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Digital Transformation in Public Health Institutions and Its Role in Improving the Quality of Health Services: Case Study of Public Hospital Institution - Ain Bassam

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Abstract:

This study aims to evaluates the current state and significance of digital transformation at the Mohammed Al-Bachir Public Hospital Institution in Ain Bassam, highlighting its pivotal role in enhancing the quality of healthcare services. The analysis has allowed for the proposal of a number of strategic solutions and recommendations aimed at elevating the level and quality of service delivery. Findings reveal that while certain digital initiatives have been launched, they represent only preliminary steps and have not evolved sufficiently to meet the advanced technological needs of modern information systems. The study also identifies several challenges that impede the full realization of these digital initiatives and offers a suite of recommendations to facilitate the successful implementation of digital transformation strategies.

Keywords: Digital Transformation, Quality of Health Services, Public Health Institutions.

Jel Classification Codes: I18, O33.

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1. INTRODUCTION

The digital revolution marks a transformative era that has precipitated extensive changes across various sectors, prompting substantial investment in digital technologies. The adoption of digital technology is no longer a mere option but a necessity for growth in the digital era.

In line with other service sectors, the health sector is keen to harness these emerging technologies to discover the most effective solutions for enhancing patient care services. Consequently, Algerian public health institutions (EPH) are actively defining and implementing digitization strategies to enhance their operational performance. This involves the integration of Information and Communication Technology (ICT) into their processes and the adoption of comprehensive strategies and projects aimed at achieving digital transformation (DT).

1.1 The Problem:

Within this framework, the problem statement can be articulated as follows:

- **To what extent will digital transformation contribute to the enhancement of healthcare service quality at the Ain Bessem public hospital institution (EPH)?**

The following hypotheses are proposed:

_ Digital transformation is a fundamental requirement for participating in the digital revolution.

_ Effective digital transformation will significantly enhance the capability of EPHs to improve service delivery and address existing challenges.

1.2 Research Objectives:

- To assess the current state and extent of digitization within EPHs in Algeria,
- To identify and analyze the challenges and constraints faced by EPHs,

- To examine the extent of digitization practices in EPHs and their impact on the quality of healthcare services,
- To offer actionable recommendations to strengthen digital transformation efforts in EPHs, thereby enhancing the quality of health services.

1.3 Theme Importance:

The significance of this study is twofold, reflecting the global application of digital transformation (DT) as a strategic imperative for service organizations aiming to enhance the quality of their offerings. Its relevance is further underscored when considering public service institutions, particularly public health institutions (EPH), on their journey toward effective digital transformation.

1.4 Study Method:

The research approach employed to address the problem and generate findings involved a descriptive methodology focused on the theoretical dimensions of digital transformation and healthcare service quality. Additionally, an analytical method was used for the empirical aspect, examining the specific case of EPH Ain Bessem. This analysis was enriched by personal interviews conducted with key personnel including the General Director, deputy directors, and engineers responsible for DT initiatives at the institution.

2. What is DT in EPHs:

DT in public health institutions involves the adoption of digitization concepts and the integration of new technologies into their management systems.

2.1 Definition of DT in EPHs:

Digital transformation, symbolized as DX, signifies a shift from traditional to digital modes of operation, epitomized by the conversion of analog data into digital formats. This transition, often described as the fourth industrial revolution, encompasses moving from paper-based systems to comprehensive digital environments (Abdel Fattah, n.d., p. 137).

In the healthcare domain, DT involves the management, transmission, and storage of digital data that can be readily accessed and utilized for medical, scientific, and administrative purposes both within and beyond local settings (Al-Sudairi, n.d., p. 188). Specifically, DT in EPHs leverages Information and Communication Technology (ICT) to revolutionize healthcare delivery, highlighted by the implementation of unified electronic medical records that consolidate specific medical data for each patient and facilitate the seamless exchange of this information across various services.

2.2 The Importance of DT in EPHs:

Digital Transformation (DT) in public health institutions (EPHs) hinges on the integration of cutting-edge technologies such as artificial intelligence, big data, and electronic health records. The transformative impact of DT in EPHs manifests through several key outcomes:

- Enhanced quality of health services,
- Cost reduction in human resource management,
- Strengthened databases and indicators for prompt utilization (Bashari, 2020, p. 584),
- Effective monitoring and containment of epidemics, mitigating their geographic and demographic impact, exemplified during the COVID-19 pandemic.

2.3 Applications of DT in EPHs:

DT within EPHs incorporates a spectrum of applications and techniques designed to improve patient care, reduce operational costs, and boost service efficiency and quality.

2.3.1 Electronic Administration: Electronic administration in EPHs entails the digital handling of administrative processes, effectively eliminating paper-based transactions through the use of electronic libraries accessed via internal networks. This shift maintains user habits while transitioning to more efficient digital practices (Abdel Shadhi & Abbas Fardours, 2018, p. 127). In the hospital setting, electronic administration (e-administration) streamlines the collection and management of medical and administrative data, facilitating the coordination across various departments including Human Resources, Finance, and Pharmacy. This digital coordination enhances the control over and access to medical and administrative services, thereby allowing for the swift and accurate acquisition of information.

2.3.2 Remote Health Protection: Remote health protection delivers personalized medical services, treatments, advice, and information to patients through advanced communication technologies, fostering accessibility and continuity of care from a distance (Jarboua, 2021, p. 5).

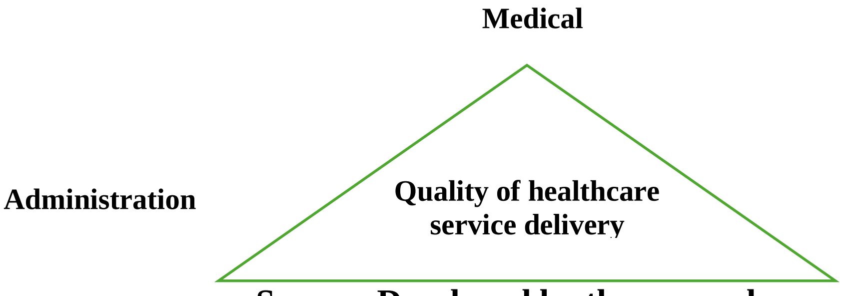
2.3.3 Electronic Medical Records (e-medical record): The consensus among healthcare and ICT professionals is that the development of electronic medical records, utilizing computer systems for the storage, processing, and transfer of data and information via networks and modern communication tools, is critical. These records are noted for their precise content and the capability for seamless, automated integration with various hospital services. One innovative implementation is the "Google Health" platform, which allows individuals to initiate and manage their health profiles online. By entering their health data, medications, test results, allergies, and other pertinent information at the outset of their treatment, patients can facilitate data sharing with connected hospitals, clinics, and pharmacies. Once patient identity is verified, specific data transfers between these healthcare facilities and the patient's online profile are enabled, ensuring that individuals can access and consult their health information at any time (Harakat & Ben Ghida, 2020, p. 506).

2.3.4 Artificial Intelligence: Artificial Intelligence (AI) is leveraged in the processing of confidential data to deliver treatment recommendations, predict patient outcomes, and enhance the decision-making processes in healthcare settings.

2.3.5 Smartphone Applications: Smartphone applications play a crucial role in helping patients manage their health status, organize their medical appointments, and access documented medical information with ease.

3. Quality in the Context of Health Services: The imperative for high-quality health services is driven by its capacity to meet the evolving desires and needs of patients.

3.1 The Concept of Health Quality: A. Donabedian articulates health quality as "the application of medical sciences and techniques to achieve the maximum health benefit without increasing exposure to risk, where the degree of quality optimally limits the risk/benefit balance" (Tiyaz, 1425 AH, p. 40). Under this framework, the determination of quality in health services hinges on striking an optimal balance between maximizing benefits for patients and society while minimizing risks and safeguarding patient well-being. The World Health Organization (WHO) offers a definition of quality as an "expectation that aligns diagnostic and treatment operations with each patient and achieves the best possible health outcomes in accordance with the latest medical sciences, at minimal cost and risk. A positive relationship with the patient cultivates loyalty towards the health institution." Quality perceptions vary based on one's role within the health system, reflecting the diverse responsibilities and interactions involved in health service delivery. The following diagram illustrates these differences:



Source: Developed by the researchers

From this analysis, it is clear that notions of quality in health services are influenced by each individual's role within the health system. Despite these variations, the overarching goal remains consistent: to deliver high-quality care that meets patient needs, enhances their health, and elevates their satisfaction levels.

3-2 Importance of the Quality of Health Services:

The critical importance of health service quality is highlighted by (Ali, 2016, pp. 138–139):

- It enables EPHs to accurately gauge the needs, preferences, and expectations of service users, thereby effectively meeting these expectations. This not only boosts the reputation of the EPH but also fosters patient loyalty and increases their engagement with the services provided.
- It contributes to the early identification and effective resolution of issues, which enhances service delivery and ensures high-quality patient care.
- The quality of health services is a pivotal factor in determining user satisfaction, influencing their experiences and interactions within the health system.
- It reduces incidents of medical errors and associated losses, both material and moral, ultimately promoting patient peace of mind and enhancing the quality of care.
- By decreasing the duration and costs of patient stays, it enhances service efficiency and improves patient experiences. Achieving a balance between quality and cost in service delivery is crucial.

Thus, the quality of healthcare services holds significant value, imprinting a distinct quality that remains ingrained in the minds of beneficiaries. It is essential for EPHs to deliver services that not only meet but exceed quality standards, ensuring precision in diagnosis and treatment. Quality in healthcare is not just a benchmark but a necessity that characterizes the health sector as it does other sectors concerned with human well-being.

3-3 Dimensions of Health Service Quality:

Health service quality encompasses five critical dimensions, encapsulated by the acronym R.A.T.E.R.

3-3-1 Reliability: Reliability is a crucial dimension that significantly influences patient experiences with health services. It reflects the degree of a patient's trust in an EPH and their confidence in receiving the promised health services accurately and promptly. This dimension underlines an EPH's capability to build loyalty through the consistent delivery of medical services characterized by high precision and competence (Adman, 2007/2008, p. 123).

3-3-2 Assurance: Assurance serves as a vital indicator of safety and trust in the provision of health services. It pertains to the confidence patients place in the abilities and qualifications of hospital personnel, encompassing medical, nursing, and administrative staff (Al-Damour, 2002, p. 365).

3-3-3 Tangibility: Tangibility relates to the physical elements of service delivery within healthcare facilities, including the condition and appearance of equipment, reception, and waiting areas. The material quality of a health facility significantly contributes to its attractiveness and trustworthiness, thereby bolstering its reputation and efficacy in delivering health services (Al-Jazairi et al., 2011, p. 21).

3-3-4 Empathy: Empathy focuses on the level of personalized care and attention provided by medical, paramedical, and administrative personnel during service delivery. It involves acknowledging and addressing the human aspects of health services by attentively listening to and addressing patients' concerns in a compassionate and respectful manner. Cultivating a positive relationship enhances the overall perception of the health facility's service quality (Al-Taweel et al., 2010, p. 18).

3-3-5 Responsiveness: Responsiveness is the capacity to efficiently meet patient requests and address urgent needs. It involves handling patient grievances with competence and flexibility in service procedures. Effective and continuous communication in responsiveness demonstrates the medical staff's readiness, capability, and commitment to patient care (Bu Abbas, n.d., p. 13).

4. Reality of DT at EPH Ain Bessem and Improvement in the Quality of Health Service Provision:

Digital transformation (DT) represents a qualitative leap forward aimed at boosting performance and enhancing patient and citizen satisfaction, as well as elevating the quality of health services and advancing the development of health institutions. At EPH Ain Bessem, DT initiatives are being progressively implemented, starting from patient reception at the welcome desk, through scheduling appointments, to streamlining administrative processes for admission. Despite these advancements, challenges persist that hinder the complete realization of DT goals. The institution is actively addressing these hurdles to fully leverage the benefits of digital transformation in healthcare.

4-1 General Overview of the EPH of Ain Bessem:

The Mohamed el Bachir Public Hospital Institution in Ain Bessem operates as a public administrative entity with legal personality and financial autonomy, under the supervision of the Wali of the wilaya of Bouira. Established by executive decree no. 07.140 on May 19, 2007, the institution outlines its organization and management, marking a significant transition from its closure in 1996 to its reopening in 2003. The primary mission of the EPH of Ain Bessem is to execute national health and population programs, with additional responsibilities including:

- Assurance: organization and programming of treatments, cures, diagnoses, and retraining of doctors within a hospital environment.
- Implementation of national health programs.
- Protection of health and purity, combating epidemics, and addressing social plagues.
- Enhancement and retraining of health personnel, utilizing the EPH as a training venue for doctors and paramedical staff through partnerships

with training institutes, as specified in Executive Decree 140.07, Article 22, and the interministerial order dated December 20, 2009. The specific organizational structure and provisions for technical services, personnel, and general resources are detailed in annex 2.

4-2 Aspects and Mechanisms of Digitization in the EPH M.El Bachir:

In the realm of public health, EPHs employ modern mechanisms to enhance the quality and efficiency of health service delivery, though these mechanisms can vary among institutions. Central to these efforts at the EPH of Ain Bessem are several digital strategies:

4-2-1 Electronic Medical Record (e-medical record):

Following Ministerial Instruction No. 206 regarding the establishment of electronic medical records (EMR), the EPH has equipped itself with the necessary hardware including computers, electronic tablets, and technical devices, alongside stabilizing the internet network and establishing a principal agent for information storage. To support this initiative, comprehensive training cycles were organized for all personnel, including practitioners, paramedics, reception desk staff, and computer engineers.

These training sessions were conducted under favourable conditions, as mandated by Instruction No. 245, which focuses on EMR training for EPHs. The implementation of the EMR began in 2018, primarily within emergency and health services. This system is designed to digitize and maintain extensive medical records that incorporate personal and administrative patient information, diagnostic data, medical history, treatment procedures, laboratory data, radiographic images, and other relevant healthcare information (Personal interview with the Medical Council President, 2024, September 23, 09:29).

4-2-2 Programs:

At the EPH, a variety of programs are operational, both in administrative and healthcare capacities, which include:

- **Epipharm Program**: This program enhances the management of the pharmacy by meticulously recording all transactions, including the inflow and outflow of medications to various departments. It efficiently manages orders, their distribution across different services and other EPHs, and ensures the anticipation of safety stock levels. Additionally, it tracks medications nearing expiration to facilitate timely actions. The program is instrumental in generating comprehensive reports on medication receipts, issuances, service-specific consumption, and overall usage.
- **Monthly Treatments Program**: Situated within the payroll department, this program manages the monthly processing of payments and various staff bonuses, ensuring timely and accurate compensation.
- **Patient Program**: This program systematically manages patient records by documenting all relevant data from their admission to discharge. It also generates detailed bills for each patient, which include treatments and medications administered during their stay as prescribed by attending physicians.
- **TCOH Accounting Program**: Implemented as a robust informational system for management accounting, this program oversees various operations including inventory monitoring and cost accounting. Launched on January 1, 2014, following Ministerial Instruction No. 8 dated October 17, 2013, and the inter-ministerial decision of October 30, 2014, it establishes a comprehensive database for the institution and has become a cornerstone in the operations of most EPHs.
- **Electronic Portal for Public Procurement**: This platform ensures the publication of all details related to public orders and specific offers, upholding the principles of transparency and free access to public procurement.

4-2-3 Platforms and Applications:

The EPH hosts several digital platforms for administrative management. These systems are either centralized at the level of the Ministry of Health or sourced from economic operators, facilitating streamlined and efficient administrative processes.

4-3 Contribution of Digitization to the Improvement of the Quality of Health Service Provisions at EPH Ain Bessem:

The EPH is dedicated to delivering superior services to citizens by leveraging technological advancements, notably through the digitization of its operations. The impact of these digital transformations on the quality of health services includes:

- **Early Diagnosis**: The use of artificial intelligence aids in the early diagnosis of diseases, significantly enhancing the likelihood of successful treatments.

- **Ease of Access**: Digital transformation facilitates the accessibility of health services for patients irrespective of time or location, particularly benefiting those in isolated or rural areas. Remote medicine practices eliminate the need for physical travel to healthcare facilities, and patients can easily access detailed information about their health conditions and available treatments via digital platforms.

- **Rapid Execution of Administrative Procedures**: Digital tools streamline administrative processes, reducing burdens and enabling healthcare staff to concentrate more effectively on patient care and timely decision-making.

- **Cost Reduction**: Addressing the escalating costs in healthcare is crucial, especially in balancing the disparities between economically diverse regions. Information and Communication Technology (ICT) through remote monitoring and protection operations can significantly cut costs.

- **Increased Efficiency and Effectiveness**: Digital tools like electronic health records enable health officials to rapidly access essential patient information, thus minimizing medical errors and enhancing service delivery.

- **Education and Health Quality**: Digital platforms also serve an educational role, enlightening patients about healthy living standards and the importance of regular medical check-ups, thereby promoting broader health awareness.

4-4 Constraints and Difficulties of DT in EPHs:

The EPH of Ain Bessem faces significant technical and operational challenges, coupled with a shortage of specialized skills in emerging technologies. Discussions with the Director and the IT engineer have confirmed these obstacles, which can be categorized as follows:

Technology-Related Problems (Ben Saleh & Boukalkoul, 2018, p. 8):

- Challenges in developing medical software due to ambiguities regarding software requirements, its functionalities, and execution conditions. This results in difficulties in selecting and implementing efficient digital solutions.
- Limited expertise in handling certain imported medical equipment, compounded by the absence of specialized training centers for learning how to operate and maintain this advanced technology.
- Outdated computer infrastructure, leading to frequent technical malfunctions and system inefficiencies that hinder the smooth operation of digital transformation efforts.
- Inadequate cybersecurity measures to protect highly sensitive medical data, exposing the institution to severe risks such as cyberattacks and data breaches. Reports of medical data breaches in the press highlight the urgency of addressing these vulnerabilities.

✓ **Administrative Constraints** (Personal interview with T.-I., 2024, September 29, 10:30):

- Weak planning and coordination at the higher administrative level in implementing digitization programs, which slows down progress and disrupts integration efforts.

- Failure to introduce necessary organizational changes that digitization requires, such as integrating or harmonizing different administrative units, defining authorities and interdepartmental relationships, and restructuring workload distribution.
- Lack of a well-defined strategic vision for ICT adoption, which could streamline the transition to fully digitized hospital systems in the future.
- Resistance to change among hospital staff, driven by uncertainty and discomfort in adopting new digital systems due to inadequate training and support mechanisms.

✓ **Internet-Related Problems** (Personal interview with T.-I., 2024, September 29, 13:40):

- **Outdated network infrastructure**—the internet system still relies on bronze cables instead of fiber optics, significantly hampering digitization efforts.
- **Frequent network slowdowns and outages**, making it difficult for hospital staff to access critical information in a timely manner.
- **Insufficient training and a lack of skilled personnel** capable of managing and optimizing digital systems effectively.

✓ **Constraints Related to Human Resources** (Personal interview with the HR Deputy Director, 2024, September 30, 09:00):

- Limited ICT awareness within the hospital's social and organizational framework, slowing down the acceptance and implementation of digital solutions.
- Reliance on traditional administrative systems, with many hospital departments still using manual documentation and outdated tabular processes instead of digital alternatives.
- Absence of high-level oversight structures to evaluate reports from commissions responsible for advancing DT. Without proper evaluation and feedback mechanisms, necessary decisions to

enhance the institution's digital readiness and adoption remain unaddressed.

- Misalignment between training programs and the practical application of digitization systems, alongside a lack of incentives to enhance digital competencies. This deficiency impedes the professional development of personnel and limits the hospital's capacity to fully embrace digital transformation.

5- CONCLUSION:

The integration of digital transformation (DT) has introduced innovative and effective techniques that enhance both performance and the quality of work. The Mohamed el Bachir Public Hospital Institution (EPH M. Bachir), like other institutions in the sector, has embraced digital transformation by modernizing certain traditional activities and incorporating advanced technological solutions.

From the findings of this study, and based on the analysis of the research problem and the validation of hypotheses, several key conclusions can be drawn:

- Digital transformation is no longer optional but a necessity for institutions in general, and particularly for healthcare institutions. In the context of rapid technological advancements, the specificity and sensitivity of healthcare services, which directly affect human lives, make DT essential.
- DT significantly influences the quality of healthcare services through the integration of internet-based systems, specialized software, and various technological tools. These innovations contribute to more efficient and effective healthcare delivery.
- Digitization helps to resolve several persistent challenges that previously hindered operational efficiency, including issues related to work time management, data security, accessibility, and service delivery constraints.
- Despite certain digitization efforts at the EPH M. Bachir, the institution remains in an early stage of technological adoption. The current level of

digital integration has not yet reached a stage that aligns with the rapid pace of technological advancements in the healthcare sector.

- Several obstacles continue to hinder the full implementation of digital transformation, particularly technical limitations related to ICT infrastructure, regulatory barriers, and inadequate training programs for management personnel that would otherwise facilitate a more seamless transition toward DT.

Based on the results of this study, the following recommendations are proposed to enhance the success of digital transformation in EPHs:

- Revise and update legal and regulatory frameworks to better support the digitization of public healthcare institutions, ensuring that policies align with modern digital requirements.
- Encourage and motivate staff by implementing structured training programs that focus on digital literacy and the use of advanced digital tools. A comprehensive motivation system should be developed to support employees who effectively adopt digitization practices.
- Enhance internet infrastructure by increasing bandwidth and ensuring reliable connectivity, which is essential for the efficient execution of digital healthcare processes.
- Raise awareness among stakeholders, including citizens, healthcare officials, and patients, regarding the importance of ICT in improving healthcare service quality. Public education initiatives should be implemented to promote digital literacy and familiarize users with available e-health solutions.
- Incorporate digital healthcare strategies into the long-term vision of EPHs, ensuring that electronic systems and digital tools become an integral part of hospital operations.
- Allocate a significant budget for digital transformation projects, facilitating the acquisition of necessary ICT resources to support the widespread adoption of digitization across all EPHs.

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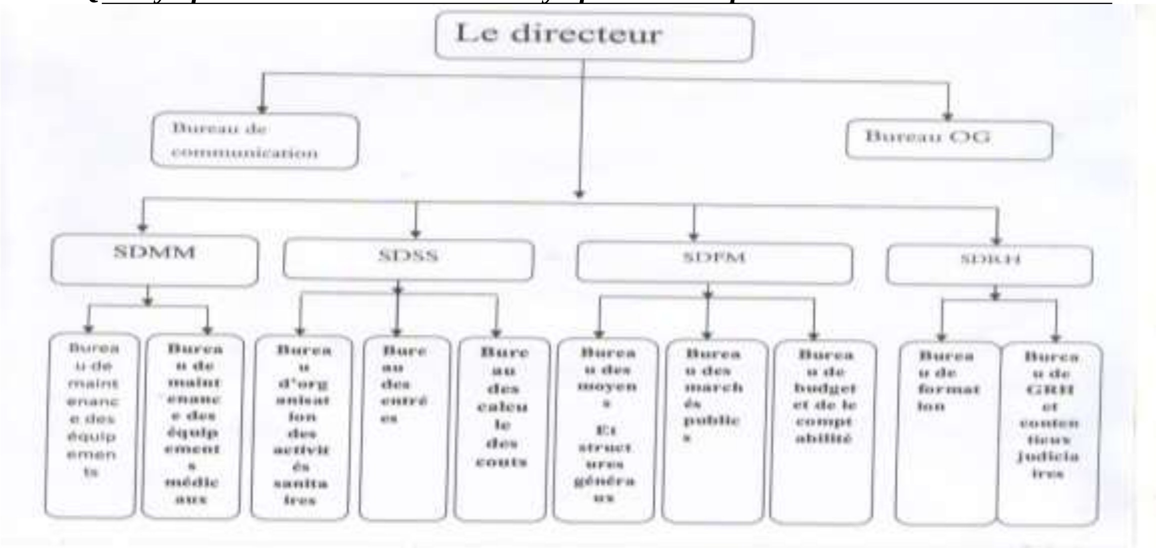
7. Appendices

Appendix 01: The Organizational Structure of EPH Ain Besem



Appendix No. 02: Technical Sheet of EPH, Mohamed Al-Bachir, Ain Bassam.

Human Resources:

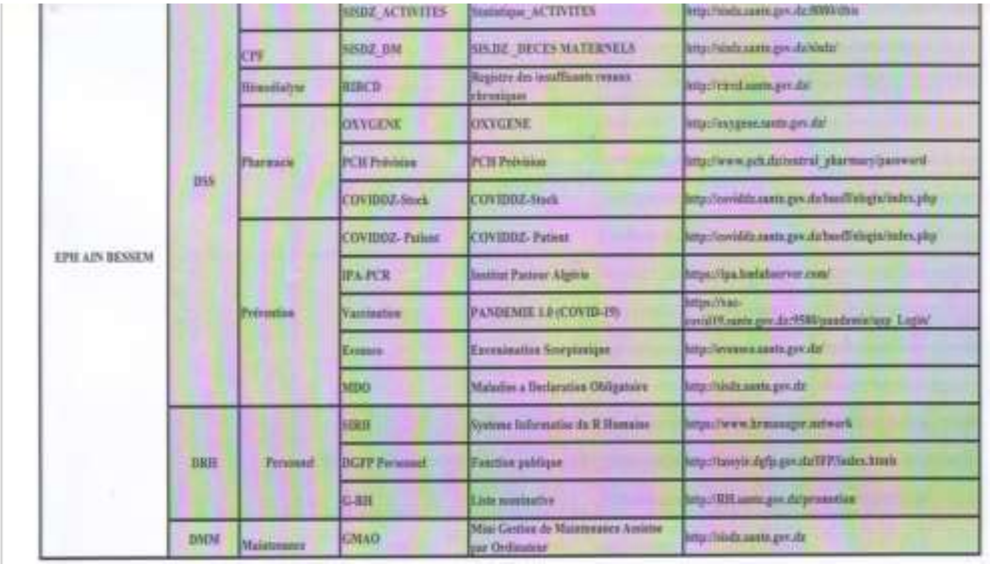
Nature	Number	Observation
Specialist Doctors	32	/
General Practitioners	26	/
Paramedical Staff	286	/
Security Agents	15	/
Guards	8	/
Operating Personnel	9	/
Contractors	51	/
Drivers	10	/

Technical Services:

Observation	Unit	Number of Beds	Service
/	ICU, Anesthesia and Operating Room	/	ICU and Anesthesia
/	Male Hospitalization, Female Hospitalization	32	General Surgery
/	Health Information	/	Hospital Hygiene, Epidemiology
/	Obstetrics and Gynecology	20	Obstetrics and Gynecology
/	X-rays, Ultrasound, CT Scan	/	Medical Imaging and Radiology

/	Microbiology, Biochemistry	/	Central Laboratory
/ External Service	Male Hospitalization, Female Hospitalization, Oncology, Hemodialysis	30	Internal Medicine
/	Pediatrics, Neonates	20	Pediatrics
/	Pharmaceutical Product Management, Pharmaceutical Product Distribution	/	Pharmacy
/	Reception and Sorting, Medical Emergencies, Surgical Emergencies	10	Medical Surgical Emergencies
112	Total		

Appendix No. 03: Platforms at the Public Hospital Institution, Ain Bassam.



EPH AIN BESSEM	DSS		SISDZ_ACTIVITES	Statistique_ACTIVITES	http://sisdz.sante.gov.dz:8080/dhis
		CPF	SISDZ_DM	SIS.DZ _DECES MATERNELS	http://sisdz.sante.gov.dz/sisdz/
		Hémodialyse	RIRCD	Registre des insuffisants renaux chroniques	http://rircd.sante.gov.dz/
		Pharmacie	OXYGENE	OXYGENE	http://oxygene.sante.gov.dz/
			PCH Prévision	PCH Prévision	http://www.pch.dz/central_pharmacy/password
			COVIDDZ-Stock	COVIDDZ-Stock	http://covid[illegible].sante.gov.dz/[illegible]/index.php
		Prévention	COVIDDZ- Patient	COVIDDZ- Patient	http://covid[illegible].sante.gov.dz/[illegible]/index.php
			IPA-PCR	Institut Pasteur Algérie	https://ipa.[illegible].com/
			Vaccination	PANDEMIE 1.0 (COVID-19)	https://vac-covid19.sante.gov.dz:9580/pandemie/app_Login/
			Envenom	Envenimation Scorpionique	http://envenom.sante.gov.dz/
			MDO	Maladies a Declaration Obligatoire	http://sisdz.sante.gov.dz
	DRH	Personnel	SIRH	Systeme Information du R Humaine	https://www.hrmanager.network
			DGFP Personnel	Fonction publique	http://[illegible].dgfp.gov.dz/TFP/index.html
			G-RH	Liste nominative	http://RH.sante.gov.dz/promotion
	DMM	Maintenance	GMAO	Mini Gestion de Maintenance Assistée par Ordinateur	http://sisdz.sante.gov.dz