CURATIO

The Official Medical Journal

Faculty of Medical Sciences . University of Sri Jayewardenepura

ISSN Number: 2961516X

CURATIO

Volume 05, No. 01, December 2025

Contents

General Information

'CURATIO' is a peer-reviewed students' journal which is named after a term of Latin origin which translates to cure, care, and treatment, which are fundamental principles in the field of medicine, published by the Faculty of Medical Sciences, University of Sri Jayewardenepura (FMS, USJ).

E version:

Web portal: http://medical.sjp.ac.lk/index.php/curatio

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Cover Page*: Barana Senasinghe (Student-31st Batch,* FMS, USJ*) Cover story: Against the backdrop of knowledge, service, and innovation, the Faculty of Medical Sciences of the University of Sri Jayewardenepura stands as a symbol of excellence in medical education and research in Sri Lanka. This cover captures not only the architectural identity of the faculty but also the spirit of the students, academics, clinicians, and researchers who continue to shape the future of healthcare with dedication and compassion.*

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Student Perceptions and Preparedness: Are Medical Students Ready for AI in Resource-poor Countries?

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Abstract

The integration of artificial intelligence (AI) into medical education is increasingly recognised as essential for the advancement of healthcare systems globally. Medical schools in resource-poor countries, such as Sri Lanka, encounter significant challenges when incorporating AI into their curricula. This study explores medical students' perceptions of AI in healthcare and identifies barriers to its integration into medical education in resource-limited settings. A review of existing evidence was conducted, focusing on Southeast Asian medical students' attitudes toward AI and the current state of AI education in these regions. Medical students in Southeast Asia view AI positively for healthcare advancement but lack knowledge and preparedness to use AI tools. Medical curricula do not adequately address AI education, leaving students unprepared for healthcare demands. Barriers include limited infrastructure, financial constraints, faculty unpreparedness, and ethical concerns. To address these challenges, AI training programs should utilise open resources and prioritise faculty development. Successful AI integration will require collaboration among medical schools, healthcare institutions, and technology companies. By focusing on context-specific AI education and addressing challenges in resource-limited countries, medical schools can prepare physicians to utilise AI effectively. Collaborative efforts are needed to align medical education with healthcare needs.

Keywords: Artificial Intelligence, Medical Education, Resource-poor Countries, Student Perceptions, Preparedness, Curriculum Integration, Healthcare Challenges

Introduction

Integrating Artificial Intelligence (AI) into medical education is becoming inevitable for the development of healthcare, as it can greatly improve how future doctors are trained. Large language model (LLM) AI tools, ChatGPT, tools for reading medical images, clinical decision support systems, and telemedicine are already changing healthcare in developed countries [1]. These developments improve the accuracy of diagnosis and treatment and make health services more effective. There is growing agreement that AI should be incorporated into medical education [2]. However, adding AI to medical curricula in countries with limited resources, such as Sri Lanka, is challenging because there is limited technology, a shortage of healthcare workers, and funding constraints. These issues make the implementation of AI in medical education difficult.

This paper aims to examine how medical students in resource-poor countries, especially in Southeast Asia, feel about using AI in their education and how ready they are for it. It provides an overview of AI education in medical schools by synthesising peer-reviewed studies. Furthermore, this paper identifies regional trends and highlights the challenges and opportunities of integrating AI into medical curricula. This paper aims to help create AI training programs that fit local needs. This will ensure that future doctors are ready for changes in healthcare technology.

Our country faces healthcare challenges owing to limited resources, inadequate infrastructure, healthcare worker shortages, and financial constraints. The integration of AI into healthcare systems offers cost-effective solutions, remote access, and improved worker efficiency. As technology transforms medical education, understanding how students perceive and prepare for AI is crucial to its ethical integration into the curriculum.

This article examines peer-reviewed studies on medical students' perceptions and preparedness for AI integration into medical education, focusing mainly on resource-poor countries in Southeast Asia. Thereafter, it discusses the problems faced by countries that have limited resources. By identifying research gaps and regional trends, this study attempts to guide the effective integration of AI into medical education, overcoming the challenges faced in our country, so that future doctors are properly trained to work with AI. These findings can help to create training programs for future doctors. These programs will teach them to work with AI systems and meet the country's future healthcare needs.

Global Context of AI in Medical Education

The integration of AI into the medical curricula is a challenge. AI can significantly improve medical education. Top universities, such as Harvard Medical School, are at the forefront of using innovative methods to teach AI. These initiatives will help future doctors learn important skills and improve healthcare delivery. However, we need to be mindful of the ethical, legal, and practical issues associated with using AI. In this way, we can maximise the benefits and minimise potential problems.

Recent studies have shown that medical students recognise AI's capability to make health care much more efficient. They feel the need to be exposed to AI early in their curriculum. An international multicentre cross-sectional study to assess AI knowledge, attitudes, and education among medical, dentistry, and veterinary students from 192 faculties in 48 developed countries found that approximately 67.6% of students generally perceived the integration of artificial intelligence (AI) in healthcare positively. Furthermore, 76.1% expressed a desire for more AI-related content to be incorporated into their curriculum. However, 75.3% acknowledged that they had limited knowledge of AI, and 76.3% reported the absence of formal AI courses. Additionally, 57.9% felt unprepared to apply AI in their prospective medical careers [3]. Subgroup analyses revealed regional differences in perceptions, although these differences were relatively small. These findings highlight a significant global gap between the increasing integration of AI in healthcare and educational preparation.

Challenges Faced by Resource-Poor Countries

Introduction of AI to the medical curriculum faces special problems in countries with fewer resources compared to richer countries. Table 1 shows the main differences between these countries when it comes to AI in medical education.

Table 1: **Challenges in integrating Artificial Intelligence into Medical education.**

Challenge Area	*Description*	*Supporting Details*
Technological Infrastructure	Inadequate infrastructure limits AI access and learning opportunities.	78% in Sub-Saharan Africa lack internet connectivity; unreliable connectivity hinders AI integration [4].
Financial Constraints	High costs of AI hardware/software are a limiting factor in resource-limited settings.	Resources are prioritised for basic needs; AI implementation is economically demanding.
Curriculum Gaps	Lack of basic AI education in medical curricula.	Students show positive attitudes but lack practical experience and formal education on AI [5].
Student Preparedness	Limited access to smartphones and computers restricts access to AI tools.	Students do not get the opportunity to use AI in studies and clinical training due to limited device access.
Faculty Preparedness	Inadequate faculty expertise in AI technologies.	Significant faculty training deficits; limited access to AI-related resources in low-income countries
Practical Experience	Students lack hands-on experience with AI applications.	Students had a basic understanding of AI, but the practical use of AI methods was low, with only a few having hands-on experience.

Student Perceptions of AI in Medical Education in Southeast Asia

Medical students worldwide acknowledge the increasing significance of AI in health care. Therefore, there is a strong need for AI education in medical schools. This finding demonstrates the importance of adding AI to medical training.

Studies from Vietnam have shown that most undergraduate medical students have little prior understanding of the role of AIs in healthcare. However, the majority expressed positive views, showing an interest in learning the fundamentals and applications of AI in medicine [6]. Likewise, in Nepal, studies show that medical students have limited AI understanding but recognise the potential impact on their careers and are willing to learn. They are uncertain about its implications for the healthcare system due to a lack of AI education in the current curriculum [7].

In both Malaysia and Bangladesh, a large number of medical students believe that AI will have a significant impact on medicine and improve medical practice. Most recognise AI's importance for their future careers and advocate for its formal integration into medical curricula [8,9]. Medical students in **Thailand** have shown a limited understanding of AI and its applications in healthcare, but they are strongly supportive of integrating AI training into their medical education [10]. In Indonesia, medical students typically show

neutral to positive attitudes toward their preparedness, understanding, and views on AI.[11].

The evidence presented above indicates that medical students across Vietnam, Nepal, Bangladesh, Malaysia, Thailand, and Indonesia share a common pattern.

- Most students have limited knowledge of AI and its applications in healthcare.
- Most express positive attitudes and are very much interested in learning AI basics.
- They recognised the inevitable use of AI in their future careers and understood its potential impact.
- There is strong support for incorporating AI training into medical curricula.
- These findings show that students do not know much about AI, but want to learn it. The question is whether medical schools are ready to teach AI. Adding AI to the curriculum could help students prepare for changes in health care technology.

Student concerns regarding the integration of AI in medical curricula

While they express enthusiasm, they also have apprehensions and concerns regarding the integration of artificial intelligence into medical education and their professional roles.

- Fear of losing jobs: Many students worry that AI might take over their doctors' jobs. For example, the fear of AI taking over radiology has made many medical students avoid choosing radiology as their career.
- Dehumanisation due to AI integration: Concerns exist regarding medicine's dehumanisation as AI enters healthcare. A Nigerian survey showed that 70.6% of medical students feared that AI could reduce their personal patient care [12].
- Ethical and societal challenges: People are worried about data privacy, bias in algorithms, transparency, accountability when there is an error, and how it affects the doctor-patient relationship.
- Scepticism about AI's abilities: Some students express scepticism regarding the capability of artificial intelligence to effectively manage tasks that inherently require emotional intelligence, empathy, personal interaction, and psychological counselling. [13]
- Job openings in the medical field lower the demand. AI systems can analyse images and perform routine tests. This might mean fewer doctors are needed in fields like radiology.
- Speciality choices affected: AI's influence on job markets affects medical students' speciality choices. They avoided radiology owing to AI. Most researchers believe that AI will revolutionise radiology [14].
- Future workforce implications: Students are concerned about the impact of AI on medicine. For instance, they wonder, if AI handles most of the tasks, what will be left for me to do?

Student Preparedness for AI in Healthcare in Southeast Asia

Although students in our region express positive attitudes towards artificial intelligence (AI), they are not yet adequately prepared to use it effectively. Several studies suggest that medical students in Southeast Asia generally possess limited knowledge of AI and its applications in the healthcare sector. [15].

In Vietnam, the majority of medical undergraduates reported a complete lack of prior knowledge regarding AI's role in healthcare and how to use AI tools in healthcare [6]. Likewise, in Thailand, most medical students do not think that they have basic knowledge about AI [10]. In Nepal, most students expressed that the current medical course did not teach them the necessary skills to use AI in their field [7]. This difference between students' positive attitude toward AI and not feeling prepared shows that medical schools in these regions need to incorporate AI education into what they already teach. Table 2 highlights the significant gaps in AI knowledge and preparedness among medical students in Southeast Asia.

Research shows that tools such as the Medical Artificial Intelligence Readiness Scale can assess medical students' readiness for AI in healthcare [11]. These tools not only provide a clear picture of student preparedness but also help educators monitor progress and design more effective AI training programs.

Table 2: **AI Knowledge and AI Preparedness Among Medical Students in Southeast Asia**

Country	*Student Feedback*	*Key Insight*
Vietnam	Most students have no prior knowledge of AI in healthcare.	Highlights a need for basic AI education.
Thailand	The majority don't feel they even have basic AI knowledge.	Shows widespread lack of AI familiarity.

Nepal	Most students say their course does not prepare them to use AI.	Points to curriculum gaps.
Overall	Students are positive about AI but feel unprepared.	Medical schools should integrate AI into existing curricula.

Challenges and Barriers in Resource-Poor Settings

The incorporation of Artificial Intelligence (AI) into medical education in Sri Lankan medical schools is a major challenge. One major problem is the significant shortage of staff trained in AI, which makes it extremely difficult to create and implement relevant courses [16]. It is difficult to create modern AI training environments because there is not enough access to technology, stable internet access, and funding. These problems are further complicated by deficiencies in technical skills and the basic infrastructure to develop and maintain AI systems. Concerns regarding ethics and data privacy have exacerbated these issues. When educational and regulatory authorities do not provide clear guidance, they confuse, and institutions do not know what to do. Medical courses are already full; therefore, adding AI would require a large restructuring process. With all of these major obstacles, the need for AI integration is growing, as AI is significantly changing and rapidly impacting healthcare, and our future doctors need to be well prepared.

Table 3: **Challenges to integrating AI in medical education in Southeast Asia:**

Challenge	*Explanation*
Lack of Trained Staff	Many medical schools don't have enough faculty who understand AI to teach or design courses.
Resource Constraints	Limited access to AI tools due to poor infrastructure, lack of technology, and insufficient funding.
Weak Technical Skills	Many institutions struggle with the tech skills needed to build and manage AI systems.
Overloaded Curriculum	Existing medical programs are already full, making it hard to fit in new content like AI.
Ethical & Data Privacy Concerns	In places with fewer regulations, protecting patient data and using AI responsibly is a big issue.

Future Directions and Recommendations

To include AI in medical education, we should first assess the perceptions and preparedness of medical students regarding AI. We can do this using surveys, interviews, and group discussions, which will help us understand their views and readiness for AI.

We need to develop and evaluate AI training programs tailored to local contexts to ensure they are relevant. Starting AI lessons early in medical school helps students think critically and find complex information.[17]. It is also crucial that medical schools establish clear ethical guidelines for AI use in education and healthcare.

Therefore, continuous evaluation and improvement of AI training programs are necessary. Regular evaluation of their effectiveness allows us to refine the curriculum and enhance student learning. To ensure continued relevance and effectiveness, AI education must adapt its curriculum in response to evolving changes in healthcare AI. Furthermore, AI should be incorporated into the current medical curriculum, instead of being taught as a separate subject [18].

The curriculum should include flexible and affordable modular programmes. Programs should use free tools and rely less on technology. Policies and funding are needed to enhance digital resources and train educators, as a lack of AI-skilled teachers makes integration difficult. Teachers should participate in workshops and collaborate with AI specialists by utilising resources to integrate AI into their teaching methods. [19] To overcome financial barriers, free online resources such as YouTube videos, open-access courses, and AI simulations should be encouraged, making AI training more accessible and affordable for medical students.

A key challenge for our institutions is the limited technology infrastructure and poor internet access. This can be resolved by developing offline learning materials, mobile education applications, and establishing community tech hubs equipped with computers and AI software. Partnerships with technology companies and non-governmental organisations (NGOs) could provide valuable support in bridging these gaps.

As AI continues to grow in medical education and healthcare, establishing ethical guidelines and transparency is crucial. Institutions must ensure that AI is used ethically and fairly. Training programs should prepare healthcare workers to address ethical challenges as AI becomes more prevalent in practice.

Thus, we should explore how artificial intelligence can support health priorities in resource-poor regions. AI tools can enhance surveillance and control of infectious diseases, improve maternal health through antenatal data analysis and remote

monitoring, and support the management of chronic non-communicable diseases in low- and middle-income countries like ours. AI-driven tools for risk prediction, treatment optimisation, and self-management could contribute to better disease prevention and care in resource-limited regions. Prioritising AI tools for local health needs will ensure a fair distribution of benefits and improve access for underserved populations.

AI technology can improve health care in hard-to-reach areas by enabling doctors to treat distant patients. Through AI, providers can monitor health and create personalised treatment plans, thus benefiting those with limited access to medical care. AI-based telehealth reduces healthcare inequalities, improves outcomes, and saves costs [20].

The collaboration between medical schools, healthcare institutions, policymakers, and technology companies is crucial for the integration of artificial intelligence into medical education. By sharing resources and engaging in cross-national cooperation, we can effectively prepare future physicians for AI-enhanced healthcare environments.

Conclusion (250 words)

In conclusion, using artificial intelligence (AI) in medical education, especially in regions with limited resources, can significantly improve healthcare. It is necessary to teach medical students AI skills and knowledge to keep up with the changes in medicine. There is a strong need to include AI in the curriculum, offer accessible training resources, and solve infrastructure issues so that all medical students can learn AI equally. The focus should be on creating simple, flexible programs that do not depend heavily on technology and instead use free tools. It is also crucial to address the lack of teachers with AI skills by offering training workshops, collaborating with AI experts, and providing support. Using free online resources, tools, and platforms, we can overcome financial and technological barriers, making AI training more accessible and affordable.

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Effects of COVID–19 Pandemic Lockdown on the Physical activity and Mental state of Sri Lankan University Athletes

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Abstract

Introduction: In an effort to mitigate the spread of the COVID-19 pandemic, the government implemented various measures, including home confinement. These measures had unintended consequences on the lifestyle of Sri Lankan university athletes.

Objectives: This study aims to elucidate the effects of the COVID-19 pandemic lockdown on the physical activity and mental well-being of Sri Lankan university athletes.

Methods: An analytical cross-sectional study was conducted among athletes from all government universities in Sri Lanka. Athletes engaged in board games and those studying at private universities were excluded. A stratified sampling method was employed for data collection. A self-administered questionnaire with the International Physical Activity Questionnaire – Short Form and the Short Warwick-Edinburgh Mental Well-Being Scale were utilised in the data collection. Data was analysed using SPSS software version 15.0, with a p-value of less than 0.05 considered significant.

Results: Data was collected from 199 participants representing 13 local universities. The lockdown negatively affected all intensities of physical activity levels (vigorous, moderate activity & walking) with a reduction in the total MET score by 2091.03. The mean total mental score before confinement was 23.08, which decreased to 20.82 during the COVID-19 lockdown (Δ 2.266), highlighting a decline in the mental state of athletes.

Conclusions: While isolation is a necessary measure to protect public health, the results indicate that it adversely impacts the physical activity and mental well-being of athletes. This may lead to detrimental consequences for the athletes' long-term careers. The data gathered would be beneficial for future recommendations during similar extended restrictions.

Keywords: COVID-19 lockdown, Sri Lanka, University athletes, Physical activity, mental wellbeing

Introduction

COVID-19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is an infectious disease resulting from a newly discovered enveloped RNA virus [1]. Initially, it posed a potentially fatal threat and emerged as a significant global public health concern. The World Health Organisation declared this serious disease a pandemic on 11th March 2020[2]. In response to this global health emergency, numerous countries implemented lockdowns and travel restrictions to mitigate the spread of COVID-19. While these measures effectively reduced the transmission rate of the infection, they also imposed a burden on public health by adversely affecting physical and mental well-being.

Sri Lankan universities offer a range of sports amenities, such as indoor and outdoor fields, swimming pools, sports equipment, and coaching resources to promote the mental and physical well-being of student-athletes. Moreover, several inter-university sporting events, like the Sri Lanka University Games (SLUG), are organised to nurture and support talent across various sports. In 2019, a total of 6,127 athletes from 13 state universities in Sri Lanka participated in the Sri Lankan university games, underscoring the engagement of university students in athletics[3].

Sri Lankan universities and schools were first closed to prevent the spread of the COVID-19 virus on March 12th, 2020.[4]Subsequently, online teaching programs were introduced in educational institutions to bridge the gap in education. However, athletes from these institutions encountered significant challenges in maintaining their training regimens at home.

Research done in these fields has shown that even a four-week cessation of training can lead to numerous physiological changes in athletes' bodies, resulting in reduced athletic performance and an increased risk of injury upon returning to sport[5]. Sports and exercise play a crucial role in maintaining mental health by reducing anxiety and

stress, and prolonged restrictions can negatively impact athletes' psychological well-being[6].

Although the effects of COVID-19 on sports have been extensively studied in developed countries, no such inquiry has been conducted in the Sri Lankan university sporting context. Government bodies and university authorities have prioritised educational activities during the lockdown period, but have not given sufficient attention to the field of sports.

Our study mainly aims to assess the changes in physical activity and mental state during the COVID-19 pandemic lockdown among Sri Lankan university athletes. Even though the lockdown phase has concluded, the insights gained will be beneficial for future recommendations during similar extended restrictions.

Methods

This study used an analytical cross-sectional design to assess changes in physical activity levels and mental well-being among university athletes during the COVID-19 confinement period. The research was conducted from September and October 2021 and included athletes from 13 Sri Lankan government universities. Participants were selected based on their involvement in university sports, while individuals from private universities and those participating exclusively in board games were excluded from the study.

The sample size was determined using the Lemeshow formula, with the expected proportion of affected athletes 86.3%[7] and 15% non-response, which yielded a minimum required number of 190 participants. A stratified sampling technique was used to distribute this sample proportionately among the 13 universities, based on athlete participation in the 2019 Sri Lankan University Games. Data collection was facilitated via an online survey using Google Forms, which was distributed across the target universities. Once the required sample size was achieved, further responses were not accepted.

A self-administered, structured questionnaire was used as the primary data collection instrument. The main version of the questionnaire was in English, with translations available in Sinhala and Tamil to accommodate participants' language preferences. The questionnaire consisted of four sections. Section 1 included an overview of the study's objectives, inclusion and exclusion criteria, and an informed consent declaration, which participants had to acknowledge before proceeding.

Section 2 gathered socio-demographic information, including gender, ethnicity, and financial status of the participant's family.

Section 3 assessed physical activity levels using the International Physical Activity Questionnaire – Short Form (IPAQ-SF), a validated tool designed to evaluate the frequency and duration of physical activity in adults aged 15 to 69 years. Participants were asked to report the number of days per week and the amount of time per day they engaged in walking, moderate-intensity, and vigorous-intensity physical activities. Using this data, a weekly total physical activity score (measured in MET-minutes/week) was calculated. This was done by multiplying the minutes they spend by the number of days they put in by a factor specific to each form of physical activity. MET values were assigned as follows: vigorous activity = 8.0 METs, moderate activity = 4.0 METs, and walking = 3.3 METs. The final MET score for each individual was obtained by summing up the MET values for all activity types.

Section 4 evaluated participants' mental well-being using the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS). This tool comprises seven items assessing aspects of mental health. Participants responded based on their experiences over the preceding two weeks. Responses were rated on a 5-point Likert scale, and total raw scores were converted into metric scores using a standard conversion table. Scores ranged from 7 to 35, with higher scores indicating better mental well-being.

All the questions that were asked in the research tools, used in sections 3 and 4, were presented in a differential format that should be answered directly in sequence regarding "before" and "during" confinement conditions. This differential response format allowed for paired comparisons.

All data were analysed using IBM SPSS Statistics software version 15.0. Changes in physical activity and mental well-being scores before and during the confinement period were assessed using paired sample t-tests. A p-value of less than 0.05 was considered statistically significant. Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura.

Results

Data were collected from 199 athletes distributed across 13 universities in Sri Lanka. Among the participants, 121 (60.8%) were male, with the majority being Sinhalese (n=140; 70.4%), followed by Tamils (n=54; 27.1%), Muslims (n=4; 2%), and Burghers (n=1; 0.5%). A significant proportion of participants reported an average

monthly income exceeding Rs 100,000 (n=65; 32.8%). The University of Ruhuna had the highest representation with 25 participants (12.6%), whereas the University of Wayamba had the least with 4 participants (2%). Of the total participants, 108 (54.3%) were engaged in outdoor sports, while 91 (45.7%) participated in indoor sports. (Table 1)

Table 1: **Frequency distribution of the socio-demographic factors of the study sample**

Socio-demographic factor		*Frequency (n)*	*Percentage (%)*
Gender	Female	78	39.2
	Male	121	60.8
Ethnicity	Burgher	1	0.5
	Muslims	4	2.0
	Sinhalese	140	70.4
	Tamils	54	27.1
Average monthly income	< Rs 20,000	7	3.5
	Rs 20,000 - Rs 49,999	40	20.2
	Rs 50,000- Rs 99,999	56	28.3
	>= Rs 100,000	65	32.8
	I don't know	30	15.2
Type of Sport	Indoor-Individual (Badminton, Table tennis, etc.)	73	36.7
	Indoor-Team (Basketball, etc.)	18	9.0
	Outdoor-Individual (Track events, Swimming, etc.)	33	16.6
	Outdoor-Team (Football, Netball, Cricket, etc.)	75	37.7
Name of the University	Eastern University	6	3.0
	Rajarata University	19	9.5
	Sabaragamuwa University	6	3.0
	South Eastern University	7	3.5
	University of Colombo	20	10.1
	University of Jaffna	24	12.1
	University of Kelaniya	21	10.6
	University of Moratuwa	20	10.1
	University of Peradeniya	20	10.1
	University of Ruhuna	25	12.6
	University of Sri Jayewardenepura	21	10.6
	Uva Wellassa University	6	3.0
	Wayamba University	4	2.0

Changes in the physical activity of university athletes during the COVID-19 lockdown

Table 2: **Changes in vigorous, moderate activities, and walking before and during lockdown.**

		Before confinement	*During confinement*	*(Δ) Δ%*	*t value*	*p-value (Paired sample t-test)*
Vigorous intensity	***Days/week***	2.71 ± 1.785	1.47 ± 1.723	1.24	8.864	<0.001
	Min/day	63.88 ± 61.464	28.71 ± 34.372	35.17	9.292	<0.001
	MET values	1771.94 ± 2306.256	590.55 ± 1107.659	1181.39	7.745	
Moderate intensity	***Days/week***	2.11 ± 1.408	1.45 ± 1.629	0.66	4.634	<0.001
	Min/day	56.26 ±52.412	29.34 ± 30.605	26.92	7.885	<0.001
	MET values	711.64 ±919.297	240.14 ± 398.694	471.5	7.469	<0.001
Walking	***Days/week***	3.74 ± 2.222	1.87 ± 1.972	1.87	12.708	<0.001
	Min/day	46.73 ± 46.443	22.37 ± 27.095	24.36	7.803	<0.001
	MET values	660.50 ± 834.218	222.34 ± 513.466	438.16	7.818	<0.001

Vigorous activity

Regarding vigorous activity, the number of days per week of vigorous physical activity during confinement decreased by 1.24 days compared to before the lockdown (t = 8.864, p<0.001). Similarly, the minutes per day of vigorous physical activity decreased by 35.17 minutes (t=9.292, p<0.001). The total MET score for vigorous physical activity during confinement decreased by 1181.39 (t=7.745, p<0.001) compared to the pre-lockdown period. (Table 2)

Moderate activity

The number of days per week and minutes per day of moderate physical activity decreased by 0.66 days (t=4.634, p<0.001) and 26.92 minutes (t=7.885, p<0.001), respectively, during the lockdown compared to before. The total MET score for moderate physical activity decreased by 471.5 (t=7.469, p<0.001). (Table 2)

Walking

In terms of walking, the number of days per week spent walking during confinement decreased by 1.87 days (t=12.708, p<0.001) compared to before. The time spent walking in minutes per day also decreased by 24.36 minutes (t=7.803, p<0.001) during confinement. The MET score for walking decreased by 438.16 (t=7.818, p<0.001) during confinement. (Table 2)

Table 3: **Changes in total MET score before and during lockdown**

	Mean score before confinement	*Mean score during confinement*	*Difference (Δ)*	*t value*	*p value (Paired sample t-test)*
Total MET score	3144.0754 ± 3217.31788	1053.0372 ± 1536.53558	2091.03	9.498	**<0.001**

Total MET score

When considering the total MET score, which encompasses all physical activities, including vigorous and moderate physical activities and walking, the mean score before confinement was 3144.07. The mean score during confinement was 1053.04. The difference between these scores is 2091.03, and it is statistically significant (t = 9.49, P<0.001). (Table 3)

Changes in the mental state of university athletes during the COVID-19 lockdown

Table 4: **Frequency distribution of the components of the mental well-being questionnaire, before and during tCOVID-19-19 lockdown**

	Never		*Rarely*		*Sometimes*		*Most of the time*		*Always*	
	Before No (%)	*During No (%)*	*Before No (%)*	*During No (%)*	*Before No (%)*	*During No (%)*	*Before No (%)*	*During No (%)*	*Before No (%)*	*During No (%)*
Feeling optimistic about the future	6.0	5.0	15.1	19.6	23.6	40.2	39.2	24.6	16.1	10.6
Feeling useful	2.5	5.0	6.0	26.6	25.6	38.2	45.2	19.6	20.6	10.6
Feeling relaxed	3.5	4.0	16.6	20.6	44.7	28.1	27.1	37.7	8.0	9.5
Dealing with problems	2.5	4.0	7.0	17.6	39.7	38.2	39.7	30.7	11.1	9.5
Thinking clearly	1.5	2.0	6.0	17.1	35.2	35.7	41.2	32.7	16.1	12.6
Feeling close to others	1.0	6.0	6.5	29.6	27.1	38.7	42.2	19.6	23.1	6.0
Able to make up my mind about things	1.0	3.0	4.0	11.1	34.7	34.7	37.7	33.2	21.6	18.

In the study sample, the majority of participants reported feeling optimistic about the future most of the time (39.2%) before the lockdown. However, during the lockdown, most individuals indicated feeling optimistic only sometimes (40.2%). The fewest participants reported never feeling optimistic, both before and during confinement (6%; 5%). Similarly, when asked if they felt useful, the largest proportion of participants responded, "most of the time" (45.2%) before the lockdown and "sometimes" (38.2%) during the lockdown. Regarding feelings of relaxation, most participants reported feeling relaxed "sometimes" both during and before confinement (44.7%; 28.1%), with the fewest responding "never" (3.5%; 4%) during and before confinement. In response to the question about dealing with problems efficiently, the majority indicated "sometimes" and "most of the time" (39.7%) before

the lockdown, while during the lockdown, the majority indicated "sometimes" (38.2%). For questions concerning thinking clearly, feeling close to others, and the ability to make decisions, the majority responded "most of the time" before confinement and "sometimes" during confinement. The least number of participants responded "never" to all three questions, both before and during confinement. (Table 4)

Table 5: Changes in total mental score before and during lockdown.

	Before confinement	*During confinement*	*Δ*	*t value*	*P value (Paired sample t-test)*
Total mean mental score	23.0816 ±4.24340	20.8154 ±3.89774	2.2662	8.171	<0.001

The mean total mental score was 23.0816 before confinement and 20.8154 during confinement. The mental score decreased by 2.2662 (t=8.171, p<0.001) during confinement compared to before, which is statistically significant. (Table 5)

Discussion

Our research encompasses data collected from athletes across 13 Sri Lankan universities, with a total of 199 responses. The study underscores the adverse impact of the COVID-19 lockdown on all levels of physical activity, including vigorous, moderate, and walking activities.

The findings of our research are consistent with various research conducted internationally, including studies in Australia[8], Italy[9] and South Africa[10]. The ECLB-COVID19 survey [11], which included 1,047 participants from Asia, Africa, and Europe, demonstrated a reduction in overall physical activity during the lockdown period. The larger sample size, comprising individuals from diverse global regions, yielded results that corroborate our study and strengthen our conclusions; specifically, that lockdowns adversely affect the physical activity of athletes.

Detraining results in numerous anatomical and physiological adaptations across various systems of the human body, including the cardiovascular, respiratory, and musculoskeletal systems. Cardiovascular changes, such as reductions in cardiac diameters, stroke volume, VO2 MAX, and an increase in heart rate, can diminish athletic performance[12]. Additionally, muscle force-generating capacity is compromised due to changes in muscle, such as reduced capillary density, enzymatic activity, insulin-dependent glucose uptake, and muscle glycogen stores[13][5].To address this issue, we propose that universities implement conditioning routines through online platforms to sustain athletes' fitness levels. These routines should include moderate exercises that accommodate the constraints of physical space and available equipment, such as barbells, weight plates, dumbbells, and resistance bands[14]. For individuals lacking equipment, exercise routines that do not require equipment, such as jogging, squats, burpees, push-ups, sit-ups, and stretching, may serve as viable alternatives[14]. Additionally, it is crucial to minimise prolonged periods of sedentary behaviour, including sitting or lying down, as well as screen time involving televisions, cell phones, computers, and video games during home confinement[14]. Furthermore, it is imperative to implement reconditioning programs for athletes before their return to sports activities to mitigate the risk of injuries[13].

The pandemic period has been associated with an increase in post-traumatic stress symptoms due to changes in athletes' living conditions, separation from their sports, and concerns about their health. In our study, the mean total mental score before confinement was 23.08, which decreased to 20.82 during the COVID-19 lockdown. Our results support the hypothesis that Sri Lankan university athletes were more adversely affected in terms of mental health during this period.

Similarly, a study conducted among soccer players worldwide revealed that 46% of respondents experienced psychological distress, while 6% suffered from depression and anxiety[15]. A study conducted in Nigeria reported, athletes participating in individual sports experienced more psychological distress when compared to those participating in team sports[6].

Mental well-being is vital for athletes' health and performance. Therefore, we recommend that university sports clubs conduct workshops via online platforms to enhance athletes' mental well-being. Additionally, we advise athletes to engage in meditation, deep breathing and new hobbies, such as gardening, to improve their physical and mental health during home confinement[14].

Strengths and limitations

The strengths of this research include the utilisation of validated questionnaires administered in multiple languages, with samples representing all

ethnic groups, universities, various types of sports, and all districts of Sri Lanka, except for Mannar. Nonetheless, the study faced limitations, such as recall bias, due to its reliance on questionnaire-based data collection, which required participants to recall their physical activity and mental state in their daily lives, as well as before the lockdown.

Conclusions

The findings of this study indicate that home confinement during the COVID-19 pandemic adversely affected the physical and mental well-being of Sri Lankan university athletes. Although a lockdown is not currently in place, the information gathered could prove beneficial for policymakers in future lockdown scenarios, as it highlights the importance of considering the physical and mental wellness of athletes in our nation.

Acknowledgement

We would like to express our sincere gratitude to all the participants who gave their kind support for the research by responding to the online questionnaire.

Conflict of Interest

No potential conflicts of interest were reported by the authors

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Language barriers in Medical Education: Perceived challenges of English Medium Learning experienced by first year medical undergraduates in Sri Lanka

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Abstract

Background: English medium has been the standard of medical education for several decades in Sri Lanka. Medical students from non-English speaking backgrounds face multiple challenges in English medium learning (EML), which can hinder their academic performance.

Objectives: To describe the perceived English proficiency and language challenges among first-year medical undergraduates and to determine the factors associated with EML challenges.

Methods: A descriptive cross-sectional study was conducted among 169 first-year medical students at the Faculty of Medical Sciences, University of Sri Jayewardenepura, using convenience sampling. Data collected via an online self-administered questionnaire and secondary data obtained from English orientation marks were analysed using SPSS-25.

Results: The mean age of participants was 21.53 years (SD = 0.9). The majority (64.5%, n=109) were female, and 87% (n=147) were Sinhalese. Most (60.4%, n=102) had an A grade pass in General English. Most had satisfactory scores in both pre-test [n=147 (87%)] and Post-test [n=132 (78.1%)] assessments during the orientation program. However, speaking was perceived as the most challenging skill, communicating ideas fluently (62%, n=105), presentations (65.1%, n=110) and speaking to lecturers in English (65.1%, n=110). Additionally, students with higher levels of anxiety (45.6%) and lower confidence (43.5%) faced greater challenges ($p < 0.05$). Many students reported that language-related challenges affected their academic performance (75.1%, n=127), particularly in anatomy (81.7%, n=147).

Conclusion: These findings highlight the gap in English speaking skills, emphasising the need for focused language support programs to assist students in building up their confidence and communication skills, particularly in the early stages of medical education.

Keywords: English Medium Learning, Challenges, Medical undergraduates

Introduction

English Medium Learning (EML) has been the norm for medical education in Sri Lanka for several decades, like most other countries. Being a non-native English-speaking country, a significant proportion of medical undergraduates who have completed their primary and secondary school education in Sinhala or Tamil enrol in university with limited proficiency in the English language. The sudden change of medium of learning to English becomes a barrier for most of the students.[1] This transition presents particular challenges in learning medical knowledge, skills, and communication, which could potentially harm their well-being and academic achievements. The English language is not only crucial as a medium of study for medical students but also serves a vital role in pursuing their future careers.[2]

Medical students frequently struggle to comprehend complex medical topics and terminology when they are delivered in English. Medical books, articles and research reports use technical terms of medicine in English.[3] As a result, students with limited English proficiency may experience difficulty in grasping the essence of the subject content, consequently leading to reduced comprehension and academic performance. A study conducted among medical students at the University of Jaffna revealed that a significant proportion of students reported having trouble understanding English-medium course materials.[4] Many of them attempted to translate phrases into their native tongue to enhance their comprehension. International medical students in China reported that their learning experiences were hindered by their lecturers' poor English communication and accents.[5] Similarly, the medical undergraduates at a University in Saudi Arabia stated that they needed more English for Medical Purposes (EMP) classes to help them become more proficient readers and speakers.[6]

The linguistic barrier impacts exams, since students believe they would perform better if tests were given in their native tongue. According to a study [7], more than half of University of Peradeniya medical students thought that speaking Sinhala during clinical exams would help them communicate more clearly.

Many studies have been conducted to identify such linguistic challenges, mainly in Asian countries. Although some of these studies were conducted in various faculties in several universities in Sri Lanka, less attention has been directed to such challenges faced by medical undergraduates and their associated factors in the Sri Lankan context.

The main aims of this study were to explore the common challenging English language skills among students and the challenging components in their academic courses, and to determine the factors associated with these challenges.

Methodology

A descriptive cross-sectional study was conducted among first-year medical students of the 2019/2020 batch at the Faculty of Medical Sciences in the University of Sri Jayewardenepura. Convenience sampling was used to conduct the study.

Data was collected by a structured and pretested online self-administered questionnaire. The link to the questionnaire was sent to the batch representatives of the 2019/2020 batch, and they were asked to share it among the batchmates. Participation was voluntary, and informed consent was obtained from the participants. To preserve the anonymity of the participants, data was collected without their names. Participants were informed about the privacy and confidentiality of collected data. Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura (REC number - CM/02/21).

Likert scales were used to assess challenges, coping strategies and associated factors (such as level of anxiety, confidence). 10 items for the questionnaire were adopted from Evans and Morrison's (2011) questionnaire on English medium instructions (EMI) linguistic challenges. Secondary data of pre- and post-orientation English marks were collected from the Language and Communication Skills Unit of the Faculty of Medical Sciences, University of Sri Jayewardenepura, with permission of the Dean and Head of Examination Unit. A pretest was performed to assess the clarity and identify shortcomings in the questionnaire.

A total of 169 questionnaires were analysed using SPSS software version 25. Associations were assessed using Chi chi-square test. Statistical significance was taken as $p< 0.05$.

Results

A total of 169 first-year medical undergraduates participated in this study, of whom the majority were females [n=109 (64.5%)]. Their mean age was 21.53 years (SD=0.9), ranging from 20 to 24 years. Most of the study participants were Sinhalese [n=147 (87%)] and from Western province [n=92 (54.4%)]. Almost a quarter (25.4%) of the participants had an approximate total family income of more than Rs. 100,000. The majority of the participants had completed their secondary education at government schools [n=149 (88.2%)], and most had entered university by the second attempt of A/L [n=79 (46.7%)]. (Table 1)

Table 1: **Frequency distribution of Sociodemographic and socio-economic characteristics of the study participants (n=169)**

Characteristics	*Frequency (N)*	*Percentage (%)*
Gender		
Male	60	35.5
Female	109	64.5
Ethnicity		
Sinhalese	147	87.0
Tamil	14	8.3
Muslim	8	4.7
Burgher	-	-
Provinces (Hometown)		
Western	92	54.4
Central	5	3.0
Southern	26	15.4
Uva	5	3.0
Sabaragamuwa	19	11.2
North-Western	13	7.7
North-Central	1	0.6
Northern	5	3.0
Eastern	3	1.8
Place of stay during academics		
At home	65	38.5
At a relative's home	3	1.8
Hostel	36	21.3
Boarding	65	38.5
Approximate total monthly family income		
<Rs. 25,000	28	16.6
Rs. 25,001 - 50,000	31	18.3
Rs. 50,001 – 100,000	58	34.3
>Rs. 100,000	43	25.4
Rather not say	9	5.3

Most participants had completed their A/Ls in Sinhala medium [n=134 (79.3%)], while only 24 participants (14.2%) had studied in English medium. The majority had A passes for General English language in both O/L [n=146 (86.4%)] and A/L [n=102 (60.4%)] examinations.

Among the English-related events during schooling, most had participated in writing events [n=118 (69.8%)]; however, participation in other events was poor (<50%), such as drama, speaking, singing and debating.

Nearly half of the study participants [n=84 (49.7%)] had completed an English course/ diploma before university admission. The results of English examinations held during the orientation programme revealed that most students had satisfactory marks for the English Orientation Pre-test [n=147 (87%)] and Post-test [n=132 (78.1%)]. (Figure 1)

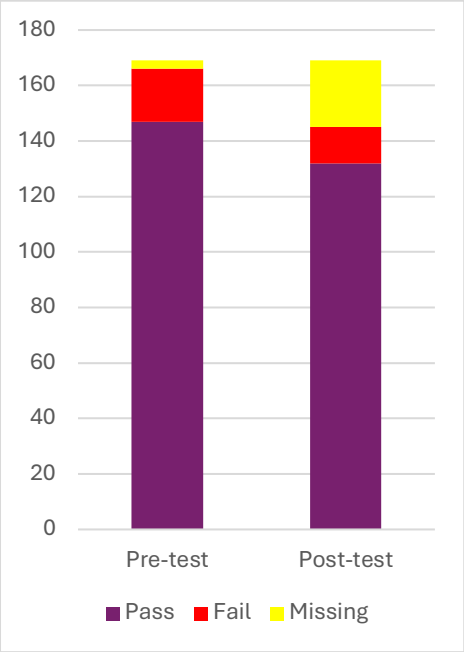

Figure 1: **Distribution of pre- --- and post-test English orientation marks of the study participants**

The common sources used by the study participants to acquire English knowledge were via Internet (94.1%), watching movies (89.9%), TV series (71.6%), reading English books (84.6%), listening to English music (72.2%), whereas listening to English news (41.4%), reading English newspapers (38.5%), and private tuition classes (44.4%) were the less commonly used methods.

Undergraduate medical students in the first year faced several challenges in English-medium learning. Concerning listening skills, the majority of the study participants agreed that they can understand the key vocabulary easily (53.8%) and follow the lecture speed (47.9%) appropriately. Concerning writing skills, the majority of the participants were able to use appropriate vocabulary (50.3%), correct spellings (46.7%) and also write with an appropriate speed (49.1%). They were also able to link sentences smoothly (40.2%). Concerning reading skills, the majority were able to understand the text (52.1%) and read at an appropriate speed (45.6%), but understanding vocabulary and terminology (40.2%) was somewhat challenging. Speaking was the most challenging skill for most of the participants; they were not able to communicate ideas fluently and express their opinions (62%) (Table 2).

Table 2: **Frequency distribution of challenges faced with English medium learning by study participants**

Characteristic	*Strongly agree*		*Agree*		*Neutral*		*Disagree*		*Strongly disagree*	
	N	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*
Listening										
I understand the key vocabulary easily	33	(19.5)	91	(53.8)	39	(23.1)	5	(3.0)	1	(0.6)
I can follow the speed of the lecture	29	(17.2)	81	(47.9)	45	(26.6)	11	(6.5)	3	(1.8)
Writing										
I can use appropriate vocabulary	25	(14.8)	85	(50.3)	47	(27.8)	12	(7.1)	-	-
I can use correct spellings	26	(15.4)	79	(46.7)	48	(28.4)	14	(8.3)	2	(1.2)
I write with an appropriate speed	25	(14.8)	83	(49.1)	47	(27.8)	13	(7.7)	1	(0.6)
I can link sentences smoothly	29	(17.2)	68	(40.2)	60	(35.5)	11	(6.5)	1	(0.6)
Reading										
I can easily understand what I read in the text	30	(17.8)	88	(52.1)	46	(27.2)	4	(2.4)	1	(0.6)
I can easily understand the vocabulary and terminology used in the text	21	(12.4)	66	(39.1)	68	(40.2)	13	(7.7)	1	(0.6)
I can read at an appropriate speed	29	(17.2)	77	(45.6)	59	(34.9)	4	(2.4)	-	-
Speaking										
I can communicate ideas fluently	13	(7.7)	51	(30.2)	69	(40.8)	29	(17.2)	7	(4.1)
I can express my opinion easily	12	(7.1)	52	(30.8)	69	(40.8)	30	(17.8)	6	(3.6)
I can speak clearly (Pronunciation)	18	(10.7)	73	(43.2)	55	(32.5)	20	(11.8)	3	(1.8)
I actively participate in discussions	14	(8.3)	47	(27.8)	76	(45.0)	26	(15.4)	6	(3.6)

For most of the study participants, facing exams (62.8%), tutorials and SGDs (58.5%), presentations (65.1%) and speaking to lecturers in English (65.1%) were fairly challenging.

The most difficult academic subject was revealed as anatomy (81.7%). The majority of the study participants had difficulties in understanding the lectures occasionally (69.2%). They faced difficulties in understanding the way the lecture was delivered (51.6%). Most of the study participants stated that challenges in English language skills affect their academic performance (75.1%). (Table 3).

Table 3: **Frequency distribution of the challenges faced during various occasions among study participants**

Students' opinions on the following occasions	*Strongly agree*		*Agree*		*Neutral*		*Disagree*		*Strongly disagree*	
	N	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*
I can confidently face exams	6	(3.6)	57	(33.7)	75	(44.4)	26	(15.4)	5	(3.0)
I can confidently face Tutorials and SGDs	9	(5.3)	61	(36.1)	69	(40.8)	22	(13.0)	8	(4.7)
I can easily do presentations in English	10	(5.9)	49	(29.0)	73	(43.2)	28	(16.6)	9	(5.3)
I can confidently speak to lecturers in English	18	(10.7)	41	(24.3)	69	(40.8)	28	(16.6)	13	(7.7)

*SGD – Small Group Discussion

About half of the study participants were satisfied with the English knowledge gained during the orientation program (50.9%), while a considerable number of participants were not sure whether it was helpful or not (43.8%). Most of the study participants were either not using (54.4%) or occasionally using (29.6%) the University English language support unit to improve their English knowledge.

The level of anxiety and the level of confidence in English medium learning among study participants were assessed using Likert scales. A considerable number of participants had some degree of anxiety (scale -2) about English medium learning (44.4%), while 5.9% had severe anxiety (scale - 4). Additionally, 43.2% were somewhat confident about English medium learning (scale - 2), while only 8.3% were highly confident (scale - 4). (Table 4).

Table 4: **Frequency distribution of the level of anxiety and confidence in English medium learning**

Characteristic	*Frequency (N)*	*Percentage (%)*
Level of anxiety		
0	29	17.2
1	26	15.4
2	75	44.4
3	29	17.2
4	10	5.9
Level of confidence		
0	4	2.4
1	31	18.3
2	73	43.2
3	47	27.8
4	14	8.3

*The level of anxiety was assessed using a Likert scale ranging from 0- no anxiety to 4- severe anxiety.
*The level of confidence was assessed using a Likert scale ranging from 0- no confidence to 4-highly confident

Associations of various factors with challenges in EML revealed several statistically significant findings. It was observed that study participants who had a low level of language anxiety had good knowledge of the English language when compared to those with high language anxiety (82% vs 64%).

This observed difference was statistically significant ($p < 0.05$). But there was no statistically significant difference between the level of confidence with knowledge of the English language ($p > 0.05$).

A statistically significant difference was observed with A/L English results and challenges in EML ($p<0.05$). Participants with good results in A/L General English (23.9%) face fewer challenges in EML than participants with poor results (65.7%). Those who had good participation in English-related events (25.9%) had fewer challenges than participants with poor participation (58.8%). This observed difference was statistically significant ($p<0.05$).

Additionally, there was a statistically significant difference between language anxiety and challenges in EML ($p<0.05$). Participants with high language-related anxiety had more challenges in EML (45.6%) compared to participants with low anxiety (5.5%) (Table 5). In contrast, a statistically significant difference in the level of confidence and challenges in EML ($p<0.05$), where participants with a low level of confidence (43.5%) faced more challenges in EML than participants with a high level of confidence (13.1%).

Table 5: **Association between language anxiety and challenges in English medium learning among study participants**

Language anxiety	*Challenges*				*Total n (%)*		*Significance*		
	Yes		*No*						
	N	*%*	*N*	*%*	*N*	*%*	*χ^2*	*df*	*P*
Low	3	(5.5)	52	(94.5)	55	(100.0)	-	-	*0.000
High	52	(45.6)	62	(54.4)	114	(100.0)	-		

*Fisher's exact test

The following are several responses provided by the students to an open-ended question for suggestions to improve their English proficiency. “Schedule English practice sessions among the batch”. “Add more interactive learning sessions during the orientation period without lecture-like sessions”. “If interactive sessions where we can talk freely in English can be held, it would be great as we can improve language, confidence and release stress”. “It is good if they practice speaking”. “Adding a vocabulary list at the end of each lecture note, if necessary, would be great”. “I like our ELA (English Literary Association) club, I hope there will be dramas and other extra opportunities for us to participate”. “The orientation English program was great. As I'm interested in the language, I'd like it if the program were continued as a short lesson a week or something. As we don't get professional help for learning English anymore.”

Discussion

This study highlights the challenges faced by first-year medical undergraduates studying in English medium, their coping strategies, and the factors associated with challenges in EML. The results reveal that many students still struggle to adjust to EML in medical faculty, especially when it comes to speaking and comprehending complex material, even though they received relatively high grades in English language at the O/L and A/L levels.

Speaking skills were found to be among the most challenging, with more than 60% of students stating that they had trouble articulating their thoughts and speaking clearly. This result aligns with research conducted in other Asian contexts. Similar difficulties speaking and comprehending spoken lectures were encountered by Saudi Arabian medical students, highlighting the necessity of focused assistance in oral language development.[9] Due to linguistic and cultural limitations, foreign medical students in China reported having trouble understanding what they were hearing and communicating academically.[5]

Many of the students still had trouble understanding academic vocabulary and specialised medical terminology, although more than half of them could follow the pace of lectures and understand ordinary reading material. This suggests that both listening and reading skills are significantly challenged. These results are consistent with previous studies that demonstrated that discipline-specific language mastery is still a persistent challenge in English Medium Instruction (EMI) settings, even though receptive skills like reading and listening tend to improve progressively.[10] The complexity of subject-specific language is a fundamental barrier in EML contexts, aligning with the fact that the vast majority of students (81.7%) found anatomy to be especially challenging.

Notably, students who participated actively in English-related school activities and had higher A/L English language results reported fewer EML challenges. This reinforces the idea that early and varied exposure to the English language—particularly through interactive or verbal elements—improves preparedness for EML contexts. Similar findings were reported in Thailand and Malaysia, where pre-university language background significantly affected medical students' confidence and adaptation in EMI programs.[11], [12]

Another critical contributary factor towards challenges in EML was language anxiety. An inverse relationship was observed between language-related anxiety and language performance. Students with low anxiety experienced comparatively fewer EML challenges than those with high language-related anxiety, thus impacting their language-related academic performance. This highlights the importance of psychological preparedness alongside linguistic training.[13] Furthermore, confidence levels also showed a statistically significant relationship with performance; students with lower confidence were more likely to encounter difficulties, indicating a potential area for help through structured communication practice and peer interaction.

Conclusions

EML continues to pose substantial academic and psychological challenges for medical undergraduates. Improving early language exposure, promoting active coping methods, and strengthening institutional support—particularly for speaking and terminology comprehension—are critical. These findings highlight the necessity for medical schools to incorporate systematic English support into the curriculum in order to enhance both language and academic competence.

Recommendations

At the university level, English orientation programs should place greater emphasis on improving students' grammar and speaking abilities. Additionally, the English language support units within faculties should offer extended assistance, particularly to students who demonstrate weaker proficiency. To further aid learning, universities should implement systems that allow students to clarify grammar-related doubts through accessible online platforms such as email, blogs, or discussion forums. Peer support groups, English classes can also be established through the Language support unit for students who are hoping to improve their language skills.

Acknowledgement

We sincerely express our gratitude to all the participants who provided their support by participating in our study. We would also like to thank the Department of Community Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, for the extensive support provided.

Abbreviations

AL – Advanced Level

EML – English Medium Learning

OL – Ordinary Level

Ethics approval and consent to participate:

Consent and Ethics approval from the research ethics committee of the Faculty of Medical Sciences,

University of Sri Jayewardenepura. (Rec no – CM/02/21) – Annexed

Consent for publication: Consent implied

Availability of data and material:

The data sets used/or analysed during the current study are available from the corresponding author upon request.

Competing interests:

No financial or non-financial competing interests

Funding: None

Author's contribution

CCA, ARA, GSA, VVA and AID contributed to the literature search, methodology, acquisition of data, analysis and interpretation of data and drafting the manuscript. The conceptualisation of the study was done by CSEG and AHDS, who were the overall supervisors. All authors proofread the final version of the manuscript.

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Frailty in Old Age in Sri Lanka: A Narrative Review

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Introduction

Frailty has emerged as a central construct in geriatric medicine, describing a state of increased vulnerability to stressors due to age-related decline across multiple physiological systems. Clinically, frailty is associated with higher risks of falls, disability, hospitalisation, institutionalisation and mortality, often independent of chronological age and comorbidity burden. Internationally, frailty prevalence among community-dwelling older adults in Asia ranges from about 3.5% to over 50%, depending on the population and tools used, with a pooled estimate of 20–25% in many meta-analyses of Asian cohorts [1].

Sri Lanka is one of the fastest-ageing countries in Asia. Demographic projections by the Department of Census and Statistics and UNFPA indicate that the proportion of older persons (≥60 years) will rise from 12.4% in 2012 to around 22–25% by the early 2040s, meaning that one in four Sri Lankans will be an older person by 2041[2]. This demographic shift is already reshaping the country's disease profile, with non-communicable diseases (NCDs), multimorbidity and functional decline dominating the morbidity landscape in older adults. Recent policy commentary has emphasised that the health system must adapt rapidly to this demographic reality, with healthy ageing and geriatric care identified as urgent priorities[3]. Within this context, frailty provides a unifying framework to understand and address the complex needs of older people in Sri Lanka.

This review synthesises available evidence on frailty in Sri Lanka, including its epidemiology, determinants, clinical consequences, assessment practices, and management strategies, while situating local findings within broader Asian and global literature. It also highlights health system and policy implications and identifies priority areas for future research. Throughout, only data that can be verified from published or publicly accessible sources are cited.

Epidemiology of Frailty in Sri Lanka.

The most robust population-based estimate of frailty in Sri Lanka comes from a cross-sectional study of rural community-dwelling older adults in Kegalle district. Using the Fried frailty phenotype, Siriwardhana and colleagues reported a frailty prevalence of 15.2% (95% CI 12.3–18.6) and pre-frailty prevalence of 48.5% (95% CI 43.8–53.2) among adults aged 60 years and over[4]. This places Sri Lanka squarely within the range observed in other Asian countries, where community-dwelling frailty prevalence typically lies between 5% and 30% [1]. Importantly, the Kegalle study also showed that frailty was strongly associated with increasing age and lower socioeconomic position, as reflected by occupation and educational level [4].

A subsequent study from the same rural district examined the association between frailty and disability, demonstrating that frail and pre-frail older adults had substantially higher rates of limitations in instrumental activities of daily living (IADL). Among frail older adults, 84.4% had at least one IADL limitation, with frailty and pre-frailty both independently associated with poorer functioning after adjusting for demographic and clinical covariates [4]. Another analysis from this cohort found that both frailty and pre-frailty were associated with poorer health-related quality of life, even after adjustment for multiple confounders [5]. Together, these rural studies underline that frailty is common and clinically meaningful in Sri Lankan community settings.

Data from clinical settings indicate even higher frailty prevalence. A 2023 study from the outpatient department of the University Hospital Kotelawala Defence University assessed 406 patients aged ≥65 years using the PRISMA-7 questionnaire and reported that 39.7% (95% CI 34.9–44.6) were frail [6]. Frailty was more prevalent among men than women in this clinic-based sample, and frailty prevalence increased with age, with over 60% of those aged ≥85 years classified as frail [6]. This figure is substantially higher than the rural Kegalle estimate, which is expected because hospital outpatient populations are enriched with individuals living with multiple chronic conditions. The same paper cites an earlier Colombo district study using a locally validated frailty instrument that reported a frailty prevalence of 14.9% among community-dwelling older adults, with higher rates among those aged ≥75 years [6]. Although details from that Colombo study are available only in abstract form, taken together, these data suggest that community prevalence may cluster around 15–20%, with marked increases in clinical and higher-

risk populations. At the regional level, a systematic review and meta-analysis of frailty in Asian community-dwelling older adults (including Sri Lanka) reported a pooled frailty prevalence of 20.5% and pre-frailty prevalence of 43.9%, with substantial heterogeneity by country, setting and instrument [7]. Sri Lankan estimates, especially the Kegalle community study and the KDU outpatient cohort, fall within the upper range of this spectrum, signalling a significant frailty burden that is likely to grow as the population ages.

Determinants of Frailty: Biological, Clinical and Social.

Frailty in Sri Lanka arises from a multifactorial interplay of biological ageing, chronic disease, nutritional deficiencies, psychosocial factors and environmental conditions. While many determinants mirror those identified in global literature, local studies shed light on several context-specific features.

Biologically, sarcopenia—the age-related decline in muscle mass and strength—appears to be a key driver and correlate of frailty. Although national prevalence estimates of sarcopenia are limited, Sri Lankan research and regional reviews suggest that sarcopenia becomes increasingly common with age and is strongly influenced by nutrition, physical activity and comorbid disease [8]. A recent cross-sectional study from Polonnaruwa district, for example, reported a sarcopenia prevalence of 49.6% among older adults, with slightly higher rates in women than men [9]. Another study of older adults in institutional care found severe sarcopenia in a majority of those classified as sarcopenic, highlighting the vulnerability of institutionalised populations [10]. Although these studies focused on sarcopenia rather than frailty per se, they underscore the high burden of muscle impairment, which is a key physical component of frailty.

Nutritional factors are central to the frailty pathway. A community-based study of older adults in Sri Lanka found that 35.3% were undernourished using a composite anthropometric index, with undernutrition more common in women, the oldest-old, and those of lower socioeconomic status [11]. Another national-level analysis reported that poor dietary variety was common across age groups and that increasing age was associated with higher odds of low muscle mass [12]. These findings resonate with clinical impressions that many older Sri Lankans consume diets low in high-quality protein and micronutrients, particularly in rural and low-income settings, contributing to sarcopenia, frailty and functional impairment.

Multimorbidity and non-communicable diseases (NCDs) represent another major determinant of frailty. The KDU outpatient study showed high rates of hypertension (49.5%), dyslipidaemia (45.6%) and diabetes mellitus (38.7%) among older attendees, with nearly three-quarters having three or more comorbidities [6]. These patterns are consistent with national data showing that cardiovascular disease, diabetes and chronic kidney disease dominate hospital admissions and outpatient visits in older age groups[13]. In frail older adults, such multimorbidity may lead to cumulative deficits across multiple organ systems, amplifying vulnerability.

Psychosocial and socioeconomic factors are equally important. In the rural Kegalle frailty study, lower education and manual or agricultural occupations were associated with greater odds of frailty and pre-frailty, suggesting that cumulative lifetime disadvantage and physically demanding work may predispose to later-life vulnerability [4]. The same research group reported that frail and pre-frail older adults had significantly worse health-related quality of life than robust peers, even after accounting for age and comorbidities, indicating that frailty is intertwined with psychosocial well-being [5]. Broader work on ageing in Sri Lanka has highlighted that many older people face financial insecurity, social isolation, and reduced family support due to labour migration and changing family structures, which further undermine resilience in late life [2].

Environmental and healthcare-system factors also shape frailty risk. Rural elders may face greater barriers to healthcare access, rehabilitation services and assistive devices, while urban low-income populations often live in congested environments with fall hazards and limited space for physical activity. Scoping work on falls among older adults in Sri Lanka emphasises the interaction between individual frailty, environmental risks (such as poor lighting and uneven floors) and lack of preventive services [14]. The absence of systematic geriatric assessment in most clinical settings means that frailty and its determinants often remain unrecognised until advanced.

Clinical Consequences: Disability, Falls, Hospitalisation and Mortality.

Sri Lankan and international data converge on the conclusion that frailty is strongly associated with adverse outcomes. In the rural Kegalle cohort, frail and pre-frail older adults had significantly higher levels of functional disability and limitations in IADL than robust individuals, with frailty status independently predicting poorer functioning [15]. The same group showed that frailty and pre-frailty were associated with lower quality of life, even after

controlling for multiple confounders [5]. These findings mirror international evidence that frailty is a powerful predictor of disability, reduced quality of life and loss of independence.

Falls constitute one of the most visible and costly consequences of frailty. A community-based study from Southern Sri Lanka, involving rural older adults, reported a 34.3% prevalence of falls and 9.6% prevalence of recurrent falls in the preceding year [16]. Risk factors included dizziness, difficulty walking and visual impairment. Although frailty was not explicitly measured in that study, such risk factors are typical components of frailty syndromes and are likely to co-occur. A more recent study of institutionalised older adults in Kandy district reported a falls prevalence of 47.1%, with 28.5% classified as fallers and 18.6% as frequent fallers[17]. Lower body flexibility and reduced cardiovascular endurance were significantly associated with falling, pointing again towards the importance of sarcopenia and deconditioning in the frailty-falls nexus. A scoping review of falls among older adults in Sri Lanka highlighted that falls represent a major cause of injury, disability and health service use, and that falls risk is likely higher among frail individuals, though specific frailty-falls data remain limited [14].

At the national level, Global Burden of Disease estimates indicate that falls among older people in Sri Lanka account for around 3.1% of total years lived with disability (YLDs), underscoring their substantial contribution to the country's disability burden [18]. Given that frailty is a consistent predictor of falls in international research, it is highly plausible that frailty is a major upstream driver of this burden in Sri Lanka as well.

Hospitalisation and health service use are also closely linked to frailty. In the KDU outpatient study, frail older adults commonly presented with musculoskeletal pain, dizziness, leg ulcers and other chronic complaints, and a notable proportion required hospital admission [6]. Although the study did not specifically examine outcomes by frailty status, international data consistently show that frail older adults have higher rates of hospitalisation, longer lengths of stay and more complications than non-frail peers [1]. Local geriatric and health policy commentaries warn that as the frail older population grows, demand on acute care, rehabilitation and long-term care services will increase sharply, straining existing resources [3].

Mortality data specific to frailty in Sri Lanka are sparse, but multiple international cohort studies and meta-analyses demonstrate that frailty is a strong predictor of all-cause mortality, with frail individuals experiencing two- to four-fold higher death rates compared with robust peers[1]. Given similarities in patterns of frailty, comorbidity and healthcare access, it is reasonable to infer that frailty likely confers substantially elevated mortality risk among Sri Lankan elders as well, particularly in the context of hospitalisation and major surgery.

Frailty Assessment in Sri Lankan Practice and Research

Frailty can be measured using deficit-accumulation indices, physical phenotype models or pragmatic screening tools. In Sri Lanka, research has utilised several internationally recognised instruments, but no single tool has yet been universally adopted in routine clinical practice.

The rural Kegalle study used the Fried frailty phenotype, which operationalises frailty based on weight loss, exhaustion, low physical activity, slow walking speed and weak grip strength [4]. This model, while resource-intensive, provides a well-validated measure of physical frailty and has facilitated comparison with international cohorts. The same research programme has also examined how frailty, so defined, relates to disability and quality of life [15].

In the KDU outpatient study, frailty was assessed using the PRISMA-7 questionnaire, a brief seven-item instrument originally developed for primary care screening [6]. The authors note that PRISMA-7 has not been formally validated in Sri Lanka, but it was chosen for its feasibility in a busy outpatient setting. This underscores a common tension between psychometric rigour and clinical practicality in low-resource environments.

Other Sri Lankan work (cited within Jayasekera et al.) has used a locally validated frailty instrument in Colombo district, and there are emerging efforts to adapt geriatric quality of life tools—such as the Sinhala version of the SarQoL® questionnaire for sarcopenia—for local use [19]. However, no nationally endorsed frailty assessment guideline currently exists, and routine frailty screening in primary care, hospital admissions or surgical pre-assessment clinics is not yet standard practice.

Given Sri Lanka's resource constraints, simple tools such as PRISMA-7, the FRAIL scale or the Clinical Frailty Scale (CFS)—which rely on brief questionnaires or global clinical judgement—may be particularly suitable for systematic implementation, provided they are validated in local populations. The current literature demonstrates proof-of-concept that frailty can be measured in Sri Lankan settings, but scaling this up will require training, workflow integration and policy support.

Management of Frailty: Evidence and Sri Lankan Realities.

Frailty is dynamic and, especially in its early stages, potentially reversible or at least modifiable. International evidence supports multidomain interventions combining exercise, nutrition, medication review and comprehensive geriatric assessment (CGA) to slow or reverse frailty progression [1].

Exercise interventions, particularly programmes incorporating resistance training, balance exercises and aerobic activity, are among the most effective strategies for improving muscle strength, gait speed and overall physical function in frail older adults. While no large frailty-specific exercise trials have yet been published from Sri Lanka, local physiotherapy literature and falls-prevention research suggest that improving lower limb strength, flexibility and cardiovascular endurance can reduce the risk of falls in institutionalised elders [17]. These findings provide a strong rationale for integrating targeted exercise programmes into institutional and community care, even if initially on a small scale.

Nutritional interventions are equally important. Given the high prevalence of undernutrition and poor dietary variety among older Sri Lankans [11], interventions that ensure adequate caloric intake, increase high-quality protein consumption and address vitamin D and micronutrient deficiencies are likely to have a substantial impact on sarcopenia and frailty. However, access to dietitians and specialised nutrition services is limited outside tertiary hospitals, and financial constraints may limit older adults' ability to purchase protein-rich foods. Community-based nutrition programmes, social protection measures and caregiver education may therefore be necessary components of a national frailty strategy.

Medication review and deprescribing are particularly relevant in the context of multimorbidity and polypharmacy. While Sri Lankan data directly linking polypharmacy and frailty are limited, the KDU outpatient cohort shows high rates of multiple comorbidities treated with several medications [6]. Internationally, reducing inappropriate medications—especially psychotropics, anticholinergics and certain antihypertensives—has been associated with improved function and reduced falls, and similar approaches are likely beneficial in Sri Lanka. Deprescribing frameworks could be integrated into routine medical clinic reviews and discharge planning.

Comprehensive Geriatric Assessment (CGA), delivered by multidisciplinary teams, is considered the gold standard for managing complex older adults, including those with frailty. Meta-analyses from high-income settings show that CGA can improve functional outcomes and reduce institutionalisation; however, in Sri Lanka, CGA is currently available only in a few specialised units and is not widely implemented [13]. Scaling up CGA-like approaches—perhaps through simplified, team-based assessments in medical wards and outpatient clinics—could provide a pragmatic path forward.

Finally, social and psychological interventions are critical but understudied. The evidence that frailty and pre-frailty correlate with poorer quality of life in rural Sri Lanka [5] highlights the need for interventions that address loneliness, depression, caregiver burden and social participation. Existing structures—such as village-level Elders' Committees, religious organisations and community centres—could be leveraged for group exercise programmes, health education, screening and peer support, though formal evaluations are lacking.

Health System and Policy Implications.

Existing demographic and epidemiological analyses stress that Sri Lanka's population ageing will profoundly affect health service demand, particularly for chronic disease management, rehabilitation and long-term care [20]. Yet frailty is not explicitly incorporated into current national policies on older people or NCDs. The National Policy for Older Persons and related strategic documents focus primarily on social security, welfare and broad health service access rather than on frailty-specific assessment and management.

Recent commentaries have argued that embedding healthy ageing and geriatric care within the national health agenda is urgent, given projections that one in four Sri Lankans will be over 60 by 2041 and the growing dominance of NCDs [3]. Frailty provides a practical organising principle for such efforts. It could be used to risk-stratify older adults in primary care, guide referral to specialised services, inform surgical and intensive care decision-making, and identify those who would benefit most from community support and rehabilitation.

Several system-level gaps are evident from the available literature: the very limited number of trained geriatricians; lack of dedicated geriatric units in most hospitals; absence of standardised frailty screening protocols; inadequate rehabilitation and long-term care infrastructure; and poor coordination between health and social sectors in supporting frail elders and their caregivers [3]. Addressing these issues will require a combination of workforce development (including training internists, family

physicians and nurses in geriatric principles), service reorganisation (such as geriatric-friendly outpatient clinics and wards), and integration of frailty assessment into existing programmes (for example, NCD clinics and elderly "healthy lifestyle" clinics).

Research Gaps and Future Directions.

Despite the importance of frailty, the Sri Lankan evidence base remains limited to a handful of community and clinic-based cross-sectional studies and a small number of related sarcopenia and falls investigations.

Key gaps include the lack of:

- Longitudinal cohort studies tracking transitions between robust, pre-frail and frail states and their consequences;
- Randomised or quasi-experimental evaluations of exercise, nutrition or CGA interventions targeted at frail or pre-frail older adults;
- National or provincial surveys incorporating frailty measures to inform planning;
- Validation studies of simple frailty screening tools (e.g. CFS, FRAIL, PRISMA-7) in diverse Sri Lankan settings;
- Analyses of frailty in high-risk clinical populations, such as patients undergoing major surgery, dialysis or oncology treatments.

Addressing these gaps will be essential for designing context-appropriate interventions and convincing policymakers to invest in frailty-oriented services. Existing cohorts, such as the Kegalle rural studies and emerging sarcopenia and diet-related cohorts [4], provide strong foundations that could be extended through follow-up and expansion.

Conclusion.

Frailty is already a common and clinically significant condition among older adults in Sri Lanka, with community-based prevalence estimates around 15% and substantially higher rates in outpatient and institutional settings [4]. It is closely associated with disability, reduced quality of life, multimorbidity, falls and increased health service use [15]. As the country moves rapidly towards a demographic profile where one in four citizens will be an older person [20], frailty will become increasingly central to clinical practice, service planning and public health.

The existing Sri Lankan literature, though limited, clearly demonstrates that frailty can be measured, that it has major functional and quality-of-life consequences, and that it is tightly bound up with sarcopenia, undernutrition, multimorbidity and social vulnerability [4]. International evidence offers a rich toolkit of interventions—exercise, nutrition, CGA, deprescribing and falls prevention—that can be adapted to Sri Lanka's context.

Moving forward, integrating frailty screening into primary care and hospital workflows, strengthening community-based rehabilitation and nutrition support, building geriatric capacity, and embedding frailty in national ageing and NCD strategies will be critical to ensuring that longer lives for Sri Lankans are also healthier, more functional and more dignified. The task now is to translate this growing evidence base—however modest—into coordinated action across clinical, community and policy domains.

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