Points (5 points for Study Design, 5 points for Rationale) • Incorrect Answer -5 Points • Passed- 0 Points • Passed Answer +5 points
4	Clinicians Choice Round (5 Subjective Questions)	• Questions were based on a patient case and the choices of medical therapies backed by research data. Participants had to make a choice while providing a rationale for their choice. • Time per question: 2 minutes • Judges scored the participants based on: ○ Rationale provided for the choice ○ Answers to Judges' questions • Each judge gave a score out of 10 and the final score was the sum of scores by all the judges i.e. 30.
5	Rapid Fire Round (30 Objective One Word Answer Questions; 6 for each team)	• Each team was asked a set of 6 questions, to be answered within a time limit of 45 seconds. • Each question carried +5 points for the correct answer and 0 for the wrong answer.

Aegeus 2023

1	Ethics Round, 'Ethically Equal' (6 Objective Direct Answer Questions)	• Questions were based on an ethical dilemma/violation, and choice of further course of action with regard to it. • One question was directed to every team. • All the teams along with the answering team got the opportunity to pounce on the question • Teams were given a chit to write their answer which was to be have to be returned to the organizers within 20 seconds (pounce window) • The answering team saying the answer out loud during the pounce windows was given e a penalty of -10 points. • If the answering team did not choose to pounce on the question in the first 20 seconds, they were given additional 20 seconds to answer the question. • Points for pounce: • Correct Answer +30 Points • Incorrect Answer -10 Points • Points for the answering team after pounce window • Correct Answer +20 Points • Incorrect Answer '0' Points
2	Biostatics and Graphs Round, 'Passing the Plots' (6 Objective Direct Answer Questions)	• Each question consisted of two sub-questions: • The first question will be based on biostatistics • The second question will be based on plots • Time per question: 30 seconds

		• If a team could not answer their biostatistics question, the plot question was passed onto the next team, until it was correctly answered.
		• Marking scheme for biostatistics:
		• Correct Answer +60 Points
		• Incorrect Answer -20 Points
		• Marking Scheme for Plots
		• Correct Answer +60 Points
		• Incorrect Answer -40 Points
3	Bias Round, 'Biased for Bias' (6 Objective Direct Answer Questions)	• Each question had different number of biases/flaws in them • The teams could choose which question they would want to answer based on their ranking from previous two rounds • Time per question: 40 seconds • Each question had a maximum of 120 points. On answering each bias/flaw the fraction wise marks were allotted • No negative marking
4	Buzzer Round, 'Blind Buzzer' (12 Objective Direct Answer Questions)	• Each team was given a buzzer to buzz • One team member with the buzzer sat in front of the other team member. • The team member without the buzzer had to answer immediately after buzzing. • Both the team members were not allowed to communicate in any form throughout the round. • If the answer was declared wrong by the quizmaster, the buzzer was reopened for rest of the teams. • Only two such attempts could be made per question.: • Correct Answer +30 Points • Incorrect Answer -10 Points
5	Study Design Round, 'Bid to Build' (12 Objective Direct Answer Questions)	• Each team has to bid their points that they had earned in the previous rounds. • If a team wished to answer that particular question, they had to make a bid to buy that question using their earned • points. The points used to bid were deducted from their current scores. • Bidding of every individual question would start with a base price of 20 points. • The process of bidding would continue until that particular question is sold to the team making the highest bid. • All the bids were in multiples of 10 • Once a team bought that particular question they were shown the question again. • Time per question: 30 seconds • Correct answer gave the team equivalent to the bidding amount and Incorrect answer gave the negative

Conduct of the Quiz

An organizing team of 6 undergraduate students, from 1st to 5th year of MBBS, were responsible for question making, managing the logistics and hosting the quiz in each edition. Questions for the quiz were created by team members using online resources and standard textbooks and were validated by professors who provided feedback on question framing and correctness. The rounds were based on topics such as ethics, biostatistics, graphs, biases, study design, manuscript writing and other important aspects of applied medical research. The quiz was hosted in two stages i.e. an online elimination round followed by the finals. Undergraduate students from 1st to 5th year were eligible to participate in teams of two. The elimination round consisted of 25-30 multiple-choice questions with a +1/0 marking scheme to be attempted in 30 minutes. Based on these scores, the top 6 teams advanced to the finals. Finals consisted of 5-7 rounds, and each round focused on a particular aspect of medical research. A detailed description of rules and scoring system of each round of every edition is provided in *Figure 1* and *Table 1*.

In the year 2023, the format of the quiz was revamped. The feedback received by the past edition's participants indicated the need to add more real-life scenarios, in depth practical knowledge, lesser reliance on subjective scoring by judges and addition of more innovation into each round to make it more exciting.

Figure 2. **Photograph From In-Person Aegeus 2023.**

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Experience

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In order to ensure the same, clinician's choice round was removed, MCQs were replaced by direct answers, each round was given an exciting name which was in line with a twisted rule for each round. Rapid fire round was also replaced by Buzzer Round to allow better scoring and tougher competition. As an objective replacement to the critical appraisal round, a round for identifying Biases in the given research summary was added. To eliminate any discrepancies or need of an expert judge opinion during the final round, process of validation by expert professor was done more stringently and questions were revised to make sure there is only a single best answer and no partially correct answer in any round.

The composition of participating teams was the same as previous editions except that even cross-college teams were allowed to participate. The Top 6 teams faced a total of 5 rounds in the final **Figure 1** & **Figure 2**. Sequence of answering teams was unique in each round based on the rules. In the Ethics round "Ethically Equal", one question was directed to each team, in the sequence A to F. However, all the other teams had an equal opportunity to attempt the question by answering via 'chits' during the first 30 sec 'pounce window'. The sequence for the Biostats round, "Passing the plots", was from F to A. This round had two sub

questions, first was to identify the most appropriate statistical test for the given analysis and second was interpreting a graph made from the related analysis. If the answering team failed to answer the first sub-question correctly the plots were passed to the next team in the sequence. The next round "Biased for Bias" had 6 questions each consisting of the same number of biases as its question number. Scores of the first two rounds were totaled and arranged in descending order. Teams in this given order were given a 'biased' choice to choose the question number they would wish to attempt. The next round was buzzer with an added twist, "Blind Buzzer", where one participant from each team was made to sit with the buzzer and the other participant who was sitting away had to answer the question, in case the buzzer was pressed by their teammate. This round consisted of 12 pictorial questions in which the participant had to connect the images and find the common link between them, which was a research term. The last round on study designs had an added twist of 'Bidding' for each question. A set of 12 questions were displayed one at a time, which were open to receive a bid from all the team. Teams had to bid from their own points which they had earned during all the previous rounds. One audience question was also kept at the end of each round. The top 2 teams were awarded with cash prizes, medals and gift hampers.

Table 2. Qualitative Feedback from Participants

| **Feedback 1: Third-Year MBBS Student** |
|---|
| "Participating in the finals of 'Aegeus - Research Quiz' was an enlightening experience. The event was not just a quiz; it was a journey through the intricacies of medical research, presented in an extremely innovative and professional manner. Kudos to the Aegeus team for organizing such a brilliant event. I'm eagerly looking forward to the next edition and encourage all my peers to experience this unique blend of learning and competition. Their hard work truly deserves all the appreciation!" |
| **Feedback 2: First-Year MBBS Student** |
| "I had the privilege of being part of 'Aegeus - Research Quiz' yesterday, and I must say, it was one of the most professionally executed events I've attended. The quiz format was remarkably innovative, fostering a deep engagement with research concepts in a competitive yet fun environment. A big thank you to the Aegeus team for such an incredible learning opportunity. I highly recommend it to everyone here and can't wait for the next one!" |
| **Feedback 3: Fourth-Year MBBS Student** |
| "Yesterday's participation in the 'Aegeus - Research Quiz' was truly a game-changer for me. The entire event was flawlessly organized, with a focus on applied knowledge and practical research skills. It was refreshing to see such enthusiasm and professionalism from the Aegeus team. This event is a must-attend for those looking to deepen their understanding of medical research. Great job by the team, and thank you for such an inspiring experience!" |
| **Feedback 4: Second-Year MBBS Student** |
| "The 'Aegeus - Research Quiz' was an exceptional event that stood out for its innovative approach to learning. Participating in the finals offered me a unique insight into the application of research in medicine, something textbooks alone cannot provide. The effort and dedication of the Aegeus team in organizing such an event are commendable. I'm already looking forward to participating in the next edition and encourage others to do the same. Such initiatives truly enrich our academic journey." |

Learnings & Conclusion

Total of 39 teams registered in 2021, 38 in 2022 and 48 in 2023, summing up to 250 participants over the course of 3 years. Top 2 teams in each edition were awarded with cash prizes, medals and gift hampers. In 2023, an online post-event feedback form was shared with the participants and the conference delegates after the quiz. The conference delegates who were not active participants of the quiz (n=320), suggested that 73% gained interest in learning and conducting research and 66% reported that they learned new research concepts while attending the quiz **Figure 3**. Quantitative Feedback from the participants is provided in **Table 2**. To improve the participation of undergraduates in

research, such competitive incentive-based quizzes represent a novel approach. It is necessary to take constructive feedback from each edition in order to improve on the next. Addition of new twists to the rounds and the scoring system also makes the quiz more exciting, gripping, competitive and most importantly enjoyable for both participants and the audience. However, registration for such events was lower compared to traditional academic quizzes, indicating the need to raise awareness. With many undergraduates now involved in research projects, it is hoped that this quiz format will serve as a foundation for future development. There is a need for scaling up such events so that

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the participation expands more students nationally and internationally.

Figure 3. **Feedback from Conference Delegates (Non-Quiz Participants)**
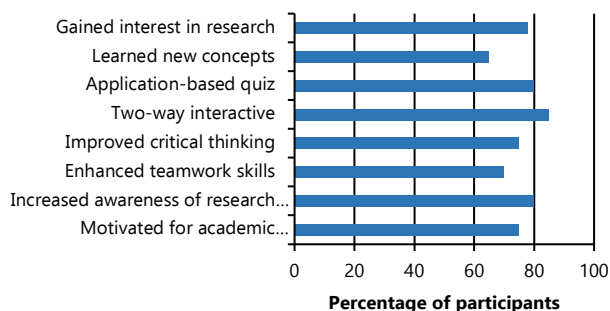
Summary – Accelerating Translation

Undergraduate students often have limited avenues to engage in research beyond workshops and conferences. In India, medical students face numerous pre-clinical and clinical quizzes, fostering a deep understanding of core concepts. Intercollegiate quizzes further stimulate their enthusiasm and focus on specific topics. Building on this, undergraduate students from A.S.P.I.R.E, the research council of Seth GS Medical College and KEM Hospital, Mumbai, launched "Aegeus," India's first undergraduate research quiz, in June 2021.Hosted annually under the "Confluence" undergraduate medical conference since 2021, "Aegeus" has grown in participation and evolved in format over three years. Students collaborated on question creation, logistics, and hosting, while professors validated the questions. The quiz covers diverse topics like ethics, biostatistics, study design, and manuscript writing, promoting practical application of research concepts. Each edition has refined the format to boost engagement and competitiveness. Feedback indicates "Aegeus" has positively impacted students' interest and understanding of research concepts. Despite its success, raising awareness to boost future participation remains a priority.

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Lessons Learned from Being Involved with Organized Medicine as a First-year Medical Student

Tai Metzger.[1] 🆔

The Experience

Organized medicine is when physicians come together to form professional organizations with the goal of advocating for themselves and patients in the public square. It consists of local, state, national, and international groups of physicians engaging with health policy and representing the interests of physicians and their patients. Examples include state medical societies, international specialty-specific groups, and national associations like the American Medical Association (AMA).

My interest in organized medicine stems from my desire to improve the field of medicine through engagement in health policy, not just scientific advancement. Growing up in the Washington, D.C. area, surrounded by politicians, lobbyists, and diplomats, I was able to see the importance of organized and passionate advocacy in making impactful change. Thus, when I started medical school, I joined my school's chapter of the AMA and was later selected to be our delegate to the Michigan State Medical Society (MSMS), our state's section of the AMA.

Our medical student chapter of the AMA worked on drafting resolutions to submit to MSMS and AMA that we believed could improve the practice of health in our state, including decreasing language barriers for patients, providing free feminine products, and increasing access to fentanyl testing strips. Part of my role as our MSMS delegate was to advocate for our resolutions at the committee hearings leading up to the MSMS House of Delegates (HOD) meeting and at the HOD itself if necessary, as well as vote on other resolutions at the HOD. At the committee hearings, the resolution authors and I explained the necessity of our resolutions and received feedback from the physician members of the MSMS before the HOD would vote on the resolutions. This helped me to grow in my ability to collaborate with peers for important causes while also giving me an experience on how to advocate for changes we want to see in medicine (*Figure 1*).

Attending the MSMS HOD meeting was one of the most eye-opening and transformative experiences of my medical school journey. This meeting provided the perfect platform to witness firsthand how organized medicine operates and how impactful physician voices can be in shaping the future of healthcare. The event took place in Lansing, our state capital, and was a full day

of robust discussions and debate, voting, and connecting with physicians from across the state (agenda can be found in *Table 1*).

Table 1. Michigan State Medical Society House of Delegates Meeting Agenda.

Time	Event
8:00 am – 4:00 pm	Registration – Center Lobby
10:00 – 11:00 am	Candidate Forum – Royale Ballroom
	Report from Chair of the Board
	Address of the CEO
	Address of the President
	Address of the President-Elect
10:30 am – 2:00 pm	Voting – Packard Room
11:00 am – 3:00 pm	Report of the Committee on Credentials and Tellers – Royale Ballroom
(Working Lunch)	Nominations and Elections
3:00 – 4:00 pm	Reports of the Reference Committees
	President's Reception – Royale Atrium

Figure 1. Michigan State Medical Society (MSMS) Student Attendees to the House of Delegates.

Legend: Medical students who attended the MSMS House of Delegates (HOD) pose for a picture with physician members following the HOD meeting.

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Experience

Walking into the conference room at the start of the HOD meeting, I was struck by the diversity of attendees. Physicians from various specialties, practice settings, and stages in their careers filled the room. The atmosphere buzzed with a mix of camaraderie and a shared sense of purpose. Here were individuals who, despite their busy clinical schedules, dedicated time and energy to advocate for the betterment of our profession and the health of our communities.

As the sessions began, I was immediately immersed in discussions that spanned a wide range of topics—everything from guidelines for newborn eye screening and cannabis use to plastic surgery medical tourism policies and the frequency of implicit bias training. A full list of topics discussed can be found in the MSMS HOD Handbook online.[1] The debates were passionate and informed, reflecting the deep commitment these physicians had to their patients and their profession. What impressed me most was the level of respect and collegiality, even when opinions differed vastly on controversial topics. It was clear that everyone in the room shared a common goal: to improve the practice of medicine and the health outcomes of the population.

One example that stood out to me was the disagreement over the MSMS stance on single-payer healthcare reform. Although the MSMS and the AMA had been debating the topic for years, the members still took the time to hear thorough discussions from both sides of the issue. While I could tell that members on each side of the issue were very passionate about their stance, and would not stop advocating for their beliefs, once the time for debating this issue concluded, everyone on both sides of the debate was able to accept the ultimate voting results, return to their seats, and continue respectful and collegial dialogue for the following discussions. Everyone there knew that even those who disagreed with them were physicians like themself who cared fiercely for their patients and the health of the public.

My involvement in organized medicine has also influenced my own views and perspectives on healthcare policies and practices. For instance, prior to attending the HOD I was not aware of the importance of water safety policies. However, after learning that drowning is the leading cause of death in the United States for children aged 1-4,[2] and that swim lessons at this age can decrease risk of drowning by 88 percent,[3] I now fully support policies that promote water safety measures. Another issue where my perspective changed was regarding plastic surgery medical tourism, which is when patients travel to other states or countries to receive cosmetic surgery. Previously, I did not see a place for physicians to prevent this, but after learning about the risks and dangers I now support—and voted in favor of--the MSMS informing the public about these potential harms.

Throughout the meeting, I had the opportunity to network with physicians who were more than willing to share their experiences and offer guidance. Their encouragement and willingness to mentor young medical professionals like myself were uplifting. One conversation that stood out was with a physician who had been actively involved in the MSMS for over two decades. He emphasized that being involved in organized medicine had

Figure 2. Michigan State Medical Society House of Delegates

Legend: The MSMS HOD meeting consisted of hundreds of delegates to discuss, debate, and vote on many important health policy resolutions and leadership positions.

enriched his career in ways he hadn't anticipated. It had provided him with a broader perspective on healthcare, allowed him to contribute to meaningful changes, and connected him with a supportive community of like-minded professionals.

I was able to witness this community at the reception following the conclusion of the official proceedings and votes. After spending the entire day engaged in intense dialogue and difficult votes over important issues, the physicians were able to come together for friendly and relaxed conversation and good food. I was once again reminded that although we often have disagreements, we are united by our shared profession.

This experience at the MSMS HOD meeting solidified my desire to be involved in organized medicine. I realized that as future physicians, we have a responsibility not only to our patients but also to our profession. Being a part of organized medicine offers a unique opportunity to influence healthcare policies, advocate for our patients and colleagues, and ensure that our voices are heard in the larger healthcare landscape.

I encourage all medical students, and practicing physicians, to seek out similar experiences during their education and beyond. Whether it's attending local or national medical society meetings, participating in student government, or joining advocacy groups, these opportunities provide invaluable insights into the broader context of our work as physicians. They allow us to see beyond the walls of our classrooms and clinics and understand the complexities of the healthcare system we are entering.

Moreover, being involved in organized medicine helps cultivate leadership skills that are crucial for our future roles. It teaches us how to effectively communicate, negotiate, and collaborate with a diverse group of stakeholders. In particular, working with my classmates on drafting our resolutions improved my teamwork and professional writing skills, while attending the committee hearings and HOD showed me how to use reliable evidence and public speaking skills to support one's positions. There are also

abundant opportunities for networking and mentorship with physicians farther along in their careers. These are skills and resources that will serve us well, whether we are advocating for a patient, leading a healthcare team, or contributing to policy discussions. This experience has convinced me to be involved in organized medicine for the rest of medical school and also when I am a practicing physician.

In conclusion, my experience at the Michigan State Medical Society House of Delegates meeting was a pivotal moment in my medical education. It opened my eyes to the importance of physician advocacy and the power of organized medicine. It inspired me to commit to being an active participant in shaping the future of healthcare. To my fellow medical students, I urge you to seek out these experiences. They will not only enrich your understanding of medicine but also empower you to make a meaningful impact in your career and beyond. Let us be the generation of physicians who are not only skilled clinicians but also passionate advocates for our profession and our patients.

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Predatory Publishing: A Medical Student Author's Perspective

Diego Arriaga Izabal.[1] 🆔

Background

The landscape of research is, for us, the average medical student, a widely unexplored area with potential new threats. Once the first work of any of us is published, a previously unknown individual has now become an aspiring researcher, and as inexperienced as its nature is, a broad range of hunters are looking upon its exotic new prey. By any means possible, these predatory publishers may easily lure us with appealing invitation e-mails to submit our manuscript to their questionable journals, accept the work in a matter of days, and finally ask us for article processing charges (APC) to generate funds for their self-interest.[1,2]

Moreover, these highly dubious publishers also take advantage of our limited knowledge in scientific research and scholarly publishing practices in comparison with senior researchers; and also of our desire of being published, as the pressure of improving one's curriculum has become our constant struggle in search of increasing employability and career progression in the highly competitive nature of the medical world.[3,4] Therefore, all the aforementioned factors combined with our lack of information about this type of journal, make us more vulnerable to their deception.

As the number of predatory publishers in both paper and electronic formats has expeditiously augmented over the last decade[1,5], the quantity of researchers who were unaware of their deceptive nature has also proportionally increased. In one study, 70.8% of the survey respondents did not know they were submitting their research to predatory journals[6]. Similarly, in the medical field, students have a low rate of awareness while groups elsewhere in medicine (e. g. specialists) had a higher rate of understanding of predatory publishing[1,3]. Given this context, raising awareness about predatory journals among medical students and young researchers is vital in tackling unethical academic publishing practices[2].

The "predatory journal" term was first described more than a decade ago by the academic librarian Jeffrey Beall as the ones "which are dishonest and lack transparency, and centers in publishing counterfeit journals to exploit the open-access model in which the author pays".[7] However, the latter views proposed renaming it to one that englobes a wider spectrum to "predatory publishers" or "deceptive journals" or "illegitimate journals".[8,9] Likewise, no definition has been widely agreed upon what constitutes a predatory journal, until four years ago an expert consensus document was developed with characteristics (distinct features of all predatory journals), markers (features that are common among predatory journals, considered 'red flags') and empirically data (data from experiments or statistical analyses that indicate differences between predatory journals and legitimate publishers) **Table 1** that can be useful to separate predatory from legitimate publishers.[3,9] Additionally, to aid in the identification of probable predatory publishers, multiple lists of probable predatory publishers have also been submitted online, being Beall's the most known.[1,10]

Table 1. **Delphi Items Consensus to Differentiate Between Predatory and Legitimate Journals.**

Factor	Items
Characteristics	The journal's operations are deceptive (misleading; not truthful).
	The journal's operations are not in keeping with best publication practices (e.g., no membership in COPE*).
	Journal has low transparency regarding its operations
	Fake impact factors are promoted by the journal.
Markers	The journal has no retraction policy.
	The journal solicits manuscripts through aggressive or persuasive emails.
	The contact details of the publisher are not easily verifiable.
Empirically derived data	The journal does not mention a Creative Commons license.
	The journal's home page has a 'look and feel' of being unprofessional.
	Editors and editorial board affiliations with the journal are not verifiable.
	The journal is not a member of COPE*.

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Experience

Table 2. **Personal Excerpts of E-mails Received from Predatory Journals.**

Exert
... considering you to be a very positive author and believing that you'd definitely support us this time we are approaching you with the SPECIAL INVITATION.
... you being an eminent author to our Journal
In fact, I've not received acknowledgement or article for the first issue of 2024 and this month is a very crucial period for me as the journal and my performance ranking would be analyzed and graded
As an honor of support and encouragement from our end for all the authors across the globe, we are providing concessions on APCs.
Being at month end we are providing a flat 30% discount on submissions received within 48hs.

The Experience

The inspiration behind this work results from my own experience of deception. One day, an invitation from a previously unknown journal arrived at my mailbox to participate in their next issue. As inexperienced as I was, multiple e-mails were interchanged with naïve excitement around the details of the request. Nevertheless, numerous 'red flags' appeared as time passed, and after conducting the corresponding research, the realization of the deceit was made. Despite no vital information was exchanged, the confidence and initial enthusiasm vanished. Ever since the first e-mail, a plethora of the same type followed up.

The main aim of sharing this anecdote is to raise awareness and highlight the primary points that make me question the credibility of a journal. In **Table 2**, there are some excerpts of different e-mails that I have received from these predatory publishers. Any ethical practices of legitimate journals would not be implicated in this kind of dubious action such as uplifting a young researcher by suggesting considerate discounts on APC or pressuring the authors to collaborate with them.

Conclusion

In summary, the path that follows beneath medical students' interest in becoming young investigators is full of deceiving endways. A wise decision of the potential journal to publish in must be made with the aid of numerous checklists, whitelists, and blacklists; but to look upon this information, raising awareness about the existence of predatory publishers and its consequences is fundamental. In this context, sharing personal experience and crucial information in dedicated journals of and for medical students is a promising course of action to reduce the increasing influence of illegitimate publishers.

Summary – Accelerating Translation

Titulo: Revistas 'depredadoras': Desde la Perspectiva de un Autor Estudiante de Medicina.

Las revistas 'depredadoras' son aquellas que son deshonestas y con falta de transparencia que se aprovechan del modelo de acceso abierto en donde los autores pagan y por medio de ello, obtienen sus ganancias con fines plenamente egoístas. Desafortunadamente, este tipo de revistas están en auge y pueden engañan con facilidad a investigadores inexperimentados como son los estudiantes de medicina que aspiran a incursionar en la investigación. En este contexto, el propósito del presente trabajo es ofrecer una vista generalizada de las revistas 'depredadoras', cómo identificarlas y evitarlas; así como también concientizar acerca de su existencia y discernir sus engañosos correos a través de mi experiencia personal.

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From Hope to Hardship: Understanding the Impact of Hierarchies and Violence in Medicine

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The Experience

"Don't take it personally."

That's the advice that several senior medical students gave me before I began my clinical rotations. At the time, I often wondered what they meant. Now, a year after completing my clinical phase of medical school, I understand why they emphasized it so much. It seems like something we say to convince ourselves that the system isn't broken. A shield, a coping mechanism, a way to navigate the workplace violence and the hierarchies we encounter daily.

Recently, I befriended a couple of preclinical students. Talking to them, I couldn't help but think, "Was I this excited about life before rotations?". The truth is, the more I thought about it, the more I remember how enthusiastic I was. Back then, I didn't fully grasp why the older students gave me that advice. I anticipated some workplace stress and occasional outbursts, but I had no idea how common it was going to be. How I was going to feel consistently diminished and underappreciated, simply because I was labeled as "just the student".

During my rotations, I witnessed students and residents grappling with imposter syndrome and burnout, enduring insults from colleagues, patients, and families. I observed my peers transition from motivated and bright-eyed individuals to cynical, disheartened professionals in a short amount of time. That's when I really started to understand why we tell ourselves that violence in the workplace is something we must endure. Because otherwise, I'm left wondering how every healthcare worker manages not to crumble under the weight of personal attacks layered on top of the inherent stress of the job.

Ultimately, I found comfort in knowing others share my struggles. This inspired me to gather information and explore how to empower future medical professionals to change the current system. With this in mind, I aim to explore the causes and types of violence in healthcare. By doing so, I hope to contribute to changing the culture and preserving the motivation we all initially have as young students entering this field *Figure 1*.

Figure 1. **Causes and Effects on Workplace Violence in Healthcare Settings.**
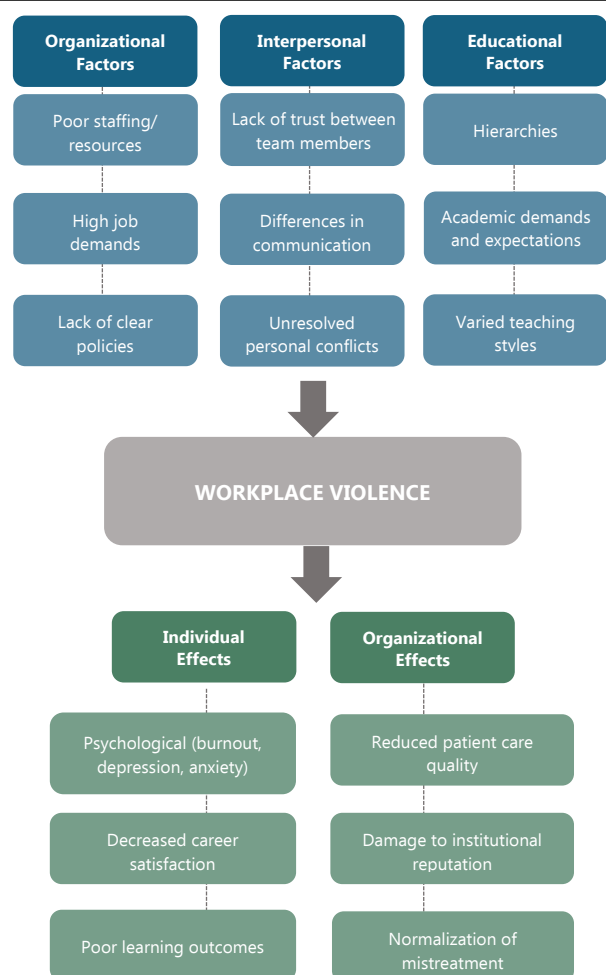
The Panorama

Workplace violence (WPV) is "any act or threat of physical violence, harassment, intimidation, or threatening behavior that

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occurs at the worksite", and is four times more prevalent in healthcare than other industries.[1] This phenomenon is influenced by organizational climate, supervisory style, and interpersonal relationships. Factors linked to increased interpersonal aggression include trait anger, interpersonal and situational conflicts, and job dissatisfaction.[2] Healthcare workers are particularly susceptible to various forms of violence, including verbal abuse, sexual harassment, demeaning behaviors, discrimination, and bullying.[3]

Trainees experiencing mistreatment from healthcare professionals are often overlooked victims, particularly in teaching hospitals.[4] This mistreatment ranges from acts of disrespect and humiliation to verbal attacks, reported by up to 83.6% of medical and nursing students during training.[5] In a study done in my country, Mexico, 52.3% of medical residents experienced violence during their training, with psychological (44%) being the most frequent.[4] These behaviors persist due to ingrained practices in medical culture, where young individuals are expected to "endure" the demands of medical practice. Subtle yet pervasive behaviors like rude comments and aggressive questioning induce shame, perceived as part of the Socratic method.[6]

Medical education operates within a structured social context where interactions are heavily influenced by power roles and hierarchies.[7] While these hierarchies ideally aim to enhance patient care and promote a positive learning environment, they often become dysfunctional, leading to increased workplace stress and mistreatment of learners.[8] In these settings, there is resistance to expressing opinions due to fear of challenging authority, with this attitude seen as a "rite of passage." This dynamic predominantly affects individuals at lower hierarchical levels, including residents, students, and nursing staff, hindering open communication, and negatively impacting work quality and learning in healthcare.[9]

This level of mistreatment isn't only experienced in clinical environments but also in research and educational settings. These mistreatments include a range of behaviors such as bullying, harassment, discrimination, and the exploitation of junior staff. These issues are often embedded within a hierarchical structure, similar to clinical medicine, where it is almost expected for junior professionals to tolerate mistreatment.[10] This contributes to broader issues in medical education because it fosters a culture where abuse and mistreatment are normalized, undermining the well-being and development of trainees. When such behaviors are tolerated or even expected, it erodes trust, hinders collaboration, and stifles open dialogue. Consequently, this toxic culture impacts not only individual trainees but also the overall quality and integrity of medical education, ultimately affecting patient care and professional standards.[11,12]

The conjunction of the hierarchical nature of medical education and workplace violence contributes to burnout and imposter syndrome among individuals in the field.[13] Mistreatment also impacts academic achievement, correlating with poorer learning outcomes, lower self-esteem, and reduced quality of patient care.[14] For instance, a study done in Brazil in 2022 showed that 94% of medical students in an academic institution felt affected by violence, with 77% feeling diminished and depressed and more than 50% reporting impaired academic performance.[15] Research indicates that students who have experienced violence are more likely to express dissatisfaction with their chosen careers and exhibit reduced confidence in making clinical decisions.[16]

The effects of structural violence are enduring and can permeate all levels of hierarchy. While it often impacts those in lower positions, such as residents and junior doctors, the toxic environment can influence individuals at all roles and levels, including those in positions of authority like senior doctors/nurses and administrative staff, as well as undergraduate students and non-clinical practitioners.[17] This systemic issue doesn't just harm the most vulnerable; it also affects those who might feel compelled to perpetuate these harmful behaviors. As a result, a culture of abuse can persist and impact everyone within the field. Simply put, this is a systemic issue with serious and widespread negative effects on all involved.

What We Can Do About It

To effectively address workplace violence and create a safer workplace, it is imperative to implement interventions at both the organizational and individual levels. This approach acknowledges that workplace violence is a systemic problem requiring systemic change while also recognizing that change is often motivated by increased awareness and open discussion of the issue.

Institutional Changes

1. **Development and implementation of effective policies:** enforce a zero-tolerance policy toward workplace violence, applicable to all professionals and anyone interacting with the facility's workforce.[1] Government agencies and organizations such as the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), The Joint Commission, and the American Hospital Association (AHA) have developed effective programs to address and mitigate workplace violence. These programs are being incorporated into training and development initiatives and are being adopted by hospitals globally.[18] However, it is essential that the knowledge and implementation of these programs be customized to address the unique needs of each institution.

2. **Education and training:** according to the National Institute for Occupational Safety and Health (NIOSH), all hospitals and healthcare settings should develop a comprehensive violence prevention program.[1] These programs should incorporate several key characteristics, including conducting assessments of unit-specific risks to identify potential areas of concern, implementing measures to prevent incidents from occurring, and making necessary adjustments to staffing levels to reduce the risk of

violence. Additionally, training staff on techniques for preventing workplace violence is crucial, as is the enhancement of record-keeping protocols to ensure thorough documentation and analysis of incidents.[19]

3. **Reporting and monitoring systems:** encourage healthcare facilities to report instances of WPV through specialized systems capable of handling such cases.[20]

4. **Support systems:** offer follow-up and support to victims and witnesses, including access to trauma and psychological counseling if needed.[19]

Individual Actions

1. **Educating ourselves:** We need to acknowledge that workplace violence is a significant issue and become adept at recognizing subtle forms of it, including microaggressions and nonverbal cues. Refer to **Table 1**, which details examples of workplace bullying as measured by the Negative Acts Questionnaire-Revised, a validated survey tool.[21] Additionally, **Table 2** outlines typical instances of horizontal workplace.[22]

2. **Engaging in training programs offered by our institutions:** Common interventions include prevention programs and simulations.[23] If available, participate in these initiatives to gain knowledge and skills in handling various scenarios.

3. **Don't repeat the patterns as you advance in your career:** It's important not to forget our own experiences and to resist adapting to environments that promote violence. Stay mindful about these issues, working both individually and institutionally to promote a culture of respect and kindness.

Conclusion

Medical education represents a journey of self-discovery and adaptation to a distinct subculture within clinical environments. The challenges related to hierarchies and workplace violence encountered during our early training stages can significantly impact our motivation, self-esteem, and mental health. No student, resident, attending physician, nurse, or any other healthcare professional should ever feel diminished or undervalued. Looking back, I wish I had understood this before starting my clinical training; perhaps then, I wouldn't have felt so isolated. If I could rephrase the advice given to me by senior colleagues, I would tell myself: "Recognize what applies to you and do not tolerate mistreatment to appease others' comfort." I now understand that I have the ability to speak out against these issues, and that these experiences have equipped me to identify opportunities for change within the system. It is crucial to address not only individual changes but also the broader systemic issues that contribute to workplace violence and hierarchical challenges in medical education. The goal is to foster a more respectful and supportive environment in the medical field. By advocating for

systemic change and supporting one another, we can advance in our careers without allowing anyone to dim our lights.

Table 1. Negative Acts Questionnaire.

Factors	Items
Work bullying	Someone withholding information which affects your performance.
	Being ordered to do work below your level of competence.
	Having key areas of responsibility removed or replaced with more trivial or unpleasant tasks.
	Being given tasks with unreasonable or impossible targets or deadlines.
	Excessive monitoring of your work.
	Being exposed to an unmanageable workload.
Personal bullying	Being humiliated or ridiculed in connection with your work.
	Spreading of gossip and rumors about you.
	Being ignored or excluded.
	Having insulting or offensive remarks made about your person, attitudes, or your private life.
	Being shouted at or being the target of spontaneous anger.
	Intimidating behavior such as finger-pointing, invasion of personal space, shoving, blocking/barring the way.
	Hints or signals from others that you should quit your job.
	Being ignored or facing a hostile reaction when you approach.
	Persistent criticism of your errors and mistakes.
	Having your opinions and views ignored.
	Practical jokes carried out by people you don't get on with.
	Having allegations made against you.

Table 2. Observed Horizontal Violence in Clinical Settings.

Behavior	Possible Manifestations
Nonverbal cues, nonverbal innuendo	Eye rolling, making faces in response to questions.
Verbal remarks, verbal affront	Snide, rude, demeaning comments, shouting, using a condescending, or patronizing tone of voice.
Actions/inactions	Refusing assistance, allocating unrealistic workloads, hoarding, or hiding supplies.
Withholding information	Deliberately withholding information.
Sabotage	Deliberately setting up another worker for failure.
Infighting	Excluding members of staff from communication.
Scapegoating	Blaming negative outcomes on one identified nurse without regard to his or her actual responsibility for those outcomes.
Passive aggressive behavior	Backstabbing, complaining to others about a person but not speaking to that person directly.
Broken confidences	Gossiping, sharing information that is meant to be private.

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Moersch-Woltman Syndrome - An Uncommon Conundrum

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Pitliya A (2023) reported a case of Moersch-Woltman syndrome (MWS) or Stiff person syndrome (SPS) associated with anti-glutamic acid decarboxylase antibodies (GAD65 antibodies) in a 57-year-old woman with antecedent of depression, who presented muscle spasms mainly involving the neck, shoulders, and upper back, progressively evolving for near two decades, but reduced after utilizing clonazepam and baclofen.[1] Worthy of note was the extensive polypharmacy that she had previously employed without success, and a significant adverse impact on daily normal activities, resulting in a gradual worsening in her quality of life. [1] Neither dystonia, multiple sclerosis, myelopathy, neuromyotonia, Parkinson's disease, primary lateral sclerosis, spinocerebellar ataxia, nor evidence of a paraneoplastic component was detected in this MWS. [1] The authors highlighted the major role of a high index of suspicion for MWS to early establish the correct diagnosis, contributing to prompt adequate management, which is mandatory to propitiate the best outcome.[1]

In this setting, the objective of the following comments on additional novel literature data is to enhance the awareness of the non-specialists about the cornerstone issues related to this very challenging condition.[2-5] Chia NH *et al.*, reviewed data of 173 people with diagnosis or suspicion of MWS between July 2016 and June 2021, based on high titers of GAD65-IgG, glycine-receptor-IgG or amphiphysin-IgG, and/or electrodiagnostic findings and detected 48 (27.75%) with confirmed MWS by GAD65-IgG (68.29%), glycine-receptor-IgG (29.26%), and amphiphysin-IgG (4.87%); while the other 125 cases (72.25%) were the non-MWS patients.[2] The MWS group had more exaggerated startle (81% vs. 56%), unexplained falls (76% vs. 46%), autoimmunity (50% vs. 27%), hypertonia (60% vs. 24%), hyperreflexia (71% vs. 43%), hyperlordosis (67% vs. 9%), and electrodiagnostic changes (74% vs. 17%); besides better response either to benzodiazepines (51% vs. 16%) or to immunotherapy (45% vs. 13%), and less probability of functional neurologic signs (6% vs. 33%).[2]

The authors highlighted the risks of misdiagnosis that were threefold more common than confirmed MWS, at least in part due to the lack of consensual guidelines for correct management and suggested the respective diagnostic criteria. These included: 1) Symptoms [1 of 2] a. Stiffness (axial regions, limbs, or both), and b. Episodic spasms (axial regions, limbs, or both) triggered by noises, tactile stimuli, or emotional stress; 2) Signs during the symptomatic phase of illness [1 of 3] a. Increased muscle tone (axial or limb), b. Exaggerated lumbar lordoses, and c. Concurrent stiffness of lumbar paraspinal and abdominal muscles; 3) Serological findings [1 of 3] a. High-titer GAD65-IgG in the serum or any positive titer in CSF, b. Glycine-R-IgG in serum and/or CSF, and c. Amphiphysin-IgG in serum and/or CSF; 4) Electrophysiological studies [1 of 3] a. Inability to relax paraspinal muscles in needle EMG, b. Exaggerated acoustic or exteroceptive responses by surface EMG, and c. Co-contraction of agonist/antagonist muscles by EMG; and 5) Exclusion of alternative diagnosis. Definite: all (1–5), probable: at least one of 1 or 2 and 3 and 5 (seropositive), or 1, 2, 4, and 5 (seronegative).[2]

Kamaleshwaran KK *et al.*, reported a 64-year-old woman with difficulty walking due to pain along with muscle rigidity in the bilateral lower extremities, and the diagnosis of MWS was confirmed by GAD65-IgG high levels. [3] She underwent imaging studies which ruled out the hypothesis of a paraneoplastic etiology for the MWS, but the 18F-FDG PET scan showed bilateral thalamic hypometabolism, and she improved by the rituximab use; worth of note was the highly hypermetabolic symmetric muscle uptake in total body with fasting for 6 hours.[3] The authors stressed that MWS should be added among abnormal muscle uptake in FDG PET/CT studies.[3]

Matsui N *et al.*, identified 30 cases of MWS GAD65-positive in Japan from January 2015 to December 2017; four patients had glycine-receptor-IgG, and one patient had both GAD65 and glycine-receptor-IgG positive.[4] The estimated prevalence of MWS was 0.11 per 100,000 population, the average age at onset of disease was 51 (26-83) years, 76% were women, and 70%

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presented with the classic manifestations of the syndrome.[4] The time from symptom onset to diagnosis was longer in the GAD65-IgG high-titer group (13 vs 2.5 months); the coexistence of diabetes mellitus and the lack of long-term immunotherapy were factors of poor outcome, and authors stressed the need for more aggressive immunotherapy in GAD65-positive patients with MWS.[4]

Perri M *et al.*, reported a 47-year-old male with difficulty walking, muscle spasms, stiffness in lower limbs, and panic attacks, who was misdiagnosed myasthenia gravis two years ago because of muscle weakness.[5] He was prescribed pyridostigmine, vilazodone, and clonazepam without control of the clinical manifestations, and presented alteration in the gait, prostration, and frequent falls; had hypertonic muscles in all the extremities, besides hyperreflexia, spasticity, and clonus in the lower limbs, and a slow march with an increased base.[5] With diagnosis of MWS GAD65-positive, IV gamma globulin was given 6 days and diazepam was titrated accordingly; thoracic images showed a mediastinal nodule that was excised (type B2 thymoma with 3 x 2 cm); the early postoperative period was with progression of stiffness refractory to increased diazepam doses, but after the pulses of methylprednisolone and IV gamma globulin, he was discharged with improved ambulation.[5] The authors emphasized the exceeding rare association (only 20 reported cases) of MWS with thymoma.[5]

In conclusion, the herein commented studies focused on the role of the early diagnosis and adequate management of the challenging MWS by a multidisciplinary team to avoid underdiagnosis and misdiagnosis. MWS diagnostic criteria include clinical manifestations, physical examination findings, serological and CSF testing, and electrophysiological study; and more aggressive immunotherapies are needed for GAD65-positive.

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