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AI AND HEALTHCARE IN THE MENA REGION

Challenges and Opportunities

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Executive Summary

Artificial Intelligence (AI) is reshaping healthcare worldwide by enhancing diagnostics, treatment, and efficiency, but its adoption varies across regions due to differences in infrastructure, governance, and capacity. In the MENA region, Gulf states are advancing rapidly while others face structural and regulatory barriers, underscoring the need for sector-specific assessments tailored to regional contexts.

This report presents a comparative analysis of the adoption and integration of AI in the healthcare sectors of four Arab countries: Saudi Arabia, Qatar, Jordan, and Tunisia. The research aims to map current trends, identify structural gaps, and provide actionable recommendations for policymakers, funders, and development partners to foster an effective and equitable AI-for-health ecosystem. The analysis is structured around four key dimensions: Policy and Governance, Digital Infrastructure, Workforce Capacity, and Implementation. The selection of countries provides a representative cross section of the region's diversity, from the technologically advanced, high-income states of the Gulf to nations with emerging institutional frameworks and more constrained resources.

The report's analysis of policy, governance, and digital infrastructure reveals a clear hierarchy of strategic maturity, and a significant implementation divide among the four focus countries. Saudi Arabia and Qatar have emerged as ambitious frontrunners, embedding AI in healthcare as a central pillar of their national transformation visions. Saudi Arabia has established a highly centralized governance model and integrated digital infrastructure, enabling large scale deployment through platforms like the Seha Virtual Hospital. Qatar leverages a network of world class research and clinical institutions to drive innovation, particularly in specialized fields, though its distributed governance model presents coordination challenges.

In contrast, Jordan is pursuing a methodical, foundational path, prioritizing the establishment of a modern regulatory environment with a new Personal Data Protection Law and a national AI ethics charter before pursuing large scale deployment. Tunisia's progress is hindered by a policy vacuum and a fragmented institutional landscape, resulting in an ecosystem of promising yet disconnected pilot projects that have not yet achieved scale.

Despite these differences, the analysis identifies five critical and universal challenges that represent systemic barriers to progress across the region.

- **Ambiguous Governance:** A failure to translate high-level ethical principles into clear, enforceable clinical regulations for consent, liability, and algorithmic bias.
- **Critical Workforce Deficit:** A profound skills gap between rapid technological investment and the AI readiness of clinicians, who largely lack formal training.
- **Data Fragmentation:** Persistent data silos and a lack of system-wide interoperability that hinder the development of robust, locally relevant AI models.
- **Immature Evaluation Frameworks:** An absence of standardized methods to assess the real-world clinical and economic impact of AI, leading to procurement that is not evidence-based.
- **Top-Down Policymaking:** Limited engagement with frontline clinicians and patients, risking a disconnect between AI solutions and practical needs.

To address these challenges, the report proposes the following strategic actions for key stakeholders.

FOR POLICYMAKERS	FOR FUNDERS AND DONORS	FOR DEVELOPMENT AND TECHNICAL PARTNERS
Codify Health-Specific AI Regulations to provide clear, predictable pathways for clinical safety, approval, and oversight.	**Invest in Foundational Infrastructure** such as interoperability frameworks and shared data registries over isolated pilot projects.	**Adopt a Co-Design Approach** by collaborating with local clinicians and patients to ensure AI solutions are relevant, trusted, and usable.
Mandate National Data Interoperability using common standards to break down the data silos that cripple AI development.	**Fund Independent, Real-World Evaluations** to build a clear evidence base for the clinical utility, cost-effectiveness, and equity impact of AI tools.	**Build Interoperable Solutions** on open standards to avoid vendor lock-in and contribute to a more connected health ecosystem.
Launch a National Workforce Strategy to embed AI and data science competencies into all health professional training and development programs.	**Earmark Resources for Inclusive Training** to close documented skills gaps for women and professionals in underserved regions.	**Operate with Transparency** by proactively publishing bias audits, model cards, and workflow impact data for all deployed solutions.
Establish Trusted Research Environments to provide secure, audited access to de-identified health data for ethically compliant innovation.		

1. Introduction

1.1. Background and Rationale:

Artificial Intelligence (AI) is rapidly transforming healthcare systems across the globe. From AI-assisted diagnostics and predictive analytics to personalized treatment plans and automated administrative processes, AI technologies are being adopted to improve service delivery, reduce costs, and expand access to care. However, the pace and scale of AI integration vary significantly across regions, shaped by differences in digital infrastructure, governance models, human capital, and socio-political dynamics.

In the MENA region, this transformation is unfolding unevenly. While some countries, particularly those in the Gulf, have made explicit commitments to AI and digital health innovation, others continue to face structural, regulatory, and capacity-related barriers. Existing global assessments of AI readiness tend to provide aggregate views without specific attention to sectoral applications like healthcare, and often overlook the unique political, economic, and infrastructural context of the Arab MENA region.

This report aims to understand how some Arab countries in the MENA region are adopting and adapting AI within their health sectors. Given the region's diversity, from high-income, technologically advanced states to conflict-affected countries with fragile health systems, a targeted, contextualized analysis is essential. Understanding this landscape is critical for identifying scalable opportunities, avoiding technology-driven inequities, and ensuring that AI investments align with national health priorities and capacities.

1.2. Objectives of the Report

The report is guided by five core objectives:

To map current trends in AI adoption across a selection of Arab MENA countries.

To analyze the absence or limited presence of AI in healthcare systems and explore contributing factors.

To identify structural and operational gaps related to digital infrastructure, policy readiness, workforce capacity, and implementation.

To highlight relevant case studies and high-potential opportunities where AI can improve health outcomes.

To synthesize findings into actionable recommendations for policymakers, funders, and development partners.

2. Methodology

2.1. Approach:

This report adopts a desk-based literature review methodology, drawing primarily from publicly available policy documents, national digital health strategies, AI governance frameworks, institutional reports, and relevant grey and academic literature related to the use of artificial intelligence in healthcare across selected MENA countries. The research prioritizes accessibility to comprehensive and verifiable data sources, ensuring that each country's profile reflects the current landscape of AI adoption in healthcare. Countries were selected to provide a representative cross-section of the region's diversity in digital maturity and AI health engagement, ranging from countries with advanced digital health ecosystems to those with emerging or minimal AI infrastructure.

The research classifies MENA countries into four tiers in terms of their AI health adoption: Advanced, Developing, Emerging, and Not Ready. The four countries analyzed, Saudi Arabia, Qatar, Jordan, and Tunisia, were strategically selected based on their alignment with the research's AI Health Adoption Categorization Framework above. This typology enables comparative insights across varied national contexts and adoption levels. Informed by the four analytical dimensions, Policy & Governance, Digital Infrastructure, Workforce Capacity, and Implementation, the country selection reflects a balance between high-level strategic ambition (e.g., Saudi Arabia and Qatar) and emerging institutional efforts amid resource and infrastructure limitations (e.g., Tunisia and Jordan). This approach ensures that the study not only captures best practices but also illuminates systemic barriers, overlooked opportunities, and policy-relevant entry points for scaling AI-driven health interventions across the region.

2.2. Analytical Framework:

This report applies a structured analytical framework built around four key dimensions of AI adoption in healthcare detailed below: Policy and Governance, Digital Infrastructure, Workforce Capacity, and Implementation. Each dimension interrogates a different layer of readiness and engagement across the four MENA countries.

POLICY AND GOVERNANCE

Examines national AI strategies, regulatory frameworks, and ethical guidelines. It assesses data protection, patient rights, and the meaningful engagement of health professionals and civil society in shaping policy.

DIGITAL INFRASTRUCTURE

Captures the technical backbone for AI, including health information systems, cloud capacity, and data exchange. It assesses the scale and equity of digital access.

WORKFORCE CAPACITY

Evaluates the available human capital, from national upskilling initiatives to training programs and medical curricula, to support AI in healthcare.

IMPLEMENTATION

Focuses on the real-world application of AI tools through use cases, pilot projects, and institutional uptake. It examines who is driving innovation and the contextual factors for success.

3. AI Adoption in Healthcare Across Saudi Arabia, Jordan, Qatar and Tunisia

3.1. Policy and Governance

A comparative analysis of the policy and governance landscapes for AI in healthcare across Saudi Arabia, Jordan, Qatar, and Tunisia reveals a clear hierarchy of strategic maturity and a significant infrastructural divide. The four countries diverge significantly in their approaches, from the ambitious, top-down integration seen in frontrunners like Saudi Arabia and Qatar to the methodical, foundational path taken by Jordan and the fragmented landscape in Tunisia. This divergence is evident across several key areas, including the structure of governance models, the completeness of regulatory frameworks, and the inclusiveness of the policy design process. The following table summarizes this cross-country comparison, highlighting the distinct pathways each nation is forging.

Table 1: Cross-Country Comparison of AI Policy & Governance in Healthcare

DIMENSION	SAUDI ARABIA	QATAR	JORDAN	TUNISIA
Strategic Approach	**Ambitious Frontrunner**. AI in health is a central pillar of "Vision 2030" and linked to system level platforms (e.g. SVH) enabling scale.	**Ambitious Frontrunner**. Health is a flagship use case in the "AI+X Nation" vision, with strong research/clinical anchors.	**Methodical & Foundational**. Prioritizes legal and ethical scaffolding before widescale deployment.	**Fragmented**. Constrained by a "policy vacuum" due to a pending national AI strategy, progress uneven.
Governance Model	**Highly Centralized**. Strong vertical coordination under Saudi Data & AI Authority (SDAIA); clear translation from policy to infrastructure.	**Distributed**. Led across advanced research and clinical institutions; creates uneven "line-of-sight" from principles to hospital practice.	**Collaborative**. Features a formal multi-stakeholder committee for policy design and coordination	**Fragmented**. Disparate agencies, limited central coordination, calls for structured co-design.
Regulatory Environment	**Most Complete among the four**. Has established clear and predictable "rules-of-the-game" supporting AI experimentation and scaling.	**Principles-Based**. High-level policies exist but face challenges in translation to practical hospital oversight.	**Foundational Laws in Place**. Has modern data protection, national AI ethics charter and telemedicine laws but lacks specific clinical AI guidance and routinised approval pathways.	**Patchwork of Legacy Laws**. Operates under outdated laws with partial modernisations; health-specific AI rules limited.
Accountability & Ethics	**Relatively most developed but still evolving**. Accountability (consent, safety, explainability) is stronger than peers yet not fully mature.	**In Progress**. Ethical principles are outlined, but translation into concrete clinical protocols is ongoing.	**In Progress**. Has a national ethics charter, but its practical application is still developing.	**Nascent**. Early translation of international norms into workable health policies.
Policy Design Process	**Top-Down & Expert-Led**. Efficient, less inclusive; risk of disconnect from frontline realities.	**Top-Down & Expert-Led**. efficiency with heightened risk of principle-practice gaps.	**Mostly Participatory**. Formal multi-stakeholder prossess and inclusivity are comparatively strongest.	**Ad-Hoc**. Not clearly defined, with calls from experts for a more structured "co-design" approach.

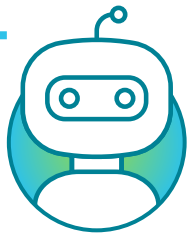
3.1.1. Saudi Arabia: Centralized Ambition and Regulated Innovation

In Saudi Arabia, the governance structure is characterized by unambiguous, centralized control with layered spaces making it hard to navigate. The Saudi Data & AI Authority (SDAIA) serves as the single national reference point for all data and AI matters including strategy, governance and ethical oversight, while the Saudi Food and Drug Authority (SFDA) provides specific guidance for AI/ML-based medical devices. The Ministry of Health is being repositioned as sector regulator and enabler through standards setting, eHealth policy, and flagship programs, with service delivery shifting to the Health Holding Company through 20 health clusters. Meanwhile, the National Platform for Health and Insurance Exchange Services (NPHIES), Co-founded by the Council of Health Insurance (CHI) and the National Health Information Center (NHIC), mandates financial and clinical data exchange across payers and providers. This top-down orchestration is driven by immense political will, underscored by the Crown Prince's direct leadership of SDAIA's board, creating a powerful incentive for rapid development in value-based care and data driven operations. The ecosystem where AI is being utilized remains complex and opaque where coordination mechanisms are not publicly mapped and lines of accountability for AI risk monitoring are diffused. A public system wide architecture of who does what is missing, constraining transparency, and implementation.

The core governance mechanism designed to balance innovation with patient protection is the stringent Personal Data Protection Law (PDPL). Its implementing regulations create a robust framework that classifies health data as "sensitive," mandating explicit consent for its use and requiring entities to conduct Data Privacy Impact Assessments (DPIAs) and appoint data protection officers (Saudi Implementing Regulation, 2023). This creates a notable tension: while the national strategy aims for an "attractive and business-friendly" environment, the significant legal and administrative burdens associated with processing health data act as a potential constraint. The Kingdom's approach to global ethics is one of careful localization; its AI Ethics Principles align with global norms of fairness and transparency but explicitly mandate that AI models must also align with "Saudi 'cultural values'" (SDAIA, 2020).

3.1.2. Qatar: Distributed Governance and the Principle-to-Practice Gap

Qatar's institutional landscape is far more distributed than Saudi Arabia's. There is no single health-AI regulator; instead, oversight is shared between the Qatar AI Committee, the Ministry of Public Health (MOPH), the Ministry of Communications and Information Technology (MCIT), and the Compliance and Data Protection (CDP) department. This network of actors, which includes world-class clinical and research institutions like HMC and QCRI, provides a strong foundation, but coordination between them is only partially described, leaving role boundaries ambiguous. The primary governance mechanism relies on high-level principles articulated in the national strategy rather than on detailed, health-specific AI regulations. This has resulted in a significant gap in clinical translation, where the application of ethical principles to concrete hospital protocols on consent, liability, and algorithmic transparency remains uneven (QCRI, 2019). Politically, the national vision to become a knowledge-based economy provides a strong incentive for AI adoption, but a key institutional constraint is the country's small population, which limits local datasets. Qatar's approach to global ethics is selective localization, participating in non-binding international norms like UNESCO's recommendations while ensuring any framework aligns with Qatari social and religious values, often through consultations with Islamic bioethics scholars (Albous et al., 2025).



In KSA, a system wide architecture of who does what is missing, constraining transparency and implementation.

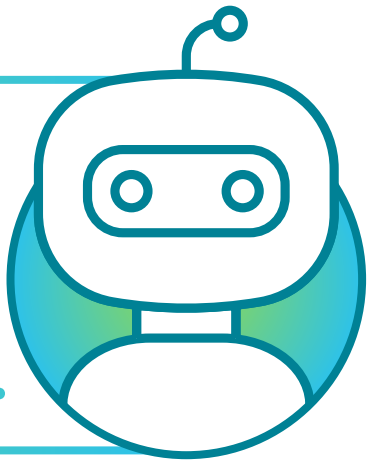
3.1.3. Jordan: Foundational Scaffolding and Collaborative Governance

The country's governance model is distinguished by its collaborative and formally inclusive structure. The Ministry of Digital Economy and Entrepreneurship (MoDEE) leads the cross-government digital transformation, with clear coordination with the Ministry of Health (MoH) on sector-specific initiatives. This partnership is formalized in the National Ministerial Committee for Artificial Intelligence, a body that brings together representatives from government, the private sector, civil society, and academia. Jordan's governance mechanisms are built on a new tapestry of foundational legal instruments, including its first comprehensive Personal Data Protection Law (PDPL No. 24 of 2023) and its National AI Ethics Charter (2022). These provide the essential "rules-of-the-game" for responsible AI use. The National Digital Health Strategy (2024–2030) is intended to translate these high-level rules into sectoral practice. Jordan's approach to global principles is one of explicit alignment, with its national ethics charter deliberately mirroring the language of WHO and UNESCO on principles like human dignity and fairness (National AI Ethics Charter, 2022).

3.1.4. Tunisia: Aspirational Policy in a Fragmented Landscape

The delay in Tunisia's national AI strategy has resulted in a fragmented governance landscape where institutions operate without a unifying framework. Key actors include the national data protection authority (INPDP), which oversees a legacy 2004 privacy law; the recently created Agence Nationale de Cybersécurité (ANCS), which is modernizing cybersecurity standards; the Ministry of Health; and the Ministry of Industry. This "dual-lead arrangement" creates coordination challenges that will need to be resolved. Governance currently relies on a patchwork of legacy privacy rules and updated cybersecurity decrees, a mechanism ill-suited to the complexities of modern AI. Critical gaps exist, including the absence of clear rules on secondary use of health data for algorithm training, national standards for anonymization, and accountability frameworks for algorithmic bias. The primary incentive for AI development comes from the promise of the pending strategy and Tunisia's high AI-talent readiness ranking. However, the policy delay is the single largest constraint. While Tunisia aligns with international norms, its operational localization for health is nascent, and the policy design process has been largely government-led, prompting calls from scholars for a more inclusive, co-designed approach (Kahna & Kourda, 2021; Jemâa et al., 2024).

Jordan's approach is of explicit alignment with its national ethic charter mirroring global principles of dignity and fairness.



3.2. Digital Infrastructure

The maturity of digital health infrastructure varies substantially across the four nations, directly influencing each country's capacity for AI deployment. The landscape ranges from Saudi Arabia's highly integrated national ecosystem, Qatar's paradoxical mix of advanced assets and system-level friction, to Jordan's foundational, developing system and Tunisia's islands of excellence amidst persistent gaps. The primary differentiating factors are the degree of interoperability, data standardization, and the availability of AI-grade computing power. The following table summarizes this comparative analysis.

Table 2: Cross-Country Comparison of Digital Health Infrastructure

DIMENSION	SAUDI ARABIA	QATAR	JORDAN	TUNISIA
Overall Status & Maturity	**Clear Leader**. Operates the most advanced and integrated digital health stack in the region.	**A Paradox of Excellence**. Possesses world-class foundational elements but is hampered by a system-wide failure of integration.	**Developing Asset**. Has a strong foundational data backbone and is rapidly improving its governance for data exchange.	**Islands of Excellence**. Shows proven capacity for national-scale projects amidst fundamental, persistent gaps in the broader system.
Key Strength & Assets	A unified national ecosystem including a digital medical record with 100% population coverage, national surveillance (HESN), and an AI cloud vision enabling platforms like the Seha Virtual Hospital.	Strong patient-facing services, high-end digitisation in tertiary care, world-class connectivity, and in-country hyperscale cloud regions.	The national Electronic Health Record system (Hakeem) provides a standardized data backbone, supported by an established government cloud policy.	Demonstrated success in specific national projects like the EVAX vaccination platform and teleradiology networks.
Primary Constraints	No specific infrastructure constraint.	A critical bottleneck caused by systemic failure of interoperability, particularly between public and private providers.	Infrastructure is still developing: has not yet achieved full nationwide data exchange or advanced analytics, though governance is strengthening in that direction.	Fundamental constraints in AI-grade compute depth and nationwide interoperability, compounded by inconsistent digitisation, especially in rural areas.

3.2.1. Saudi Arabia: An Integrated Infrastructure for National-Scale AI

Saudi Arabia's digital infrastructure is strategically designed to capture the vast amounts of structured data generated during routine healthcare operations, creating a rich resource for large-scale AI. National interoperability objectives, embedded in the Health Sector Transformation Program, ensure that sector platforms for appointments (Mawid), e-prescribing (Wasfaty), and referrals (Ehalty) create a rich data ecosystem. Alongside these, national disease-surveillance registries (e.g., HESN) expand population-level datasets suitable for AI training and public-health analytics. This is all supported by a national AI cloud vision (like the 'Olympus' project), which shows the government is building the powerful, secure computing infrastructure needed to host and run advanced AI models (SDAIA, 2020). Widespread public adoption of smart health applications enriches this ecosystem with patient-generated insights, providing valuable features for prediction and triage, with the PDPL framework supplying regulatory guardrails (Albinsaad et al., 2024; Saudi Implementing Regulation, 2023).

Despite this advanced state, key priorities remain. These include establishing routine Fast Healthcare Interoperability Resource (FHIR)-based exchange between public and private providers to break down residual silos; standardising minimal datasets for high-value domains such as imaging, oncology and diabetes; and developing Trusted Research Environments (TREs), secure enclaves with audited pseudonymisation and access logs, to accelerate clinical–academic innovation while maintaining compliance. Creating standardized blueprints, or reference architectures, for how to safely deploy AI models within a hospital's own network would make the process easier, faster, and more scalable. (SDAIA, 2020; Solaiman et al., 2024).

3.2.2. Qatar: Advanced Foundations and the Interoperability Imperative

Qatar's strengths in patient-facing and tertiary-care digitisation are well documented. The Primary Health Care Corporation (PHCC) has expanded digital access via mobile apps and patient portals, and the country's consistently high connectivity rankings create fertile ground for AI pilots in telemedicine and chronic-disease management at leading centres (PHCC, 2021; Peninsula Qatar, 2018; Peninsula Qatar, 2024). These assets underpin ongoing radiology and chronic-care innovations and position tertiary providers to serve as testbeds for wider adoption.

However, there is little public information about how data is shared between different providers, a critical gap that prevents the development of more advanced AI that needs to draw data from multiple sources, like different hospitals and labs. Documentation in the open domain provides limited specificity on the backbone, common identifiers, FHIR/semantic harmonisation, real-time APIs, and consent/consumption logs, creating uncertainty for innovators (QCRI, 2019; El-Khoury & Albarashdi, 2025). The critical next step is to clarify the architecture for real-time data exchange and to formalise cloud governance for clinical inference and model lifecycle management, which would reduce integration friction and support diffusion beyond elite tertiary centres (QCRI, 2019; El-Khoury & Albarashdi, 2025).

In Qatar, there is little public information about how data is shared between different providers.

3.2.3. Jordan: Leveraging a Foundational EHR for Strategic Analytics

Jordan's national EHR backbone, Hakeem, is a critical enabler for AI-assisted quality improvement, providing longitudinal clinical data across major public providers (Electronic Health Solutions). The National Digital Health Strategy 2024–2030 aims to strengthen e-HIS governance, expand coverage and enable analytics layers atop routine care data, shifting the system from basic digitisation toward value-adding AI use cases in quality improvement and population health (National Digital Health Strategy 2024–2030).

This trajectory is supported by the Government Cloud (Platforms & Services) Policy (2020), which provides a secure hosting baseline for health data and models, alongside evolving national cybersecurity capacity (Government Cloud Policy, 2020). As connectivity improves beyond large cities, opportunities expand for AI-enabled triage and remote monitoring in peripheral facilities. Key next steps involve standardising interoperability across provider networks, clarifying data-sharing agreements, and enabling Trusted Research Environments (TREs) for de-identified analysis and multi-site validation, measures that would lower barriers to clinical–academic partnerships and accelerate ethically compliant AI experimentation (National Digital Health Strategy 2024–2030; Government Cloud Policy, 2020).

3.2.4. Tunisia: Navigating Foundational Gaps and Pockets of Innovation

Tunisia's operational digital services, such as the EVAX vaccination platform, national teleradiology networks, and the RNS (National Nursing Platform), demonstrate the capability to run population-scale and specialist workflows and can serve as launchpads for targeted AI applications (e.g., imaging prioritisation, vaccine operations analytics) (Ministry of Health, 2021; World Bank, 2025). Recent cybersecurity and cloud measures modernise the hosting environment for health workloads, establishing the policy basis for more advanced analytics (Government of Tunisia, 2023).

Nationwide interoperability and market depth in AI-grade compute (e.g., GPUs) remain binding constraints on broad deployment (World Bank, 2025). While connectivity indicators are generally strong, persistent last-mile divides shape where AI-enabled telehealth and analytics can be deployed effectively (QUNIE Corp., 2022; Tunisienumerique, 2025a; Tunisienumerique, 2025b). The crucial next step is a national interoperability roadmap that defines standards for data exchange. This roadmap should include government-approved purchasing guides that help hospitals choose AI tools that aren't tied to a single vendor, and it should prioritize the creation of high-quality, centralized datasets for key health conditions to help successful pilot projects expand across the country. (World Bank, 2025).

In Tunisia, the critical next step is a national interoperability roadmap that defines standards for data exchange.

3.3. Workforce Capacity

A profound gap exists between strategic AI aspirations and the on-the-ground readiness of the clinical workforce across all four nations, representing a critical bottleneck to progress. This challenge universally manifests as shortfalls in three key areas: clinical readiness to use AI tools, data stewardship to manage information, and the technical Machine Learning Operations (MLOps) capacity to deploy models. While the skills gap is a shared problem, the approaches to building human capital and the specific equity concerns vary significantly from one country to another. The following table summarizes these comparative findings.

Table 3: Cross-Country Comparison of Workforce Capacity

DIMENSION	SAUDI ARABIA	QATAR	JORDAN	TUNISIA
Core Challenge	Strategic investment has outpaced workforce readiness, producing a "last-mile" gap in clinical adoption across clinical readiness, data stewardship, and machine learning operations (MLOps); over 70% of specialists in some fields report no AI training.	Similar ambition-readiness gap across clinical workforce, data stewardship and MLOps, with uneven uptake across facilities and roles.	Translate strong foundational informatics skills into applied, clinical AI and analytics capabilities.	A fragmented and uncoordinated approach to capacity building that relies on isolated projects rather than a cohesive national program.
Capacity Building Approach	Leverages system-level platforms (e.g., Seha Virtual Hospital) as "learning infrastructure" alongside targeted initiatives; coverage outside leading centres remains uneven.	Multiple training channels via research/clinical institutions; reach and standardisation vary.	The most systematic approach; workforce development is a national priority, with skills growing organically from managing the national EHR and via structured training (e.g., Hakeem Academy).	A "bottom-up" ecosystem driven by incubators and project-based, multi-partner collaborations rather than a national strategy.
Equity & Specific Gaps	Large pockets of clinicians without AI training; limited protected time and uneven professional development integration.	A significant and documented gender gap in AI experience among healthcare staff; variable access beyond tertiary hubs.	Primary gap is specialized clinical AI skills need formal pathways, incentives, protected time.	Structural labor market barriers hinder the retention of women in tech roles; clinicians lack protected time for data work.

Building on this comparative overview, a more detailed examination of each nation's workforce environment reveals the specific mechanisms, challenges, and priorities shaping their human capital development for an AI-enabled future.

3.3.1. Saudi Arabia: Strategic Upskilling and the Last-Mile Challenge

Skills development is a declared pillar of Saudi Arabia's national AI strategy, with programs aimed at expanding technical and applied competencies across all sectors, including health (SDAIA, 2020). This strategic intent is materializing through multiple pathways. Medical curricula are increasingly referencing AI foundations and data literacy, and advanced national platforms like the Seha Virtual Hospital are being leveraged as practical learning arenas. These platforms provide distributed clinical teams with direct exposure to decision-support tools and virtual care workflows, supporting the organic emergence of clinical champions and operational data teams.

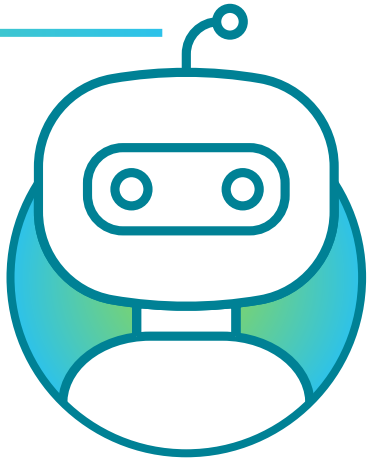
Despite these efforts, peer-reviewed studies consistently highlight significant clinical readiness gaps. Recurring recommendations from researchers point to the need for protected time and dedicated mentorship for clinicians to engage in applied data science, alongside stronger interfaces between clinicians, data stewards, and engineers to bridge the operational divide (AlSharhan et al., 2024; Syed & Al-Rawi, 2023). Standardizing new role profiles, such as clinical informaticians and MLOps engineers, is seen as a crucial step to move beyond reliance on ad-hoc champions toward a more structured, team-based approach to data practice. Furthermore, inclusion remains an area requiring deliberate design to ensure that women and professionals outside major urban hubs have equitable access to upskilling pathways and applied apprenticeships, thereby broadening the national talent base.

3.3.2. Qatar: Concentrated Expertise and Uneven Readiness

Qatar exhibits strong evidence of formal education and provider-based training, with a dense ecosystem of postgraduate programs, short courses, and hospital-led initiatives at institutions like Hamad Medical Corporation and Sidra Medicine. These programs are effectively cultivating clinical familiarity with AI workflows, quality concepts, and model oversight, particularly within specialized domains like radiology, oncology, and metabolic disease management (Ahmed, 2022; Ahmad et al., 2023).

However, this expertise appears to be highly concentrated, leading to uneven readiness across the broader health system. Beyond the leading tertiary centers, there are significant needs in foundational areas such as data stewardship, validation practices, and routine maintenance protocols for AI tools. Published materials call for clearer pipelines to translate skills from training programs into daily ward-level practice, which would require institutional commitments to protected time and incentives for clinician and data scientist collaboration (El-Khoury & Albarashdi, 2025; Al-Qudimat et al., 2025). Targeted inclusion also remains a work in progress. A key next step is to institutionalize skills more broadly by accrediting Continuing Professional Development (CPD) linked to AI oversight, a measure that would help distribute capabilities across the entire system rather than confining them to specialist hubs.

In Qatar, the AI expertise is highly concentrated in leading tertiary centers, leading to uneven readiness across the broader health system.



3.3.3. Jordan: A Foundational Training Ground for the Next Generation of Skills

Jordan's national rollout of its Electronic Health Information System (e-HIS) serves as a practical, system-wide training ground for a new generation of digital health professionals. This process organically builds foundational capacity by creating demand for informatics roles, data stewards, and governance processes that are compliant with the country's new Personal Data Protection Law (PDPL). This ensures that a baseline of documentation quality, basic analytics, and data governance is established within public provider settings (National Digital Health Strategy 2024–2030).

The primary challenge for Jordan is now to progress from these operational skills to more advanced clinical AI capabilities. Public materials highlight the opportunity to embed "AI-adjacent competencies"—such as quality improvement analytics, risk prediction validation, and human-in-the-loop practices—through in-service training that is directly tied to the daily use of the e-HIS. Equity of access is a key consideration in this next phase. Enabling regional facilities to participate in training, experiment within safe sandboxes, and partner with universities will be crucial to reduce the concentration of advanced capabilities in the capital and support sustainable, nationwide adoption.

3.3.4. Tunisia: Nurturing Talent in a Developing Ecosystem

Tunisia's workforce capacity is being nurtured through a vibrant ecosystem of multi-partner programs and incubators like Connect'Innov, which are building both entrepreneurial and technical skills in digital health (Connect'Innov, 2020; World Bank, 2025). These initiatives create valuable entry points for clinicians and engineers to collaborate on developing targeted AI solutions.

However, significant inclusion challenges persist. While women's participation in tertiary education is high, their representation in advanced AI and health data roles remains uneven, and rural access to digital skills training lags significantly, echoing broader digital divide patterns (ONEQ–World Bank, 2020; Freedom House, 2022). Addressing this requires targeted interventions such as scholarships, apprenticeships, and institutional commitments to providing protected time for applied projects in regional hospitals. Furthermore, scholarship from the region emphasizes the need for a co-design approach to workforce development itself, where policymakers, professionals, and users collaborate to ensure that training curricula align with the practical needs and ethical expectations of local clinical contexts. This participatory approach can accelerate skill internalization and promote more responsible uptake of AI technologies (Jemâa et al., 2024).

3.4. Implementation

The real-world implementation of AI solutions reveals a clear hierarchy of scale and integration across the four nations, from Saudi Arabia's large-scale, embedded systems to Tunisia's fragmented landscape of pilots. This divergence is mirrored by a universal weakness in evaluation mechanisms, as no country has yet established a comprehensive framework for assessing the real-world clinical and economic impact of these technologies. The following table summarizes these findings, comparing each country's implementation status, key application areas, and evaluation maturity.

Table 4: Cross-Country Comparison of AI Implementation in Health

DIMENSION	SAUDI ARABIA	QATAR	JORDAN	TUNISIA
Implementation Status & Scale	**Definitive Leader**. Deploys large-scale, integrated AI as part of a national multi-platform strategy embedded in public infrastructure.	**Institutionalized Pathways**. Shows clear "pilot-to-programme" progression, institutionalizing sophisticated applications in specialized fields.	**Foundational Focus**. Methodical rollout of national digital platforms (EHR expansion, new virtual hospital) as the rails for future AI use cases; public sector the dominant implementer.	**Most Fragmented**. A vibrant but disconnected population-scale platforms (e.g., EVAX) and do pilots that have not achieved scale.
Key Application Areas	Precision oncology, robotic surgery, and public health surveillance (via Seha Virtual Hospital and advanced clinical centers).	Specialized fields like genomics, radiotherapy, and medical imaging, driven by major public health providers.	Expansion of the national Electronic Health Record (EHR) and launch of a virtual hospital as enabling infrastructure.	The EVAX vaccination platform and smaller-scale, academic or start-up-led pilot projects.
Evaluation Maturity	**Emerging**. Relies on impressive internal operational metrics (e.g., reduced wait times) but lacks routine, comprehensive real-world impact assessment.	**Most Diverse Methods**. Uses retrospective validations and specific clinical metrics (e.g., AUC, clinician override rates), though multi-site evaluations are limited.	**Nascent**. Focused on platform rollout; shares the regional weakness of lacking a standardized framework for assessing real-world impact.	**Limited to Technical Accuracy**. Evaluations focus almost entirely on model performance, with little evidence of impact on clinical workflows or patient outcomes.

Building on this comparative overview, a more detailed examination of each nation's implementation landscape reveals the specific projects, evaluation cultures, and strategic priorities shaping their path from pilot projects to systemic integration.

3.4.1. Saudi Arabia: Anchoring AI in System-Level Workflows

Saudi Arabia's system-level platforms, including the Seha Virtual Hospital and the Health Electronic Surveillance Network (HESN), anchor AI within day-to-day digitized workflows. This integration enables a range of AI-assisted use cases, from triage and public health surveillance to the increasing uptake of imaging AI in select clinical sites. However, published commentary emphasizes the need to move towards "evaluation by default," a framework where bias audits, workflow impact studies, and safety incident tracking are routine components of any AI deployment. A key recommendation to strengthen accountability is the embedding of model-oversight committees directly into existing hospital quality assurance structures.

Looking forward, scaling innovation beyond initial pilots will require a more sophisticated approach to procurement and governance. This includes developing procurement templates that clarify model lifecycle responsibilities, covering everything from initial training and ongoing monitoring to the eventual decommissioning of an AI system. Furthermore, standardized data-sharing agreements are needed to enable continuous model validation while preserving patient privacy, an area where national frameworks can provide crucial support (SDAIA, 2020; Solaiman et al., 2024).

3.4.2. Qatar: From Tertiary Hubs to System-Wide Value

Qatar's leading medical centers report a maturing implementation culture, with clinical AI pilots in radiology and oncology that include performance metrics like Area Under the Curve (AUC) and workflow indicators such as clinician override rates. Partnerships with global vendors and academic institutes are proving crucial to adapt AI tools to the local case-mix, ensuring models are relevant to the nation's specific patient populations and disease profiles (Philips, 2025; Sidra Medicine, 2025).

While pathways from pilot to program are visible in these tertiary hubs, system-wide scale depends on solving the interoperability challenge and establishing clear maintenance routines across all providers. Expanding multi-site trials and standardizing reporting protocols would accelerate the diffusion of proven technologies and, critically, inform payer and regulator decisions regarding reimbursement and approval. Additionally, documentation points to the importance of leveraging patient-facing solutions, like health apps and portals, by embedding feedback loops from these channels directly into service redesign. This patient-centric approach will be vital to strengthening the value case for AI in areas beyond diagnostic imaging, such as chronic disease management (PHCC, 2021; Peninsula Qatar, 2024).

In KSA, there is a need to move towards "evaluation by default," a framework where bias audits, workflow impact studies and safety incident tracking are routine components of any AI deployment.

3.4.3. Jordan: An "Infrastructure-First" Path to Implementation

Jordan's implementation strategy is currently "infrastructure-first." The continued expansion of its Electronic Health Information System (e-HIS) and the establishment of new linkages between facilities, such as the Digital Health Centre, provide the essential rails for future AI applications. Once data quality and exchange routines are mature, these rails will support AI-driven risk prediction, triage, and referral optimization. The next phase involves launching applied pilots that leverage the rich data from the Hakeem system for quality improvement. A key priority is to build governance directly into these initial projects, with clear protocols for validation, clinician override, and incident reporting that are fully aligned with the constraints of the Personal Data Protection Law (PDPL).

To ensure long-term success and avoid vendor lock-in, Jordan's future efforts will need to focus on procurement models that foreground interoperability, cloud portability, and role clarity for model monitoring. This will help ensure that AI solutions are maintainable across the country's resource-diverse facilities. Publishing the results from these pilots across multiple hospitals would then serve to catalyze system-wide learning and support decisions on scaling (National Digital Health Strategy 2024–2030).

3.4.4. Tunisia: From "Islands of Excellence" to Networks of Practice

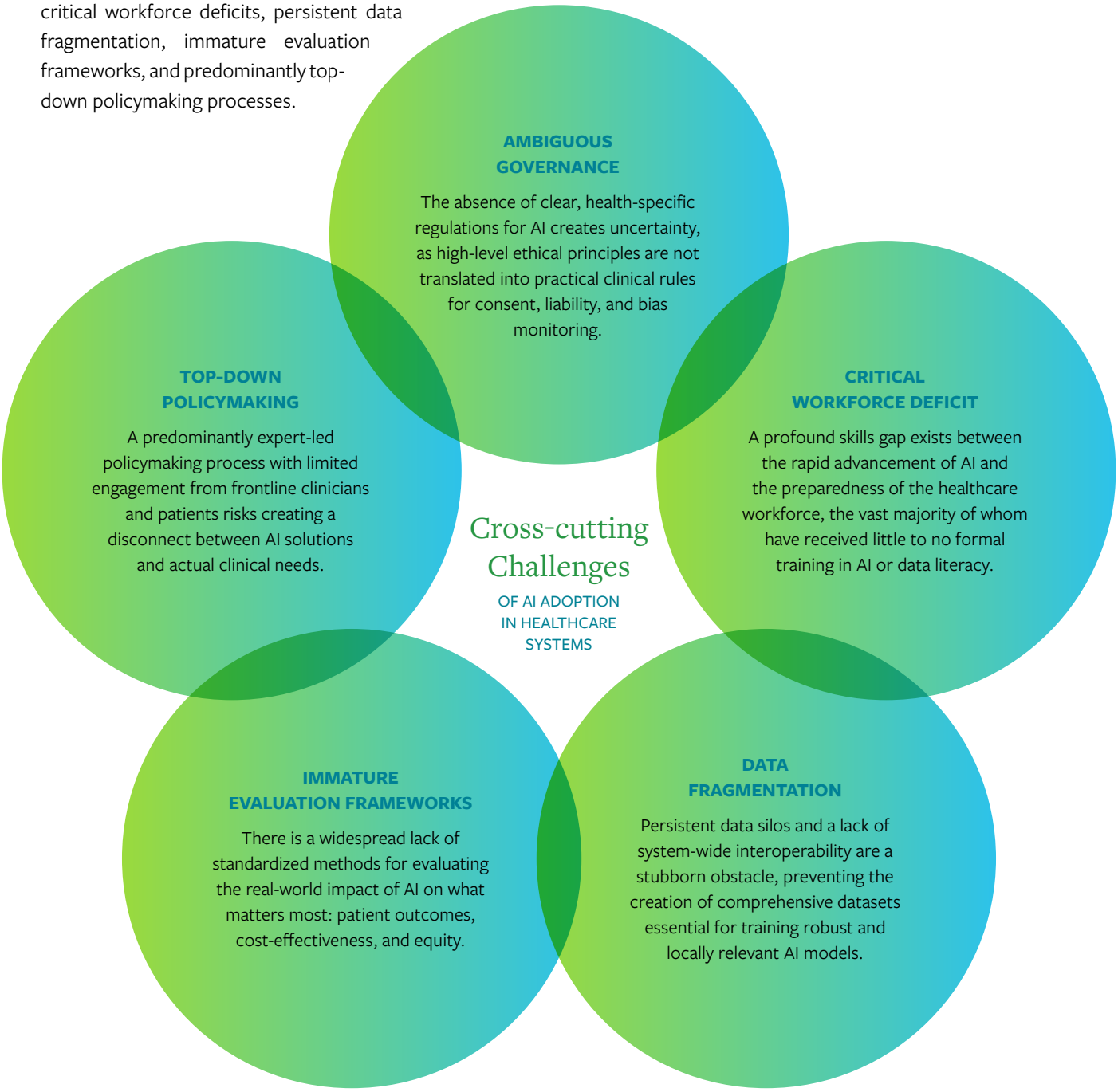
Tunisia's existing digital services, such as the EVAX vaccination platform and national teleradiology networks, demonstrate a capacity for deploying digital tools at population and specialty scale. These "islands of excellence" can serve as pathfinders and launchpads for targeted AI applications. However, scaling AI beyond these pilots will require significant investment in shared infrastructure and standardized processes. This includes developing shared services, such as national image archives with curated labels, which are essential to support model training and validation for the entire innovation ecosystem.

A crucial next step is to create procurement templates that emphasize open standards and cloud portability to mitigate the risk of vendor lock-in. To ensure equity, regional hospitals should be included in the national strategy through phased adoption plans and tele-supervision to avoid widening the center-periphery digital divide. The ultimate strategic goal for Tunisia is to leverage partnerships with universities and incubators to transform its "islands of excellence" into interconnected "networks of practice," where common data services and mentorship can enable the repeated and responsible adoption of AI across multiple specialties (Connect'Innov, 2020; World Bank, 2025).

Jordan's implementation strategy is currently "infrastructure first," which will provide the essential rails for future AI applications.

4. Cross-Cutting Challenges and Gaps

A comparative analysis of Artificial Intelligence adoption in the healthcare sectors of Saudi Arabia, Qatar, Jordan, and Tunisia reveals a set of common challenges. These issues represent systemic barriers to the effective, equitable, and safe integration of AI, transcending national economic status and strategic ambition. While each nation possesses a unique context, five interconnected challenges emerge as universal hurdles in the journey from strategic vision to tangible clinical value: ambiguous governance, critical workforce deficits, persistent data fragmentation, immature evaluation frameworks, and predominantly top-down policymaking processes.



4.1. Ambiguous Governance and Underdeveloped Regulatory Pathways

A primary and universal challenge is the presence of ambiguous governance structures and the absence of clear, health specific regulatory pathways for AI. Even in frontrunner nations like Saudi Arabia and Qatar, where national AI strategies are well defined, a significant gap persists between high level principles and their practical application in clinical protocols. This manifests as a failure to translate broad ethical guidelines into concrete rules for patient consent, medico legal liability, and algorithmic bias monitoring (National AI Ethics Charter, 2022). This regulatory uncertainty, as noted by clinicians, creates a significant obstacle to adoption by leaving providers and institutions exposed to undefined risks (AlSharhan et al., 2024). The situation is more complex in Jordan and Tunisia, where innovators must navigate a patchwork of general data protection laws not specifically designed for AI, alongside newer cybersecurity decrees and legacy health regulations. This lack of a predictable and health specific regulatory environment chills investment, discourages clinical adoption, and ultimately slows the crucial transition of AI tools from contained pilot projects to standard, system wide practice.

4.2. Critical Deficits in Workforce Capacity and Readiness

Arguably the most significant bottleneck identified across all four nations is the profound and alarming disconnect between the rapid advancement of AI technology and the preparedness of the healthcare workforce. In every country analyzed, the overwhelming majority of clinicians, nurses, and allied health professionals have received little to no formal training in AI principles, data literacy, or the ethical use of algorithmic tools. The stark figures from Saudi Arabia and Qatar, where over 70% of specialists in some fields lack any training, underscore the depth of this problem (AlSharhan et al., 2024; Ahmed, 2022). This knowledge deficit is a fundamental barrier to adoption, as it breeds mistrust, inhibits the effective use of new tools, and prevents health systems from realizing the immense potential of their technological investments. This is compounded by a lack of institutional support, including insufficient protected time and mentorship for clinicians to engage with new technologies, and inequitable access to the few training opportunities that exist, which risks widening the skills gap between urban centers and peripheral regions (ONEQ–World Bank, 2020).

4.3. Persistent Data Fragmentation and Foundational Infrastructure Gaps

Despite substantial investments in digitization, persistent data silos and a lack of true system wide interoperability remain a stubborn obstacle. The vision of a seamless flow of patient data across the health ecosystem is far from reality. This is vividly illustrated in Qatar, where the practice of patients physically carrying printed records between public and private facilities persists, leading to inefficiencies and fragmented care (Peninsula Qatar, 2024). This challenge prevents the creation of the comprehensive, longitudinal datasets that are essential for training robust, unbiased, and locally relevant AI models. It also cripples the effectiveness of clinical decision support tools at the point of care, as they often lack a complete view of the patient's history. These data silos represent a foundational weakness that undermines nearly every other effort to advance AI in health, and are further complicated by variable underlying infrastructure, including access to secure cloud environments and the AI grade compute power necessary for advanced applications (SDAIA, 2020).

4.4. Immature Frameworks for Evaluation and Procurement

The analysis reveals a widespread lack of standardized frameworks for evaluating the real world impact of AI applications. Most assessments, where they exist at all, are narrowly focused on technical metrics like model accuracy, as seen in Tunisia's pilots, or operational efficiencies like reduced waiting times, as reported in Saudi Arabia (Solaiman et al., 2024). There is a critical absence of rigorous, independent evaluation focused on what matters most: improved patient outcomes, cost effectiveness, and equity. Without robust frameworks for prospective clinical trials and post market surveillance, procurement decisions risk being driven by hype rather than evidence. This not only leads to inefficient allocation of resources but also means the potential for AI to cause harm or exacerbate health disparities cannot be effectively monitored or mitigated. This evaluation gap is directly linked to procurement challenges, including the risk of vendor lock in and unclear approval pathways that slow the diffusion of proven innovations.

4.5. Top-Down Policymaking and Limited Stakeholder Engagement

Finally, the policymaking process for AI in health across the region is predominantly characterized as a top down and expert led endeavor. While Jordan's national committee suggests a more inclusive model, the evidence from Saudi Arabia and Qatar points to limited systematic engagement of frontline clinicians, patient advocacy groups, and private innovators in shaping regulations (Solaiman et al., 2024). This approach, while efficient, creates a significant risk that policies will be disconnected from clinical realities and patient preferences. This can lead to the development of tools that are difficult to integrate into established workflows and that fail to build the necessary public trust for widespread adoption. As scholars from the region have highlighted, a more inclusive, co-designed approach is essential to ensure that AI solutions are aligned with the practical needs and ethical expectations of local contexts.

5. Conclusion and Strategic Recommendations

The analysis of Saudi Arabia, Qatar, Jordan, Tunisia reveals a shift from exploratory pilots toward routine, data-enabled care. Progress, however, remains uneven along four areas including the translation of high-level principles into operational clinical governance, the quality and interoperability of health data, the preparedness of clinical and data teams, and the maturity of real world evaluation. This operationalization gap indicates the significant disconnect between the ambitious vision for AI in healthcare and the foundational capacities required for its effective and equitable implementation. The cross-cutting challenges identified above are not isolated issues but systemic barriers that likely resonate across the broader MENA region.

While this report provides a representative cross-section, extending this comparative analysis to other key regional actors, particularly higher-investment systems such as the United Arab Emirates, and other North African countries, would offer a more complete picture of the evolving AI-for-health landscape. Such coverage will clarify which constraints are systemic versus country-specific, where advanced systems prioritized optimization, and where emerging systems can accelerate adoption by adapting proven components in the region. The subsequent phase of this research needs to examine the private sector role particularly in relation to how procurement models, data-sharing agreements, and liability allocation shape scalability, data access and sustainability. Lastly, the research needs a country-level deep dive into equity and access to explore the distributional effects across urban and peripheral facilities, public and private providers, and priority population groups. Attention to connectivity, language, consent practice, affordability, and organizational capacity will help determine effective availability and use of AI-enabled services as experienced by end users and providers.

To address these cross-cutting challenges and unlock the transformative potential of AI in healthcare, a concerted and strategic effort is required from all stakeholders. The following recommendations are tailored to policymakers, funders, and technical partners to foster a more effective, equitable, and sustainable AI-for-health ecosystem.

Strategic Recommendations for AI Adoption in Healthcare Across Four Arab Countries

Policy Makers	▫ Codify clear, health-specific regulatory pathways for clinical AI. ▫ Mandate national data interoperability standards. ▫ Integrate AI and data science competencies into all levels of healthcare education. ▫ Create national Trusted Research Environments (TREs).
Funders and Donors	▫ Prioritize investments in foundational digital infrastructure. ▫ Catalyze independent, real-world evaluations of AI tools. ▫ Resource targeted training programs to ensure equitable AI skills development.
Development and Technical Partners	▫ Co-design with local users to ensure AI tools are relevant, trusted, and fit for purpose. ▫ Build maintainable and interoperable solutions on open standards. ▫ Institutionalize a culture of evaluation and publishing performance data and bias audits.

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