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CORRESPONDENCE

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Seven-year experience in pathology capacity development project including education for pathology residents and pathology technologists in Cambodia: Challenges and opportunities

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Abstract: This article discusses a 7-year (2017–2023) collaborative project aimed at pathology capacity development in Cambodia, where the pathology workforce is limited due to historical and infrastructural challenges. Cambodia's increasing cancer burden necessitates the expansion of pathology services; however, the country has only a small number of health professionals related to pathological services. Since 2017, the project, funded by Japan's Ministry of Health, Labor, and Welfare, has involved Japanese pathologists providing lectures and technical advice and Cambodian pathologists gaining training in Japan. Over time, the project expanded to support both pathologists and pathology technologists, focusing on capacity building, through a residency program for pathologists and a bridging course for laboratory technologists. The project faced several challenges, including maintaining the quality and sustainability of education, improving practical training environments, and addressing the international migration of a trained workforce. Despite these obstacles, the program trained several residents and led to the development of educational materials. The project also highlighted opportunities to mobilize Cambodian pathologists working abroad and incorporate digital technology into the education system. The article concludes that strengthening the local pathology workforce requires systemic changes, including developing the capacity of Cambodian pathologists to take on leadership roles in teaching and supporting the education system, as well as utilizing Cambodian pathologists abroad as a resource for education and service delivery.

***Keywords*:** Cambodia, pathology workforce, continuing education

Introduction

Improved pathological capacity is critical to correspond to the increased demand for cancer diagnosis and conditions that require a pathological diagnosis; however, many low- and middle-income countries have limited resources to strengthen their pathology services (*1*). In Cambodia, with the epidemiologic and demographic transitions, the burden of cancer is increasing, and there is a growing demand for scaling up cancer management (*2*), resulting in the urgent need to strengthen pathology services in the country. Unfortunately, pathology is one of the neglected fields in the country. Combined with the history of the Khmer Rouge, which left the country with few pathologists, the number of pathologists in Cambodia is tremendously limited (*3*).

In 2014, there were only four Cambodian pathologists providing pathology services (*3*). In 2017, the National Center for Global Health and Medicine (NCGM) in Japan started a collaborative project with the University of Health Science (UHS), a national university in Cambodia, to support pathology education for residents and pathology technologists (NCGM was reborn by merging with the National Institute of Infectious Diseases and became the Japan Institute for Health Security (JIHS) in April 2025). This article describes our 7-year experience of pathology capacity development, including residents' and technologists' education in partnership with a national university and the NCGM. We also describe some challenges and opportunities identified through the project implementation process.

Pathology education in Cambodia

Only one pathology residency program, provided by the UHS, is available in Cambodia. For the first batch of a residency program at the UHS, with a 4-year curriculum, residents were selected in 2014; the program started in 2015. Although the well-structured curriculum developed by a foreign consultant was available, the UHS initially assigned only one pathologist as a faculty member for the program. Therefore, the course could not teach all the subjects in the curriculum.

Collaborative training programs

The outline of the collaborative training programs is illustrated in Table 1. The NCGM initiated collaborative training with the UHS in the first phase (2017–2019) and the second (2020–2023). During the first phase, the project aimed to support the capacity building of existing pathologists as faculties of the residency program and residents as future pathologists in the country. Since the early 2000s, foreign pathologists from Germany, Japan, and France had been providing support to the pathology departments in hospitals. However, there was no established framework for technical support for this residency program. Lectures were divided among foreign supporters within the in the curriculum. This project began offering lectures in pulmonary and gynecological pathology, along with hands-on training. In 2019, the project initiated its support to the second batch of residents. At the same time, the Technical School for Medical Care (TSMC), an academic institute under the jurisdiction of the UHS, introduced a laboratory technologist bridging course aimed at upgrading the competencies of laboratory technologists and providing them with a bachelor's degree. This project supported refining the syllabus and developing education materials in local language so that Cambodian pathologists could provide lectures and practice on pathology laboratory in the course.

On average, between 2017 and 2023, Japanese pathology specialists visited Cambodia twice a year to provide lectures and technical advice. The project invited Cambodian pathologists or residents to Japan once a year for training in pathology laboratory management as part of their continuing education. The project continued to provide online lectures and support during the coronavirus disease (COVID-19) pandemic.

During the 7 years of the project, 11 pathology residents completed the course and were certified as pathologists. The pathology education materials for the TSMC course have been developed and are being used by two Cambodian pathologists.

Challenges in capacity development of pathology professionals in Cambodia

Human resource development requires a systemic approach, which involves a wide range of aspects, from policy and legal inputs to the production, deployment, and retention of health personnel (*4*). This project focused on production activity only, which is the education of pathologists and pathology technologists.

During the 7 years of activities, the project experienced four critical challenges in the process of developing the pathology education system in Cambodia: *i*) maintaining the quality of lectures and its sustainability, *ii*) maintaining the quality of the practical training environment, *iii*) understanding the barriers to technology application in education, *iv*) consideration of international migration after education. These factors are related to the education process as a pre-service training

Table 1. Outline of the collaborative training programs

Year	Milestones
2014	• Only 4 Cambodian pathologists were practicing in the country. • Pathology services were found to be severely limited due to historical and structural challenges.
2015	• First batch of pathology residents enrolled in the newly established UHS residency program. • Curriculum developed with international consultation, but lacked sufficient faculty.
2017	• NCGM-UHS collaborative project began. (1st phase: support for existing pathology workforce). • Japanese experts started providing lectures and hands-on training.
2019	• 1st batch of 5 pathology residents graduated from UHS. • 2nd batch of pathology residents enrolled in UHS.
2020	• MoU signed between NCGM and UHS (2nd phase: strengthening pathology education system).
2023	• One graduate from the 1st batch appointed as an official lecturer at UHS. • Digital slide program introduced to support online education.
2024-25	• Three more residents from the 2nd batch appointed as official lecturers at UHS.

NCGM, National Center for Global Health and Medicine, Japan; UHS, University of Health Science, Cambodia.

and deployment of human resources (*5*).

Maintaining the quality of lectures and its sustainability

The first challenge was maintaining the quality of education and sustainability of the educational program. The quality of education heavily relies on the knowledge and skills of the lecturers. However, the capacity development of lecturers takes a long time, especially in a country like Cambodia, where few mid-career pathologists are qualified as lecturers. Bringing pathology specialists from abroad is a quick solution. However, attention should also be paid to develop the capacity of Cambodian pathologists to be lecturers, to ensure sustainability in the long run. In 2017, the NCGM and several Japanese pathologists contributed, covering about 6 subjects and 5–10 h out of 100 h in the curriculum. Pathology specialists from other countries, such as Germany, Switzerland, and Malaysia, also taught the residents. In 2020, the NCGM signed a memorandum of understanding with the UHS to place the capacity building of pathology specialists capable of teaching pathology courses at the university at the core of its activities. Since then, the NCGM, with other co-actors, including Japan Society of Pathology and Japan Society of Clinical Cytology have been committed to collaborating (above simply providing lectures) to strengthen Cambodian pathologists' capacity to teach. The project ultimately aimed to ensure that Cambodia's pathology education system would independently provide lectures on its own (*6*). The NCGM therefore put face-to-face discussions with the UHS dean of the pathology education system at the core of the collaborative activities. As of 2024, 9 years after starting the resident course in 2015, 5 first-batch and 6 second-batch residents have graduated and started their careers as pathologists. Several other Cambodian pathologists were not trained in the resident course but developed their careers outside the country. They started fully contributing to pathology in hospitals and labs in Cambodia. The UHS has set specific requirements for domestic pathologists to be appointed as lecturers in the resident course. Although this initially limited the contribution of Cambodian pathologists to the education system, one graduate of the first-batch resident course, who sufficiently met the requirements set by the UHS, was appointed as an official lecturer in 2023. As of January 2025, three additional graduates from the second batch have been appointed as official lecturers. Several other graduates from the first- and second-batch residencies are now candidates for official lectureship. Although this progress is encouraging, it will still take time before Cambodian lecturers can fully cover the entire residency program.

Maintaining the quality of a practical training environment

The second challenge faced during the project was maintaining the quality of the practical training environment. As the quality of pathology diagnosis is influenced by both pathology slide conditions and pathologists' knowledge, a well-prepared specimen and slide prepared by trained laboratory technologists is a prerequisite to providing accurate pathology diagnosis. Pathology consumables, including various reagents, essential antibodies, and well-maintained laboratory equipment, all contribute to slide quality. However, with an unstable supply chain and the limited market size in Cambodia, local hospitals encountered considerable difficulties in improving the procurement of these consumables. Consequently, pathologists and technologists rarely had enough experience outside the lecture rooms in preparing or evaluating high-quality slides.

Understanding the barriers to technology application in education

During the COVID-19 period, the project took advantage of technology and online lectures through digital slides. For pathology, online teaching is comparable to face-to-face lectures if digital slides are readily available. However, storing digital slides is a challenge in the real-world setting as it requires responsible local personnel to manage the data and a place for storage (*7*). In the project, if the UHS, the main body of pathology education, agreed on the importance and advantages of using digital slides in the education system, they would be fully introduced. Like many examples of unused equipment provided by foreign countries, without domestic incentives and commitment to utilizing new equipment, introducing new tools only leads to non-use. In other words, the local initiative can only implement introduction of digital teaching materials and equipment in education through sustainable resource allocation, such as budget and designated personnel. In 2023, the project initiated purchase of a monthly subscription to digital slides, which do not require data storage, for trial use. The project also provided digital teaching materials and ensured that they were used by Cambodian pathologists. During on-site training in Cambodia, the project aimed to have Japanese lecturers supervise them when teaching with the materials.

Consideration of international migration after education

Lastly, reflecting common obstacles in any human resource development, the project experienced international migration of the trained workforce. Five first-batch residents started their training. However, after graduation in 2019, only two chose to remain in Cambodia as pathologists, whereas others opted to pursue opportunities abroad. Identifying the factors that cause pathologists to work abroad is beyond the project's

scope; however, employment situations could be one of the reasons. Only a few national hospitals in Phnom Penh have pathology laboratories where pathologists can be employed. The environment is also limited in the availability of reagents and necessary consumables, as described previously. Although budgetary allocations for pathology reagents and consumables have improved significantly across hospitals, the lack of procurement routes for some critical reagents and equipment in Cambodia poses ongoing challenges. On a more positive note, preparations for establishing a pathology department at a hospital, which is expected to become the third national cancer center, are underway. This development will expand the domestic recruitment market for pathology professionals in the country. Health workforce development should align with financial and structural input, such as personal remuneration and budgetary support for further capacity development and infrastructural updates (*8*). Although it may be overly simplistic to attribute the international migration of the trained workforce solely to domestic working conditions, there is a clear need to create an appealing work environment and provide incentives to encourage pathologists to stay and contribute to Cambodia's healthcare system.

On the other hand, the project identified possible opportunities to mobilize pathologists abroad as part of pathology service resources in Cambodia. Notably, online consulting and diagnosis of pathological specimens by Cambodian pathologists abroad have been implemented in certain cases. This setting could be redefined as a global "brain network" (*9*). With the skills to prepare digital slides, pathologists in Cambodia can connect to Cambodian pathologists working overseas, regardless of the physical distance (*10*). Moreover, the availability of digital slides and online teaching suggests the possibility of mobilizing those pathologists, who were a part of the brain drain from Cambodia's education system.

In conclusion, the project identified two insights for pathology education toward human resource development: *i*) fostering the next generation of Cambodian pathologists to take leadership roles in teaching and supporting the education system, and *ii*) mobilizing pathologists who work overseas as a human resource in pathology education. After 7 years of educational support, several pathologists started contributing to the field of pathology in Cambodia. They have adequate knowledge and experience in pathology, and their experience can be utilized to enrich the education system by employing them as lecturers. Such ongoing professional development and empowerment of young pathologists and laboratory technologists could lay the foundation for establishing academic societies in the future and faculty development at the university. At the same time, the education system in Cambodia needs to be flexible and find a sustainable way to incorporate young, growing talents in the field of pathology and their contribution into its structure. On a similar note, utilizing Cambodian pathologists abroad can create a breakthrough in the shortage of human resources and pathology capacity. If the pathology education system in Cambodia can effectively collaborate with Cambodian pathologists abroad and incorporate their skills and capacity into the existing services, it will be an excellent resource for future pathology development in Cambodia.

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