Curricula Mapping of Physician Associate/Physician Assistant-Comparable Professions Worldwide Using the Learning Opportunities, Objectives, and Outcomes Platform

Smalley, Scott MScPAS, PGDHSE, PA-C, Clinical Associate; Bruza-Augatis*, Mirela MS, PA-C; Colletti, Thomas DHSc, PA-C Emeritus, DFAAPA; Heistermann, Peter MD; Mahmud, Alias MEd, PhD; Song, David PA-Student; Juarez, Laura PA-C, MPAS, MPH; Tshotetsi, Lumbani MSc Epi; Fahringer, David MSPH, PA-C; Smith, Jami MPA, MEd, PA-C; Ahlers, Olaf MD, PhD; Showstark, Mary PA-C, FAWM

Scott Smalley, MScPAS, PGDHSE, PA-C, is the President of the International Academy of Physician Associate Educators, prior Academic Head of the Division of Clinical Associates, University of Witwatersrand, Faculty of Health Sciences, Johannesburg, South Africa.

Mirela Bruza-Augatis, MS, PA-C, is a Research Scientist at the National Commission on Certification of PAs, Johns Creek, Georgia, and an Adjunct Faculty at the Department of Physician Assistant, Seton Hall University, Nutley, New Jersey.

Thomas Colletti, DHSc, PA-C Emeritus, DFAAPA, is a Professor at the Doctor of Medical Science, College of Health Sciences, University of Lynchburg, Lynchburg, Virginia.

Peter Heistermann, MD, is a Professor at the Fliedner University of Applied Sciences and the Chairman/President of the German University Association of Physician Assistants in Cologne, Germany.

Alias Mahmud, MEd, PhD, is a Senior Lecturer in the Faculty of Medicine, National University of Malaysia, Kuala Lumpur, Malaysia.

David Song, is a Physician Associate student at Yale Physician Associate Program, New Haven, Connecticut.

Laura Juarez, PA-C, MPAS, MPH, is the President of La Academia de Asociados Médicos de Puerto Rico (AAMPR), founding Academic Coordinator of PA program at San Juan Bautista in Caguas, PR. He is also an assistant professor at Touro University, Dorado, Puerto Rico.

Lumbani Tshotetsi, MSc Epi, is a Lecturer in the Clinical Associate Program, Department of Family Medicine, University of Pretoria, Pretoria, South Africa.

David Fahringer, MSPH, PA-C, is the prior Program Director, Department of Physician Assistant, College of Health Sciences, University of Kentucky, Lexington, Kentucky.

Jami Smith, MPA, MEd, PA-C, is the Founding Director of Didactic Education for the Physician Assistant Program at Delaware Valley University, Doylestown, Pennsylvania.

Olaf Ahlers, MD, is a Professor for Research in Health Science Education at the Faculty of Health Sciences Brandenburg, Brandenburg Medical School Theodor Fontane (MHB), Neuruppin, Germany. He is also a coordinator of the international LOOOP network for curriculum mapping at the Institute of Medical Informatics at Charité - Universitätsmedizin Berlin, Germany.

Mary Showstark, PA-C, is an Assistant Professor Adjunct at Yale Online Physician Assistant Program, New Haven, Connecticut.

***Correspondence should be addressed to:** Mirela Bruza-Augatis, MS, PA-C, Research Scientist, National Commission on Certification of PAs, Johns Creek, 30097, Georgia. Adjunct Faculty at the Department of Physician Assistant, Seton Hall University, Nutley, NJ, 07110; Email: bruzaami@shu.edu

The authors declare no conflict of interest.

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the views or positions of their employers, companies, institutions, or other associated parties.

The Journal of Physician Assistant Education 35(1):p 108-115, March 2024. | DOI: 10.1097/JPA.0000000000000571

ABSTRACT

Given the international growth of physician associate/physician assistant (PA) and PA-comparable professions, it is crucial to understand the educational curricula of PA/PA-comparable professions worldwide. This article provides an overview of the process and development of the PA/PA-comparable curricula mapping design applying an international framework. It uses an innovative web-based tool, the Learning Opportunities, Objectives, and Outcomes Platform (LOOOP), to map and evaluate course content, teaching strategies, assessment formats, and learning outcomes. It highlights the project's rationale, challenges, and future implications.

BACKGROUND

In 2019, the World Health Organization (WHO), Educational Commission for Foreign Medical Graduates (ECFMG), and Global Health Workforce Network co-hosted the Global Symposium on Health Workforce Accreditation and Regulation in Istanbul, Turkey. One of the Global Symposium aims was to engage global experts to address health care workforce education, accreditation, and regulation issues to expand and optimize the global health workforce.[1] During the symposium, the ECFMG inquired about the educational preparation and training of physician associate/physician assistant (PA) and PA-comparable professions. This symposium was an impetus for the question: what do we know about PA/PA-comparable professions' education and their curricula on a global level?

The International Standard Classification of Occupations (ISCO) manual of the International Labour Organization provides information on occupations worldwide.[2] It organizes the occupations into a defined set of groups based on job tasks and duties. The ISCO manual classifies the PA/PA-comparable profession under the *Health Professional* category as *Paramedical Practitioners*, alongside medical doctors, nurses, and veterinarians. However, only 2 (out of 33)[3] professional titles are recognized in the manual (eg, clinical officers and feldshers).[2] This manual defines the PA/PA-comparable professionals as:

> "Paramedical practitioners [who] provide advisory, diagnostic, curative, and preventive medical services more limited in scope and complexity than those carried out by medical doctors. They work autonomously, or with limited supervision by medical doctors, and apply advanced clinical procedures for treating and preventing diseases, injuries, and other physical or mental impairments common conditions to specific communities."[2(p.131)]

Although the ISCO manual lists the tasks that the *Paramedical Practitioners* can perform,[2] it does not describe the educational preparation and training of the PA/PA-comparable profession. Thus, several international organizations and associations representing the PA/PA-comparable profession (Table 1) are working together to increase collaboration, recognition, and understanding of the profession.

Table 1. - PA/PA Comparable Organizations Worldwide

Organization Name	**Audience**	**Web site**
International Academy of Physician Associate Educators (IAPAE)	Educators	www.iapae.org
Global Association of Clinical Officers and Physician Associates (GACOPA)	Practicing PA/PA-comparable professions, advocacy and policy makers	https://www.facebook.com/p/Global-Association-of-Clinical-Officers-and-Physician-Associates-100065486109477/
International Physician Associate Organization (IPAO)	Advocacy	www.internationalpas.org
International Federation of Physician Assistant/Physician Associate/Clinical Officer/Clinical Associate/Comparable Professional Students (IFPACS)	Students	www.ifpacs.org
European Network of PA Educators (ENPAE)	Educators	www.enpae.org
Physician Associates/Assistants for Global Health (PAGH)	Practicing PAs and PA students interested in global health	https://www.pasforglobalhealth.com/

PA, physician assistant.

Furthermore, the current literature confirms that PA/PA-comparable professions have existed since the 18th century and span over 62 countries worldwide under 33 different country practice titles and 5 US territories (Table 2).[3] It also provides descriptive information and evidence of individual countries with PA/PA-comparable professions[4-7]; however, there is a paucity of evidence-based research comparing the PA/PA-comparable educational curricula. Moreover, there is considerable variance in the scope of practice, as demonstrated by the literature, on what the PA/PA-comparable professional can do, emphasizing the need to understand the backbone of the profession's pedagogical training.[8] Noting the gap in the literature and the need for more comparison analysis for the PA/PA-comparable profession education, a group of PA/PA-comparable educators sought to map the curricula to enhance the understanding of the PA/PA-comparable education/training worldwide. The objective was to develop a curriculum mapping platform to assess the content, teaching formats, assessment strategies, and learning outcomes of PA/PA-comparable education. This endeavor would provide institutions of higher education, policymakers, governmental agencies, health care organizations, and PA/PA-comparable educational programs, for the first time, with a common evidence-based language for PA/PA-comparable education and training with applications of role for the respective national needs.

Table 2. - A List of 33 PA/PA-Comparable Country Practice Titles in 62 Countries and 5 US Territories[3]

PA/PA-Comparable Practice Title	Country Name
Asociado Médico (AM)	Puerto Rico
Assistant Doctor (AD)	China
Assistant General Practitioner (AGP)	China
Assistant Medical Officer (AMO)	Sri Lanka, Tanzania, Malaysia
Attaché de Santé (AS)	Burkina Faso
Attaché en Chirurgie (AC)	Burkina Faso
Baga Emch (BE)	Mongolia
Clinical Associate (ClinA)	Malawi, South Africa
Clinical Health Officer (CHO)	Somaliland
Clinical Officer (CO)	Benin, Cameroon, Central African Republic, Democratic Republic of the Congo, Eritrea, Gabon, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Namibia, Rwanda, Somalia, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe
Community Based Physician Assistant (CBPA)	Vietnam
Community Health Assistant (CHA)	Sierra Leone
Community Health Officer (CHO)	Nigeria, Sierra Leone
Community Health Scientist (CHS)	Nigeria
Community Health Technician (CHT)	Colombia, Mexico, Peru, Sierra Leone
Community Health Technologist (CHTt)	Nigeria
Doctor Assistant (DA)	Botswana
Feldsher (FS)	Estonia, Kazakhstan, Kyrgyzstan, Mongolia, Poland, Russia, Ukraine, Uzbekistan
Health Assistant (HA)	Nepal, Marshall Island
Health Extension Officer (HAO)	Micronesia, Papua New Guinea
Health Officer (HO)	Ethiopia, Senegal, Cabo Verde
Integrated Emergency Surgical Officer (IESO)	Ethiopia
Medical Assistant (MA)	Bangladesh, Chad, Côte D'Ivoire, Malawi, Malaysia, Sudan, Togo
Medical Associate (MAss)	Lao People's Democratic Republic
Medical Extension Officer (MEO)	Bolivia, Brazil, Guyana
Medical Licentiate (ML)	Zambia
Physician Assistant (PA)	Afghanistan, Australia, Bulgaria, Canada, Cambodia, Germany, Ghana, Israel, Liberia, Myanmar, the Netherlands, Poland
Physician Associate (PA)	American Samoa, England, Guam, India, New Zealand, Northern Ireland, Scotland, Northern Mariana Islands, Republic of Ireland, Scotland, Switzerland, US Virgin Islands, the United States, Wales
Public Health Officer (PHO)	Ethiopia
Sub-Assistant Community Medical Officer (SACMO)	Bangladesh
Technicale Paramedicales (TP)	Burundi
Tecnicos de Cirurgia (TC)	Mozambique

Tecnicos de Medicina (TM)	Mozambique

PA, physician assistant.

INITIAL HISTORY AND THE LEARNING OPPORTUNITIES, OBJECTIVES, AND OUTCOMES PLATFORM

In 2020, during the Second Annual Global Association of Clinical Officers and Physician Associates conference in Kigali, Rwanda, some participants formed an education committee to research the global PA/PA-comparable professions' curricula. Educators from various universities started collecting and mapping the curricula using an Excel spreadsheet. Several months later, an innovative online tool to map the curriculum was identified—LOOOP: Learning Opportunities, Objectives, and Outcomes Platform.[9]

The LOOOP research team designed the online curriculum mapping software LOOOP in 2004 in Germany. The LOOOP management system is a web-based platform for curriculum mapping, and it has been used to map curricula within universities globally.[9,10] Its mapping concepts were initially based on an American Association for Medical Education (AMEE) guide by Ronald Harden,[11] the former president of AMEE. At present, LOOOP has never been used to map and compare curricula programs across countries. A team of PA/PA-comparable educators adopted and customized the LOOOP variables and structure to fit the needs of PA/PA-comparable professions worldwide to map and evaluate the curricula content, teaching formats, assessment strategies, and learning outcomes.

METHODS

Planning and Development of the PA/PA-comparable Curriculum Map LOOOP Model

The LOOOP and PA/PA-comparable committee started in 2020 and comprised a small group of PA/PA-comparable educators and the LOOOP team. The committee met virtually weekly and developed a catalog for each process and a user guide. Below, we describe 4 steps on how we developed the PA/PA-comparable LOOOP curriculum map.

The committee's first step was to identify source documents encompassing the diverse PA/PA-comparable curricula worldwide. After a comprehensive review of numerous source documents, including PA Education Association (PAEA) Core Competencies for New PA Graduates,[12] Canadian PA Competency Framework,[13] the National Commission on Certifications of PAs blueprint,[14] and Entrustable Professional Activities[15] for medical residents, the 2022 World Health Organization[16] Global Competency and Outcomes Framework for Universal Health Coverage[16] ("WHO Framework") was identified as a template which best tailored the purpose of the international curricula mapping. The WHO Framework is designed to guide educators into competency-based education outcomes for health care workers. It allows health care educators to align the WHO Framework competencies with their curricula to fit the population's and health system's needs. Moreover, it focuses on the practice activities for health workers with preservice education pathways of 12 to 48 months, which includes PA/PA-comparable roles.[8,16] This WHO framework consists of 24 competencies within 6 domains: (1) People-centeredness, (2) Decision making, (3) Communication, (4) Collaboration, (5) Evidence-informed practice, and (6) Personal conduct

and 35 practice activities. A full report of the 2022 World Health Organization Global Competency and Outcomes Framework for Universal Health Coverage can be found at https://www.who.int/publications/i/item/9789240034662.

The second step was determining which variables to map and the curriculum mapping procedures. The variables decided based on the wide-ranging literature review include degree, course name and type (didactic/clinical), year, credits and/or hours, teaching format, medical content, learning objectives, assessment strategies, course outcomes, LOOOP's combined taxonomy[9] (based on modified Bloom's Taxonomy[17] and Miller's clinical skills concept[18]), and the Medical Subject Headings[19] index catalog.[10,11,20-22] We also used an alpha-3-digit International Organization for Standardization code[23] to identify each country within the LOOOP platform. Then, 4 committee members independently conducted a preliminary trial in LOOOP, mapping one course from 4 different PA/PA-comparable curricula to test the applicability of the LOOOP system variables created.

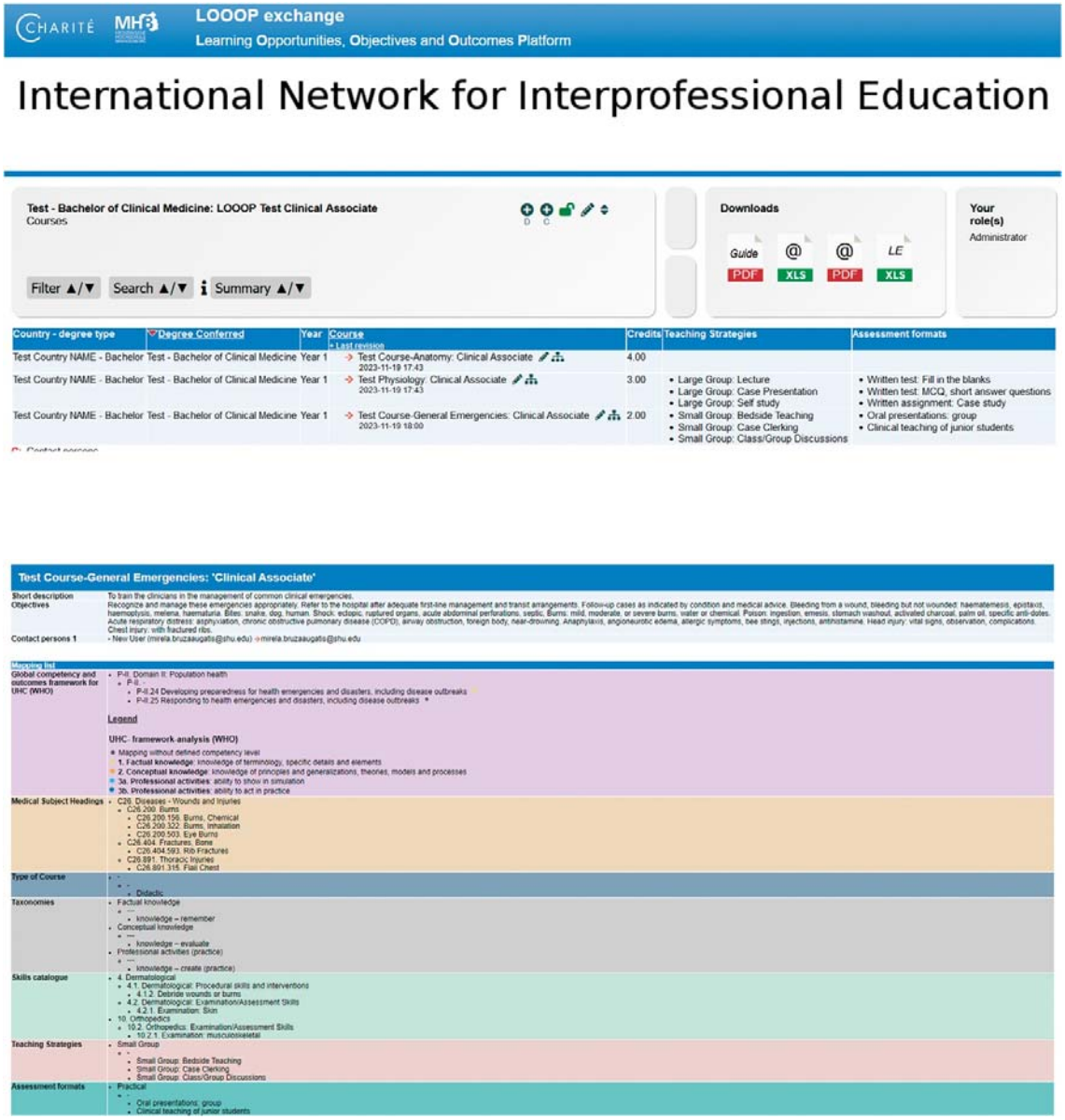
The third step was to pilot mapping the entire curriculum of 4 countries in LOOOP. It was noted that several countries have different formats for presenting course credits/hours and learning objectives. Some countries reported hours spent in the course, and others only reported credit hours without defining how credits were calculated. The learning objectives also varied. For instance, one curriculum had one set of learning objectives for the entire course, while another curriculum had individualized learning objectives for each organ system. To rectify for the variance in reporting credits/hours and learning objectives, we documented the information on the LOOOP platform but did not include them in the first phase of the mapping system.

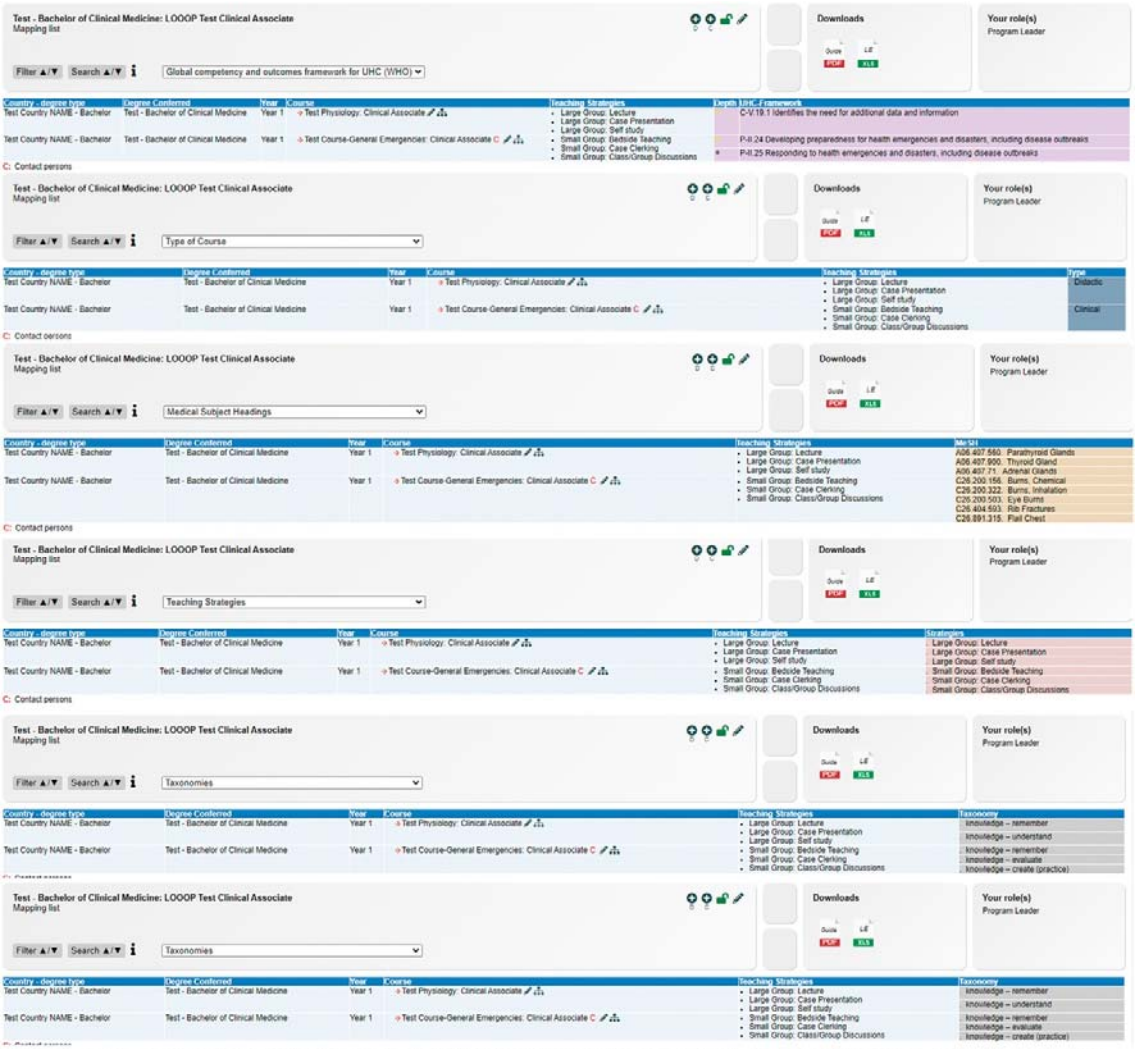
The fourth step was to pair PA/PA-comparable educators who had mastered the LOOOP platform with educators from other countries with expertise in that specific country's curricula to map the information efficiently and accurately. The PA/PA-comparable educators group identified the International Academy of Physician Associate Educators (IAPAE) as the organization to oversee the project. International Academy of Physician Associate Educators was established in 2007 as a diverse organization of international health care educators to unite the global PA/PA-comparable educators around the globe under a shared set of values, beliefs, and goals.[24] The IAPAE leadership team created a user guide with a step-by-step process to facilitate the mapping procedures. International Academy of Physician Associate Educators has connected with educators in more than 40 countries around the world who have PA-PA comparable education programs and are now involved in this curriculum mapping project.

RESULTS

The PA/PA-comparable LOOOP curriculum mapping commenced in 2020. The pilot period was completed in 2022. In 2022, feedback was elicited from international PA/PA-comparable educators, and the IAPAE organization started managing the project. Since then, 46 curricula have been collected, 7 countries' curricula have been fully mapped (eg, Botswana, Ethiopia, Kenya, Malawi, Liberia, Sierra Leone, and Zimbabwe), and 8 additional countries are currently being mapped. Examining the currently mapped curricula is still preliminary, and the data will

be available for publication once the assessment is complete. Figure 1 illustrates a sample of the PA/PA-comparable curriculum map in LOOOP.





*Note: The content listed above is for illustration purposes and does not represent any specific curricula or country.

Figure 1.: Sample of PA/PA-comparable curriculum map LOOOP model. The content listed above is for illustration purposes and does not represent any specific curricula or country. LOOOP, Learning Opportunities, Objectives, and Outcomes Platform; PA, physician assistant.

DISCUSSION

This is the first article that describes the development of an international PA/PA-comparable mapping curricula using a web-based online platform, LOOOP. Although not all countries' PA/PA-comparable curricula have been fully mapped, significant strides have been made in the past 3 years. Identifying an internationally established web-based online curriculum platform and customizing its structure to adapt to the diverse and unique PA/PA-comparable curricula from many countries was a 2-year process. The LOOOP team and PA/PA-comparable educators' committee commenced with 6 educators in 2020 and has expanded to over 46 PA/PA-comparable educators worldwide, contributing their expertise to the project. Providing a user guide has been helpful to acquaint users with the mapping process. The buddy system, pairing experienced mappers with new members, has effectively oriented educators to mapping.[25]

The LOOOP platform facilitated the process as it was customizable to include a variety of PA/PA-comparable components of global curricula. The PA/PA-comparable LOOOP curriculum map effectively integrates all parts of the curriculum to inform the international PA/PA-comparable community and compare and contrast what is being taught in various PA/PA-comparable programs. Nevertheless, all the advances have not come without struggles. Challenges included hesitancy among some countries to share their curricula. This is because many countries do not have authorization to release their curricula without the permission of the country's Ministry of Health. Variations of PA/PA-comparable curricula standards also exist. Some countries have a national curriculum vs. an individual educational institutional curriculum.

A previous study by Lang et al[26] validates our efforts. The authors demonstrate that comparing country-to-country curricula in PA/PA-comparable education is possible. The researchers conducted an exploratory study to examine 6 accredited German PA curricula with the US PA curricula (using the 2010 PAEA survey[27] report of didactic and clinical curriculum). Their analysis found that despite some differences, the content of medical areas is similar for both countries, highlighting possible curricula differences that could be due to each country's scope of practice, educational model, culture, and health care system. Thus, the PA/PA-comparable LOOOP curricula map would provide an essential tool that will assist in recommending accreditation and/or competency standards within or across countries, potentially supporting international PA education minimum competency standards. It also helps support a more effective and efficient education on a global level. It offers the potential for student mobility and institutional partnership.[28] It allows educators to assess their individual curriculum and compare it with PA/PA-comparable curricula among neighboring countries as well as map to the WHO Framework. The key is to exchange information about the PA/PA-comparable curricula and make the findings accessible to stakeholders such as the Ministries of Health, Ministries of Education, Ministries of Finance, universities/colleges, accreditation organizations, licensure boards, employers, and health educators worldwide interested in developing future strategies to optimize the profession.

LIMITATIONS

As with any project, limitations and constraints are inevitable, no matter how well it is designed and tested. The PA/PA-comparable LOOOP curriculum variables were constructed by US PA educators with global health and curriculum design expertise. Input from international PA/PA-comparable educators was not elicited during the initial stages of this design; however, it would have been vital to include international feedback earlier in the process.

The selection of the variables to be customized in LOOOP and redesigning the web-based platform to compare the curricula of institutions across countries were challenging as there are no prior published studies, to this date, that have reported an international curriculum mapping guide in health care education. Considering that this is an innovative endeavor, it is important to recognize its benefit and value to the PA/PA-comparable education for the future.

CONCLUSION

Curriculum mapping encompasses elements to align learning outcomes with course content, teaching strategies, and assessment formats. Mapping the PA/PA-comparable education curricula is an essential step for the profession to understand PA/PA-comparable education/training worldwide. The PA/PA-comparable professions are developed to fit a country's needs. The roles of PA/PA-comparable professionals vary based on their scope of practice. Mapping the PA/PA-comparable professions' education curricula worldwide will assist in better understanding these influential health professionals' education and clinical roles. The final goal for this endeavor is to create the foundation for studying PA/PA-comparable curricula using a web-based curriculum mapping platform. Future research should explore the impact and utilization of this international curriculum mapping within or across countries with PA/PA-comparable educational programs.

ACKNOWLEDGMENTS

Thank you to the involved members of the LOOOP research and development team, especially Matthias Seidel, Till Rech, Julian Suhr, Jan Vincent Wyszynski, Anna Schilli, Franziska Arnold, Leonie Roehnisch, and all PA/PA-comparable educators globally contributing to the LOOOP PA/PA-comparable curricula: Ando Kerlen; Khondoker Monir; Thabo Sebetso; Penka Vracheva; Colombe Bizu; Sharona Kanofsky; Kate Straughton; Fitsum Taye; Mulugeta Abate; Anthony Arkoh; R. Shivakumar; Somu Chatterjee; Joseph Choge; Brian Murigi Wairimu; Solomon Chomba; Norris Nurhan; Quinten van den Driesschen; David Awoleye; Maluo Magaru; Ryan Hunton; Sylwia Bareja; Nathan Rutatina; Khalid Omar; Zuki Tshabalala; Peter Ngor; Sonia Barbosa; Anita Manser; Rosemary Mushi; Shometi Maijei; Norman Nuwagaba; Annet Namugosa; Alex Kachwano; Joseph Mwale.

REFERENCES

1. World Health Organization. Global Strategy on Human Resources for Health: Workforce 2030; 2016. https://iris.who.int/bitstream/handle/10665/250368/9789241511131-eng.pdf?sequence=1. Accessed November 9, 2023.
2. International Labour Organization. International Standard Classification of Occupations: ISCO-08; 2012. http://www.ilo.org/public/english/bureau/stat/isco/index.htm. Accessed November 16, 2023.
3. Turkewitz A, Sallen J, Smith RM, Pitchford K, Kay L, Smalley S. The benefits and limitations of establishing the physician associate profession globally: a systematic review and mixed method study. J Am Acad Physician Assoc. 2024. In press.
4. Couper I. Physician assistants in South Africa. JAAPA. 2014;27(6):9-10. doi: 10.1097/01.JAA.0000446987.41563.dd
5. van den Driesschen Q, de Roo F. Physician assistants in the Netherlands. JAAPA. 2014;27(9):10-11. doi: 10.1097/01.JAA.0000453240.00098.83
6. Heistermann P, Lang T, Heilmann C, Meyer-Treschan T. A brief introduction to PAs in Germany. JAAPA. 2022;35(6):52-55. doi: 10.1097/01.JAA.0000830208.07114.a0

7. Vracheva P, Hooker RS. Physician Assistant Education in Bulgaria. J Physician Assist Educ. 2021;32(1):43-47. doi: 10.1097/JPA.0000000000000345
8. Showstark M, Smith J, Honda T. Understanding the scope of practice of physician associate/physician associate comparable professions using the World Health Organization global competency and outcomes framework for universal health coverage. Hum Resour Health. 2023;21(1):50. doi: 10.1186/s12960-023-00828-2
9. Balzer F, Hautz WE, Spies C, et al. Development and alignment of undergraduate medical curricula in a web-based, dynamic Learning Opportunities, Objectives and Outcome Platform (LOOOP). Med Teach. 2016;38(4):369-377. doi: 10.3109/0142159X.2015.1035054
10. Treadwell I, Botha G, Ahlers O. Initiating curriculum mapping on the web-based, interactive learning opportunities, objectives and outcome platform (LOOOP). Afr J Health Prof Educ. 2019;11(1):27. doi: 10.7196/ajhpe.2019.v11i1.1073
11. Harden RM. AMEE Guide No. 21: curriculum mapping: a tool for transparent and authentic teaching and learning. Med Teach. 2001;23(2):123-137. doi: 10.1080/01421590120036547
12. Hills K, Bondy MJ, McNellis B, et al. Core Competencies for New Physician Assistant Graduates; 2018. https://paeaonline.org/our-work/current-issues/core-competencies. Accessed October 1, 2023.
13. Jones I, Burrows K, Nickell L, Millham A. Canadian Physician Assistant Competency Framework 2021: Canadian EPA-PA. JCANPA. 2021;3(7). doi: https://doi.org/10.5203/jcanpa.v3i7.905
14. National Commission on Certification of Physician Assistants (NCCPA). Physician Assistant National Certifying Examination (PANCE) Content Blueprint; 2019. https://www.nccpa.net/become-certified/pance-blueprint/. Accessed November 10, 2023.
15. Obeso V, Brown D, Phillipi C, et al. Core Entrustable Professional Activities for Entering Residency Pilot Program. Toolkits for the 13 Core Entrustable Professional Activities for Entering Residency; 2017. https://www.aamc.org/download/484778/data/epa13toolkit.pdf. Accessed November 1, 2023.
16. World Health Organization. Global Competency and Outcomes Framework for Universal Health Coverage. Geneva: WHO; 2022. Licence: CC BY-NC-S3.0 IGO. http://apps.who.int/iris. Accessed November 1, 2023.
17. Anderson LW. Objectives, evaluation, and the improvement of education. Stud Educ Eval. 2005;31(2-3):102-113. doi: 10.1016/j.stueduc.2005.05.004
18. Miller GE. The assessment of clinical skills/competence/performance. Acad Med. 1990;65(9 suppl l):63-67. doi: 10.1097/00001888-199009000-00045
19. US National Library of Medicine. Medical Subject Headings. 2023. https://www.nlm.nih.gov/mesh/meshhome.html. Accessed November 16, 2023
20. Willett TG. Current status of curriculum mapping in Canada and the UK. Med Educ. 2008;42(8):786-793. doi: 10.1111/j.1365-2923.2008.03093.x
21. Komenda M, Schwarz D, Švancara J, Vaitsis C, Zary N, Dušek L. Practical use of medical terminology in curriculum mapping. Comput Biol Med. 2015;63(1):74-82. doi: 10.1016/j.compbiomed.2015.05.006

22. Al-Eyd G, Achike F, Agarwal M, et al. Curriculum mapping as a tool to facilitate curriculum development: a new School of Medicine experience. BMC Med Educ. 2018;18(1):185-188. doi: 10.1186/s12909-018-1289-9
23. International Bank Account Number (IBAN). Country Codes Alpha-2 & Alpha-3. https://www.iban.com/country-codes. Accessed December 12, 2020.
24. About IAPAE. International Academy of Physician Associate Educators (IAPAE). 2023. https://www.iapae.org/. Accessed November 16, 2023.
25. Venables L, Smith N. Implementation of electronic curriculum mapping and alignment in the Faculty of Health Sciences at Nelson Mandela University. Internationales LOOOP-Symposium Presentation; 2023. https://www.fgw-brandenburg.de/wp-content/uploads/2023/08/Programm-LOOOP-Symposium-2023.pdf. Accessed November 19, 2023.
26. Lang T, Berkowitz O, Heistermann P. A comparison of German and United States physician assistant curricula. J Physician Assist Educ. 2022;33(1):66-71. doi: 10.1097/JPA.0000000000000406
27. Physician Assistant Education Association. Physician Assistant Education Association 2010 Curriculum Survey Report; 2010. https://paeaonline.org/resources/public-resources/research-reports/curriculum-survey-and-reports. Accessed November 17, 2023.
28. Davey AK. Internationalization of the curriculum in health programs. BMC Med Educ. 2023;23(1):1-12. doi: 10.1186/s12909-023-04271-8