

African School of Pediatric Oncology Initiative: Implementation of a Pediatric Oncology Diploma Program to Address Critical Workforce Shortages in French-Speaking Africa

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PURPOSE In 2012, the French African Pediatric Oncology Group established the African School of Pediatric Oncology (EAOP), a training program supported by the Sanofi Espoir Foundation's My Child Matters program. As part of the EAOP, the pediatric oncology training diploma is a 1-year intensive training program. We present this training and certification program as a model for subspecialty training for low- and middle-income countries.

METHODS A 14-member committee of multidisciplinary experts finalized a curriculum patterned on the French model Diplôme Inter-Universitaire d'Oncologie Pédiatrique. The program trained per year 15 to 25 physician participants committed to returning to their home country to work at their parent institutions. Training included didactic lectures, both in person and online; an onsite practicum; and a research project. Evaluation included participant evaluation and feedback on the effectiveness and quality of training.

RESULTS The first cohort began in October 2014, and by January 2019, 72 participants from three cohorts had been trained. Of the first 72 trainees from 19 French-speaking African countries, 55 (76%) graduated and returned to their countries of origin. Four new pediatric oncology units have been established in Niger, Benin, Central African Republic, and Gabon by the graduates. Sixty-six participants registered on the e-learning platform and continue their education through the EAOP Web site.

CONCLUSION This training model rapidly increased the pool of qualified pediatric oncology professionals in French-speaking countries of Africa. It is feasible and scalable but requires sustained funding and ongoing mentoring of graduates to maximize its impact.

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INTRODUCTION

According to a global report by the WHO, chronic diseases are responsible for > 60% of all deaths worldwide, with 80% of these deaths occurring in lower- and middle-income countries (LMICs). In adults, cancer is the second leading cause of death but could be reduced by at least 40% if preventive measures were in place.¹ Pediatric cancer is not preventable, but early correct diagnosis and high-quality treatment lead to 80% cure rates for children who develop cancer.²

A 2017 study by the International Agency for Research on Cancer and the International Association of Cancer Registries showed that the global occurrence of childhood cancer has increased by 13% since the 1980s, which indicates a rising need for improved pediatric oncology services.³ This trend will have profound effects in Africa because the African population today represents 16.4% of the world population (1.2 of 7.3 billion), is the fastest growing continent, and

is estimated to reach 25% of the global population by 2050. In addition, 41% of Africans are < 15 years of age compared with 26% of people in the rest of the world.⁴

In 2019, Ward et al⁵ estimated that there were 397,000 incident cases of childhood cancer worldwide in 2015 of which only 224,000 were diagnosed. This finding suggests that 43% of childhood cancer cases were undiagnosed globally, with substantial variation by region that ranged from 3% in Western Europe and North America to 57% in western Africa. By taking into account population projections, Ward et al⁵ estimated that there will be 6.7 million cases of childhood cancer worldwide from 2015 to 2030.

To address the increasingly urgent and specific need for pediatric oncology in French-speaking African countries, a group of physicians and volunteers created the French African Pediatric Oncology Group (GFAOP) in 2000 led by Jean Lemerle, MD.⁶ The group aimed to improve health care quality and access

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in French-speaking African countries by establishing pilot units. The pilot units emphasized the need for pediatric oncology health care provider training because some clinicians who work in French-speaking African countries had not received such specialized or formal training.⁷ The proposed educational programs designed for western populations are costly and increase the risk of brain drain because salaries are higher and working conditions are better. Furthermore, the training program must be incorporated into a more comprehensive and efficient global pediatric oncology health care program.

In 2012, the GFAOP established the African School of Pediatric Oncology (EAOP). This project is supported primarily by the Sanofi Espoir Foundation as part of the My Child Matters program.⁸ Other supporters include the Lalla Salma Foundation for Cancer Prevention and Treatment, the Moroccan Society of Pediatric Hematology and Oncology, the Gustave Roussy Institute's School of Cancer, and the Moroccan parents association Avenir.

Initially, the EAOP began with offering intensive, unaccredited courses in pediatric oncology, but feedback from both directors and participants stated a need for more in-depth training and prompted the GFAOP to develop a formal pediatric oncology training program with the following objective: To provide physicians in French-speaking African countries with standardized pediatric oncology knowledge and skills to raise the level of competency in physicians working with children with cancer.⁹ This article describes the framework of the diploma program and reports the results of the first three cohorts.

METHODS

Training Committee

The first step in this process was the establishment of a training committee (TC). The EAOP TC included renowned faculty members with pediatric oncology experience in LMICs. The committee comprised 14 members with different backgrounds (10 pediatric oncologists, two radiation therapists, one pathologist, one pediatric surgeon) and nationalities (seven Moroccan, five French, two American).

The TC's mission was to develop the training objectives and core curriculum for the Pediatric Oncology Diploma, evaluate and select the trainers, validate objectives and practical training sites, assist in the selection of program participants, approve research topics, and evaluate participants' written examinations and research projects. The TC was supervised by the EAOP training program directors. The first TC task was to develop the pilot curriculum.

Curriculum Building

To select the most appropriate training model for French-speaking African countries, the EAOP began with comparing the French and American systems of specialized pediatric oncology training. Because participants were often the sole pediatric oncology practitioners in their regions,

priority was given to a program that enabled participants to gain the most critical skills with the least amount of time spent away from their local positions. Thus, in accordance with the needs, resources, and limitations of clinicians in French-speaking African countries, the French model Diplôme Inter-Universitaire d'Oncologie Pédiatrique was selected.¹⁰ The curriculum objectives were also concordant with the American Society of Pediatric Hematology/Oncology.¹¹ Table 1 lists and compares curricula between American and French training programs. As a result of this process, the EAOP established in 2014 the first formal program of its kind in Africa: a 1-year diploma program in pediatric oncology known as the Diplôme Universitaire de Cancerologie Pédiatrique (DUCP). The program was delivered in French to ensure participants' maximal comprehension.

Table 2 lists an outline of the training program. After developing the training program, the TC began the process of curriculum recognition. The committee developed the program curriculum in compliance with the Mohammed V University and Paris-Sud University criteria for a diplôme universitaire program. The curriculum was submitted for recognition by the two universities as a formal training program in pediatric oncology.

Participant Selection

Upon a call for application through the GFAOP and the Moroccan national pediatric oncology network, the training program admitted 15 to 25 new fellows per year. The target audience included French-speaking African clinicians from various specialties in managing children with cancer (pediatric oncologists, pediatricians, radiation therapists, pediatric surgeons, etc). The applicants were required to provide a curriculum vitae, letter of intent, and letter of recommendation from their head of department. All participants had to express commitment to returning to their institutions to serve in pediatric oncology. Most of the selected participants (70%) received financial support from the GFAOP through the My Child Matters program, which covered transportation, lodging, university registration fees, and a per diem. Approximately 20% of selected participants were unable to join the program because of financial constraints. The total cost of each cohort is approximately 60,000 euros.

Development of e-Learning Component

In the second year of the program, the e-learning platform was developed to reduce the duration of required onsite learning and to enhance and supplement the independent learning component. All lectures were recorded separately for use specifically in the e-learning platform, which was implemented during cohort 3. The online training system was part of a systemic vision that mixed face-to-face and distance learning (so-called blended learning), which alternated face-to-face sessions organized in Rabat with distance learning through the e-learning platform.¹²

TABLE 1. Comparison of Curricula Between American and French Training Programs

Component	ASPHO (US system)	DUCP (French system)	Comments
Duration	3 years	1 year	DUCP format designed to minimize valuable time spent away from local units
Language of instruction	English	French	Selected for maximized utility for use in French-speaking African countries
Structure	Multiple relations Research component	Theoretical modules Practical training (3-6 months) Research project	Condensed practical training for focus on key practical objectives
Objectives	Ensure a solid basis of medical knowledge, critical thinking abilities, literature review, diagnostic acumen, and technical skills as required for optimal patient care delivery in pediatric oncology Develop leadership, cooperative, and empathetic skills of clinicians to enable effective communication with colleagues, patients, and families Encourage clinicians to adopt the primary perspective of advocate for patients and their families using knowledge of the local health care system, constraints, and available resources, to provide flexible and customized care Expose clinicians to and facilitate their participation in multi-institutional collaborative research as exemplified by pediatric oncology cooperative groups and encourage them to become active members of the profession's national and international societies	DUCP focuses specifically on needs of LMICs (limited resources, treatment abandonment, adapted protocols) and on the most frequent cancers found in French-speaking African countries	
Target audience	Licensed pediatricians	All clinicians (residents and licensed) who manage pediatric patients with cancer (pediatricians, pediatric oncologists, radiotherapists, etc)	The DUCP program is not limited to pediatricians to increase overall capacity of limited resource systems All members of a multidisciplinary medical team are eligible for this training
Academic recognition	Board certification as a pediatric hematologist/oncologist	University-issued diploma that documents 1 year of formal pediatric oncology training	In the French system, board-certified subspecialization does not exist; instead, clinicians can undergo pediatric oncology subspecialty training recognized by a university

Abbreviations: ASPHO, American Society of Pediatric Hematology/Oncology; DUCP, Diplôme Universitaire de Cancerologie Pédiatrique; LMIC, low- and middle-income country.

TABLE 2. Diploma Program Outline

Component	Comment/Description
Core curriculum	
Module 1*	Epidemiology of pediatric cancer Pediatric oncology in Africa Predisposing factors and genetics Clinical presentation and early diagnosis Appropriate diagnosis studies in disease diagnosis and staging Multidisciplinary and treatment principles (chemotherapy, adjuvant therapy, stem-cell transplantation)
Module 2	Research: ethics in research, methodology and study design, development of research protocols, manuscript preparation Leukemia: acute lymphoblastic leukemia, acute myeloblastic leukemia, chronic myeloid leukemia, myelodysplastic syndromes, myeloproliferative syndromes Lymphomas: non-Hodgkin, Hodgkin
Module 3	Solid tumors Wilms and other renal tumors Neuroblastoma Malignant germ cell tumors Hepatoblastoma and other liver tumors Soft tissue sarcomas
Module 4	Solid tumors Histiocytic disorders Nasopharyngeal carcinoma Retinoblastoma Brain tumors Osteosarcoma and Ewing sarcoma
Module 5†	Supportive care Palliative care Late effects in cancer survivors Information delivery and disclosure of the cancer diagnosis
Practical training	
Selection criteria for practical training sites	All training sites must have at least one available pediatric oncology trainer, have a new patient intake of at least 50 per year, have regular multidisciplinary meetings, and treat both leukemia and solid tumors
Practical training objectives	Upon completion of the training the fellows should acquire skills in diagnosis, staging, and monitoring of common childhood malignancies; a multidisciplinary approach; professionalism (ethics, respect, responsibility, communication, and self-awareness); leadership and collaboration skills
Technical competencies	Principles of chemotherapy administration Supportive care and management of adverse effects (extravasation, tumor lysis syndrome, etc) Lumbar puncture with instillation of intrathecal chemotherapy Bone marrow aspiration and bone marrow biopsy Effective pain management Comprehensive management of a terminally ill child
Research project	Objectives: expose participants to clinical research methods and promote publication in the field of pediatric oncology

*Module 1 was available online since September 2018 (cohort 4).

†The majority of module 5 was available online for cohort 3 on the e-learning platform.

Development of Evaluation Tools

Evaluation of participants. After didactic courses and clinical practical training, each participant had to pass an examination to demonstrate their knowledge base and clinical skills in pediatric oncology. The examination included one clinical case and three written questions related to specific cancers, supportive care, palliative medicine, and so forth. The 6-month practical training included evaluation for professional behavior and clinical competencies on the basis of a rubric that covered the practical training objectives (Table 2). The research project required

a formal presentation and was evaluated on the relevance of the topic to daily practice, methods quality and accuracy, data collection and analysis, clarity of results, and insightful interpretation and discussion. Participants were offered mentorship in their research projects from the 24 trainers and practical training facilitators. Success in the training program depended on board approval that covered three main sections: theoretical knowledge, clinical practice/practical training, and research project evaluation.

Program feedback survey. After completion of their training, all participants were asked to complete an anonymous

feedback survey of 40 items (Table 6) on effectiveness and quality of training. Participants could respond using a 6-point Likert scale from strongly agree to strongly disagree. Descriptive statistics were calculated as proportions of response options.

e-Learning feedback form. After the launch of the e-learning curriculum in cohort 3, participants' satisfaction was assessed using a short survey with five open-ended questions. The survey evaluated technical and pedagogical aspects of the platform.

RESULTS

The Pilot Curriculum

Outline of curriculum. Table 2 lists an outline of the pediatric oncology diploma training program. The topics covered are similar to most pediatric oncology training programs available globally, but the content of the DUCP curriculum was specifically adapted to African LMICs by prioritizing the most curable diseases encountered in these countries, focusing on supportive care, and developing the multidisciplinary team. The curriculum emphasized the importance of using adapted protocols, such as GFAOP-adapted protocols,^{13,14} International Society of Paediatric Oncology Paediatric Oncology in Developing Countries protocols,¹⁵ and other published protocols with a proven record in LMICs.¹⁶ Other issues specific to pediatric oncology in LMICs, such as treatment abandonment, early diagnosis, and coping with limitations in resources, were also addressed.^{16,17}

The duration of training was 12 months and comprised didactic lectures (120 hours given in five 3-day intensive sessions), 6 months of onsite practical training, and the completion of a research project that required a formal presentation at the end of the year. Research topics were selected on the basis of the recommendations of the TC with input from the participant. Each topic was required to have practical applications and to add value to the participant's local or regional context. The practical training allowed the participants to acquire the competencies listed in Table 2. More than 24 trainers from different institutions were voluntarily involved in this program without compensation (transportation and lodging were covered by participant registration fees).

The e-learning component. The e-learning platform¹² includes recorded lectures for modules 1 through 5 that became available during the course of the program, with module 5 available as of September 2018 in time for use by cohort 3. Access was limited to program participants and to individually authorized persons. As of January 2019, the platform was accessed by 66 users: 10 trainers, 44 participants from cohort 2 and 3, three platform administrators, and nine visitors. The platform content included relevant literature (26 articles), one clinical case, and online lectures (Table 3). The total volume of courses recorded is 12 hours.

Demographics of Program Participants

Table 4 lists the demographics of program participants. From October 2014 to October 2017, we recruited 72 participants in three cohorts (26 in cohort 1, 25 in cohort 2, and 21 in cohort 3). The age of program participants decreased with each cohort, from 7.6% of participants age < 35 years in cohort 1 to 32% in cohort 2 and 43% in cohort 3. Cohorts 1 and 2 had a greater number of clinicians with previous pediatric oncology experience; all 21 participants in cohort 3 entered the program with no prior experience in pediatric oncology. Participants were from 19 French-speaking African countries and from a variety of specialties (mainly pediatrics, pediatric surgery, and radiotherapy; Table 4).

Upon completion of the DUCP program, the participants from Benin, Central African Republic, Gabon, and Niger were the first clinicians to begin practicing pediatric oncology in their countries. The diploma contributed to the administrative and peer recognition of participants as qualified physicians and promoted the initiation of pediatric oncologic activity in their respective countries with GFAOP support. Figure 1 shows the countries that were represented in the program and the pediatric oncology units created by DUCP participants.

Evaluation

Participant evaluation. Among the 72 participants in the DUCP program, 55 successfully completed the program; four withdrew from the program; and 13 did not complete

TABLE 3. Use of e-Learning Content

Module and Lecture Topic	No. of Viewers
Module 1	
Scintigraphic imaging	16
Histopathology of pediatric tumors	15
Anticancer treatment	17
Tumor markers in pediatric oncology	22
Module 5	
Late effects	19
Supportive care	38
Nausea and vomiting	26
Palliative care	14
Mucositis	17
Announcement	22
Neutropenic fever	15
Tumor lysis syndrome	20
Module 2	
Hodgkin lymphoma	18
Diagnosis of leukemia	16
Module 4	
Imaging in bone tumors	12

TABLE 4. Demographics of the Pediatric Hematology/Oncology Fellowship Participants

Characteristic	Total, No.	Cohort, No.		
		1 (2014-2015)	2 (2015-2016)	3 (2016-2017)
Age, years				
25-30	2	0	2	0
31-35	17	2	6	9
> 35	53	24	17	12
Experience in pediatric oncology				
≤ 1 year	57	19	17	21
> 1 year	15	7	8	0
Sex				
Male	27	9	10	8
Female	45	17	15	13
Specialty				
Pediatrician	51	21	16	13
Pediatric surgeon	7	1	3	2
Biologist	1	0	1	0
Hematologist	5	4	3	0
Radiotherapist	5	0	1	4
General physician	2	0	0	2
Adult oncologist	1	0	1	0
Country of origin				
Algeria	3	0	3	0
Benin	2	0	0	2
Burkina Faso	3	0	2	1
Burundi	1	1	0	0
Cameroon	3	0	1	2
Central African Republic	2	2	0	0
The Republic of Congo	2	1	1	0
Guinea	3	0	2	1
Gabon	2	2	0	0
Ivory Coast	1	0	1	0
Madagascar	1	0	1	0
Mali	6	2	2	2
Morocco	31	13	9	9
Mauritania	1	1	0	0
Niger	4	2	0	2
Democratic Republic of Congo	2	0	2	0
Senegal	2	0	0	2
Togo	2	1	1	0
Tunisia	1	1	0	0
Evaluation of participants, No. (%)				
Passed	55 (76)	20 (77)	22 (88)	13 (62)
Failed	17	6	3	8
Total	72	26	25	21

one or more evaluations, including 11 who did not complete the research project largely because of administrative factors and, in one case, political instability. Among the participants who did not complete the research project, five were also unable to complete their practicum. One participant presented a final research project, but it was rejected by the review committee, and one participant did not pass the written examination.

The selected topics for the clinical research projects primarily concerned the adaptation of pediatric oncology treatment to LMICs, the prevention of treatment abandonment, and international collaboration, consistent with issues important for pediatric oncology in LMICs. Clinical controlled trials were mainly evaluations of single-arm treatment protocols through clinical data collection, analysis of disease characteristics, treatment, and outcomes. Table 5 lists the selected research topics.

Projects were originally scheduled for completion within a 12-month period; the deadline was extended to 18 months to accommodate requests for extra time. Four projects were presented as posters and one as an oral presentation during International Society of Paediatric Oncology meetings.¹⁹⁻²² Two research articles are currently in the publication process.

The majority of the practical training was conducted in Moroccan general pediatric oncology units (54 participants) that met the practical training site criteria, with the exception of training for one participant in Tunisia and three in Algeria who were permitted to train in preapproved selected units. The 14 remaining participants (seven pediatric surgeons, five radiotherapists, one biologist, and one adult oncologist) trained in their respective specialties at locations that treat children with cancer, while regularly attending multidisciplinary meetings. Nine participants were unable to complete their practical training. Five pediatric surgeons completed a 6-month additional practicum in Europe (four in France, one in Belgium), and four pediatric oncologists completed a 2-month additional practicum in France.

Program feedback survey. Fifty-three participants responded to the end-of-training survey. In general, the respondents were satisfied in all aspects of the program. The majority of respondents who included a written comment expressed a desire for additional time in the theoretical component as well as additional time and resources allocated to the research project. The final comments were related to challenges in the research project, such as inappropriate or unfeasible topic selection, lack of access to patient information needed for the project, and similar practical obstacles. Some clinicians not specialized in pediatric oncology (surgeons, radiotherapists) expressed a desire to have more-tailored theoretical training for their specialties (Table 6).

E-learning platform feedback (cohort 3). Eighteen participants from cohort 3 responded to the e-learning platform

survey (Table 7). Most agreed or strongly agreed to items related to technical and pedagogical aspects of the platform. Twenty-two percent of respondents reported technical problems related to Internet access and speed. Written comments included a desire to see an expansion of courses offered through the platform.

Success Stories

The two participants from the Central African Republic were the first clinicians to practice pediatric oncology in the

country. One was referred to the program by a Central African Republic–based nongovernmental organization (the Bangui Childhood Cancer Association). The second, a political refugee who was in residency for pediatrics in Morocco, was recruited by the program and approved by the Bangui Hospital. The two trained together in cohort 1 and have both since returned to the Central African Republic and begun working together to create a pediatric oncology unit in Bangui, which has been accepted as part of the GFAOP network.

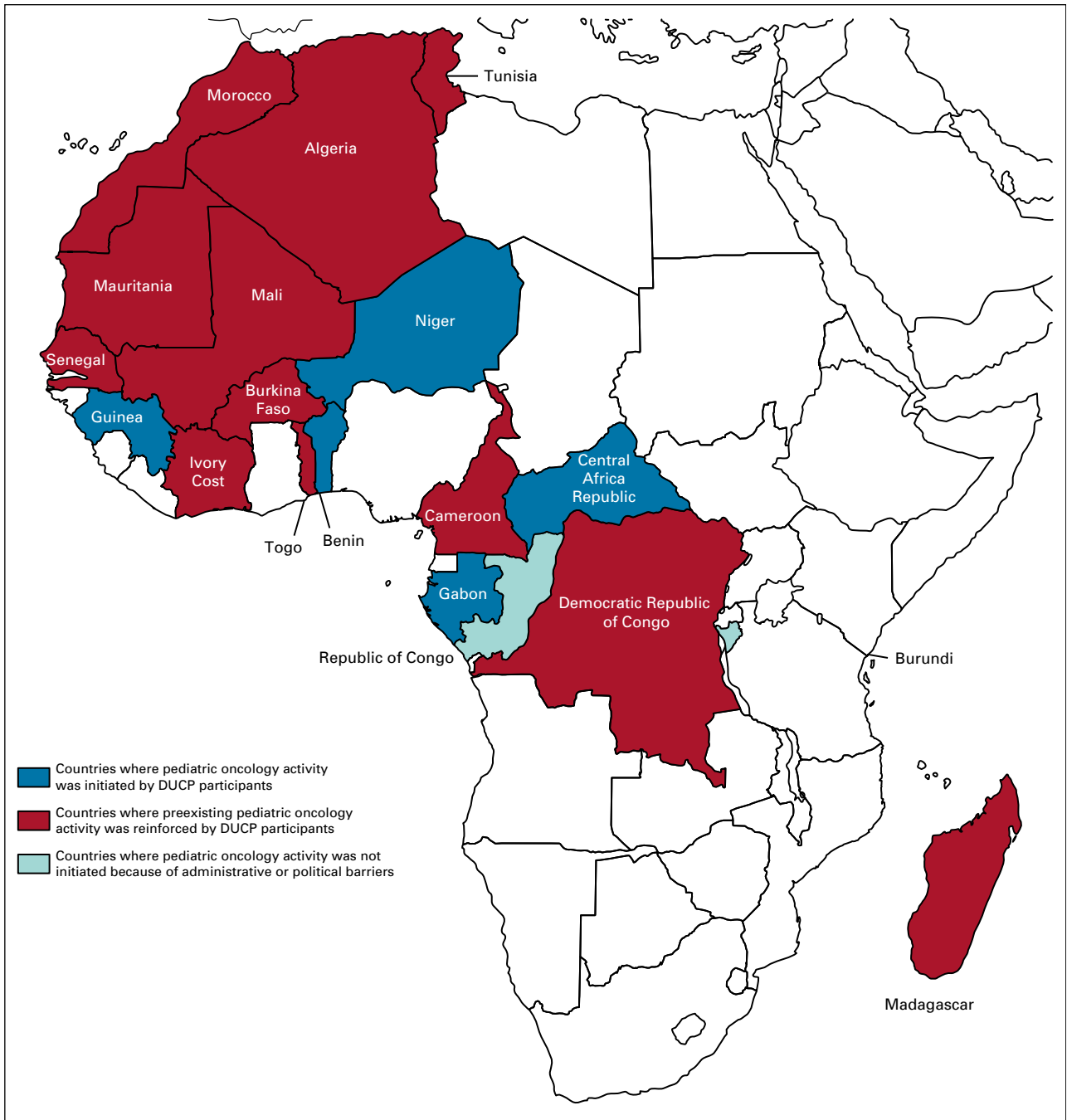


FIG 1. Map of Africa that shows the countries with participants in the Diplôme Universitaire de Cancerologie Pédiatrique (DUCP) program.

TABLE 5. Dissertation Topics of Pediatric Oncology Diploma Recipients During the First 6 Years of the Training Program

Topic	No. of Diploma Recipients
Leukemia and lymphoma	
Acute leukemia	7
Non-Hodgkin lymphoma	4
Hodgkin lymphoma	1
Solid tumors	
Neuroblastoma	6
Pediatric brain tumor	3
Retinoblastoma	4
Soft tissue sarcoma	2
Nephroblastoma	3
Nasopharyngeal carcinoma	1
Germ cell tumors	1
Supportive care	11
Nutrition	
Neutropenic fever and infection	
Transfusion	
Mucositis	
Palliative care	
Pain management	
Psychosocial issues	3
Psychosocial impact of cancer	
Psychological and social needs during cancer treatment	
Other	8
General characteristics of newly diagnosed patients	
Mortality causes	
Neurocognitive sequelae	
Cancer in neonates	
Gynecologic malignant tumors	
Metronomic chemotherapy	
Ambulatory administration of high-dose methotrexate	
Treatment abandonment	
Total	55

The clinic of an experienced Moroccan pediatric oncologist from cohort 1 has since been approved as a practical training site for the DUCP program. This graduate mentored five participants from cohorts 2 and 3. Of 55 participants who completed the program, 54 (98%) returned to their respective countries to develop local pediatric oncology programs.

DISCUSSION

In a region with limited infrastructure, resources, and quality training facilities, it was an impressive feat to

coordinate the necessary funding, human resources, and academic framework to launch and execute a long-term academic program. Working together, we overcame many logistical challenges, such as coordinating partners from > 20 nationalities, more than five nongovernmental organizations, and two universities. Of note, the diploma is now considered a prerequisite for initiating any pediatric oncology activity in French-speaking African countries. An analogous program for Anglophone sub-Saharan Africa was established in 2016 in Uganda as part of the Global Hematology-Oncology Programs of Excellence program of Texas Children's Hospital.²³

The EAOP was able to recruit 72 participants from 19 African countries for the DUCP program. Before admission to the program, many participants were performing pediatric oncology tasks with limited, informal training that was largely on the basis of observational learning. After completion of the diploma program, many were able to reinforce their existing centers and, in some cases, establish satellite units outside the referral center. In the latest cohorts, the participants were younger than those of the first cohort, and none had prior pediatric oncology work experience. Eight participants from countries without previous pediatric oncology facilities were able to return and establish the first pediatric oncology units in their countries with support and ongoing mentoring from their GFAOP colleagues. Moreover, the multidisciplinary nature of the participants promoted a holistic approach to patient treatment and emphasized the value of nursing when developing pediatric cancer services.

Trained clinicians are referring new participants to the program on the basis of this success. Priority is given to those who are supported by their government and who have a secure position in their home country after their training to ensure the sustainability of the program.

The theoretical training was delivered in French, and the practical training component was shortened to maximize learning while minimizing the impact on the participants' local facilities during the participants' time away from home to receive the Morocco-based components of the training. The program included a research component to ensure that it furthered knowledge in the field and to develop analytical thinking skills needed for continuous quality improvement at the participants' own pediatric cancer units.

Participants found the theoretical training to be too condensed and expressed a desire for less-compact sessions spread over 4 days instead of 3. In response, we developed an e-learning platform to reduce the intensity of the face-to-face sessions and to allow more class time for deeper discussion and case studies.

Overall, we experienced very few challenges during the practical training and received positive feedback from program participants and their mentors. Despite practical training in Morocco, the non-Moroccan participants were

TABLE 6. Results of the Program Feedback Survey (n = 53)

Criteria	Responses, No. (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Theoretical training					
The content of the theoretical training is adapted to local needs	0	0	0	17 (32)	36 (68)
The content provides added value to your daily practice	1 (2)	0	1 (2)	15 (28)	36 (68)
The training facilitates the acquisition of skills	1 (2)	0	1 (2)	20 (38)	31 (58)
The exchange with the trainers was mutually beneficial	0	0	1 (2)	20 (38)	32 (60)
The theoretical training was satisfying and met your overall needs	0	0	3 (6)	28 (53)	22 (41)
Practical training					
The practical training allowed you to acquire practical skills	0	0	4 (8)	15 (28)	34 (64)
The supervision of trainees was satisfactory	0	1 (2)	3 (6)	23 (43)	26 (49)
Practical training sites were adequate	0	0	4 (8)	17 (32)	32 (60)
The interaction with the team was satisfactory and beneficial	0	0	4 (8)	22 (41)	27 (51)
Research project					
The subject was appropriate	0	1 (2)	4 (8)	16 (30)	32 (60)
The research project was adequately supervised	0	0	1 (2)	26 (49)	26 (49)
Project material information was accessible	1 (2)	0	3 (6)	26 (49)	23 (43)
Training evaluation					
The training methodology was adequate	0	0	3 (6)	25 (47)	25 (47)
The trainers were adequately skilled	0	0	1 (2)	21 (40)	31 (58)
The use of concrete examples was sufficient	0	0	3 (6)	24 (45)	26 (49)
The trainers were interested and enthusiastic	0	0	1 (2)	23 (43)	29 (55)
The trainers were motivating	0	0	4 (8)	23 (43)	26 (49)
The trainers communicated clearly and efficiently	0	0	4 (8)	18 (34)	31 (58)
General organization					
The training schedule was convenient	0	1 (2)	0	19 (36)	33 (62)
The balance between theory and practice was satisfactory	0	0	2 (4)	29 (55)	22 (41)
The number of hours of training was appropriate	2 (4)	3 (6)	5 (9)	29 (55)	14 (26)
Equipment at training sites was adequate	1 (2)	0	3 (6)	29 (55)	20 (37)
The quality of documentation was adequate	1 (2)	1 (2)	4 (8)	22 (41)	25 (47)
Other outcomes					
The training had an overall impact on your daily practice	0	0	0	19 (36)	34 (64)
The training met your expectations	0	1 (2)	1 (2)	23 (43)	28 (53)

able to overcome language barriers with Arabic-speaking patients with limited French because of team integration and support from their many bilingual colleagues.

Participants were also required to select a topic and conduct a research project. We found that the participants were not adequately prepared to conduct academic research and complete the writing component. It became apparent that they required basic training and additional development in many specialized skills needed to successfully conduct research (ie, research methods, data management, statistical analysis, research ethics, writing skills, communication, professionalism).²⁴⁻²⁶ For participants who elected to conduct their research in Morocco, they experienced delays once they returned to their home

countries because they found difficulties in accessing information and communicating with their Moroccan-based mentors. Participants who opted to conduct research in their home institutions faced delays as well because they could not begin their studies before the practical training component had been completed. These delays resulted in most participants finding themselves unable to complete their projects within the originally allocated 12 months. The program was unofficially extended to 18 months in the first three cohorts and has been officially extended for cohort 4 onward. Because of these factors plus the language barrier, as most pediatric oncology journals use English, only two participants have prepared their research projects for peer-reviewed publication. In addition,

TABLE 7. Results of the e-Learning Platform Feedback Survey (Cohort 3)

Criteria	Responses, No. (%)					Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Technical aspects						
Access to the platform	0	0	1 (5.6)	7 (38.9)	10 (55.6)	18
Navigation facilities	0	0	0	10 (55.6)	8 (44.4)	18
Pedagogical aspects						
Platform expectations	0	0	0	8 (44.0)	10 (56.0)	18
Platform activities	0	0	0	8 (44.0)	10 (56.0)	18
		Yes			No	
Technical problems, No. (%)		4 (22)			14 (78)	

Comments and suggestions: desire to see an expansion of courses offered through the platform.

a need exists for more in-depth training on publication requirements.

The establishment of the e-learning platform has been another major success of the program because it has given EAOP the opportunity to use this tool to access existing resources. In following its commitment to the development of e-learning resources, the GFAOP recorded lectures for many years but did not have access to an online platform to host and share them. The establishment of the online platform represents EAOP's first successful endeavor in the field of distance learning. The content of the platform has continued to expand and improve, and DUCP program participants have successfully accessed the materials during the home-based parts of the training.

The introduction of lectures through the e-learning platform has demonstrated the potential for increased use of this method and should be actively promoted in learning environments. Increased learner engagement in using the platform can be improved by sending regular notifications. Once the platform was established, we could focus on the quality of the recordings because professional recording allows participants to focus on the material. In addition, we hope to make the information available through a smart phone application in the future.

To address the lack of Internet access in some of the most remote pediatric oncology units, we are working to provide the e-learning content on compact disc. Use of the DUCP e-learning platform also benefits participants by teaching them how to navigate the Internet; find information from abroad using the available online resources; and use other e-learning platforms, such as St Jude's Children Research

Hospital's Cure4Kids, which offers seminars in several languages, mainly English.^{27,28}

A new community of pediatric oncologists has formed since the DUCP program participants connected during training. This group is anticipated to keep networking, sharing experiences, and working together in research programs both nationally and internationally.

The first challenge for the sustainability of the program is keeping the partners engaged and invested. Secondly, we need to continue to recruit relevant participants, even if pediatric oncology numbers are limited in Africa. We project that in the near future, our participant pool may diminish, and we may need to adjust the content to different specialties. Finally, we require continued access to funding, although continued program success will lead to better recognition and financial support.

In conclusion, we successfully created and implemented a dual-university accreditation program for pediatric oncology training in French-speaking African countries. Two thirds of participants completed the program, and 98% of them returned to their home countries to practice, including in Gabon, Central African Republic, Benin, and Niger, that had no pediatric oncology program before the DUCP program. We have built a community on social media that regularly shares updates to ensure follow-up. We have also designed a follow-up survey to evaluate participants' experience of the program as well as their progress and development in the time since the training, which will be sent shortly. The e-learning French-language pediatric oncology platform remains as a durable educational asset for current and former program participants, and the program is ongoing with a fourth cohort having been recruited.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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REFERENCES

1. WHO: Global status report on noncommunicable diseases, 2010. http://www.who.int/nmh/publications/ncd_report_full_en.pdf
2. Lam CG, Howard SC, Bouffet E, et al: Science and health for all children with cancer. *Science* 363:1182-1186, 2019
3. International Agency for Research on Cancer: Latest data show a global increase of 13% in childhood cancer incidence over two decades, 2017. https://www.iarc.fr/wp-content/uploads/2018/07/pr251_E.pdf
4. United Nations: World Population Prospects: The 2017 Revision, 2017. <https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html>
5. Ward ZJ, Yeh JM, Bhakta N, et al: Estimating the total incidence of global childhood cancer: A simulation-based analysis. *Lancet Oncol* 20:483-493, 2019
6. Groupe Franco-Africain d'Oncologie Pédiatrique: GFAOP home page. <http://www.gfaop.org>
7. Harif M, Traoré F, Hessissen L, et al: Challenges for paediatric oncology in Africa. *Lancet Oncol* 14:279-281, 2013
8. Howard SC, Zaidi A, Cao X, et al: The My Child Matters programme: Effect of public-private partnerships on paediatric cancer care in low-income and middle-income countries. *Lancet Oncol* 19:e252-e266, 2018
9. Hessissen L, Patte C, Leverger G, et al: The African School of Pediatric Oncology Initiative: Report from the French African Group of Pediatric Oncology. *Pediatr Blood Cancer* 62:292s, 2015 (abstr P212)
10. Vassal G, Landman-Parker J, Baruchel A, et al: Multidisciplinarity, education, and training in pediatric oncology-hematology [in French]. *Arch Pediatr* 22:1217-1222, 2015
11. Hastings C, Wechsler DS, Stine KC, et al: Consensus on a core curriculum in American training programs in pediatric hematology-oncology: A report from the ASPHO Training Committee. *Pediatr Hematol Oncol* 24:503-512, 2007
12. Groupe Franco-Africain d'Oncologie Pédiatrique: Diplôme Universitaire en Cancérologie Pédiatrique e-learning platform. <http://e-gfaop.org>
13. Traoré F, Sylla F, Togo B, et al: Treatment of retinoblastoma in sub-Saharan Africa: Experience of the paediatric oncology unit at Gabriel Toure Teaching Hospital and the Institute of African Tropical Ophthalmology, Bamako, Mali. *Pediatr Blood Cancer* 65:e27101, 2018
14. Harif M, Barsaoui S, Bencheikroun S, et al: Treatment of B-cell lymphoma with LMB modified protocols in Africa--report of the French-African Pediatric Oncology Group (GFAOP). *Pediatr Blood Cancer* 50:1138-1142, 2008
15. Hesseling P, Israels T, Harif M, et al: Practical recommendations for the management of children with endemic Burkitt lymphoma (BL) in a resource limited setting. *Pediatr Blood Cancer* 60:357-362, 2013
16. Hayes FA, Thompson EI, Hustu HO, et al: The response of Ewing's sarcoma to sequential cyclophosphamide and Adriamycin induction therapy. *J Clin Oncol* 1:45-51, 1983
17. Ribeiro RC, Steliarova-Foucher E, Magrath I, et al: Baseline status of paediatric oncology care in ten low-income or mid-income countries receiving My Child Matters support: A descriptive study. *Lancet Oncol* 9:721-729, 2008
18. Arora RS, Eden T, Pizer B: The problem of treatment abandonment in children from developing countries with cancer. *Pediatr Blood Cancer* 49:941-946, 2007
19. Benmiloud S, El Kababri M, Kili A, et al: Central nervous system relapse in children with acute lymphoblastic leukemia: Experience of the Moroccan National Protocol (MARALL 2006). *Pediatr Blood Cancer* 63:101s, 2016 (abstr P0019)
20. El Kababri M, Ndakissa B, Kili A, et al: Mortality in a paediatric haematology oncology center (Rabat, Morocco). *Pediatr Blood Cancer* 63:278s, 2016 (abstr P0929)

21. Hessissen L, Khoubila N, Moudden L, et al: Pain management in Morocco: Report from The Moroccan Society of Pediatric Hematology and Oncology. *Pediatr Blood Cancer* 62:379s, 2015 (abstr 585)
 22. Bouda C, Traore F, Atteby JJ, et al: A multicenter study for treatment of children with Burkitt lymphoma in sub Saharan paediatric units. A study of the "Groupe Franco Africain D'oncologie Pédiatrique" (GFAOP). *Pediatr Blood Cancer* 62:156s, 2015 (abstr 0045)
 23. Lubega J, Airewele G, Frugé E, et al: Capacity building: A novel pediatric hematology-oncology fellowship program in sub-Saharan Africa. *Blood Adv* 2:11-13, 2018
 24. Denburg AE, Joffe S, Gupta S, et al: Pediatric oncology research in low income countries: Ethical concepts and challenges. *Pediatr Blood Cancer* 58:492-497, 2012
 25. Frugé E, Mahoney DH, Poplack DG, et al: Leadership: "They never taught me this in medical school." *J Pediatr Hematol Oncol* 32:304-308, 2010
 26. Kesselheim JC, Atlas M, Adams D, et al: Humanism and professionalism education for pediatric hematology-oncology fellows: A model for pediatric subspecialty training. *Pediatr Blood Cancer* 62:335-340, 2015
 27. St Jude's Research Hospital: Cure4Kids home page. <http://www.cure4kids.org>
 28. Van Kirk Villalobos A, Quintana Y, Ribeiro RC: Cure4Kids for kids: School-based cancer education outreach. *Stud Health Technol Inform* 172:111-119, 2012
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