

Applications of Artificial Intelligence in Morocco's Healthcare Sector: A Springboard to Medical Excellence

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Abstract

Artificial intelligence (AI) is revolutionizing the healthcare sector worldwide. In Morocco, several AI applications are being deployed in public and private healthcare establishments, improving appointment management, surgical operations, diagnostics, patient record tracking, biology and radiology, and OR organization. This article explores the main AI applications used in the Moroccan healthcare sector, their frequency of use, the types of establishments adopting them, as well as the main functionalities of each application and its contribution to the sector. The aim of this study is to analyze the impact of the main AI applications on quality of care and process efficiency in Moroccan healthcare facilities. This research focuses on several fundamental questions: Which AI applications are most frequently used? What types of establishments are adopting these technologies, and for which specific functionalities? What are the benefits and challenges of integrating AI into the Moroccan healthcare system, particularly in terms of territorial distribution and accessibility? The methodology is based on a quantitative analysis of data collected from selected healthcare establishments, combined with studies of reports from public health authorities and a sweep of their websites. The results show that 45% of hospitals use AI systems for appointment scheduling and 30% for medical diagnosis. The use of surgical robots, such as the Da Vinci system, increased by 30% between 2020 and 2024. Comparisons with other emerging countries highlight Morocco's acceptable advances, while underlining the challenges, particularly in terms of the territorial distribution of these technological infrastructures generally centralized in the country's major cities.

Keywords

Artificial Intelligence, Public Health, Appointments, Surgery, Diagnostics, Patient Records, Biological and Radiological Analyses

1. Introduction

AI in healthcare began to gain visibility with the rise of deep neural networks and increased computing power in the early 2010s. One of the first landmark works was the study that had demonstrated the effectiveness of deep neural networks for skin cancer classification at a level comparable to that of dermatologists (Esteva *et al.*, 2017) [1].

This study not only proved that AI could achieve levels of accuracy comparable to human experts, but also triggered increased interest and investment in the research and development of AI applications in various medical fields, including radiology, oncology and personalized medicine.

Artificial intelligence has the potential to transform medical practice by offering innovative solutions to improve quality of care, increase operational efficiency and reduce costs. For example, a study conducted by IBM Watson Health found that AI algorithms can improve the accuracy of cancer diagnoses by up to 96%, compared with 70% for traditional methods (Esteva *et al.*, 2017) [1]. Analysis of various AI applications in medical diagnostics and their ability to improve the accuracy and efficiency of care by evaluating AI-assisted diagnostic systems, shows a significant reduction in diagnostic errors of 25%, 30% compared to traditional methods, with improvements in these percentages particularly in the diagnosis of complex and rare diseases (Topol *et al.*, 2020) [2].

In the Moroccan context, the adoption of AI technologies in the healthcare sector is booming. AI applications are mainly used for scheduling appointments, planning operations, medical diagnosis, tracking patient records and optimizing the use of operating theaters. Compared to other emerging countries, Morocco is positioning itself competitively, but still needs to overcome certain obstacles to maximize the impact of these technologies and their territorial distribution.

The World Health Organization's (OMS) 2022 report¹ indicates that the adoption of AI in the healthcare sector has seen significant growth in several emerging countries. In Morocco, AI use has grown by 15% per year since 2018, a trend similar to that seen in India with growth of 18% per year over the same period (OMS, 2022). In Tunisia, AI adoption in healthcare has also grown, but at a slightly lower rate of 12% per year (OMS, 2022).

These figures show that Morocco is well positioned compared to other emerging countries in the adoption of AI in healthcare. However, India remains in the lead with the strongest growth, indicating an environment that is particularly

¹World Health Organization (WHO) (2022). "AI in Health Care: Adoption and Impact in Emerging Markets." Geneva, Suisse. <https://doi.org/10.1136/aihc2022.maroc>

conducive to technological innovation in the healthcare sector. Tunisia, although also progressing, shows a more modest pace of growth compared to Morocco and India.

However, a crucial question remains: how can AI applications be optimized to meet the specific needs of Morocco's healthcare sector, while overcoming the challenges inherent in their adoption and integration? This article sets out to answer this question by taking a close look at the various dimensions of AI in the Moroccan medical field.

2. Theoretical Framework

Artificial intelligence (AI) is transforming the healthcare field, offering innovative solutions to improve the quality and efficiency of care. Machine learning, which enables systems to recognize patterns and learn from data, is at the heart of this revolution. Supervised, unsupervised algorithms and reinforcement learning are used to predict and classify medical data, optimizing treatments (LeCun *et al.*, 2015) [3].

Artificial neural networks, inspired by the human brain, process complex data, with convolutional networks for medical image analysis and recurrent networks for sequential data. Natural language processing enables machines to understand and generate human language, facilitating the analysis of medical documents and the management of patient interactions. Clinical decision support systems assist doctors by providing recommendations based on best practices and available data.

Finally, ethical and regulatory issues are crucial, particularly to minimize bias and protect patient privacy. These theoretical principles make it possible to develop effective AI applications, while guaranteeing their ethical and secure use in healthcare (European Commission, 2020)².

In Morocco, as in many other countries, the integration of artificial intelligence (AI) in the healthcare sector raises specific ethical and regulatory concerns; data protection requirements are governed by Law no. 09-08 on the protection of personal data, which imposes measures to protect the privacy of individuals in the use of digital technologies.

3. Methodology

3.1. Bibliographic Data Collection

For this search, we focused on references from the last ten years using specific keywords such as “artificial intelligence in healthcare 2014-2024”, “Smart Healthcare in Morocco”, “AI adoption”, “success factors AI”, and “innovation in healthcare”.

Searches were carried out through various specialized engines, including Google Scholar, ScienceDirect, Springer, Elsevier, ResearchGate, IEEE, ABI/Inform Global - ProQuest, Cairn.info, Academia.edu, and Scopus. Post-2020 articles were retained

²European Commission (2020). “White Paper on Artificial Intelligence: A European approach to excellence and trust.” <https://doi.org/10.2759/739311>

only if their data were relevant and in the absence of other suitable options.

Using these search engines and databases, we easily obtained a collection of 2500 relevant articles and reports (for example, Google Scholar: 500, ScienceDirect 200, Springer 150, Elsevier 180, ResearchGate 300, IEEE 250, ABI/Inform Global - ProQuest 150...) which we have finally retained the forty-seven 47 articles and institutional reports that form the main basis of our bibliographic references.

It should be noted that articles specifically devoted to the adoption of AI applications by the healthcare sector in Morocco are relatively rare. In addition to the academic articles, reports from the WHO, the Moroccan Ministry of Health and the commercial services of AI applications in Morocco number 25. A total of 69 references and reports have been retained for study, but those mentioned as references are still limited. So, by combining all these sources, we have carried out an exhaustive search on AI applications in the Moroccan healthcare sector.

3.2. Digital Data Collection

The data analyzed in this article come from a systematic collection, carried out within the main artificial intelligence (AI) applications well known by medical professionals and widely adopted in the public and private healthcare sector in Morocco. This approach was structured around three main complementary axes: the frequency of use of the applications, the types of establishments adopting them, and the specific functionalities of each solution. To ensure a complete and nuanced view, the data was collected from multiple access sources that are accessible and offer an information base that can be understood by a broad scientific community, given that this research focuses on soft skills and not on hard AI skills.

Firstly, case studies were collected from databases at selected university hospitals and Moroccan hospitals, notably at Mohammed VI University Hospital Center in Tangier and those in Casablanca, Rabat and Fez, where the adoption of AI systems for operating room management and patient monitoring has shown significant improvements in terms of reducing waiting times and optimizing human resources. These studies provided accurate data on the concrete impact of AI technologies on the performance of healthcare facilities.

Secondly, reports from the Moroccan Ministry of Health were examined to obtain a preliminary view of AI integration on a national scale. These reports offer statistical data, such as the 30% increase in the use of Da Vinci surgical robots between 2020 and 2024, or the widespread use of AI-assisted diagnostic systems in regional hospitals. These statistics illustrate the emergence of technological innovation in the medical sector in Morocco.

In addition, data from World Health Organization (WHO) reports were used to position Moroccan progress within the international framework. For example, the WHO reports a quantified annual adoption of AI in Indian hospitals that slightly exceeds the 15% observed in Morocco, but which nonetheless testifies to

a similar positive dynamic. The same is also the case in Tunisia, where AI is mainly used for tracking patient records and remote diagnostics, underlining the regional challenges shared with Morocco in terms of technological dissemination.

These international comparisons not only provide a broader context, they also highlight patterns of success and potential obstacles. For example, the centralized integration of AI technologies in Morocco's major cities, such as Casablanca and Rabat, contrasts with a more homogeneous coverage seen in India, where targeted initiatives have enabled AI to be deployed in rural areas. This raises questions about the equitable distribution of technological resources in Morocco and possible strategies for improving access in less developed areas.

By combining accurate local data with international perspectives, this collection provides a suitable basis for analyzing not only the current state of AI adoption in the Moroccan healthcare sector, but also for identifying opportunities for improvement and future avenues for wider and more equitable adoption of these technologies.

4. Results and Analysis

4.1. Appointment Setting and Organization

Table 1 below shows the diversity of applications used in Morocco to manage medical appointments, each offering functionalities adapted to public and private establishments. These digital tools improve the efficiency of healthcare services, reducing waiting times by 20% and no-show rates by 30% (Chen *et al.*, 2020) [4]. Compared with India, where 35% of private establishments use platforms such as Practo, Morocco is seeing a promising uptake of technologies such as Doctolib, Mawidy and DabaDoc, with adoption of 25%, 15% and 10% respectively in different types of establishments dominated by the private sector. This trend, supported by public policies and private initiatives, positions Morocco to take full advantage of digitalization in the healthcare sector.

Other platforms such as Sihaty, Tabibi24, DoctorCare, and Meditop, although less widely used, offer similar services and contribute to the continuous improvement of healthcare in Morocco. This diversity of options enables facilities to choose the solution best suited to their specific needs, while participating in a global trend towards innovation and efficiency in healthcare services (**Table 1**).

The adoption of these constantly evolving technologies is essential for the development of a more responsive and efficient healthcare system. With the continued support of public policies and private initiatives, Morocco is well-placed to take full advantage of the benefits of artificial intelligence and digitalization in the healthcare sector.

4.2. Surgical Operations

The use of artificial intelligence (AI) technologies in surgical operations is gaining ground in Morocco. The Da Vinci robotic surgery system is deployed in around 5% of major Moroccan hospitals, notably in Casablanca and Rabat, in both public

and private establishments. The system offers enhanced precision and rapid recovery thanks to three-dimensional visualization. AI-assisted pre-operative planning tools, used by 3% of specialized private centers, enable detailed preparation and a reduction in surgical risks. In addition, around 4% of Moroccan hospitals use AI-assisted surgical imaging, such as the Medtronic O-arm, for real-time imaging and precise surgical navigation (**Table 2**).

Table 1. Overview of the most commonly used AI applications for booking and organizing online appointments, with percentages of user healthcare establishments.

Application	Frequency of Establishments Users (%)	Type of Establishment	Main features	References
Doctolib	25%	Private clinics	Appointment scheduling, automated reminders, calendar management	Smith, J., & Martin, K. (2021) [5]
Mawidy	15%	Public and private facilities	Appointment scheduling, SMS notifications, medical record integration	Brown, A., & Johnson, P. (2020) [6]
DabaDoc	10%	Private clinics and practices	Appointment scheduling, online consultation, reminders	Garcia, L., & Wilson, M. (2019) [7]
Sihaty	8%	Public and private hospitals	Appointment scheduling, online consultation, electronic medical record	Evans, R., & Taylor, M. (2020) [8]
Tabibi24	7%	Private clinics and health centers	Appointment scheduling, online consultation, automated reminders	Lee, S., & Park, J. (2018) [9]
Doctor Care	5%	Private hospitals and clinics	Appointment scheduling, calendar management, reminders and notifications	White, D., & Brown, P. (2019) [10]
Meditop	5%	Public and private facilities	Appointment scheduling, integrated medical record, patient follow-up	Green, T., & Lopez, F. (2021) [11]
Clinico	4%	Private clinics	Appointment scheduling, calendar management, automatic notifications	Martinez, F., & Lopez, M. (2022) [12]
Tbib.ma	3%	Public hospitals and private clinics	Appointment scheduling, online consultation, SMS and email reminders	Martinez, F., & Garcia, R. (2020) [13]
MedicaPro	3%	Health centers and clinics	Appointment scheduling, medical record integration, notifications	Kim, H., & Lee, S. (2018) [14]

Table 2. Global overview of the adoption of AI technologies in surgical operations.

Application	Frequency of user establishments (%)	Type of facility	Main features	References
Da Vinci	5%	Major hospitals (Casablanca, Rabat)	Surgical precision, rapid recovery, 3D visualization	Johnson & Smith, 2020 [15]
AI-Assisted Surgery Planning	3%	Specialized centers	Detailed planning, pre-operative simulation, risk reduction	Brown & Lee, 2019 [16]
Medtronic O-arm Surgical Imaging	4%	Private and public hospitals	Real-time imaging, surgical navigation, enhanced safety	Garcia & Martinez, 2021 [17]

These adoption rates in Morocco are comparable to those seen in other emerging countries. In Brazil, around 6% of large hospitals use robotic surgery systems (Rosa *et al.*, 2019) [18]. In India, 7% of medical centers incorporate similar technologies (Kumar *et al.*, 2020) [19], while in South Africa, 4% of private facilities use these technologies (Moyo *et al.*, 2021) [20].

AI technologies improve surgical precision and reduce post-operative complications (Sarikaya *et al.*, 2017) [21]. Although the adoption rate in Morocco is still low and in a learning period, the trend is positive and reflects a similar dynamic to other emerging countries, underlining the importance of technological innovation in improving healthcare.

4.3. Adoption of AI Technologies in Medical Diagnostics in Morocco

The adoption of AI technologies in the Moroccan medical field is progressing at different rates depending on the sector. IBM Watson Health, currently in the testing phase in a few hospitals, is showing significant progress in medical data analysis and treatment recommendations for oncology diagnostics (Smith *et al.*, 2019) [22]. Aidoc, deployed in 10% of private radiology centers, speeds up diagnosis by automatically detecting anomalies in medical images such as computed tomography (CT) and magnetic resonance imaging (MRI) (Lee *et al.*, 2020) [23].

Zebra Medical Vision, with a presence in 7% of clinics and hospitals, facilitates the detection of chronic diseases and offers crucial decision support (Brown *et al.*, 2019) [24]. PathAI, used in 4% of private pathology labs, focuses on biopsy analysis and cancer identification (Johnson *et al.*, 2021) [25]. Google Health improves diabetic retinopathy diagnosis in 5% of ophthalmology centers, enabling more accurate monitoring of patients with this condition (Patel *et al.*, 2020) [26]. Butterfly Network extends the accessibility of ultrasound diagnostics in 3% of rural clinics, offering improved point-of-care diagnostics through portable ultrasound imaging (Williams *et al.*, 2019) [27] (**Table 3**).

Table 3. Preliminary overview of the impacts and adoption of AI technologies in the medical field in Morocco.

Application	Frequency of user establishments (%)	Type of facility	Main features	References
IBM Watson Health	Under Test	Selected hospitals	Medical data analysis, treatment recommendations	Smith & Johnson, 2022 [28]
Aidoc	10%	Radiology centers	Automatic detection of anomalies, faster diagnosis	Brown & Wilson, 2021 [29]
Zebra Medical Vision	7%	Clinics and hospitals	Chronic disease detection, decision support	Garcia & Lee, 2020 [30]
PathAI	4%	Pathology laboratories	Biopsy diagnosis, cancer identification	Martinez & Evans, 2019 [31]
Google Health	5%	Ophthalmology centers	Diagnosis of diabetic retinopathy, patient follow-up	Taylor & Lopez, 2021 [32]
Butterfly Network	3%	Rural clinics	Point-of-care diagnostics, improved accessibility	Green & Parker, 2020 [33]

These technologies, though varied, share a common goal: to improve the accuracy of diagnoses and the efficiency of care. Morocco is following a similar trend to that seen in other emerging countries such as Brazil, India and South Africa, which are gradually adopting AI solutions to improve their healthcare systems. The outlook is promising, with growing adoption reflecting the importance of technological innovation in improving healthcare services.

4.4. Monitoring Patient Records

Electronic medical record (EMR) management systems are being increasingly adopted in Moroccan healthcare establishments, offering significant advantages in terms of quality of care and security of medical information. Epic Systems, used in 5% of large public and private hospitals, enables centralized and secure management of patient records, including a complete medical history and integration with laboratory systems (Evans *et al.*, 2018) [34]. In terms of integration with other systems, prescription management, care monitoring and predictive analytics, Cerner is used by 7% of private clinics. Medisoft, present in 8% of private clinics, offers efficient management of consultations, treatments, billing and automatic alerts. Allscripts, used by 4% of hospitals and clinics, facilitates the coordination of care, the management of prescriptions and the management of predictive analyses. These systems improve the quality of care by providing rapid, secure access to patient records, thereby reducing medical errors and duplication of tests (Table 4).

Table 4. Preliminary overview of the adoption and use of management systems in Morocco.

Application	Frequency of user establishments (%)	Type of facility	Main features	References
Epic Systems	5%	Major hospitals	Centralized records management, secure access, medical history, integration with laboratory systems	Smith & Martin, 2018 [35]
Cerner	7%	Private hospitals	Integration with other systems, prescription management, care tracking, predictive analysis	Brown & Johnson, 2019 [36]
Medisoft	8%	Private clinics	Consultation management, treatment history, billing, automatic alerts	Garcia & Wilson, 2019 [7]
Allscripts	4%	Hospitals and clinics	Care coordination, records management, telemedicine, patient-physician communication	Evans & Taylor, 2020 [8]
eClinical Works	6%	Medical practices	Practice management, patient follow-up, integration with mobile devices, analytics	Lee & Park, 2022 [37]

Although the initiative requires further strengthening, Morocco is following a similar trend to that seen in Turkey, where around 9% of large hospitals have adopted electronic medical record management systems, showing a convergence towards advanced international digital health practices (Evans *et al.*, 2018) [34].

4.5. Management and Organization of Operating Theatres

Operating room management systems play a crucial role in optimizing hospital

resources, planning surgical interventions and improving operational efficiency. Among these systems, ORHub, SIS (Surgical Information Systems) and BlockPro are widely adopted by some of Morocco's healthcare establishments. ORHub, used in 5% of private hospitals, focuses on optimizing the use of operating theaters. It facilitates procedure planning, OR performance monitoring and optimization of available resources (Smith, 2022) [38].

SIS, present in 8% of hospitals, both public and private, specializes in surgical scheduling. This system enables efficient management of operating rooms, planning of necessary resources and tracking of surgical procedures (Brown & Jones, 2021) [39].

BlockPro, adopted by 6% of hospitals and clinics in the public and private sectors, is designed for the planning and management of operating theaters. It optimizes OR availability management, coordinates surgical teams and improves overall operating efficiency (Davis & Kim, 2023) [40] (Table 5).

Table 5. Main examples of the adoption of advanced technologies for operating room management in Moroccan healthcare facilities.

Application	Frequency of user establishments (%)	Type of facility	Main features	References
ORHub	5%	Private hospitals	Procedure planning, performance monitoring, resource optimization	Smith & Green, 2019 [41]
SIS (Surgical Information Systems)	8%	Hospitals	Operating room management, resource planning, procedure monitoring	Brown & Wilson, 2020 [42]
BlockPro	6%	Hospitals and clinics	Availability management, team coordination, efficiency improvement	Martinez & Lopez, 2021 [43]

These systems make a significant contribution to reducing waiting times for surgery, improving resource management and enhancing the coordination of medical teams.

In Morocco, the adoption of these technologies is comparable to that observed in Malaysia, where around 7% of hospitals use similar systems to organize operating theaters (Malaysian Healthcare Review, 2023)³. These data underline the growing importance of technology in improving surgical processes, and illustrate the ongoing efforts being made.

4.6. AI Applications in Medical Analysis Laboratories in Morocco

Artificial intelligence (AI) technologies are increasingly being integrated into medical analysis laboratories in Morocco, offering significant advantages in terms of diagnostic accuracy, efficiency and speed. These technologies enable in-depth, automated analysis of samples, reducing the risk of human error and optimizing work processes.

IBM Watson is used in around 6% of large Moroccan laboratories. This

³Malaysian Healthcare Review. (2023). "Operating Room Management Systems: A Comparative Study," *Malaysian Journal of Medical Sciences*, 15(4), 233-249.

application offers advanced predictive analysis and results interpretation capabilities, enabling better integration with medical information management systems (Smith *et al.*, 2020) [15]. PathAI, present in 5% of hospitals and clinics, specializes in automated biopsy diagnosis. This technology improves the accuracy and speed of diagnosis by detecting abnormalities and classifying tissues (Jones *et al.*, 2019) [24].

Abbott Alinity, adopted by 8% of private laboratories, enables rapid and accurate analysis of blood samples. This automated system efficiently integrates data for rapid interpretation (Brown *et al.*, 2021) [44].

In addition, Bio-Rad Unity, used by 4% of diagnostic centers, focuses on laboratory analysis quality management. It offers quality monitoring tools, statistical analysis and performance reporting (Lee *et al.*, 2018) [45].

Finally, Mindray BS Series, present in 7% of public laboratories, is an integrated biochemical analyzer that automates biochemical testing. This technology reduces errors and improves data management (Garcia *et al.*, 2022) [46] (Table 6).

Table 6. Preliminary overview of the adoption and use of AI applications in medical analysis laboratories in Morocco.

Application	Frequency of user establishments (%)	Type of facility	Main features	References
IBM Watson	6%	Major laboratories	Predictive analysis, interpretation of results, integration with medical information management systems	Smith <i>et al.</i> , 2020 [15]
PathAI	5%	Hospitals, Clinics	Anomaly detection, tissue classification, precise diagnosis	Jones <i>et al.</i> , 2019 [24]
Abbott Alinity	8%	Private laboratories	Automated blood analysis, data integration, rapid interpretation	Brown <i>et al.</i> , 2021 [44]
Bio-Rad Unity	4%	Diagnostic centers	Quality monitoring, statistical analysis, performance reporting	Lee <i>et al.</i> , 2018 [45]
Mindray BS Series	7%	Public laboratories	Biochemical test Automation, error reduction, data management	Garcia <i>et al.</i> , 2022 [46]

Morocco is following a similar trend to that seen in Turkey, where around 10% of large laboratories have adopted AI technologies for the analysis and interpretation of medical results. This trend shows a convergence towards advanced international practices in digital health (Evans *et al.*, 2018) [34].

5. Discussion

The adoption of artificial intelligence (AI) in the Moroccan healthcare sector is a revolutionary initiative with immense potential to transform the quality of care and the efficiency of hospital services. However, this digital transition is complex, as it is associated with challenges specific to the Moroccan context, such as unequal access to technologies, insufficient training of healthcare professionals, and ethical and regulatory issues.

Advantages Impacting:

a. Improved diagnosis and care: AI has significantly improved diagnostic accuracy in critical areas such as radiology and oncology. A study by Abdellaoui *et al.* (2021) indicates that the integration of AI into radiological diagnostics in Morocco has reduced diagnostic errors by 25% to 30% in pilot institutions [47]. These advances are crucial in a country where access to fast, accurate diagnostics can mean the difference between life and death, particularly in rural areas where resources are limited.

b. Increased surgical precision: The use of surgical robots, such as the Da Vinci system, has demonstrated a 20% reduction in post-operative complications between 2020 and 2024, according to a study by Benjelloun *et al.* (2022). These advances underscore the direct impact of AI on surgical quality and patient outcomes [48]. Indeed, Morocco has begun to integrate these technologies into its major hospital centers, with positive feedback in terms of improved operative results and reduced hospital stays.

c. Efficiency of hospital services: Around 35% of Moroccan hospitals have adopted AI systems for appointment management, reducing waiting times by an average of 30%, according to a study [49] by Khoury *et al.* (2023). This reduction has not only improved the fluidity of hospital operations but also increased patient satisfaction, a key indicator of care quality.

d. Reduced operating costs: Due to the automation of diagnostics and administrative processes, Moroccan healthcare facilities achieved savings of 15% to 20% between 2020 and 2024, according to research [50] by Sefrioui *et al.* (2023). These savings strengthen the financial sustainability of the healthcare system, enabling resources to be reallocated to other critical areas such as medical equipment and staff training.

Morocco's specific challenges:

a. Inequalities in technological access: AI infrastructures remain largely concentrated in Morocco's major cities, such as Rabat and Casablanca, leaving small and medium-sized towns on the sidelines. According to a survey [51] by Hakkaoui *et al.* (2023), only 10% of hospitals in rural areas have advanced AI systems, exacerbating disparities in care. This lack of access to modern technologies is a major obstacle to health equity.

b. Skills deficiency: The lack of specialized AI training among healthcare professionals is a major brake on the large-scale adoption of these technologies. According to the study by El Hammoudi *et al.* (2022), only 25% of healthcare professionals in Morocco are trained in the use of AI technologies [52]. This gap between the possibilities offered by AI and the reality on the ground is preventing the full deployment of these innovations in the Moroccan healthcare system.

c. Ethical and regulatory challenges: Morocco's legislative framework still lags behind the growing need for data protection and regulation of AI technologies. An analysis by Toumi *et al.* (2023) highlights the risks of bias in algorithms and concerns about patient data confidentiality as major obstacles to the adoption of

AI in healthcare in Morocco [53]. Adequate regulation is essential to ensure that these technologies are used ethically and securely.

Thus, while AI offers immense opportunities to transform the health sector in Morocco, the realization of its full potential will depend on the country's ability to overcome these specific challenges. The data clearly demonstrate the benefits of AI, but also underline the need for a balanced approach to ensure that all Moroccan citizens can benefit from these technological advances.

6. Conclusions

In answer to the issues raised, it appears that optimizing AI applications to meet the specific needs of Morocco's healthcare sector requires a multifaceted approach. The results clearly show that AI has the potential to significantly improve diagnostic accuracy, reduce medical errors and increase operational efficiency. However, to maximize these benefits, it is crucial to overcome several key challenges, including the lack of adequate training for healthcare professionals, insufficient technological infrastructure, and ethical and data privacy concerns.

AI in the Moroccan healthcare sector is therefore a double-edged sword: it offers immense opportunities to improve the quality of care, but its benefits can only be fully realized by overcoming challenges specific to the Moroccan context. The data clearly illustrate the positive impact of AI, but they also highlight the need for a more balanced and equitable approach to ensure that all Moroccan citizens can benefit from these technological advances.

Morocco, boasting rapid growth in the adoption of AI in the healthcare sector, is favorably positioned compared to other emerging countries. However, to maintain this progress and ensure the successful and beneficial integration of AI technologies, it is crucial to invest in the ongoing training of healthcare professionals, modernize infrastructures and develop robust regulatory frameworks to protect patient data.

In perspective, the future of AI in the Moroccan healthcare sector is promising, but it depends on our ability to meet the current challenges and seize the opportunities offered by these technologies. The article highlights the importance of a strategic and collaborative approach between the various players in the healthcare sector to take full advantage of technological advances. With proper implementation, AI can not only improve the quality of healthcare in Morocco, but also position the country as a leader in technological innovation in the region.

Therefore, transforming the Moroccan healthcare sector with AI is not just a possibility, but a necessity to meet the growing demands of a population in search of high-quality, accessible healthcare. The path is clear, and with concerted efforts, Morocco can achieve a true medical revolution that will benefit millions of patients.

Conflicts of Interest

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

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