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Ten ways to accelerate the benefits of digital health in Saudi Arabia

Saudi Arabia has already taken steps to digitize its healthcare system and fast-track improvements in patient experience, quality of care, and efficiency.

By Mahdi AlBasri, MD; Ali Ustun; and Panco Georgiev, MD, in collaboration with The Center for Improving Value in Health in Saudi Arabia.

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Digital technology offers healthcare systems significant benefits, including better-coordinated care, real-time monitoring of chronic diseases, more accurate diagnoses, more effective treatments, and convenience for both patient and physician. Digital healthcare also delivers substantial economic benefits—cost savings that can be reinvested into other priority health areas. In a 2020 paper, McKinsey Global Institute estimated that connected devices and advanced networks in healthcare could generate $250 billion to $420 billion in global GDP by 2030.[1]

In Saudi Arabia (KSA), digital healthcare could play a vital role in increasing healthcare efficiency and producing better outcomes, unlocking as much as $27 billion by 2030. The country has already taken many steps in this direction, starting with its Vision 2030 healthcare transformation in 2016 to improve healthcare efficiency, the quality of care, and the patient experience. Initially, e-health efforts focused on digitizing provider and national solutions in the form of electronic health records (EHRs) and clinical workflow management systems. Since the COVID-19 pandemic, though, Saudi Arabia has expanded its digital offerings to include consumer-centric solutions, specifically virtual care.

To examine the economic benefits that could be realized by increasing the use of digital healthcare technologies in in Saudi Arabia, McKinsey collaborated with the country's Center for Improving Value in Health to run a quantitative and qualitative analysis.[2] The analysis found that more widespread adoption of digital healthcare solutions could unlock $15 billion to $27 billion more economic benefit to the KSA health system as a whole in 2030—including the Ministry of Health, provider organizations, payers, physicians, and patients—than is promised by current adoption rates (see sidebar "Methodology for calculating the economic benefit"). That is 10 to 15 percent of Saudi Arabia's total projected health expenditure for 2030 that could be reinvested into other areas and enhance patient outcomes.

In this article, we outline the sources of the savings we identified and then present ten ways stakeholder groups can accelerate the process of realizing these benefits.

Sources of savings

The savings we identified could come from five economic benefit pools (Exhibits 1 and 2): making interactions virtual where appropriate, offering self-service options, increasing applications for decision intelligence systems, automating workflow, and going paperless.

Virtual interactions

Virtual interactions constitute 41 percent of the potential benefit, producing between SAR 6 billion and SAR 9 billion in savings by 2030. These derive mainly from three types of consumer-facing solutions:

— *Remote monitoring of chronic diseases* could help providers limit the cost of caring for patients with diseases such as diabetes. For example, between 2011 and 2015, diabetic emergency department visits in Saudi Arabia increased by 21 percent; in 2013, the country's cost of managing diabetes was close to $1 billion.[3] Remote monitoring technologies currently have a low adoption rate in Saudi Arabia.[4] If they were adopted more broadly, they could help reduce emergency admissions and improve the control of diseases. For example, patients with diabetes could receive an alert if they forget to take their medications.

— *Electronic triaging* can help reduce non-urgent emergency department visits. Such visits, which include conditions that could be managed at home or at a primary-care clinic, currently constitute 50 percent of total emergency visits in Saudi Arabia.[5] By using artificial intelligence (AI) systems to perform triaging for patients, hospitals could provide care to urgent cases more quickly while reducing overcrowding in emergency departments throughout the nation.

[1] For more, see "Connected world: An evolution in connectivity beyond the 5G revolution," McKinsey Global Institute, February 20, 2020.
[2] Abdulkarim Alhowaish, "Economic costs of diabetes in Saudi Arabia," *Journal of Family Community Medicine*, January–April 2013.
[3] Ziyad Almalki et al., "National rates of emergency department visits associated with diabetes in Saudi Arabia, 2011–2015," *Annals of Saudi Medicine*, April 2019.
[4] Based on the following categories for adoption rate estimates: high (between 70 and 100 percent), maturing (40 to 69 percent), emerging (5 to 39 percent), and low/not adopted (0 to 5 percent).
[5] Nawaf Alhabdan et al., "Exploring emergency department visits: Factors influencing individuals' decisions, knowledge of triage systems and waiting times, and experiences during visits to a tertiary hospital in Saudi Arabia," *International Journal of Emergency Medicine*, 2019, Volume 12.

Methodology for calculating the economic benefit

This study assesses the potential cost savings that could be generated in the KSA healthcare system by scaling the adoption and implementation of digital healthcare solutions. While clinical and patient outcomes of care are likely to improve because of digital healthcare, we have not quantified these. Our methodology is based on an economic benefit modeling approach developed by McKinsey that has been validated in Austria, Canada, Germany, and the United Kingdom. This approach includes the following procedures:

1. *Mapping digital healthcare solutions.* We interviewed a range of experts to identify the 26 types of digital healthcare solutions assessed in this study. Based on these interviews, we mapped the solutions to five distinct categories.

2. *Research papers.* We reviewed more than 500 research papers, publications, and case studies. Based on this research, we identified 82 evidence-based accelerators through which digital solutions could generate value against healthcare spending.

3. *Areas of care.* The accelerators were applied to five healthcare spending areas in Saudi Arabia—primary outpatient care, secondary outpatient care, acute inpatient care, rehabilitation, and nursing/long-term care.

4. *Healthcare spending*. We used the healthcare database of the intergovernmental Organisation for Economic Co-operation and Development (OECD) to identify total healthcare spending in Saudi Arabia in both the private and public sectors, categorized according to the five areas of care. We then built healthcare-spending forecasts through 2030 to identify the potential digital healthcare economic benefit to be unlocked by that year. We primarily used linear forecasting, although we ran adjustments based on assumptions derived from Vision 2030, the new Saudi Arabian model of care. These assumptions included greater spending on preventive care and shifting more resources from secondary care toward primary care. We assumed, based on an OECD breakdown of healthcare cost structures, that the total cost of outpatient care services would equal 50 percent of healthcare spending, the total cost of inpatient services would account for 49 percent, and less than 1 percent would go to home care services. For medical goods, we assumed that 60 percent of costs would be inpatient-related and the remainder outpatient-related.

5. *Analytical tools.* We used a multilevel driver tree logic (that is, cost = unit price × activity per person × number of people) to guarantee that only the correct initial values were applied to use cases. We deduplicated the data to avoid double counting.

6. *Adoption rate calculation and stakeholder interviews.* For each identified digital healthcare solution, we calculated current KSA adoption rates through triangulation involving stakeholder input, expert assessment, literature, and KSA case studies. Adoption rate estimates were factored into our analysis so that we would not overestimate the potential economic benefit and could focus on the value of solutions that have not yet been adopted at scale. In this triangulation approach, we first mapped 29 digital healthcare use cases against seven key stakeholders. Second, we conducted panel interviews with representatives from these stakeholder institutions to generate a qualitative view of adoption rates. Finally, we conducted a challenge session to debate and provide rationales for various adoption rates using existing literature and case studies. (Note: The numbers we used are rough estimates.)

7. *Potential economic benefit reporting.* Our calculations of digital healthcare value consider that some economic benefit has already been realized from certain accelerators with high adoption rates (Exhibit 2). For these accelerators, we estimate the remaining economic benefit yet to be gained by increasing adoption rates to 100 percent or whatever level is feasible by 2030.

— *Virtual consultations*, which have an emerging adoption rate, may benefit both patients and providers. Patients enjoy the convenience and time savings of not having to travel to the secondary-care facility and wait to see a provider.[6] And providers can use their time more efficiently, thus helping advance a value-based care agenda.

Self-care and self-service

Patient self-care and self-services account for 17 percent of the potential benefit, totaling between SAR 2.6 billion and SAR 6.6 billion by 2030.[7] These will be key to Saudi Arabia's new model of care that emphasizes disease prevention.[8] They include chronic-disease applications that facilitate prescription adherence and pill management, solutions that promote healthy diets and physical activity, and digital diagnostics for home-collected blood panels and screenings. The adoption rate of these solutions is low, so most of the potential from scaling them has yet to be realized.

Self-service solutions also give patients greater control over their access to care by allowing them to book clinic visits, reschedule appointments, and schedule diagnostic tests themselves. Such services exist today in Saudi Arabia, but many opportunities to increase adoption rates remain.

Decision intelligence systems

Decision intelligence systems make up 16 percent of the potential benefit, or SAR 2.3 billion to SAR 3.8 billion by 2030. Many KSA providers have implemented performance dashboards, but there are opportunities beyond this technology. For example, genomic profiling, when performed with robust patient privacy and safeguards, can generate a full pharmacogenomic profile from a swab that the patient performs at home. This profile can be used to identify the most compatible drug and appropriate dose for each individual, which can improve health outcomes and reduce the occurrence of adverse reactions.

Another example is clinical decision support in hospitals. Many of these software solutions use machine-learning algorithms to identify patterns in a patient's clinical charts and then generate recommendations for management plans. The software can also reduce medical errors by warning physicians about potential drug interactions or contraindications.

A third example is patient flow management software solutions that allow administrators to manage ward occupancy throughout the hospital with greater efficiency, preventing unnecessarily long patient stays.

Workflow automation

Workflow automation accounts for 13 percent of the potential benefit, between SAR 2.1 billion to SAR 4.7 billion in savings by 2030. Future-of-work studies show that 30 to 40 percent of work in the KSA health sector could be automated by 2030. Such automation would enable professionals to focus on higher-order tasks and the empathetic, human side of care. Workflow automation could improve patient experience, the quality of data for clinical decision making, and organizational healthcare.[9] Our qualitative research showed that electronic referral tools have been widely adopted in Saudi Arabia over the past three years, owing in large part to the Ehalati (My Referral) system, launched in 2019 (Exhibit 3). Additional value could be generated from other solutions, such as patient flow organization systems, robotic process automation (in the transportation of medication and blood samples, for example, and laundry processing and storage), nurse mobile connectivity, radio-frequency identification (RFID), and scaling of electronic intensive care units.

Paperless data

Paperless data will represent 12 percent of the potential benefit in 2030, equaling between SAR 1.9 billion and SAR 2.7 billion. Unified digital

[6] Jenny Cordina et al., "Patients love telehealth—physicians are not so sure," McKinsey & Company, February 22, 2022.
[7] This does not include remote monitoring solutions, which are included under virtual interactions.
[8] Sharfuddin Chowdhury et al., "Transformation of health care and the new model of care in Saudi Arabia: Kingdom's Vision 2030," *Journal of Medicine and Life*, May–June 2021, Volume 14, Number 3.
[9] Brandon Carrus, Sameer Chowdhary, and Rob Whiteman, "Making healthcare more affordable through scalable automation," McKinsey & Company, September 16, 2020.

medical records promote greater efficiency by allowing healthcare professionals to focus on high value-add tasks rather than administrative ones. Saudi Arabia could expand electronic health records beyond online patient-record documentation and into more accurate disease and condition group coding and could develop portals that allow patients to access their medical reports.

Inter- and intrahospital communication could also be enhanced with software that can increase productivity, replacing traditional in-person multidisciplinary committees and facilitating rapid doctor-to-doctor communication about patient care between departments and hospitals.

Exhibit 1

The details of the economic benefit pools for KSA total digital healthcare.

Savings indicated in Saudi Riyal, billion[1]

Benefit pool	Technology use case	Total lower bound 2030 savings without adjustment	Total upper bound 2030 savings without adjustment	Total lower bound savings adjusted for adoption	Total upper bound savings adjusted for adoption
Electronic health record/ paperless	AI virtual assistant	0.85	0.85	0.81	0.81
	Electronic health record (EHR)/health information exchange (HIE)	2.89	5.20	0.43	0.78
	E-prescribing	0.35	0.90	0.21	0.54
	Intrahospital staff communication software	0.63	0.78	0.44	0.55
Electronic health record/ paperless total		**4.71**	**7.73**	**1.89**	**2.67**
Online interactions	E-triage (web/algorithm-based risk assessment)	2.91	3.00	2.76	2.85
	Live audio/video consultations (telemedicine)	1.50	3.06	1.20	2.45
	Remote monitoring	2.44	3.90	2.32	3.70
Online interactions total		**6.85**	**9.96**	**6.28**	**9.00**
Outcomes transparency/ decision support	Analytics for payers	0.52	0.52	0.52	0.52
	Clinical decision support	1.12	1.29	1.01	1.16
	Genetic testing and analysis	0.07	0.11	0.07	0.11
	Patient flow management	0.54	1.67	0.52	1.63
	Performance dashboards	1.30	2.01	0.26	0.40
Outcomes transparency/ decision support total		**3.54**	**5.59**	**2.38**	**3.82**

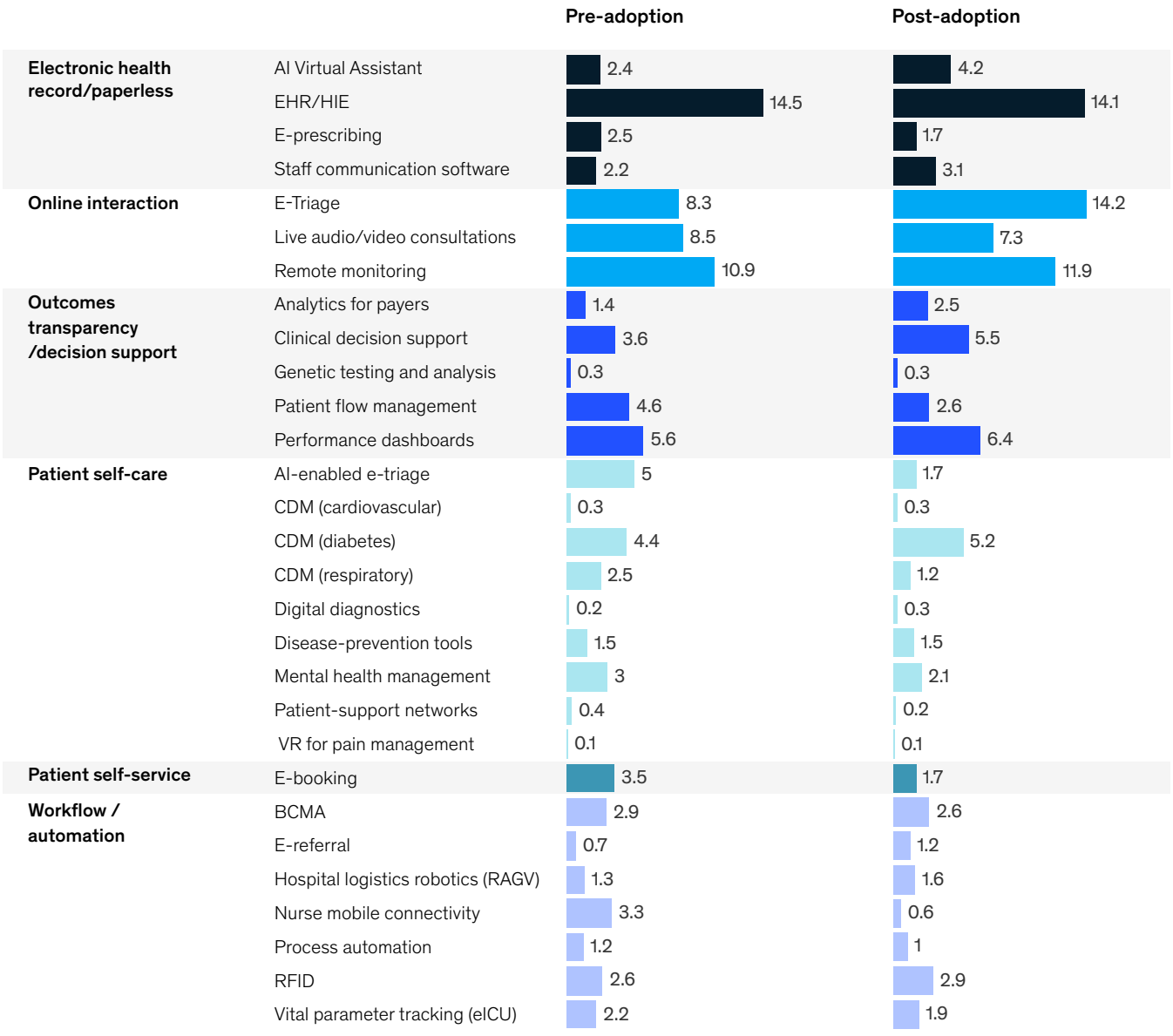
Benefit pool	Technology use case	Total lower bound 2030 savings without adjustment	Total upper bound 2030 savings without adjustment	Total lower bound savings adjusted for adoption	Total upper bound savings adjusted for adoption
Patient self-care and self-service	AI-enabled e-triage	0.36	1.78	0.35	1.73
	Chronic disease management (cardiovascular)	0.06	0.12	0.06	0.12
	Chronic disease management (diabetes)	1.06	1.60	1.00	1.52
	Chronic disease management (respiratory)	0.24	0.90	0.24	0.90
	Digital diagnostics	0.06	0.07	0.06	0.07
	Disease-prevention tools	0.30	0.53	0.28	0.51
	Mental health management	0.43	1.07	0.43	1.07
	Patient-support networks	0.05	0.16	0.04	0.15
	Virtual reality (VR) for pain management	0.02	0.04	0.02	0.04
	E-booking	0.35	1.27	0.14	0.51
Patient self-care and self-services total		2.92	7.55	2.63	6.62
Workflow/automation	Bar-coding medication administration (BCMA)	0.54	1.03	0.48	0.93
	E-referral	0.24	0.24	0.04	0.04
	Hospital logistics robotics (robotic automated guided vehicles)	0.32	0.48	0.32	0.48
	Nurse mobile connectivity	0.12	1.20	0.12	1.19
	Process automation through robotics	0.21	0.42	0.21	0.41
	Radio-frequency identification (RFID)	0.59	0.94	0.59	0.94
	Vital parameter tracking (eICU)	0.39	0.77	0.38	0.75
Workflow/automation total		2.40	5.09	2.12	4.74
Grand total		20.42	35.92	15.3	26.85

[1]Column total figures may not fully add up due to rounding

Exhibit 2

Health technology can unlock benefits for the Saudi Arabia healthcare system.

Share of total savings from digital adoption, 2030 (Saudi Riyal, billion), %



Source: McKinsey analysis

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Ten accelerators of digital health adoption

Multiple stakeholders can contribute to accelerating the realization of digital health value in Saudi Arabia (see sidebar "Methodology for identifying the accelerators"). The four main categories of stakeholders are technology companies and investors, providers, payers, and strategy owners. To identify the accelerators with the most potential for Saudi Arabia, we looked at examples of how these stakeholders accelerated digital healthcare implementation and increased adoption rates, which in turn led to improvements in patient outcomes. We prioritized these accelerators based on feasibility and their ability to generate a major impact on a national level.

Technology companies and their investors

Technology companies and investors should consider pursuing research on the outcomes of employing digital technologies, as well as increasing their focus on user (patient) experience.

1. Proving impact through outcomes research

The healthcare industry is evidence based. New digital technologies must prove they can have a beneficial impact on patient outcomes to gain adoption by physicians. In the United States, Better Therapeutics, formerly known as FareWell, offers a digital product for cardiometabolic conditions based on behavioral health principles. A longitudinal study of users of the platform showed an average 0.8-point reduction in HbA1c in diabetic users.[10] By gathering real-world evidence that shows how its technologies add value and improve outcomes, Better Therapeutics encourages adoption and attracts investment.

2. Addressing usability and experience through human-centered principles

User experience in digital healthcare solutions is more important than ever. A McKinsey survey in August 2021 showed that 15 percent of respondents in the United States with a primary-care physician (PCP) switched providers in the past year. Among those who switched, 35 percent cited one or more reasons related to the patient experience.[11]

Companies developing solutions can adopt a human-centered, design-oriented approach by using ethnographic research to identify user "pain points" and mapping multiple patient journeys for primary care or for various conditions, such as diabetes and pregnancy. Eventually, this patient data will support a broader digital healthcare ecosystem that enhances the experience for users and their families.

For example, one global EHR software provider conducts "immersion trips" where software

[10] Mark A. Berman et al., "Change in glycemic control with use of a digital therapeutic in adults with type 2 diabetes: Cohort study," *JMIR Publications*, 2018, Volume 3, Number 1.
[11] Jenny Cordina, Jennifer Fowkes, Rupal Malani, and Laura Medford-Davis, "Patients love telehealth—physicians are not so sure," February 22, 2022, McKinsey.com.

Methodology for identifying the accelerators

To identify possible accelerators for the adoption and implementation of digital healthcare solutions in Saudi Arabia, we used a two-step approach:

1. *Global examples:* We used a combination of expert interviews and research to identify examples of nations or healthcare systems that have already adopted each digital healthcare solution. We then extracted the ways in which those nations or healthcare systems have fast-tracked digital healthcare adoption and implementation.

2. *Prioritization:* We mapped the accelerators against their relevant stakeholder in the KSA ecosystem today (decision maker, payer, provider, or technology company/investor) and then prioritized those that our analysis suggested would have the highest value and impact (Exhibit 3).

developers visit providers to see how they use the EHR system and gain a better understanding of the problems providers encounter during care delivery.[12] Medical technology companies operating in Saudi Arabia and those seeking to deploy validated systems there can use such a human-centered, iterative-development approach to make sure their digital product or service meets local user needs and to encourage adoption.

Healthcare providers

Organizations providing healthcare should consider incentives to encourage their professionals to adopt digital technologies, development of digital talent and capabilities, and involvement of professionals in decision making related to technology adoption.

3. Introducing incentives for healthcare professionals

Examples worldwide show that thoughtfully designed incentives can encourage healthcare providers to adopt digital healthcare services. For example, in response to the COVID pandemic, the US Centers for Medicare & Medicaid Services (CMS) in 2021 changed its physician fee schedule to allow for the reimbursement of activities associated with remote patient monitoring, including time spent either in-person or through connected channels.[13] CMS expects this program to increase access to telehealth and remote monitoring services for patients. Though CMS has not committed to keeping this change, similar programs in other countries could increase access to telehealth and remote monitoring if kept in place over time. Governing agencies would need to monitor whether changes in reimbursement for telehealth affects patient care, directly or indirectly.

Public-sector providers are currently undergoing a transformation to accountable care organizations. Similar incentive program could be implemented once the new environment has been established.

4. Digital immersion for the development of talent and capabilities

KSA healthcare providers could encourage the adoption of digital healthcare technologies by scaling digital healthcare immersion programs for healthcare professionals. Continuing medical education (CME) programs can build healthcare professionals' foundational digital healthcare skills, including basic coding and tools like EHRs and patient applications.

In Finland, the University of Oulu introduced digital healthcare immersion to students of medicine and other healthcare professions. The university collaborates with the Finnish national MEDigi project, which aims to enhance workforce capabilities in digital healthcare through targeted education.[14] The program's objective is to build a digitally capable, next-generation workforce of health professionals.

Building capabilities for digital immersion will be key to fueling adoption by healthcare professionals, and the Finnish program offers an example for implementation. In Saudi Arabia, too, providers may be able to collaborate with local institutions.

5. Involving healthcare professionals in integrating technological solutions

To reduce skepticism among healthcare professionals and gain their trust, provider organizations could draw clear blueprints illustrating how their proposed solutions support patient care delivery and how the new technology can integrate smoothly with existing digital tools. A recent research review

[12] "Immersion trips are part of user-centered design," May 20, 2019.

[13] "Medicare Program; CY 2021 Payment Policies Under the Physician Fee Schedule and Other Changes to Part B Payment Policies; Medicare Shared Savings Program Requirements; Medicaid Promoting Interoperability Program Requirements for Eligible Professionals; Quality Payment Program; Coverage of Opioid Use Disorder Services Furnished by Opioid Treatment Programs; Medicare Enrollment of Opioid Treatment Programs; Electronic Prescribing for Controlled Substances for a Covered Part D Drug; Payment for Office/Outpatient Evaluation and Management Services; Hospital IQR Program; Establish New Code Categories; Medicare Diabetes Prevention Program (MDPP) Expanded Model Emergency Policy; Coding and Payment for Virtual Check-In Services Interim Final Rule Policy; Coding and Payment for Personal Protective Equipment (PPE) Interim Final Rule Policy; Regulatory Revisions in Response to the Public Health Emergency (PHE) for COVID-19; and Finalization of Certain Provisions From the March 31st, May 8th and September 2nd Interim Final Rules in Response to the PHE for COVID-19; Correction," *Federal Register*, Volume 86, January 19, 2021.

[14] "MEDigi is updating medical education," University of Oulu, updated February 20, 2020; Heidi Enwald, "The status of ehealth in Finland," November 21, 2019.

found a direct correlation between physician adoption of digital healthcare solutions like telemedicine and their degree of involvement and perception of clarity in the process.[15] Involving healthcare professionals up front may increase the long-term success of digital healthcare.

In 2018, South Korea announced its plan to develop and deploy a homegrown AI system called Dr. Answer that could aid in the diagnosis and management of eight pathologies, including heart disease and breast cancer. The launch was phased over three years and involved the collaboration of dozens of hospital representatives and AI developers.[16] Dr. Answer helped South Korea become recognized as a world leader in digital healthcare deployment.[17] Following its success in South Korea, Dr. Answer is now being tested in other national markets, including Saudi Arabia.

Payers

Payers should consider incentives for institutions to use digital means of accepting reimbursements. They also could promote the use of digital tools that improve management of health conditions and lower costs.

6. Creating institutional reimbursement incentives and programs

Saudi Arabia is currently undergoing a transformation in its public-sector healthcare reimbursement system that could see the establishment of a new national insurance fund for managing reimbursements. Digital healthcare technologies could play a role.

A similar example in the United States involves the government insurance programs Medicare and Medicaid, which introduced programs using economic incentives to encourage institutions to adopt, implement, and upgrade their electronic healthcare record systems. The program has encouraged most US hospitals to shift from written to electronic medical records, driving adoption to more than 90 percent nationwide and providing critical support for patient care.[18] Implementing the program required confronting challenges that included a lack of interoperability between different organizations' systems and the difficulty of the government earning a return on its investment.

Massachusetts, a US state, provides an additional incentive program, called Health Care Innovation Investment (HCII), which allows providers to seek funding for telemedicine pilot programs and other digital healthcare solutions. HCII, which has disbursed $11.3 million to date, has helped fuel innovation in care-delivery models by granting funds for telemedicine pilot programs and other digital healthcare solutions.[19]

In Saudi Arabia, private-sector payers and, once activated, public payers could employ similar methods to encourage institutions to adopt digital healthcare tools and technologies.

7. Granting members complimentary access to a diverse suite of digital healthcare products, including therapeutics

Public-sector and some private-sector providers in Saudi Arabia already offer complimentary telemedicine for members. In the public sector, this is primarily offered through government applications. Payers could diversify this offering into a broader range of impactful digital healthcare solutions either independently or by collaborating with medical technology companies. They could then play a role in encouraging members to adopt digital healthcare by granting them complimentary access to these services, in turn benefiting from improved patient outcomes, reduced healthcare costs, and an improved member experience.

A number of health insurance companies in the United States partnered with Livongo, a subsidiary of Teladoc, to offer its members a comprehensive digitally based diabetes management program. A retrospective study of the Livongo for Diabetes program over a year found that patients' well-being improved, and their diabetes-related medical costs

[15] Mary Nguyen et al., "A review of patient and provider satisfaction with telemedicine," *Current Allergy and Asthma Reports*, September 2020, Volume 20, Number 11.
[16] "South Korea, the perfect environment for digital health," Nature Portfolio, n.d.; *Global Expert Mission: South Korea and Japan Digital Health and Medtech 2019*, UK Knowledge Transfer Network, 2019.
[17] Elske Ammenwerth et al., "International comparison of six basic ehealth indicators across 14 countries: An ehealth benchmarking study," *Methods of Information in Medicine*, December 2020, Volume 59, Supplement 2.
[18] "Non-federal acute care hospital electronic health record adoption," HealthIT.gov, last reviewed July 22, 2021.
[19] "HPC innovation investments," Massachusetts Health Policy Commission, n.d.

decreased by 22 percent.[20] The complimentary program gave members access to a range of digital healthcare services, including 24/7 coaching, blood sugar monitoring that sent data back to their managing clinician, and dietary recommendations.[21]

Policy makers

KSA policy makers should consider setting goals for digital adoption, establishing a design for the healthcare system as a whole, and establishing policies that reward the use of technologies that improve health outcomes while lowering costs.

8. Aligning national digital healthcare targets

Creating a clear road map for digital adoption could encourage faster implementation and provide a basis for evaluating progress. As seen in other countries, the road map could include a target date for public and private hospitals to achieve Healthcare Information and Management Systems Society (HIMSS) standards for stages 6 and 7, the highest stages of digital health technology maturity, which deal with EHRs and analytics capabilities.

Beyond high-level targets, tactical digital healthcare targets could be introduced—for instance, telemedicine for primary-care and select specialty-care clinic visits, along with targets for teleconsultation resolution rates to encourage higher efficacy and quality of care. Other targets could include diabetes-management applications and targets for lower diabetic emergency admissions for those with access to the tools.

9. Designing a national digital healthcare architecture

Any national digital healthcare transformation depends on interoperability among multiple systems, including registries, electronic health records, and workforce management systems in hospitals and institutions. A national healthcare technology architecture connected with national services in ministries beyond Health could serve as a blueprint for all state entities and the private sector. The government could accomplish this by establishing standards for application programming interfaces (APIs) for new digital healthcare solutions introduced by public- or private-sector entities.

Saudi Arabia has already taken steps in this direction through its development of the National Platform for Health Information Exchange Service (NPHIES), an architecture for the shared electronic health record system that could be scaled for the whole sector, across digital healthcare technologies, as has been done in other countries. For example, more than a decade ago in Finland, the government launched a national e-health architecture that instituted common interoperability standards. This framework allowed Finland to launch Kanta, a suite of services including electronic prescriptions, a patient data repository, national healthcare registries, and other systems. Today, this program has fully scaled and is deployed across the country.[22]

Saudi Arabia could consider national standards to facilitate interoperability not just among various clusters and semi-governmental providers but also among private-sector hospitals. This can be done across all types of digital healthcare technologies.

10. Broader digital healthcare application

Strategy owners can also establish guides on the reimbursement of digital healthcare. In 2018, Saudi Arabia launched protocols that guide private health insurance companies to reimburse patients for telemedicine visits. These can be scaled beyond telemedicine into other digital healthcare technologies. For example, people with diabetes could be offered reimbursement for dietary support through telemedicine, AI recommendation software, and digital therapeutics.

[20] Christopher M. Whaley et al., "Reduced medical spending associated with increased use of a remote diabetes management program and lower or emean blood glucose levels," *Journal of Medical Economics*, April 23, 2019, Volume 22, Number 9.
[21] "BlueCross BlueShield offers free diabetes management program for members," BlueCross BlueShield, press release, September 28, 2020.
[22] *National e-health architecture—from strategy to practice*, Ministry of Social Affairs and Health, Finland, May 2015.

Exhibit 3

Indicative estimates of digital healthcare solution adoption rates in Saudi Arabia, based on qualitative research.

Technology	Estimated adoption rate in Saudi Arabia[1]	Rationale summary
Electronic health record (EHR)/health information exchange (HIE)	High	Widespread adoption of EHR in the public- and private-sector systems as part of the Ministry of Health's digital Visual Realization Office program and National Platform for Health Information Exchange Services launch, although some small polyclinics and centers are still in transition
E-referral	High	Widespread adoption in the public sector, specifically since the introduction of the electronic Ehalty system for government-to-government and government-to-private sector transfers; however, there are minimal private-to-private e-referrals
Performance dashboards	High	Usage has grown during the COVID-19 pandemic to optimize hospital bed allocation during peak times
E-booking	Maturing	High adoption (70%) for primary health center visits booked through Sehhaty, but e-booking rates are lower at public hospitals (30%), and adoption is uneven in the private sector
E-prescribing	Maturing	The public sector has increasingly adopted the Wasfaty system, which aims to facilitate obtaining medication and medical supplies through accredited pharmacies; adoption rates are increasing at private hospitals
AI virtual assistant	Emerging	Limited number of pilot solutions in the private sector
Bar-coding medication administration (BCMA)	Emerging	Primarily used early in the medication supply chain, such as in procurement
Chronic disease management (cardiovascular)	Emerging	Limited offerings in the market, such as Sehhaty's weight and blood-pressure management features, have not been widely adopted by patients
Clinical decision support	Emerging	Not available at scale yet; mostly used in private-sector hospitals and some technologically advanced public-sector hospitals
Disease-prevention tools	Emerging	No notable offerings used at scale
E-triage (web/algorithm-based risk assessment)	Emerging	Very few patients self-triaging applications (primarily symptom self-checkers by telemedicine start-ups) have been adopted by patients across Saudi Arabia
Intrahospital staff communication software	Emerging	Currently, staff depend mostly on pagers and instant messaging, but the need exists for more advanced communications software, including cluster-to-cluster and hospital-to-hospital communication among staff
Live audio/video consultations (telemedicine)	Emerging	Solutions such as the app Sehhaty, which offers weight and blood-pressure management, are available in the market, but patient adoption has been slow
Patient-support networks	Emerging	WhatsApp support groups have developed organically in certain communities, but advanced digital-connection networks are not yet active
Remote monitoring	Emerging	Very few remote patient-monitoring solutions in the public-sector system, although some semi-governmental hospitals and private-sector players offer such solutions for complex patient cases

Technology	Estimate adoption rate in Saudi Arabia	Rationale summary
AI-enabled e-triage	Low/not adopted	No notable offerings used at scale
Analytics for payers	Low/not adopted	No notable offerings used at scale
Chronic disease management (diabetes)	Low/not adopted	Despite a few early offerings in the market, such as Sehhaty, patient adoption rates are low
Chronic disease management (respiratory)	Low/not adopted	No notable offerings used at scale in Saudi Arabia yet
Digital diagnostics	Low/not adopted	No notable offerings used at scale
Genetic testing and analysis	Low/not adopted	No notable offerings used at scale
Hospital logistics robotics (robotic automated guided vehicle)	Low/not adopted	Current examples include popular start-up applications like Nala
Mental health management	Low/not adopted	There are only a few offerings—mainly from foreign applications and small-scaled start-ups—with limited usage in this underserved market
Nurse mobile connectivity	Low/not adopted	Solutions are new to the system and mainly piloted in some private hospitals
Patient flow management	Low/not adopted	No notable offerings used at scale yet, but technologically advanced private hospitals have begun pilot programs
Process automation through robotics	Low/not adopted	Some private pharmacies use process automation, but no notable offerings are used at scale
Radio-frequency identification (RFID)	Low/not adopted	No notable offerings used at scale
Virtual reality (VR) for pain management	Low/not adopted	There have been some experimental use cases, but no notable offerings used at scale thus far
Vital parameter tracking (eICU)	Low/not adopted	Private and government hospitals have some strong eICU programs, primarily in areas that are underserved by specialized ICU staff, but none of these programs operate at scale yet

[1]Adoption rate estimates are categorized as high (70–100%), maturing (40–69%), emerging (5–9%), and low/not adopted (0–5%).

In Germany, authorities issued guides to payers on digital therapeutics. As part of the Digital Healthcare Act passed in 2019, Germany introduced its Digital Health Applications (DiGA) list, which contains federally approved digital therapeutics applications, including mental health and diabetes apps. DiGA created a pathway for patients to be reimbursed for the cost of applications prescribed by a provider. The use of approved applications increased after the launch of the DiGA program.[23] Developers can apply to have their apps added to the federal list if they meet specific requirements around data privacy and interoperability standards.[24]

[23] GlobalData Healthcare, "Increasing use of digital therapeutics in Germany since reimbursement pathway announced," *Pharmaceutical Technology*, January 22, 2021.
[24] "Germany's 'DiGA' digital health fast track process is modeling a new way to regulate market access and reimbursement," Sidley, December 10, 2021.

Accelerating digital healthcare in Saudi Arabia

Digital healthcare solutions have the potential for considerable benefits for Saudi Arabia. Stakeholders in the public and private sectors can use the framework in this paper to evaluate which solutions warrant the most investment and the highest-priority rollouts to improve the quality of care for patients.

We identified ten potential accelerators that stakeholders in Saudi Arabia could consider, including setting the groundwork for success by establishing digital healthcare targets and developing technological architecture blueprints and standards. Payers could implement institutional incentives and grant members complimentary access to digital health solutions. For providers, thoughtfully designed incentives, talent development, and involving physicians in phasing technological rollouts can go a long way toward encouraging greater adoption and enhancing clinical outcomes of care. Technology companies and their investors could play an instrumental role in tackling usability by adopting a human-centered approach grounded in authentic patient journeys and build on these as part of a broader healthcare ecosystem. Finally, conducting outcomes research as digital healthcare solutions are implemented is crucial not only to prove their value through real-world evidence but also to gain stakeholder trust.

Mahdi AlBasri, MD, is a consultant based in McKinsey's Dubai office; where **Panco Georgiev, MD**, is a senior partner; and **Ali Ustun** is a partner in the Doha office.

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AI-enabled e-triage: A system that classifies patients by risk and generates guidance on whether they need admission or other treatment

AI virtual assistant: Application of artificial-intelligence-based text-speech functionality and voice recognition that helps health professionals document patient notes, predict and manage patient workflow, and manage charts

Analytics for payers: Machine-learning solutions that allow payers to evaluate value-based care, overstaying at hospitals, and related decisions

Bar-coding medication administration (BCMA): Use of bar codes on medications to control medication inventory and help prevent medical errors and other adverse events

Chronic disease management: Applications that allow patients to self-monitor, including medication reminders and AI dietitian

Clinical decision support: System that helps doctors make differential diagnoses and generate potential management plans (including AI imaging interpretation)

Digital diagnostics: Diagnosis of patients outside of clinical facilities, including in their homes

Disease-prevention tools: Electronic tools to decrease risk factors by promoting weight management, smoking cessation, and other measures

E-booking: Application that allows patients to book medical visits online

Electronic health records (EHR)/health information exchange (HIE): Electronic records of patient data, replacing handwritten or other records on paper

E-prescribing: Software that allows clinicians to issue prescriptions that go directly to a pharmacy by electronic means without any additional documents and are linked to patient IDs

E-referral: Application that enables the seamless transfer of patient information to another clinician or hospital

E-triage (web-/algorithm-based risk assessment): A web-based algorithm that patients use to self-triage

Genetic testing and analysis: Genomic analysis of patients that can allow for better dosage determinations, thus reducing side effects and hospitalizations

Hospital logistics robotics (robotic automated guided vehicles): Application that manages logistical work traditionally done by nonclinical staff, such as deliveries and filing

Live audio/video consultations (telemedicine): Application of phone or video conferencing that enables patients to visit with clinicians online

Mental health management: Application that supports mental health management using music and tools of psychology

Nurse mobile connectivity: Optimizes the way nurses manage both inpatients and outpatients, reducing referrals, unnecessary consults, and other inefficiencies

Patient flow management: Software that manages the flow and transfer of patients from ward to ward to optimize length of stay and use of beds

Patient-support networks: Allow patients with the same condition to connect with one another online

Performance dashboards: A system that collects, analyzes, and displays performance indicators to help healthcare providers monitor clinical efficiency, identify underutilized areas, find unused beds, and track lengths of stay against benchmarks

Process automation through robotics: Use of robots for inpatient nursing tasks such as vitals testing and blood draws

Radio-frequency identification (RFID): Automatic method of scanning tagged objects to track their location in the supply chain

Remote monitoring: System that monitors patient vitals and other parameters remotely, away from the healthcare site, and notifies clinicians of any emergencies detected

Virtual reality (VR) for pain management: Applications that immerse users in a virtual environment/setting. This can be used to help lessen opioid use

Vital-parameter tracking (eICU): System for remote monitoring of patients in intensive care units