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Knowledge Enhancement Tools for Healthcare Professionals in Oncology

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Abstract

Background: The burden of cancer is rising in low- and middle-income countries (LMICs), yet major gaps persist in oncology education and workforce capacity. In Senegal, the shortage of trained oncology professionals and limited access to up-to-date educational resources compromise the quality of care. **Objective:** This project aimed to strengthen oncology education in Senegal through the development and deployment of a suite of digital learning tools adapted to the local context, targeting healthcare professionals and patients. **Methods:** Supported by an Independent Medical Education grant from Pfizer, the project adopted a blended educational approach combining online modules, in-person workshops, and interactive content. Topics addressed included breast cancer care, chemotherapy, radiotherapy, multidisciplinary coordination, and patient education. A total of seven specialty modules and six patient/nurse-targeted modules were produced and made freely accessible via the online platform https://cancer-senegal.org. Impact was measured through pre- and post-training assessments, participant feedback, and platform analytics. **Results:** More than 100 healthcare professionals engaged with the content, with knowledge gains averaging 28% post-intervention. High satisfaction levels were reported, particularly for the modular structure and contextual relevance of the material. Nurses and allied professionals also benefited from targeted practical guides, while patient-facing tools improved communication and understanding of the care pathway. **Conclusion:** This initiative demonstrates that a context-sensitive, multi-format educational platform can significantly enhance oncology training and multidisciplinary coordination in LMICs. The open-access nature of the tools supports long-term dissemination and capacity building across francophone Africa.

Keywords

Oncology Education, Digital Learning, LMICs, Senegal, Cancer Training, Multidisciplinary Care, Breast Cancer, Health Workforce Development, E-Learning, Medical Education

1. Introduction

Cancer care in low- and middle-income countries (LMICs) faces critical challenges due to shortages in trained oncology professionals and limited educational resources [1]. A global survey found an extreme shortage of oncologists in many African countries, with over 1000 new cancer cases per oncologist in 78% of surveyed African nations [2]. This workforce gap contributes to high cancer mortality; in 21 African countries the cancer mortality-to-incidence ratio exceeds 70% [2]. Senegal exemplifies these challenges. As of 2019, there was only one formally trained medical oncologist in Senegal, with general practitioners and surgeons administering most chemotherapy [3]. National cancer mortality is around 72%, reflecting late diagnoses and shortages of skilled personnel and equipment [3]. Crucial topics such as palliative care have historically been absent from medical and nursing school curricula in Senegal, leaving many providers unfamiliar with modern pain management and cancer care principles [4]. These educational deficits hinder the adoption of new oncology treatments and best practices [5].

While oncology education remains a challenge across low- and middle-income countries (LMICs), Francophone West Africa faces a particularly acute gap. Most available training programs and resources are developed in Anglophone contexts, creating linguistic and contextual barriers for French-speaking healthcare professionals. Furthermore, limited access to structured oncology curricula, a shortage of local specialists, and fragmented continuing education pathways contribute to delayed diagnoses and suboptimal care delivery. This project was explicitly designed to bridge these structural and linguistic divides by offering culturally adapted, language-accessible educational tools tailored to the realities of Francophone African settings.

To address these gaps, the "Knowledge Enhancement Tools for Healthcare Professionals in Oncology" project was launched in Senegal. This project, conducted in 2024-2025 with support from a Pfizer Independent Medical Education grant, aimed to empower healthcare providers with up-to-date oncology knowledge and skills, with a focus on breast cancer care [3]. The initiative targeted oncologists, nurses, pharmacists, and other clinicians involved in cancer management. Recognizing the busy schedules and diverse needs of adult learners, the program adopted a blended educational approach including online learning modules, interactive webinars, and in-person workshops. All content was developed in French (Senegal's official language) and tailored to the local context to maximize relevance and accessibility. This article describes the project's design, results, and

lessons learned. We discuss how multifaceted educational tools can improve oncology practice in Senegal and similar settings, and consider the implications for clinical practice, research, and public health.

2. Methods

2.1. Design and Setting

The project was structured as a 12-month educational intervention (April 2024-March 2025) based at Cheikh Anta Diop University in Dakar, Senegal. It was implemented in collaboration with the Institut de Prévoyance Médico-Social (IPMS) and Senegal's national society against cancer. The target population was healthcare professionals involved in oncology care in Senegal, primarily in the Dakar region. This included physicians (oncologists, surgeons, radiotherapists), oncology nurses, pharmacists, and other allied providers. The intervention design was informed by adult learning principles and the identified needs of local practitioners.

2.2. Needs Assessment

At project initiation, a comprehensive needs assessment was conducted to identify specific oncology knowledge gaps and learning preferences among the target audience. This assessment comprised surveys and semi-structured interviews with a sample of 15 oncology healthcare workers in Dakar.

These data confirmed a critical educational deficit and guided the development of targeted content [5]. The needs assessment also highlighted specific topic gaps, including limited familiarity with the latest breast cancer treatment protocols, challenges in interpreting advanced diagnostic imaging, and insufficient training in communicating with patients about their treatment plans in a culturally sensitive manner [5].

2.3. Intervention Development

Based on the identified needs, the project team created a multi-modal curriculum called the "Knowledge Enhancement Tools" package. Core components included:

- **Online Modules:** A series of self-paced e-learning modules covering key oncology topics. Priority was given to breast cancer diagnosis and management, while also addressing other prevalent cancers (e.g. cervical cancer, pediatric cancers, hematologic malignancies). All materials were developed in French and reviewed by local oncology experts for accuracy and cultural relevance [6]. The online content was hosted on a dedicated platform (the *Oncologie—Hub d'Information sur le Cancer*, accessible at https://cancer-senegal.org) [7], enabling participants throughout Senegal to access the modules on-demand.
- **Interactive Webinars:** Regular live webinars were organized (approximately one per month) featuring presentations by oncology specialists on specific topics (e.g. updates in breast cancer systemic therapy, radiotherapy planning, man-

aging chemotherapy side effects). These webinars enabled real-time question-and-answer sessions. Participants could join via video conference or phone, expanding reach to those outside Dakar. Webinar recordings were later made available on the project platform for asynchronous viewing.

- **Workshops and Case Discussions:** Two in-person workshops were conducted in Dakar during the project. The first was a mid-term workshop focused on breast cancer management, including multidisciplinary case discussions (surgery, medical oncology, and radiotherapy perspectives). The second was a broader oncology symposium near project conclusion, covering various tumor types and featuring interactive tumor board-style case reviews. These sessions emphasized collaborative learning, with attendees working in teams to formulate diagnostic and treatment plans for presented cases. Role-playing and patient perspective discussions were included to reinforce patient-centered care approaches [5]. Travel scholarships were provided to a limited number of participants from regional hospitals to encourage attendance from outside the capital.
- **Supplementary Materials:** The project developed French-language reference materials such as quick-reference guides, treatment algorithms, and patient education pamphlets. Topics included breast cancer early detection, chemotherapy safety, and communication strategies. These resources were distributed via the online platform and at in-person events. Participants were encouraged to share and utilize these tools within their home institutions.
- **Expert Collaboration and Content Validation:** The educational content was created by a multidisciplinary team of local experts. Contributors included Senegalese oncologists, surgeons, radiologists, oncology pharmacists, and nursing educators, as well as advisory input from oncology specialists abroad. This collaboration ensured content was up-to-date with global standards while remaining relevant to Senegal's context [5]. Draft modules were pilot-tested by a small group of target end-users, and their feedback was incorporated to improve clarity and applicability. Importantly, local guidelines and resource availability were considered, for example, recommendations in the training on chemotherapy and radiotherapy were tailored to what is feasible within Senegal's health system.

2.4. Patient-Directed Educational Materials

In parallel with professional training, the project developed educational tools for patients, including five thematic brochures. These materials addressed core topics such as understanding cancer diagnosis, chemotherapy side effects, radiotherapy sessions, and breast cancer care. All resources were created in plain language and reviewed for health literacy and cultural appropriateness.

2.5. Implementation

The online platform was launched in October 2024, after approximately six

months of content development. Invitations and announcements were disseminated through the National Oncology Society, hospital departments, and professional networks. Webinars were scheduled after work hours or on weekends to maximize live attendance. Reminders and summaries were sent via email and WhatsApp groups to maintain engagement. The in-person workshops in Dakar were held in November 2024 and March 2025, coinciding with broader medical conferences to leverage attendance.

2.6. Evaluation Strategy

A mixed-methods evaluation was embedded in the project to assess outcomes. Quantitative knowledge gain was measured using pre- and post-module quizzes and a pre/post test administered at the start and end of the project. Participants took an initial assessment covering core oncology knowledge areas prior to accessing the educational content. The same or similar assessment was repeated after completion of all modules or at project end. The primary outcome was an improvement in test scores. Secondary outcomes included self-reported changes in confidence and practice. After each webinar and workshop, attendees completed feedback surveys rating the relevance, quality, and their learning gains, as well as open-ended questions on persistent gaps and suggestions. Engagement metrics (module completion rates, webinar attendance logs, platform usage statistics) were collected to gauge reach and participation.

2.7. Data Analysis

Pre- and post-test scores were compared using paired statistical tests (e.g. paired t-test) to evaluate knowledge improvement. Survey responses were summarized with descriptive statistics. Qualitative feedback from interviews and open-ended survey questions was analyzed thematically to identify common benefits and challenges. The evaluation was primarily formative given the project's educational nature, aiming to inform future improvements. Given that this was an educational program without a control group, analyses focused on before-after changes and participant perceptions, rather than causal inference.

Pre- and post-test scores were analysed using paired t-tests to assess statistically significant differences in mean scores before and after the training modules. A Wilcoxon signed-rank test was used as a non-parametric alternative when data did not meet normality assumptions. Statistical analyses were conducted using Jamovi (Version 2.6.2.al).

Ethical approval was obtained from the institutional review board of Cheikh Anta Diop University for use of survey and test data, and informed consent was obtained from all participants for their data to be used in aggregate reporting.

3. Results

3.1. Participant Characteristics and Reach

A total of 100 healthcare professionals participated in the program over the 12-

month period. Of these, about 60% were physicians (including 8 oncologists or oncology fellows, 12 surgeons, and several general practitioners involved in oncology care), 30% were oncology or general nurses, and 10% were pharmacists or other allied staff. The majority (approximately 70%) were based in Dakar, with the remainder from regional hospitals or clinics. Participant engagement was strong: 85 individuals (85% of enrollees) completed at least one online module, and 65% completed all modules. Live webinar attendance averaged 40 - 50 participants per session, and the recordings were later accessed over 200 total times on the platform. The first in-person workshop (breast cancer focus) drew 45 attendees from 5 regions of Senegal, while the final workshop had 60 attendees and included some international observers from neighboring West African countries.

3.2. Needs Assessment Findings

The baseline needs assessment confirmed significant knowledge gaps. In addition to the quantitative findings noted earlier, qualitative interviews revealed that many providers felt isolated in keeping up with oncology advances. For example, practitioners outside the capital reported difficulty accessing latest clinical guidelines and oncology journals. Variation in practice was evident: some physicians relied on outdated chemotherapy protocols, and nurses had received little formal training in cancer care beyond basic nursing school. These insights reinforced the necessity of the project's content. Crucially, the strong interest in digital learning (nearly 70% preferred more online resources) validated the project's decision to create an online hub.

3.3. Educational Content Delivered

By the end of the project, a comprehensive suite of educational tools had been delivered. Seven online modules were developed and made available on the platform, covering cancers by specialty (Gynecology, Hematology, Pediatrics, ENT, Sarcomas and soft tissue, Digestive Tract), as well as modules designed for nurses and patients: Understanding Chemotherapy—Essential Guide, Understanding Radiotherapy in Oncology, Explore the Complete Care Pathway for Breast Cancer, Understand and Act, Nursing Role in Oncology Care, Your Cancer Care Journey.

The in-person workshops further reinforced the learning. At the breast cancer workshop, case discussions highlighted practical challenges (e.g. managing locally advanced cases with limited radiotherapy machines available) and encouraged peer learning. Many attendees noted that this was the first time a multidisciplinary tumor board format had been simulated outside the main cancer center, an experience they found valuable.

3.4. Knowledge Outcomes

Analysis of the pre- and post-training assessments demonstrated significant improvements in oncology knowledge. The mean score on the comprehensive on-

cology quiz increased from 58% at baseline to 80% after completion of the modules and webinars ($p < 0.001$). Improvement was observed across all subject areas, with particularly large gains in breast cancer management knowledge. For instance, only 40% of participants initially knew the recommended first-line chemotherapy regimen for HER2-positive metastatic breast cancer, whereas 85% answered this correctly in the post-test. Participants' ability to interpret cancer staging scans also improved, as evidenced by higher post-intervention scores on image-based questions. These results suggest the educational tools were effective in closing specific knowledge gaps.

Furthermore, 88% of participants reported increased confidence in their ability to manage cancer patients as a result of the training. In follow-up surveys, a majority of physicians indicated they were more likely to follow evidence-based guidelines for treatment. For example, several doctors noted they planned to incorporate new chemotherapy protocols learned for breast cancer, and nurses reported greater comfort in handling chemotherapy side effects and patient counseling. One oncology nurse wrote, "I feel more capable now to educate my patients on side effects and to catch complications early, thanks to the skills I gained from the online modules and discussions." Such self-reported practice changes, while subjective, align with the knowledge gains measured.

3.5. Persistent Gaps

Despite these improvements, the project revealed ongoing challenges. Not all target users engaged with the platform; about 15 registered healthcare providers (15% of enrollees) were largely inactive or did not complete any modules, often citing lack of time or intermittent internet connectivity as barriers. Participants from outside Dakar, in particular, faced connectivity issues that occasionally hindered accessing webinars live. Additionally, some advanced topics (e.g. cancer clinical research, molecular oncology) were beyond the scope of this program and remain areas for future training. Through feedback, participants expressed a desire for more hands-on training in certain skills—for instance, surgical residents wanted more practical workshops on oncology surgical techniques, and nurses suggested additional in-person simulations for managing oncologic emergencies. Systemic issues also persist: improving knowledge alone does not solve the lack of resources for optimal care. Several participants highlighted that even with better knowledge, they are constrained by shortages of chemotherapy drugs and radiotherapy facilities. Thus, while the educational intervention was necessary and beneficial, it is not sufficient on its own to overcome all care deficits.

Finally, the project's focus on breast cancer was appropriate given its burden, but it meant that other cancer types received comparatively less attention. Some practitioners (e.g. those interested in gastrointestinal cancers) noted they would appreciate future modules on those topics. These gaps point to the need for ongoing education beyond the project's duration. On a positive note, the project created a foundation—a repository of materials and a network of engaged professionals—that can be built upon to continue addressing these gaps.

4. Discussion

4.1. Key Findings

This educational initiative substantially improved oncology knowledge and self-reported preparedness among healthcare professionals in Senegal. We found that baseline deficits in oncology practice were considerable—consistent with prior reports of limited oncology training opportunities in West Africa (3). The project's multifaceted approach (combining online modules, webinars, and workshops) was effective in addressing many of these gaps. Over the one-year period, approximately 100 providers engaged with the program, and post-training test scores increased by more than 20 percentage points on average. Participants particularly benefited in areas of breast cancer management, reflecting the project's strategic focus. Nearly all respondents indicated the tools were relevant to their clinical practice, and the majority felt more confident in providing care. These findings demonstrate that a targeted, context-appropriate educational intervention can yield significant gains in provider knowledge in a short time. Importantly, the intervention reached not only specialist physicians but also nurses and general practitioners, indicating its broad applicability across the oncology care team. Such inclusive capacity building is crucial in a setting like Senegal where task-sharing is common due to specialist shortages [3].

The project also successfully established a new digital resource—an online oncology information hub—that remains available for continuing education. Usage statistics and feedback suggest a strong appetite for such resources among Senegalese health workers. This aligns with experiences in other African contexts showing high interest and readiness for e-learning in oncology [6]. The high completion rate of modules (65% of participants finished all modules) is notable and suggests that, when content is made accessible and relevant, busy healthcare providers will invest time in learning. Taken together, these results affirm that the educational deficits identified can be mitigated through well-designed knowledge enhancement tools.

4.2. Interpretation

Our results are consistent with the broader literature on oncology training in LMICs and provide new insights specific to Francophone West Africa. Previous studies have emphasized that lack of an adequately trained oncology workforce is a major barrier to improving cancer outcomes in low-resource settings. This project demonstrates that even in a country with very limited oncology specialists, a locally led training program can rapidly build capacity among the existing health workforce. The significant improvement in knowledge and confidence among participants suggests that many had an untapped potential that was realized once given access to up-to-date information and teaching. In effect, the intervention helped to "democratize" oncology expertise beyond the single tertiary cancer center in Dakar, spreading knowledge to regional hospitals and clinics.

One interpretation of the strong engagement is that the blend of online and

face-to-face learning was particularly suitable. Busy clinicians often cannot attend long off-site trainings; the self-paced online modules allowed flexibility, while the scheduled webinars and workshops provided interactivity and accountability. The COVID-19 pandemic, which normalized online education, likely facilitated acceptance of the digital format [3]. Indeed, a 2021 survey of African oncology professionals found that over 90% have access to a computer and are interested in online oncology education [6], highlighting that lack of infrastructure may be less of a barrier than assumed. Our project leveraged this readiness successfully. The improvement in test scores mirrors findings from other contexts where structured continuing medical education significantly increased oncology knowledge and competence [7]. For example, brief online courses have been shown to improve oncologists' knowledge and confidence in high-income settings [7]; our work extends this evidence to an LMIC setting.

It is important to note that while knowledge gains were clear, translating knowledge into practice will depend on additional factors. Participants now better understand standard treatments, but if essential chemotherapy drugs or radiation therapy are unavailable or if referral pathways are weak, patient outcomes may not immediately improve. Nonetheless, improved provider knowledge is a critical first step toward better care, as it can lead to incremental changes (such as more accurate diagnoses, better supportive care, and advocacy for system improvements). We observed early signs of practice change—e.g. clinicians intending to implement new protocols—which are encouraging. Over time, we expect that this enhanced expertise will contribute to more standardized and guideline-concordant care, which in turn can improve outcomes like early-stage diagnosis rates and treatment success.

Our findings also underscore the importance of local context in designing training. The use of French and inclusion of Senegal-specific guidelines (for example, highlighting local referral processes, resource availability, and cultural communication aspects) were frequently cited by participants as valuable. This localization likely improved both uptake and effectiveness of the training. It differentiates our approach from generic international courses and speaks to the need for regionally tailored educational content. Additionally, involving local experts as faculty fostered trust and relevance; participants could learn from colleagues who understand the daily realities and challenges in Senegal. This collaborative model aligns with recommendations to engage local and diaspora oncologists in Africa to build capacity and "turn brain drain into brain circulation" [3].

The project also highlights how a focus on a priority area can serve as a feasible entry point for broader oncology training.

5. Implications for Clinical Practice, Research, and Public Health

5.1. Clinical Practice

The improvements observed suggest that patients stand to benefit from more

knowledgeable providers. In the short term, participating clinicians are likely to apply their new knowledge to make more informed treatment decisions and provide better counseling to patients. For instance, a more confident and informed nurse can educate patients on chemotherapy side effects and symptom management, potentially improving adherence and reducing complications. Physicians who have updated their knowledge may be more inclined to follow evidence-based treatment protocols (rather than outdated regimens), which can improve efficacy of care. Over the long term, if this model of continuing education is sustained, we can expect a gradual elevation of oncology care standards nationally. Ultimately, better-trained providers can contribute to earlier cancer detection (through improved clinical suspicion and referral) and more appropriate treatments, which could help reduce the extremely high mortality-to-incidence ratio currently seen in Senegal and similar countries [2]. An important practice implication is the need to integrate such educational tools into routine professional development. For example, the platform and materials from this project could be used in residency programs or hospital continuing education sessions, thereby continually reinforcing good practice. The project also fostered a network of practitioners interested in oncology, which encourages continued case discussions and consultation, further enhancing clinical decision-making beyond the project period.

5.2. Research

This project reveals several areas where further research is warranted. One area is the impact of educational interventions on patient outcomes. While improving provider knowledge is assumed to improve care, there is sparse data from LMICs directly linking training programs to metrics like patient survival or quality of life [5]. Future studies could formally evaluate whether facilities that engaged with the Knowledge Enhancement Tools subsequently show better patient outcomes (for example, higher rates of patients receiving guideline-concordant therapy or improved treatment completion rates). Another research implication is to explore the optimal mix of educational modalities for sustained learning. Our project combined online and in-person methods; research could compare this blended approach with purely online or purely workshop-based training to determine the most cost-effective and scalable strategy. Additionally, the needs assessment identified persistent knowledge gaps (e.g. in advanced imaging or research literacy); these could guide the development of new training content, and researchers can evaluate innovative teaching techniques (such as virtual reality simulations or tele-mentoring) to address them. There is also an opportunity to study participant retention and motivation in voluntary continuing education—understanding why some healthcare workers did not engage fully could inform strategies to increase uptake (for instance, incentive mechanisms or integrating training with certification requirements). Lastly, this project adds to the limited literature on francophone Africa in oncology education. Publishing and disseminating such findings

(as we aim to do with this article) is itself important, as a recent scoping review highlighted a paucity of published educational initiatives from LMICs [5]. By sharing successes and challenges, we contribute to a growing evidence base that can benefit similar programs in other countries [8].

5.3. Public Health

At a health system level, the project demonstrates a model for capacity building that could be scaled up to strengthen cancer control. National cancer control plans in many African countries recognize human resource development as a key pillar [3]. This project's approach—leveraging technology and local expertise to deliver CME (Continuing Medical Education)—can be incorporated into national strategies. Ministries of Health and professional councils could adopt the online platform as an official repository for oncology CME and require or encourage healthcare providers to complete certain modules for license renewal or career advancement. Such integration would institutionalize continuous learning and help maintain competencies. Furthermore, the multi-disciplinary nature of our audience (doctors, nurses, pharmacists) is crucial for public health impact: cancer care is delivered by teams, and improving knowledge across the team can synergistically improve patient navigation and treatment adherence. Strengthening oncology training also aligns with the broader goal of moving towards universal health coverage for non-communicable diseases in Africa. As cancer incidence rises on the continent [3], ensuring that the health workforce is well-trained will be vital for scaling up services like screening, diagnosis, and treatment. In Senegal, an immediate implication is the potential to expand this program nationally, reaching more providers in remote areas. The fact that our participants came primarily from urban centers indicates an ongoing urban-rural gap. Public health efforts should focus on extending training and support to peripheral regions, possibly by empowering the participants of this project to become trainers ("train-the-trainer" approach). Finally, success in knowledge enhancement can support advocacy for other investments—for example, demonstrating provider readiness may help policymakers justify the procurement of additional chemotherapy drugs or radiotherapy machines, knowing that staff are prepared to use them effectively. In summary, this educational initiative not only builds individual capacity but also contributes to system-level strengthening for cancer control.

6. Conclusions

The "Knowledge Enhancement Tools for Healthcare Professionals in Oncology" project in Senegal demonstrated that a focused educational intervention can substantially improve oncology knowledge and empower healthcare providers in a resource-limited setting. Over the course of one year, this program addressed critical educational deficits by delivering up-to-date content through a blend of online modules, interactive webinars, and hands-on workshops. Participants showed significant gains in knowledge, particularly in breast cancer manage-

ment, and reported increased confidence in caring for cancer patients. These outcomes suggest that even in the context of severe specialist shortages and infrastructural challenges, investing in the education of the existing health workforce can yield rapid benefits. Notably, the creation of an online oncology platform (https://cancer-senegal.org) provides a lasting repository for continued learning and can be expanded to cover more topics and reach more providers over time.

This project also offers important lessons. Tailoring educational tools to the local context—language, epidemiology, and health system realities—was key to engagement and success. Multi-modal and collaborative learning approaches helped accommodate diverse learner needs and built a community of practice that will persist beyond the project. However, knowledge improvement is only one piece of the puzzle in strengthening cancer care. The persistent gaps identified (such as resource constraints and the need for more advanced training in certain areas) highlight that education must be part of a broader strategy including health system investments and ongoing mentorship. We encourage stakeholders in Senegal and similar countries to integrate such knowledge enhancement programs into national cancer control efforts, as a complement to expanding infrastructure.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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