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Anatomy for All: Engaging Communities in Indonesia and Malaysia

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ABSTRACT

Anatomical literacy is fundamental for medical education, benefitting both medical students and the general population. Understanding human anatomy empowers individuals to make informed health decisions, supports early recognition of health issues, promotes adherence to treatment plans, and enhances communication with healthcare providers. Anatomical outreach programmes play a crucial role in disseminating this knowledge, making it accessible and relevant to diverse communities. These programmes foster public interest in anatomy, influence career choices in healthcare professions, and provide dynamic learning opportunities through hands-on experiences. In Indonesia and Malaysia, these programmes bridge the gap between healthcare services and the population, improving health literacy and access to care, especially for marginalised groups. Universities and medical schools engage with communities through initiatives such as educational visits, exhibitions, seminars, and practical sessions, addressing broader educational challenges like declining interest in science, technology, engineering and mathematics (STEM) subjects among students. By promoting anatomy education and public health literacy, these initiatives contribute to better health outcomes and inspire future generations to pursue careers in healthcare and STEM fields. This study explores how seven universities and their anatomy educators in Indonesia and Malaysia reach diverse communities, showcasing innovative approaches to anatomy education and community involvement. These efforts reflect a commitment to bridging the gap between academic knowledge and public health awareness in culturally similar neighbouring countries.

Keywords: Anatomy outreach, Anatomy outreach programme, Anatomy literacy, Community engagement, Health literacy

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INTRODUCTION

Anatomy, a core subject in medical and health education, provides essential knowledge about the human body's structure and function. Anatomical literacy has benefits far beyond the scope of medical education, significantly enhancing public health understanding (1). For the general population, a solid grasp of anatomy empowers individuals to make well-informed decisions about their health. This foundational knowledge supports early recognition of health issues, promotes adherence to treatment plans, and improves communication with healthcare providers (2). Additionally, it dispels myths about health conditions, reduces stigma, and fosters empathy, improving personal and family healthcare decision-making. Furthermore, introducing anatomical concepts to school children and youths not only reinforces these benefits but also increases their interest in science and motivation to learn, fostering a lifelong appreciation of health and science. Recent data indicate a worrying trend of declining interest in science, technology, engineering and mathematics (STEM) fields among school children and youths worldwide (3–5). While students exhibit a strong interest in STEM in the early phases of education, this interest declines as they grow older (6). This decline is particularly concerning given the growing demand for STEM professionals in the global job market. In Southeast Asia, science literacy is on a concerning downward trajectory, particularly in countries like Malaysia and Indonesia (5, 6). Recent assessments, such as the Programme for International Student Assessment (PISA), have shown a decline in students' performance in science subjects (4, 7), a trend that threatens the future scientific and technological competitiveness of these nations.

Anatomy outreach programmes underscore the critical importance of making anatomical knowledge accessible and relevant to diverse communities. This inclusive and innovative approach aims to disseminate anatomical education across various segments of society and enhance anatomical knowledge among various groups, including students and the general public (8). Indeed, such initiatives improve individuals' understanding of anatomical structures and foster interest in anatomy, potentially influencing career choices in healthcare professions (9). By offering hands-on experiences in anatomy laboratories and exposure to human body structures, outreach programmes provide dynamic learning opportunities for members of all age groups. Outreach programmes also enhance community engagement and education, leading to improved acceptance of healthcare activities (10) and increasing referrals to primary care by eliminating barriers to care (11). Furthermore, these programmes contribute to professional development and skills enhancement for both students and healthcare practitioners (12).

In the context of Indonesia and Malaysia, these outreach programmes are particularly vital, as they bridge the gap between healthcare services and the population, improving access to healthcare, especially for marginalised groups. Anatomy education in these nations plays a pivotal role in shaping healthcare practices and promoting health literacy (13). The healthcare and educational landscapes in Indonesia and Malaysia are evolving, with a growing emphasis on the importance of anatomy education in medical training and public health initiatives. Despite their shared colonial history, both countries independently

strive to develop their human resources, with education systems tailored to meet their unique needs and goals (14). Through collaborative efforts and educational initiatives, both countries are enhancing the public's understanding of anatomy, ultimately improving health outcomes for their communities.

By examining the current state of anatomy education and community outreach in Indonesia and Malaysia, this article aims to highlight the critical importance of engaging diverse communities in anatomical education and evaluate community acceptance of anatomy outreach programmes and their influence on enhancing health literacy. By critically analysing the existing frameworks and the ongoing efforts in anatomy outreach programmes, this article provides insights into how Indonesia and Malaysia are leveraging these initiatives to foster more informed and health-conscious populations. This early exploration can pave the way for future learning and inspire the next generation of healthcare professionals and scientists.

University Involvement in Anatomy Outreach Programmes

Anatomy education is a core component of the medical curriculum in Indonesian and Malaysian medical schools, which follow traditional, integrated, or hybrid models (15, 16). These curricula rely heavily on theoretical instruction complemented by practical sessions. Numerous medical schools in both Indonesia and Malaysia have established robust anatomy departments. However, many of these schools face shortages of cadavers and advanced anatomical models, which can hinder hands-on learning (17, 18). While traditional methods like cadaver dissection are still highly valued (19), integrating modern technology and innovative teaching approaches is an ongoing process. Increasingly, medical schools are incorporating tools such as virtual dissection tables and three-dimensional (3D) models to enhance anatomy education (20). There is also a need for ongoing training and development of anatomy educators to ensure they keep updated with modern teaching methods and technological advancements (15, 19). By addressing these challenges and continuously refining their educational strategies, Indonesian and Malaysian medical schools are committed to delivering high-quality anatomy education that aligns with the evolving needs of medical students and the healthcare sector. This holistic approach underscores the importance of ongoing innovation and adaptation in medical education to meet the dynamic demands of healthcare delivery and public health.

In addition to these efforts, Indonesian and Malaysian medical schools are expanding their focus to include community education and outreach (13). Initiatives are being developed to educate the broader public about basic anatomy and health, aiming to improve health literacy among communities. Despite these proactive steps, Indonesia and Malaysia are facing several national challenges. These challenges underscore the importance of integrated approaches that not only strengthen anatomy education but also address broader educational and health literacy needs across diverse populations. According to a report from the Organisation for Economic Co-operation and Development (OECD), more jobs in the STEM domain are needed, and this demand is expected to increase in the coming years (21). To address these challenges, Indonesia and Malaysia are prioritising initiatives to enhance STEM education across all educational levels. This measure includes improving science literacy among the general population through public awareness campaigns and community outreach initiatives.

Overall, higher education institutions (HEIs) serve as hubs of knowledge and innovation, fostering partnerships that benefit both the academic community and the broader public. By engaging in anatomy outreach programmes, universities not only fulfil their social responsibility but also enrich the learning experience of students and contribute to community development. Anatomy departments in HEIs in Indonesia and Malaysia have leveraged their resources and expertise to engage with the community in various ways. Some institutions open their anatomy laboratories and museums to the community for educational programmes and workshops. They also offer access to specialised equipment and resources, such as virtual museums and advanced anatomy software, which may not be readily available elsewhere. These initiatives help demystify the subject of anatomy, making it more accessible and engaging to the public. Faculty members in anatomy departments play a crucial role in planning and executing these outreach activities, collaborating with community organisations, schools and local governments to identify needs and develop relevant programmes. Activities might include health screenings, educational seminars and cultural events, all with a focus on anatomical education and health literacy. Faculty members also contribute their expertise by giving lectures on specialised topics, conducting hands-on workshops and mentoring students involved in anatomy-related projects within the community. They guide students through research initiatives that address local health challenges and improve public understanding of anatomy.

Students in medical and allied health programmes also actively participate in these outreach efforts, applying their knowledge and skills to real-world issues. They undertake specific projects, such as public health campaigns focused on anatomy and health education, environmental conservation efforts that highlight the impact on health, and technology training for underserved communities, emphasising the importance of anatomical knowledge. Students also volunteer their time to assist in community service initiatives, providing direct support to residents and enhancing their practical skills.

Additionally, anatomy departments in HEIs in Indonesia and Malaysia are responsible for ensuring the successful implementation of community outreach programmes. Various approaches and tools have been employed in performing anatomy community outreach, depending on the needs and target audience. These approaches include anatomy laboratory education programmes, workshops, school, museum, and virtual outreach programmes, anatomy outreach kits, and anatomy art programmes (22). These diverse methods ensure that information is accessible to the target community and foster holistic participation.

METHODS

This study highlights several models of anatomy outreach programmes that have been successfully implemented in Indonesia and Malaysia. Each university programme is unique and has its own objectives, utilising diverse strategies to engage communities and enhance public health literacy. For this study, data were collected from lecturers and researchers in the field of anatomy from both countries, including four from Indonesia and three from Malaysia. The four universities from Indonesia are the Universitas Sebelas Maret (UNS) in Surakarta, a legal entity state university located in Central Java; Universitas Jenderal Soedirman (UNSOED) and Universitas Lambung Mangkurat (ULM), which are public service agency state universities located in Central Java and South Kalimantan, respectively; and one private university located in Yogyakarta, Universitas Islam Indonesia (UII). Meanwhile, the three universities from Malaysia are Universiti Teknologi MARA (UiTM), Universiti Sains Malaysia (USM) and Newcastle University Medicine Malaysia (NUMed).

RESULTS

Based on our exploration, it appears that the anatomy outreach programme in Indonesia has not been widely publicised despite the numerous activities aimed at promoting anatomy and anatomical education to the general public. In contrast, anatomy outreach programmes in Malaysia are more structured and are often integrated into the community service initiatives of academic institutions. Many Malaysian institutions organise these programmes in conjunction with World Anatomy Day (WAD), celebrated annually on 15th October. These programmes can be categorised into three main types: outreach programmes for preschool students, school students and the general public. The following sections elaborate on each of these models, providing examples from four Indonesian and three Malaysian universities to illustrate how they effectively engage various community groups.

The Anatomy Outreach Programme at the Faculty of Medicine, UNS, Indonesia

The community outreach programme conducted by the Department of Anatomy at the Faculty of Medicine, UNS in Surakarta, includes several key activities aimed at engaging different segments of the community and promoting anatomical education. These activities include hosting visits, during which the department welcomes diverse community groups, such as school children from kindergarten to elementary school, religious committees and the general public. These visits offer the public an opportunity to learn about anatomy in an interactive and accessible way. Additionally, the department organises exhibitions and special activities at least twice a year, typically during the university's anniversary celebrations and the school holiday period. These events are designed to showcase anatomical knowledge and foster public interest in the field.

Regarding anatomy teaching, the department has implemented a mentoring programme in which senior students are appointed as student assistants to provide mentorship to junior students on topics related to anatomy. This peer-to-peer educational approach not only helps reinforce the mentors' knowledge but also makes the learning process more accessible and effective for the junior students. In addition to their mentoring roles, these assistant students also participate in anatomy outreach programmes.

Moreover, the Department of Anatomy collaborates with other non-governmental agencies to conduct community service activities on predetermined topics. During these activities, anatomy lecturers and student assistants introduce anatomy to the community. The content is tailored to align with national priority health programmes, addressing issues such as stunting, anaemia and non-communicable diseases like diabetes mellitus and hypertension. This approach ensures that the anatomical materials provided are relevant and beneficial to the community. The department also collaborates with schools that have previously visited the facility. Although these collaborations have not been formally legalised due to the absence of specific university regulations regarding outreach, they remain an integral part of the programme. After implementing these activities, the department periodically evaluates client satisfaction and requests feedback from participants, ensuring continuous improvement and responsiveness to community needs.

Based on our evaluation, participants' knowledge and understanding of their bodies and health had improved, empowering them to maintain their health more effectively. Figure 1 illustrates the anatomy outreach activities that were organised by the Department of Anatomy, Faculty of Medicine, UNS.

Figure 1: (A) An instructor explaining how to study anatomy to visiting high school students; (B) Various responses from senior high school students during their visit to the anatomy laboratory, UNS; and (C) A visitor trying out ARnatomy software during the university's anniversary visit.

The Anatomy Outreach Programme at Faculty of Medicine, UNSOED, Indonesia

The Anatomy Outreach Programme at the Faculty of Medicine, UNSOED in Central Java is an innovative initiative designed to enhance public understanding and appreciation of human anatomy. The programme involves diverse activities such as hosting visits from various community groups, including school children and university students, providing anatomy learning sessions, and organising exhibitions and special events. By mentoring assistant lecturers and leveraging social media, the programme aims to introduce anatomy to a broad audience, thereby fostering an interest in the subject and promoting health awareness.

Community engagement is a core component of the programme, with direct involvement in local communities to address health issues pertinent to individuals' daily lives. Activities focus on raising awareness about diseases related to farming activities, facilitated by medical consultants who integrate anatomical education into their discussions. This approach not only educates the community about health risks but also highlights the importance of anatomical knowledge in understanding and preventing diseases. Surveys and feedback mechanisms are employed to evaluate the programme's impact and ensure continuous improvement. The participants who visited the exhibition and took part in the outreach activities indicated that they gained a better understanding of their body structure and were committed to taking better care of it.

Support from UNSOED is evident through the establishment of new facilities for anatomy practicals and the procurement of advanced learning media, such as plastination and Anatomage tables. Despite human resource and infrastructure challenges, the university is committed to enhancing the anatomy learning experience. Plans include opening the laboratory to the public, offering health education programmes, collaborating with educational institutions and expanding the university's online presence. These efforts aim to solidify the programme's role in promoting anatomy education and health awareness within the community. Figure 2 illustrates the anatomy outreach activities that were organised by the Faculty of Medicine, UNSOED.

Figure 2: (A) A visit from elementary students and (B) other university students to the anatomy laboratory, UNSOED.

Anatomy Outreach Programme at the Faculty of Medicine, ULM, Indonesia

The Department of Anatomy in the Faculty of Medicine, ULM, South Kalimantan, has conducted an outreach programme in the form of the Avicenna Medical Science Olympiad for high school students for a long time. This competition aims to introduce medical science, particularly anatomy, to high school students across Indonesia, with a special focus on the island of Kalimantan. The competition not only seeks to introduce the Faculty of Medicine ULM to high school students but also to enhance their interest in human body structures and inspire the younger generation to explore careers in medicine. The outreach activities include public seminars for high school students about human organ systems, medical science quizzes, and introductions to the anatomy laboratory and human body models. Anatomy lecturers are involved in judging and evaluating the students as they present their knowledge of human anatomy. Through this event, students from across Indonesia can directly observe how anatomical knowledge is built, studied at the Faculty of Medicine, and applied in everyday practice.

Additionally, the department personnel conduct public seminars and educational outreach sessions, presenting anatomical images and their relation to diseases. These sessions are typically held in community gathering places such as mosques and Islamic boarding schools, considering the Islamic religious nature of the Kalimantan community. Health and anatomy education is also delivered via local radio in the city of Martapura, South Kalimantan. This strategy allows for a wider audience reach compared to the approach mentioned above. Figure 3 illustrates the anatomy outreach activities organised by the Faculty of Medicine, ULM.

Figure 3: (A) A group of students presenting their work at the Avicenna Medical Science Olympiad, organised by ULM; (B) Two judges from the Anatomy Department, ULM, assessing the anatomical knowledge of participants in the Avicenna Medical Science Olympiad; and (C) High school students learning about anatomy in the human anatomy laboratory at ULM.

Anatomy Outreach Programme at the Faculty of Medicine, UII, Indonesia

The Faculty of Medicine at UII in Yogyakarta emphasises high-quality anatomy education through the Department of Anatomy, which includes five lecturers, two laboratory assistants and 25 student assistants. The department's curriculum features lectures, tutorials and practicals supported by a well-equipped anatomy laboratory. Prioritising safety and comprehensive learning, the department is developing an anatomy museum within the laboratory, utilising diverse educational media such as formalin-preserved and ethanol-preserved cadavers, plastinated models, mannequins, anatomy atlases, anatomy software and digital anatomy table.

The anatomy museum is being improved gradually on an annual basis. The museum is primarily designed as a learning facility for students of the Faculty of Medicine at UII. It serves as a comprehensive venue where these students can learn about human anatomy in a hands-on environment. In addition to internal learning processes, the anatomy museum is also available to external parties for educational purposes. Several educational institutions in Yogyakarta collaborate with the UII Anatomy Department on anatomy practicums in the museum. In addition, the museum regularly receives visitors from other institutions, ranging from kindergarten, elementary, middle, and high school to diploma and undergraduate programmes across Indonesia. The feedback from the participants indicated that they were amazed by the body's structure and expressed an intention to take better care of their health. Figure 4 depicts the anatomy outreach activities conducted by the UII Faculty of Medicine.

Figure 4: (A) Kindergarten; (B) elementary; (C) junior high, and high school students visiting the FK UII Anatomy Museum. Visitors learn about human anatomy through table displays and mannequins.

Anatomy Outreach Programme for Pre-school Students by UiTM, Malaysia

The Department of Anatomy in the Faculty of Medicine, Universiti Teknologi MARA Sungai Buloh campus, organised Young Anatomist Day, aiming to spark young children's curiosity about anatomy through a series of interactive activities. This event was the first programme in Malaysia to introduce anatomy knowledge to young children in a hands-on, game-based format. The half-day initiative was designed to provide young anatomists, 5–12 years of age, with opportunities to explore various aspects of anatomy, including anatomical dissection, gross anatomy, histology, embryology and applied anatomy. This objective aligns with the Science, Technology, Engineering, Art, and Mathematics Education Guide created by the Ministry of Education of Malaysia, which aims to improve early childhood education.

During the programme, the young anatomists were divided into small groups. Each group received a treasure map indicating the locations of 10 anatomy station games. At each station, quizzes and explanations were provided by game masters to further spark the young anatomists' interest in anatomy. At the end of the programme, all participants were gathered, and Young Anatomist Awards were given to the best groups. A short question-and-answer session was also held for the young anatomists and their parents to answer simple anatomy questions.

The feedback from parents was overwhelmingly positive, with 100% stating that the programme had high educational value and was fun, providing young anatomists with a unique and immersive learning experience. The programme not only imparted knowledge but also developed valuable soft skills, such as teamwork and communication, which will benefit the children throughout their lives. The Department of Anatomy hopes to organise the Young Anatomist ExploRACE programme on an annual basis. Figure 5 shows the event that was the first programme in Malaysia to introduce anatomy knowledge to young children in a hands-on, game-based format. The half-day initiative was designed to provide young anatomists, 5–12 years of age, with opportunities to explore various aspects of anatomy, including anatomical dissection, gross anatomy, histology, embryology and applied anatomy.

Figure 5: (A) The kids were learning anatomy by labelling anatomical structures on the skeleton; (B) Creating 3D anatomical art using clay by observing the 3D structure of the bones.

Anatomy School Outreach Programmes by USM, Malaysia

The Department of Anatomy at the School of Medical Sciences, Universiti Sains Malaysia actively participates in an anatomy outreach programme, organising exhibitions, competitions and biology classes for secondary school students in rural areas of Kelantan. The main aim of the School Anatomy Outreach Programme in Kelantan is to increase interest in learning science and improve science literacy among school children and youths in the rural areas of Kelantan, addressing the significant decline in the number of students pursuing careers in science. The department also frequently welcomes primary and secondary school students to the anatomy museum and shares anatomical knowledge with the general public through a self-developed virtual museum, which is freely accessible online. Over the past five years, the anatomy museum has received more than 5,000 visitors, including children participating in educational trips. Additionally, the department organises competitions for school children during the celebration of WAD.

On 15th September 2021, during the COVID-19 pandemic, the WAD celebration at USM was held online. One of the activities organised during the event was called Let's Play Dough, designed for children under 13 years of age. Participants used plasticine to create models of organs or anatomical structures based on their creativity. The organiser also provided a video showing children how to make their own playdough, which was fun for the children and cost-effective. The theme for the activity was modelling human body parts or organs. The objective was to foster interest and enhance children's creative thinking skills as well as provide early exposure to the structure of the human body. The children were required to submit photographs of their creative artwork as evidence of their learning. Figure 6 presents several examples of the imaginative artwork produced by the children. The introduction of basic anatomy knowledge to young children was both crucial and fascinating for them. They enjoyed modelling their internal organs and were eager to learn about their body structures in greater detail (13).

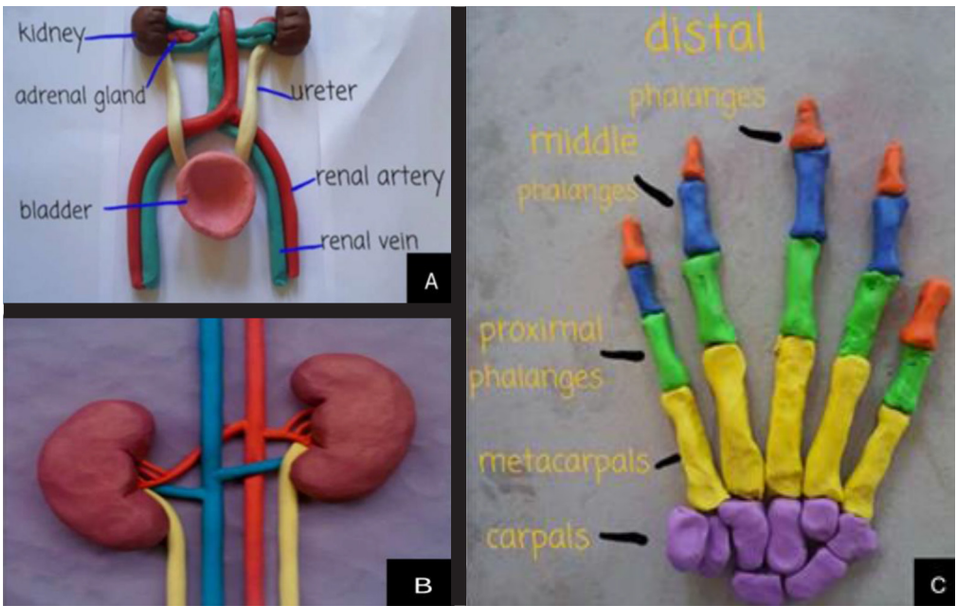

Figure 6: Creative artwork by the kids in the Let's Play Dough activity during WAD 2021 celebration at USM. (A) Organs involved in the urinary system; (B) Kidneys, renal vessels and ureters; and (C) Small bones that constitute the hand (adapted from Simok et al. [13]).

On 20th May 2024, the Anatomy Department at USM conducted an anatomy outreach programme as part of the Science and al-Quran Carnival at Falahiah Islamic Secondary School in Kelantan, Malaysia. The event, which ran from 8:30 am to 2:00 pm, attracted 340 high school students, aiming to boost interest in science education against the backdrop of declining science enrolment. The programme featured anatomy models, including plastic, plastinated and jar specimens. The models were displayed together with their anatomical descriptions and corresponding Quranic verses to show the parallelism between science and the holy Quran. A fun anatomy quiz further engaged students, many of whom were exposed to anatomy for the first time. The event also involved students and teachers from eight nearby schools, sparking their interest in organising similar future events. The verbal and online feedback indicated that students were highly satisfied with this event and that it had increased their interest in pure science education. Figure 7 details the anatomy outreach programme implemented during the Science and al-Quran Carnival at Falahiah Islamic Secondary School.

Figure 7: Full attendance of students actively engaging with insightful questions and attentively listening to explanations by USM anatomy lecturers.

Anatomy Outreach Programme for the General Public Implemented by the NUMed, Malaysia

In commemoration of WAD, the Anatomy Working Group (AWG) of NUMed, in collaboration with the Newcastle Anatomy (UK) team, organised a public exhibition to enhance anatomical awareness, promote the diversity of anatomical disciplines, and attract young scientists and the community to the field of anatomy. This large-scale event was hosted at AEON Mall Bukit Indah, one of the largest and busiest shopping centres in the Iskandar Puteri region. It was the first event of its kind at the mall, and the AEON Bukit Indah management team was delighted by its overwhelming success, evidenced by the hundreds of visitors who engaged with the booths and activities. The day-long programme was a collaborative effort between the AWG, the NUMed Asian Medical Students' Association (AMSA), and AEON Mall Bukit Indah. More than 20 interactive anatomical booths, activities and games were set up to engage the public. The exhibition also showcased over 50 anatomical models, including skeletal muscles, the heart, brain, eye, whole torso, skulls, bones and reproductive organs. Securing sponsorships from major companies like Elsevier and Legoland, as well as support from the AEON Mall, was essential in planning an event of this magnitude.

To encourage visitors to explore the various booths, a stamp card system was introduced at the registration desk. Participants could collect stamps at each booth they visited, and upon completing the card, they were eligible to receive a gift provided by the sponsors. The event garnered significant attention, particularly due to the showcasing of anatomical models, including some newly built interactive models created by AMSA students and virtual dissections using the Complete Anatomy software programme.

In addition to the exhibition booths and activities, a highlight of the event was the anatomy-themed body painting and catwalk competition. This creative showcase not only attracted shoppers to watch the catwalk but also drew many participants to the body painting booth,

with numerous attendees requesting anatomy-themed paintings. Another visually striking component of the exhibition was the display of realistic-looking edible anatomy cakes featuring meticulous depictions of the head, brain, muscles, blood vessels, nerves, bones and brain tissues. The handmade anatomy cake, masterfully created by one of the AWG members, was ceremoniously cut and distributed to both the organising committee and the public during the closing ceremony. Additionally, anatomy-themed cupcakes were made available for purchase, further captivating the audience's attention and imagination.

Feedback from participants was overwhelmingly positive, with many expressing appreciation for the rare opportunity to be exposed to such an engaging and informative exhibition. The organisers hope to make this an annual event, providing the public with an enduring and enriching experience in the field of anatomy. Figure 8 details the public exhibition organised by the NUMed Department of Anatomy.

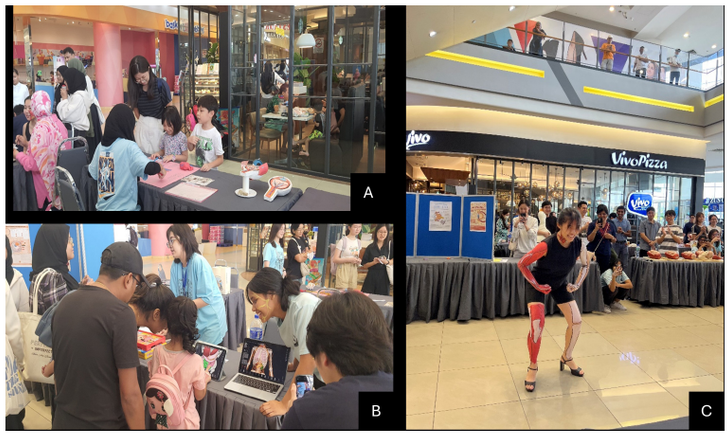

Figure 8: (A) Engaging the public through interactive, play-based activities that utilise anatomy models and student demonstrators; (B) Activities using 3D anatomy software designed for young children and their families to explore and appreciate digital anatomy teaching tools; and (C) An anatomy body art painting competition in which models creatively showcased their body paintings.

CHALLENGES AND SOLUTIONS

Despite the crucial role of anatomical outreach programmes in promoting health literacy and awareness, particularly in underserved and diverse communities in Indonesia and Malaysia, these initiatives often encounter several challenges that can impede their implementation and effectiveness. Addressing these challenges through innovative solutions and strategic approaches is essential for enhancing the impact of anatomical outreach programmes.

One of the primary challenges is resource limitations. Anatomical outreach programmes frequently face constraints related to limited resources, which can significantly hinder their activities, affecting staffing, materials, and the scope and reach of the programmes. In order to mitigate these challenges, it is crucial to seek additional funding from governmental and non-governmental sources. Establishing partnerships with organisations that share similar goals can also help by pooling resources and expertise. Moreover, optimising resource allocation by prioritising high-impact activities and cost-effective methods can maximise the effectiveness of outreach efforts (23). Addressing resource limitations can set the stage for more effective community engagement.

Engaging diverse communities presents another significant challenge, as varying levels of interest, accessibility and cultural factors can affect participation. Tailoring outreach initiatives to meet the specific needs and preferences of different communities is essential. Conducting needs assessments to understand community priorities and preferences, fostering trust through transparent and respectful communication, and promoting inclusivity and cultural sensitivity are all crucial in this process (24). By collaborating with community leaders and members, programmes can be designed and implemented in ways that resonate more deeply with the target audience. Effective community engagement directly addresses barriers to access (25).

Barriers such as lack of awareness, stigma and logistical challenges can impede individuals' access to anatomical outreach services. In order to overcome these barriers, it is important to implement targeted outreach efforts that raise awareness about the benefits and availability of services. Educational campaigns can help address stigma by providing accurate information and fostering a supportive environment. Additionally, logistical support, such as transportation and flexible scheduling, can make it easier for individuals to participate in outreach activities (26). Overcoming these barriers contributes to the long-term sustainability of the programmes.

It is essential to tackle challenges concerning funding, staffing and community support to maintain the long-term viability of anatomical outreach programmes. Developing sustainable funding models, such as securing long-term grants and exploring revenue-generating activities, can provide financial stability (27). Building capacity within the community by training local staff and volunteers can enhance programme continuity. Furthermore, fostering partnerships with stakeholders, including local governments, healthcare providers, and community organisations, can garner broader support for the programme. Moreover, sustainability is closely linked to effective evaluation and monitoring (28).

Effective evaluation and monitoring are essential for assessing the impact of anatomical outreach programmes and identifying areas for improvement (29). Implementing robust evaluation frameworks that include both quantitative and qualitative measures can provide comprehensive insights into programme effectiveness. Systematic data collection and analysis enable continuous improvement and adaptation of outreach strategies. Additionally, feedback from participants and stakeholders can be used to inform programmatic decisions and enhance responsiveness to community needs (30). Continuous evaluation and adaptation also require cultural sensitivity to ensure that programmes remain relevant and effective within the community.

It is also crucial to address cultural differences and sensitivities to ensure that anatomical outreach programmes are inclusive and relevant to diverse communities. Engaging community members in the design and implementation of programmes can ensure that cultural norms and practices are respected, and adapting outreach strategies to align with cultural preferences and values can enhance the acceptance and impact of the programmes (31). Culturally sensitive approaches foster trust and cooperation, making it more likely that community members will engage with and benefit from these programmes. Indeed, ensuring cultural sensitivity is crucial in efforts to foster health literacy. Furthermore, to effectively promote health literacy through anatomical outreach, it is necessary to address educational gaps, misinformation and access barriers. Providing accurate and accessible health information is fundamental. This can involve offering educational resources in multiple languages and using various formats, such as visual aids and interactive sessions, to cater to different learning styles (8). Collaborating with local healthcare providers to deliver

targeted health education initiatives can also enhance the reach and effectiveness of these programmes (32).

Recognising and addressing these challenges through thoughtful and strategic approaches can significantly enhance the effectiveness, reach, and impact of anatomical outreach programmes. This measure is crucial, as these programmes have the potential to engage diverse communities, promote health literacy, and ultimately contribute to better health outcomes.

CONCLUSION

Anatomy outreach programmes in Indonesia and Malaysia have demonstrated significant potential in enhancing health literacy and empowering communities. By engaging the public through workshops, lectures and interactive demonstrations, these programmes help individuals understand their anatomy and make informed health decisions. This situation leads to improved healthcare practices, such as increased awareness of preventive measures and early detection of health issues. Furthermore, these programmes inspire educational advancement by sparking interest in healthcare careers, promoting lifelong learning, fostering a deeper cultural understanding of health practices, and encouraging healthy lifestyle choices. In order to build on this success, future efforts should focus on expanding outreach to underserved rural areas and conducting longitudinal studies to assess long-term outcomes. We suggest incorporating pre- and post-surveys or other quantitative measures as part of these future studies to better understand the impact on health literacy and STEM interest. Furthermore, developing partnerships with local institutions and leveraging technology can amplify the programmes' reach and effectiveness. Addressing challenges like resource constraints and cultural sensitivities will be critical to ensuring sustainability. These steps will not only strengthen the programme but also establish it as a replicable model for other educational initiatives.

Additionally, the expansion and sustainability of these outreach efforts are crucial issues. International collaboration and partnerships can further enhance the impact of these initiatives, facilitating the exchange of knowledge and resources. The future of anatomy education through community engagement emphasises the importance of innovative and tailored approaches to meet local needs. By continuing to develop and expand these programmes, Indonesian and Malaysian institutions can significantly contribute to public health and education, fostering a more health-conscious and scientifically literate society while inspiring future generations to pursue careers in healthcare and STEM fields.

Overall, this study clearly demonstrates the positive impact of university-led outreach programmes on community health literacy. It is crucial to measure the long-term outcomes of these programmes and expand them to rural areas in the future.

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