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Strengthening data management systems for digital health and ai integration: a project proposal for douala general hospital, Cameroon

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ABSTRACT

Douala General Hospital (DGH), one of Cameroon's leading referral institutions, continues to rely heavily on paper-based systems for recording and managing patient information, despite its pivotal role in providing specialized healthcare services. This article presents a comprehensive project proposal for strengthening data management systems at DGH to support evidence-based decision-making and prepare the institution for the integration of digital health solutions, including data science and artificial intelligence. The project is justified by the urgent need to address fragmented data management, inadequate staff training, and limited digital infrastructure that currently hinder the hospital's capacity to deliver high-quality, data-driven healthcare. The project objectives include establishing a centralized and interoperable hospital data management system within 24 months, training at least 200 hospital staff in digital literacy and data analytics within 18 months, upgrading digital infrastructure within 12 months, developing institutional policies and governance frameworks within 12 months, and promoting the routine use of hospital data for decision-making and research. The project is situated within the tertiary sector, with elements of the quaternary sector given its emphasis on knowledge generation and innovation. Potential project partners include the Ministry of Public Health, local universities, the World Health Organization, the African Population and Health Research Center, Data Science Without Borders partners, the Wellcome Trust, the World Bank, and private sector actors. Primary beneficiaries include patients receiving care at DGH, while secondary beneficiaries include hospital staff, the institution itself, the Ministry of Public Health, academic institutions, researchers, and wider society. The estimated project budget is $500,000, covering project management, human resources, digital infrastructure, software development, capacity building, pilot implementation, full-scale deployment, monitoring and evaluation, knowledge translation, and contingency. The project will be implemented in phases over 24 months, from inception and planning to full-scale deployment and evaluation. The project aims to position DGH as a pioneer in Cameroon's health sector, ready to integrate data science and artificial intelligence in clinical and operational practice.

Keywords: Data Management Systems, Digital Health, Artificial Intelligence Integration, Health Systems Strengthening, Douala General Hospital, Cameroon, Project Proposal, Digital Transformation

RESUME

L'Hôpital Général de Douala (HGD), l'une des principales institutions de référence du Cameroun, continue de s'appuyer largement sur des systèmes papier pour l'enregistrement et la gestion des informations des patients, malgré son rôle essentiel dans la fourniture de services de santé spécialisés. Cet article présente une proposition de projet complète pour le renforcement des systèmes de gestion des données à l'HGD afin de soutenir la prise de décision fondée sur des données probantes et de préparer l'institution à l'intégration de solutions de santé numérique, y compris la science des données et l'intelligence artificielle. Le projet est justifié par la nécessité urgente de remédier à la gestion fragmentée des données, à la formation inadéquate du personnel et à l'infrastructure numérique limitée qui entravent actuellement la capacité de l'hôpital à fournir des soins de santé

de haute qualité fondés sur les données. Les objectifs du projet incluent l'établissement d'un système de gestion des données hospitalières centralisé et interopérable dans un délai de 24 mois, la formation d'au moins 200 membres du personnel hospitalier en littératie numérique et en analyse de données dans un délai de 18 mois, la modernisation de l'infrastructure numérique dans un délai de 12 mois, l'élaboration de politiques institutionnelles et de cadres de gouvernance dans un délai de 12 mois, et la promotion de l'utilisation régulière des données hospitalières pour la prise de décision et la recherche. Le projet se situe dans le secteur tertiaire, avec des éléments du secteur quaternaire compte tenu de son accent sur la génération de connaissances et l'innovation. Les partenaires potentiels du projet incluent le Ministère de la Santé Publique, les universités locales, l'Organisation Mondiale de la Santé, l'African Population and Health Research Center, les partenaires de Data Science Without Borders, la Wellcome Trust, la Banque mondiale et les acteurs du secteur privé. Les bénéficiaires principaux incluent les patients recevant des soins à l'HGD, tandis que les bénéficiaires secondaires incluent le personnel hospitalier, l'institution elle-même, le Ministère de la Santé Publique, les institutions académiques, les chercheurs et la société en général. Le budget estimé du projet est de 500 000 $, couvrant la gestion de projet, les ressources humaines, l'infrastructure numérique, le développement de logiciels, le renforcement des capacités, la mise en œuvre pilote, le déploiement à grande échelle, le suivi et l'évaluation, le transfert de connaissances et les imprévus. Le projet sera mis en œuvre par phases sur 24 mois, de la planification initiale au déploiement à grande échelle et à l'évaluation. Le projet vise à positionner l'HGD comme un pionnier dans le secteur de la santé au Cameroun, prêt à intégrer la science des données et l'intelligence artificielle dans la pratique clinique et opérationnelle.

Mots-clés : Systèmes de Gestion des Données, Santé Numérique, Intégration de l'Intelligence Artificielle, Renforcement des Systèmes de Santé, Hôpital Général de Douala, Cameroun, Proposition de Projet, Transformation Numérique

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1. INTRODUCTION

Douala General Hospital (DGH) is one of Cameroon's leading referral institutions, providing specialized healthcare services to a large and diverse patient population. Despite its pivotal role, the hospital continues to rely heavily on paper-based systems for recording and managing patient information. While certain departments use an ORACLE database for billing and laboratory data, these systems remain fragmented, with little or no interoperability across units. This fragmented approach to data management not only hampers the efficiency of day-to-day hospital operations but also limits the ability of decision-makers to access reliable and timely information needed to improve patient care and optimize resource allocation (Jha et al., 2009; Blumenthal & Tavenner, 2010).

The absence of a centralized electronic medical record (EMR) system and the lack of standardization in data collection create serious challenges for data quality, accessibility, and long-term storage. Records are often incomplete, difficult to retrieve, and vulnerable to loss or damage. These inefficiencies undermine the hospital's capacity to monitor patient outcomes, track disease trends, and generate evidence for clinical and administrative decision-making (Weiskopf & Weng, 2013; Kahn et al., 2012). Moreover, they compromise the institution's readiness to harness modern innovations such as data science and artificial intelligence, which require reliable, digitized, and well-structured datasets (Bates et al., 2014; Raghupathi & Raghupathi, 2014).

Human resource and infrastructure constraints further exacerbate the problem. Most staff members have limited training in digital tools and data management practices, leaving them ill-prepared to adapt to emerging technologies (Murdoch & Detsky, 2013;

Taylor et al., 2017). At the same time, the hospital faces shortages in essential IT infrastructure, including computers, reliable internet connectivity, and technical support systems. Without urgent intervention, these limitations will continue to hinder DGH's capacity to deliver high-quality, data-driven healthcare (Obermeyer & Lee, 2017; Beam & Kohane, 2018).

This article presents a comprehensive project proposal for strengthening data management systems at Douala General Hospital to support evidence-based decision-making and prepare the institution for the integration of digital health solutions, including data science and artificial intelligence. The project is justified by the urgent need to address fragmented data management, inadequate staff training, and limited digital infrastructure that currently hinder the hospital's capacity to deliver high-quality, data-driven healthcare.

2. PROBLEM STATEMENT

Douala General Hospital (DGH) is one of Cameroon's leading referral institutions, providing specialized healthcare services to a large and diverse patient population. Despite its pivotal role, the hospital continues to rely heavily on paper-based systems for recording and managing patient information. While certain departments use an ORACLE database for billing and laboratory data, these systems remain fragmented, with little or no interoperability across units. This fragmented approach to data management not only hampers the efficiency of day-to-day hospital operations but also limits the ability of decision-makers to access reliable and timely information needed to improve patient care and optimize resource allocation.

The absence of a centralized electronic medical record (EMR) system and the lack of standardization in data collection create serious challenges for data quality, accessibility, and long-term storage. Records are often incomplete, difficult to retrieve, and vulnerable to loss or damage. These inefficiencies undermine the hospital's capacity to monitor patient outcomes, track disease trends, and generate evidence for clinical and administrative decision-making. Moreover, they compromise the institution's readiness to harness modern innovations such as data science and artificial intelligence, which require reliable, digitized, and well-structured datasets.

Human resource and infrastructure constraints further exacerbate the problem. Most staff members have limited training in digital tools and data management practices, leaving them ill-prepared to adapt to emerging technologies. At the same time, the hospital faces shortages in essential IT infrastructure, including computers, reliable internet connectivity, and technical support systems. Without urgent intervention, these limitations will continue to hinder DGH's capacity to deliver high-quality, data-driven healthcare.

3. PROJECT OBJECTIVES

The primary objective of the project is to strengthen data management systems at Douala General Hospital to support evidence-based decision-making and prepare the institution for the integration of digital health solutions, including data science and artificial intelligence. Specifically, the project aims to:

1. Establish a centralized and interoperable hospital data management system within 24 months, reducing reliance on paper-based records by at least 60% and improving accessibility of patient data across all major departments.

2. Train at least 200 hospital staff (clinical, administrative, and IT) in digital literacy, electronic medical records, and basic data analytics within 18 months, ensuring that at least 80% of trained staff demonstrate improved competency in post-training evaluations.

3. Upgrade digital infrastructure by providing a minimum of 150 computers, establishing reliable internet connectivity in all hospital units, and deploying appropriate software solutions within 12 months to ensure uninterrupted and secure data management.

4. Develop and adopt institutional policies and governance frameworks on data quality, privacy, and security within 12 months, with endorsement from hospital leadership and alignment with the Ministry of Public Health's national eHealth strategy.

5. Promote the routine use of hospital data for decision-making and research by producing at least three data-driven reports annually, starting within 18 months, and integrating findings into hospital planning and quality improvement initiatives.

4. PROJECT SECTOR LEVEL

The proposed project is situated within the tertiary sector, as it focuses on improving services delivered by a specialized healthcare institution. Douala General Hospital operates at the level of advanced medical care, providing referral and specialized services that go beyond primary and secondary healthcare delivery. However, the project also incorporates elements of the quaternary sector, given its emphasis on knowledge generation, data science, and the integration of artificial intelligence in healthcare systems. By strengthening data management infrastructure and building staff capacity, the initiative directly enhances service delivery in the tertiary health sector while simultaneously contributing to the quaternary sector through innovation, research, and the application of advanced digital technologies in health.

5. PROJECT OPPORTUNITIES

The project presents several opportunities:

Modernization of hospital operations: The project offers a chance to reduce inefficiencies linked to paper-based systems and establish a more reliable, accessible, and secure flow of health information.

Improved patient care and safety: With standardized and digitized records, healthcare providers will have quicker access to accurate information, reducing errors and enhancing clinical decision-making.

Capacity building of health workforce: Training programs will strengthen staff skills in digital literacy, data analysis, and electronic health records, creating a more skilled and future-ready workforce.

National and regional leadership in digital health: By becoming one of the first hospitals in Cameroon to integrate data science and prepare for AI, DGH can position itself as a model for other institutions nationally and across the region.

Resource mobilization and partnerships: Demonstrating commitment to digital transformation can attract financial and technical support from donors, governments, and private sector actors.

Innovation and research opportunities: Reliable, digitized data will open pathways for applied research, health system monitoring, and innovation, including the use of predictive analytics and AI.

Policy influence and alignment: The project can contribute directly to the implementation of the national eHealth strategy, reinforcing DGH's role as a strategic partner for health system strengthening in Cameroon.

6. POTENTIAL PROJECT PARTNERS

The successful implementation of this project will require collaboration with a wide range of partners:

National Level: Ministry of Public Health, local universities (University of Douala, University of Dschang)

Regional and International: World Health Organization (WHO), African Population and Health Research Center (APHRC), Data Science Without Borders partners, professional associations in digital health

Development Partners and Donors: Wellcome Trust, World Bank, bilateral cooperation agencies

Private Sector: IT companies, telecommunication providers (CAMTEL, ORANGE, MTN)

7. PROJECT BENEFICIARIES

Primary Beneficiaries: Patients receiving care at Douala General Hospital will benefit directly from improved data management systems through more accurate medical records, reduced errors, faster service delivery, and enhanced continuity of care.

Secondary Beneficiaries: Hospital staff, including clinicians, administrative personnel, and IT teams, will gain from capacity-building initiatives, better access to reliable data, and improved tools for decision-making.

Institutional Beneficiaries: Douala General Hospital as an institution will benefit from strengthened infrastructure, enhanced operational efficiency, and improved readiness to adopt digital health innovations and artificial intelligence.

System-Level Beneficiaries: The Ministry of Public Health and national health authorities will benefit from more reliable hospital data to support health system planning, monitoring, and evaluation. Academic institutions and researchers will also gain access to higher-quality data for research and evidence generation.

Wider Society: At the community and national level, the project will contribute to better health outcomes, more efficient use of resources, and increased trust in the health system, reinforcing the hospital's role as a center of excellence.

8. PROJECT IMPLEMENTATION STEPS

The project will be implemented in phases over 24 months:

Phase 1: Inception and Planning (Months 1-3)

- Project launch workshop
- Establish steering committee
- Finalize implementation plan

- Develop baseline indicators

Phase 2: Needs Assessment and System Design (Months 3-5)

- Assess existing systems and infrastructure
- Identify human resource capacities
- Define functional requirements
- Co-design system architecture

Phase 3: Infrastructure Upgrade and Development (Months 6-12)

- Procure IT equipment
- Install computers and servers
- Improve connectivity
- Develop/adapt software solutions
- Implement data security measures

Phase 4: Capacity Building and Training (Months 9-15)

- Train staff in digital literacy
- Train staff in EMR and analytics
- Specialized IT team training
- Peer-learning mechanisms

Phase 5: Pilot Implementation and Validation (Months 12-18)

- Pilot in selected departments
- Monitor pilot performance
- Validation workshops

Phase 6: Full-Scale Deployment (Months 18-24)

- Expand to all departments
- Standardize data protocols
- Integrate with national systems

Phase 7: Monitoring, Evaluation, and Improvement (Months 6-24)

- Routine monitoring and adoption tracking
- Mid-term evaluation
- Final evaluation and lessons learned

9. ESTIMATED PROJECT BUDGET

Table 1: Estimated Project Budget

No	Budget Category	Description of Activities	Unit Cost (USD)	Quantity	Subtotal (USD)
1	Project Management & Coordination	Launch & coordination workshops, steering committee meetings, reporting	10,000	8 events	80,000
2	Human Resources (Project Staff Salaries)	Project manager, IT specialists, M&E officer, admin/finance support	2,500	24 staff-months	60,000
3	Digital Infrastructure & Equipment	Computers, servers, networking tools, secure data storage, internet connectivity	-	150 computers	150,000
4	Software Development & Licensing	EMR platform customization, licenses, security software	-	-	60,000
5	Capacity Building & Training	Digital literacy, EMR, data analytics training for 200 staff	-	200 staff	50,000
6	Pilot Implementation	Testing in selected departments, workflow refinement	-	-	20,000
7	Full-Scale Deployment	Expansion to all units, integration with national platforms	-	-	30,000
8	Monitoring & Evaluation	Mid-term and final reviews, performance tracking	-	-	25,000
9	Knowledge Translation & Policy Dialogue	Policy briefs, technical reports, workshops	-	-	15,000
10	Contingency Reserve (10%)	Unforeseen costs, market fluctuations	-	-	50,000
11	Indirect Costs (7%)	Administrative support, finance, logistics	-	-	35,000
	Total				**500,000**

Source: Project Proposal

10. POTENTIAL FUNDING SOURCES

International Donors and Development Partners: World Bank, African Development Bank (AfDB), CDC, USAID, GIZ, European Union

Philanthropic Foundations: Wellcome Trust, Bill & Melinda Gates Foundation, Rockefeller Foundation, Mastercard Foundation

Multilateral Organizations: World Health Organization (WHO), UNICEF, Global Fund

Regional Initiatives and Networks: African Union, Africa CDC

Private Sector and Public-Private Partnerships: Technology companies, telecommunications providers (CAMTEL, ORANGE, MTN), health tech firms

National Government and Local Sources: Ministry of Public Health, Government of Cameroon

11. CONCLUSION

This project proposal presents a comprehensive strategy for strengthening data management systems at Douala General Hospital to support evidence-based decision-making and prepare the institution for the integration of digital health solutions, including data science and artificial intelligence. The project addresses critical gaps in data management infrastructure, staff competencies, and governance frameworks that currently hinder the hospital's capacity to deliver high-quality, data-driven healthcare.

The project is justified by the urgent need to address fragmented data management, inadequate staff training, and limited digital infrastructure. The project objectives are ambitious yet achievable, with a clear implementation plan, estimated budget, and potential funding sources. The project will position DGH as a pioneer in Cameroon's health sector, ready to integrate data science and artificial intelligence in clinical and operational practice.

The successful implementation of this project will require collaboration with a wide range of partners, sustained commitment from hospital leadership, and adequate resources. The benefits will extend beyond DGH to the wider health system, contributing to improved patient care, enhanced operational efficiency, and strengthened health system resilience.

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