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Artificial Intelligence and Healthcare in Emerging Markets

By Monique Mrazek and Felicity O'Neill

Half of the world's population remains without access to essential health services, with many individuals driven into poverty each year by out-of-pocket health expenses.[1] UNCTAD estimates that to meet health-related Sustainable Development Goal objectives, over $140 billion in private sector finance is required annually between 2015 and 2030.[2] Significant investments in health technology, including those using digital health and artificial intelligence, are expected to contribute to bridging the health service gap in emerging markets, given the potential of these new innovations to reach underserved patients. Many health-tech innovators are integrating AI into their product solutions, with early examples showing promise in improving diagnoses, reducing costs, and enabling access to remote health services. COVID-19 has accelerated the pace of transition to digital health applications, including those that integrate AI. On a system-wide level, much remains to be done by all healthcare stakeholders to create sustainable ecosystems that facilitate these innovations in achieving scale while beneficially reaching the lowest-income patients in emerging markets.

Improving access to healthcare is critical to achieving the World Bank Group's twin goals of ending extreme poverty and boosting shared prosperity in all countries. Healthy individuals have higher levels of human capital, enabling them to realize their potential as productive members of society and raising output in the countries where they reside.[3]

Technology has always played an important role in the delivery of healthcare. The use case for artificial intelligence, or AI, in health dates to the late 1990s, when machine learning was first used to help doctors identify cancers in medical images.[4] The more widespread diffusion of AI into health businesses over the past decade has been facilitated by general improvements in computing power, machine processes such as natural language processing, and robotics, combined with the exponential accumulation of health-related data from sources such as electronic medical records (EMRs), the proliferation of health data tracking devices such as smart phones, digital images, and genomic data.

The confluence of AI and other digital technologies has enormous potential to improve health outcomes globally. For example, patient data can be aggregated and assessed to improve risk analytics, radiology imaging solutions can assist specialists to more efficiently and effectively assess images, and machine learning platforms can reduce the unit costs of health administration through automated scheduling functions and triage chatbots, freeing up specialists to spend time on patient care. Some of these AI health applications have been accelerated in the response to COVID, including in emerging markets; AI has been applied broadly, from drug and vaccine research and patient triage to contract tracing and surveillance systems, and predicting severe COVID cases.

Achieving true scale in the use of AI, however, will require building trust with health consumers, including through collaboration between data providers, health-tech companies, regulators, governments, and the public, to agree on principles and frameworks for constructing and managing patient data sets, governing and monitoring algorithm performance, and safeguarding personal data, among other issues.

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What is AI?

This note adopts the definition of AI set out in EM Compass Note 69, as a broad term for computer systems that can continuously scan their environment, learn from it, and take action in response to what they are sensing and human-defined objectives.[5] This means that AI is not one type of machine or robot, but a series of approaches, methods, and technologies that display intelligent behavior by analyzing their environments and taking actions—with some degree of autonomy—to achieve specific targets that can improve the provision of health services.[6] Though AI was established as a discipline more than a century ago, AI techniques have seen rapid progress over the past decade, supported by an evolution in machine learning as well as improvements in computing power, data storage, and communications networks.[7]

Investment in Health Businesses Using AI is Growing

The broad scope of digital health applications and the potential size of the healthcare market is driving significant investment flows in health technology (health-tech). Because the distribution of venture capital (VC) investments into AI-specific technologies closely tracks the flow of overall VC flows, the latter can be used as a proxy for interest in AI by country. The number of health-tech deals and total funding have increased rapidly over the past decade, approaching 800 deals and $15 billion in funding in 2018 before falling slightly in 2019 (Figure 1). Investment flows are concentrated in the United States, though flows to China and India are increasing.[8]

AI-specific investments account for an increasing portion of total health-tech funding. U.S.-based health-tech companies aiming to integrate AI technologies received over $2 billion in funding in 2018.[9] The intended application of these investments ranged from digital diagnosis to clinical decision support and precision medicine. Accenture estimates the health AI market in the United States will grow at a 40 percent annual rate, reaching $6.6 billion by 2021.[10] AI health is projected to grow

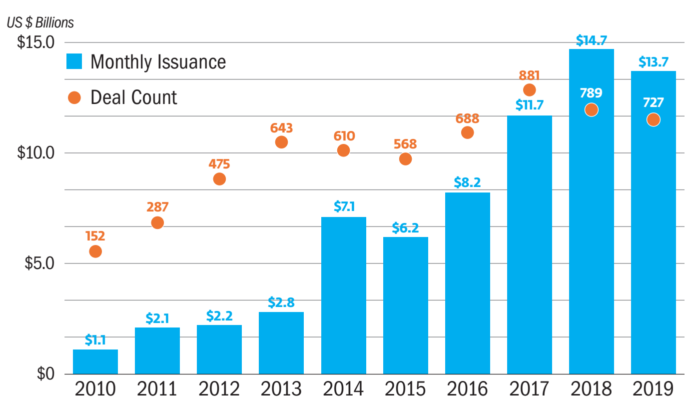

FIGURE 1 Global Funding in Health-Tech Companies

Source: StartUp Health Insights, data as of Dec 31, 2019.

in China by an annual rate of 52.8 percent between 2019 and 2025.[11] Since health AI is in a nascent stage in most emerging markets, comparable data is not available, however growth is expected in certain applications, particularly post-COVID.

The Integration of AI into Health Businesses Will Help Deliver and Scale Development Impact

As Figure 2 illustrates, health-tech businesses are finding applications for AI across the health ecosystem, from innovations such as drug discovery, imaging and diagnostics technology, and genomics, to delivering health system efficiencies and enhanced customer relationship management. The integration of AI into the health sector is changing both the structure of the market and the nature of services. At a structural level, non-traditional players such as digital-tech giants are leveraging their extensive databases to compete with traditional providers. For example, Google, through its subsidiary Verily, is focused on using data to improve healthcare via analytics tools, interventions, and research, among other things. And Apple's focus in healthcare builds on the vast amount of data it captures daily from users of its products, with the potential of eventually becoming a "portable health record" for users, as well as leveraging that data for health research or even to help develop medical devices. At a service level, AI is being applied to diverse data-sources—including patient images, prescription information, clinician notes, and wearable device activity logs—to personalize healthcare advice, generate probable diagnoses, and increase access to affordable consultations.

Current investment activity in AI for healthcare, particularly in developed markets, is focused on operational or system efficiencies such as automating booking systems and patient records.[12] In emerging markets, where significant health-system supply and access gaps are pervasive, there is a wider scope for leveraging data, where such data is available and well structured, and applying AI to deliver innovative services across the ecosystem. Yet there are both risks and challenges to scaling these applications and business models across emerging markets to achieve widescale development impact.

Unlocking data for health research

Health data is amassed from a range of sources, such as electronic medical records (EMRs), payer records, wearables and mobile phones, genomic sequencing, medical research, and mandated government records. The volume of this health-related data is increasing exponentially. According to Dell EMC's Global Data Protection Index, healthcare organizations saw an annual growth rate in health data of 878 percent between 2016 to 2018, to an average of 8.41 petabytes across organizations (equivalent to 8.4 million gigabytes).[13] There is enormous potential to mine and analyze this data using AI, to facilitate better and more personalized care, to reduce medical errors, and to enable earlier diagnoses of disease. The challenge, however, particularly in emerging markets, is to have enough quality and well-structured data for assessment.

Some companies are helping to tackle the weakness in data interoperability by cleaning and structuring data and overlaying analytics to make meaningful predictions to improve health. For example, China-based Linkdoc Technology Ltd. has partnerships with over 500 oncology hospitals across China, applying machine learning and human language processing to structure millions of clinical EMRs into research grade data for government bodies, insurers, and pharmaceutical and research companies in over 30 Chinese provinces.[14] In addition to structuring data for research, machine learning can also be applied to big data to match patients to clinical trials, to speed-up drug discovery, and to identify effective life-science therapies.[15] For example, SOPHiA Genetics' AI technology computes one genomic profile every four minutes and has analyzed hundreds of thousands of genomic profiles, to facilitate the matching of patients to clinical trials across their research community of more than 980 leading hospitals in 81 countries.[16] Through IFC's TechEmerge program, SOPHiA Genetics completed a pilot in Brazil with DASA, a leading diagnostics company in the country.

Focusing on prevention

Using data to move the dial on the global health system from treatment to prevention will be critical to mitigating the growing cost of non-communicable diseases (NCDs), which are the largest cause of mortality and disability in developing countries, estimated to cause a cumulative loss to global output of $47 trillion between 2011 and 2030.[17]

AI can be applied to big data to provide personalized and responsive ancillary health services that 'nudge' consumers toward preventative behaviors. For example, South African health insurance company Discovery is using a 'shared value' business model, applying machine learning to data accrued from its partners—supermarkets, fitness firms, and health providers—to determine what financial rewards each customer receives for positive health behaviors. These include meeting 'in-range' health outcomes in annual checks, undertaking preventative checks such as pap smears, purchasing healthy food, and exercising regularly.[18] The shared value is created as customers receive financial rewards for beneficial health decisions while the insurer reduces the average risk of its customer pool.

AI technology also allows Discovery to scale its products across markets by tracking a variety of data—images, spending

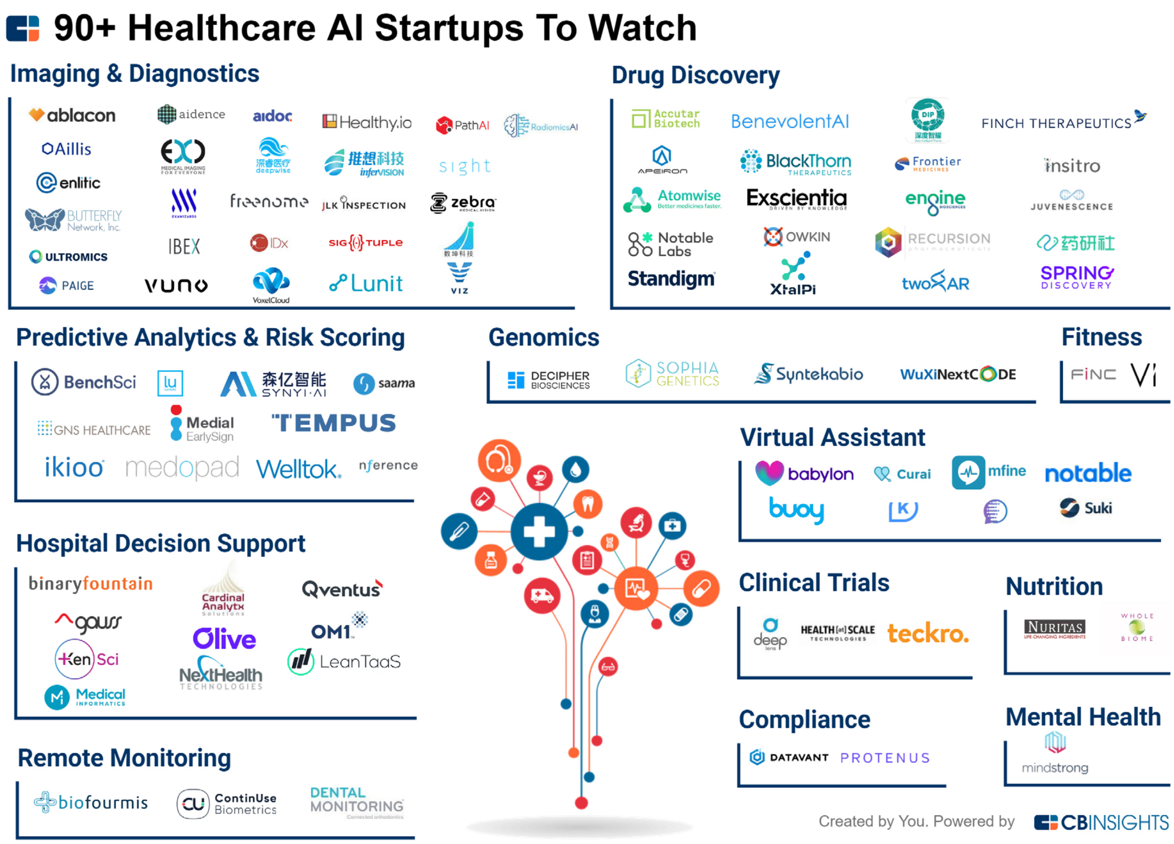

FIGURE 2 Healthcare AI Startups

Source: CB Insights, 2019. "From Drug R&D to Diagnostics: 90+ Artificial Intelligence Startups In Healthcare." https://www.cbinsights.com/research/artificial-intelligence-startups-healthcare/.

records, health reports—across currencies, languages, and time zones. As of mid-2018, Discovery was serving over 19 million customers globally through its primary market in South Africa, as well as in the United Kingdom, China, and the United States, and through partnerships with existing insurers in 15 other countries.[19] Of course, innovations like Discovery's platform are yet to reach lower-income emerging market consumers where an insurance gap is pervasive.[20]

Improving healthcare efficiency and effectiveness

Software-as-a-service providers are now leveraging a wide variety of data sources to automate systems, driving more effective services and addressing system inefficiencies. For example, data including patient history, consultation notes, diagnostic images, public information, and pharmaceutical prescriptions can be assessed by AI-enabled software to automate workflow (follow-up appointments, patient records, triage, etc.), freeing doctors to spend more time with patients.[21] These software solutions drive impact in emerging markets by addressing a number of pain points such as difficulties finding an appropriate provider or specialist, a lack of transparency regarding the quality of service provision, and underdeveloped medical record systems.

China's Ping An Good Doctor, one the largest online platforms in the world, had 346 million registered users as of June 2020, a growth of 10 percent over the previous year, with 26.7 percent growth in consultations over the year previous (831,000 consultations in the first half of 2020) in response to the need arising from COVID.[22] The company's application uses AI technologies to pre-triage patients to facilitate 24/7 online consultation services via its in-house medical team. By integrating its online medical appointment services with its offline partnerships, Ping An Good Doctor has established a closed-loop healthcare ecosystem. That is, a one-stop shop for convenient, quality-vetted, and efficient access to medical consultations, pharmaceuticals, and wellness services (Chinese medicine, dental, oral, and cosmetic health).

Machine learning can also be used to assist clinicians in delivering more effective or personalized patient care. Clinicas del Azucar is a specialty diabetes clinic chain in Mexico (and an IFC client) that analyzes its database to drive improved health outcomes and operational efficiencies. In 2018, Clinicas launched its Diabetes Nudge Lab, which leverages its patient database and applies behavioral analytics and AI to segment patients by behavioral archetypes. The Lab then personalizes a treatment strategy for each patient tailored to their unique characteristics.

Reaching underserved communities

Consumers in emerging markets who have, on average, a lower supply of healthcare services, have expressed a higher willingness to engage with digital healthcare. A 2016 YouGov survey found that 94 percent of consumers in Nigeria would be willing to talk to a chatbot to answer health questions, diagnose a condition, and recommend a treatment, as compared with only 54 percent for the broader Europe, Middle East and Africa region.[23] This greater openness to digital health engagement means that there is a huge market for digital health solutions that reduce the cost of reaching patient segments, particularly in rural areas, that were too costly using traditional business models.

Virtual care has applications across the healthcare ecosystem, from remote consultations to dispensing pharmaceuticals. Indian platform DocsApp has developed a clinical AI platform called CLARA that connects patients to specialists and facilitates remote diagnoses and treatment.[24] Potential patients enter personal details and health concerns into the app. Machine learning is then applied to this information and to public data sources to generate a probable diagnosis and recommend a specialist. The patient then has the option to review the user ratings and credentials of the specialist and pay a fee online if they wish to proceed to consultation via chat or call. The doctor can provide a prescription or referral for lab tests, if required, which can be delivered to the user for an additional fee.[25]

Babylon is another health-tech company—operating in the United Kingdom, Rwanda, and more recently Canada– leveraging AI to provide 24/7 remote appointments and treatment advice. The company's chatbot 'Ask Babylon' applies natural language processing to interpret users' symptoms and combines this information with public information and the patient's medical history to provide relevant health and triage information, including whether further care should be sought.[26] The application then facilitates users in consulting with a doctor via video, phone calls, and text messages. Having the opportunity for users to receive advice via SMS is a game-changer in lower-income and rural areas where the 3G-4G connectivity and smart-device penetration required for video consultations are missing or inadequate.

Reaching truly underserved segments often requires business models that go beyond the commercialization of phone applications or automation of clinical systems to more direct outreach. For example, Salauno, Mexico's largest eye care chain (and an IFC client), leverages an AI algorithm, developed with Microsoft, to detect diseases such as diabetic retinopathy for patients in marginalized areas. Through outreach camps, done in collaboration with a local partner (a nongovernmental organization, government entity, private company, etc.), Salauno's mobile application is assisted by the AI algorithm to detect diabetic retinopathy, with patients needing more specialized care referred to a hub facility. To date, the company has provided eyecare services to more than 340,000 patients in Mexico City at more accessible prices.[27]

Clinician support to better use scarce medical resources

It will not always be appropriate for AI-enabled diagnostics to replace human decision-making. There is, however, a strong case for diagnostics using AI to aid specialists, especially where healthcare systems are hampered by a scarcity of health infrastructure such as laboratories and imaging centers, and a shortage of specialized professionals such as pathologists, radiologists, and cardiologists.

Although many use cases are still at early or trial stages, AI technology can be integrated into imaging and diagnostics processes to allow physicians and technicians to spend time where it matters—on complex cases, clinical interpretation, and patient communication. Aidoc is an Israeli company developing advanced healthcare-grade AI-based decision support software aimed at: increasing the efficiency and quality of the acute radiology workflow; detecting critical findings in CT exams (including hemorrhages, fractures, and aneurysms); and highlighting the findings for radiologists to help them prioritize urgent patients. IFC's TechEmerge program has facilitated a pilot for Aidoc's software with Grupo Fleury, a leading diagnostic chain in Brazil, resulting in a commercial partnership to scale the solution.

Another example is Israel-based Zebra Medical Vision, whose AI technology helps radiologists by drawing on millions of imaging and correlated clinical records to automatically detect medical conditions faster and help radiologists provide more comprehensive, accurate outcomes—faster and without compromising quality of care.[28] Zebra guarantees the delivery of AI solutions at a flat rate of up to $1 per scan as part of its mission to provide high quality, affordable care to the world's population.[29] In June 2020, Zebra partnered with IFC portfolio company Apollo Hospitals Group in India to deploy its software to improve the speed and reliability of COVID diagnosis.[30]

Another pain point being addressed by decision-support software is inadequate access to ICT infrastructure. Tricog is a software-as-a-service business that uses machine learning algorithms to remotely analyze electrocardiograms to facilitate faster responses to heart attacks. The technology is cloud-based and enabled by a combination of 2G, 3G, and wireless connectivity, which means it can be used in rural areas with lower connectivity. Today, Tricog operates across 510 clinics and 24 hospitals in both rural and urban locations. It has been used on 300,000 patients and has prevented 15,000 heart attacks.

U.S.-based Zenysis, an interoperability platform, has been offering its data analytics and AI-driven solutions to help tackle population-level health problems in some of the world's most challenging markets, including several countries in Africa and Asia. In response to the COVID crisis, Zeynsis has been working with emerging countries to establish virtual control rooms that provide governments with real-time analytics on such areas as COVID test results, availability of tests, personal protective equipment and ventilators, human resources data, and patient mobility data. Going forward, Zenysis expects that by training machine learning algorithms on historical data, important improvements in predicting public health needs in the future should yield better drug and vaccine procurement for global health.[31]

The evolution of precision medicine

Applications of genomic medicine, such as oncology diagnosis and management,[32] have been facilitated by technological innovations that reduce the cost and improve the speed and accuracy of testing. The cost of whole human genome sequencing in the United States fell from $4,000 to $1,500 between mid and late 2015 alone and has since fallen further.[33] The cost-effective application of genomic testing is facilitating the development of "precision medicine," a data-driven approach to medicine that accounts for variability in genes, environment, and lifestyle factors to personalize medical care.[34] AI technologies that can assess and learn from a wide range and structure of data inputs are central to facilitating the growth of precision medicine. For example, Medgenome, a U.S.-Indian personalized medicine company, leverages its bioinformatics capacity to support human genetics research that leverages patient data from over 500 hospitals in India, providing insights into the genetic diversity of over 4,500 population groups in India.[35] For now, the still relatively high cost of genomics and an underdeveloped regulatory environment for the commercialization of genomic solutions in many countries will restrict use cases to higher-income populations.

Constraints and Risks to Achieving Scale for True Development Impact

While the bulk of the investments and applications of AI in health are largely targeted to developed markets, there is an increase in applications being developed for use cases in emerging markets. This is particularly true in the response to the COVID pandemic. Nevertheless, technological barriers such as access to and affordability of smart devices, digital connectivity gap (access and quality), and digital literacy remain important impediments in this early phase of rolling out AI-enabled tools in emerging markets. Over time, given the potential of digital-enabled solutions and AI to improve the affordability of healthcare and reach underserved communities, these solutions are expected to become more pervasive, including in lower-income settings. However, digital inclusion will be key for AI-enabled health-tech solutions to reach scale in emerging markets. There are constraints that require alignment, as well as risks that must be managed for AI-driven health solutions to scale.

Regulatory friction in commercializing health innovations

Healthcare is a high-stakes game, which means there are good reasons for rigorous regulatory frameworks. One barrier to commercialization of new innovations is uncertainty created by gaps in regulatory frameworks. Governance and legal frameworks for virtual care or the remote prescription of pharmaceuticals are untested or underdeveloped in many countries. COVID led several countries to temporarily waive limits on telehealth, while others turned a blind eye given the urgency and necessity for remote care options during the pandemic. Yet not all digital-health technologies require high levels of scrutiny, particularly for applications that allow users to track their own NDC-related health metrics, which is why the U.S. Food and Drug Administration is developing a pilot program to allow low-risk digital health products on to the market without regulatory review.[36]

AI innovations are fed by data, which means the commercialization of technologies must also navigate a plethora of data regulations, from storage to security and interoperability. In the United States, for example, FDA regulatory guidance on genomics will soon extend to cybersecurity.[37] There is a trade-off in balancing high standards for patient consent, data privacy, and data protection—such as through data localization laws[38]—with the need for large structured datasets to design and train new AI applications to make healthcare more personalized, efficient, and preventative.[39] This trade-off is likely to play out differently across markets, depending on context-specific cultural, socioeconomic, and institutional factors.

Non-representative AI: potential bias and misdiagnosis

Given the sensitivity of health data, there are several challenges to constructing big data sets needed to apply AI technologies. Nonsynchronous data formats and privacy restrictions within healthcare organizations and across systems limit the size of structured datasets that can be constructed to train algorithms. Even if companies like Linkdoc can construct sizeable datasets, the resulting technology cannot always be scaled across markets, as populations with different ethnic origins may have different predispositions for disease. To date, genomic medicine has largely been developed from populations with European ancestry, limiting clinical applications of precision medicine in regions largely composed of other ethnicities.[40]

In addition to data-related barriers, the use of machine learning in clinical diagnostic applications carries several inherent risks that researchers continue to grapple with. A useful framework for considering clinical AI quality and safety issues in medicine has been developed by Robert Challen (of the EPSRC Centre for Predictive Modelling in Healthcare, University of Exeter) and other colleagues.[41] Some of the risks in applying machine learning to clinical medicine that they highlighted include:

- distributional shift caused by a mismatch between the data a system is trained on and the data used in operation, which may be caused by disease patterns changing over time;
- black-box decision making, where a system's predictions are not open to inspection or cannot be interpreted by the clinicians that rely on its judgements, resulting in misdiagnosis that is only apparent after prolonged use;
- insensitivity to impact, where a system is designed to make accurate decisions at the cost of either missed diagnoses or overdiagnosis, a dilemma that human clinicians are trained to address with judgment; and
- negative unintended consequences caused by a system trained only on historical data or using irrelevant datapoints that miss important predictive factors, resulting in missed or inaccurate diagnoses or overdiagnosis.

Appropriateness of using AI across the health-ecosystem

Given the risks outlined above, there are legitimate questions about when AI technologies are appropriate for use in patient diagnosis and treatment. Ethical grey areas include the use of chatbots to replace clinicians in diagnosing some illnesses, and allowing algorithms to make triage decisions in critical care. There are also grey areas regarding privacy, such as whether AI can unlock patient anonymity—by accident or design—with unintended consequences for the use of patient records via third-parties like health-insurers, resulting in social discrimination and stigmatization.[42] These grey areas will rely on robust clinical trials to show that, on average, algorithms make better decisions than clinicians in some cases and that these decisions are governed by appropriate regulatory and clinical frameworks to justify their use in assisting or replacing human clinicians.

Institutional Inertia

Many health-tech innovations are a result of rigorous academic research. Commercialization of these innovations requires regulatory and institutional ecosystems that facilitate collaboration among academia, venture capitalists and angel investors, and entrepreneurs, and aligning policy and industry frameworks. Taking cities that have raised more than $200 million in health start-up funding in 2018 as a proxy, these ecosystems are concentrated in the United States—San Francisco, New York, Boston, and Chicago—with only Beijing and Paris attracting comparable investment flows. Though, cities outside the United States are catching up, with Tel Aviv, Bangalore, Guangzhou, and Hangzhou each receiving over $100 million in health start-up investment in 2018.[43]

These geographically concentrated investment flows mean that countries with the greatest health gaps have the largest hurdles to developing and diffusing locally appropriate solutions for some healthcare needs. Additionally, start-ups require time to build trust with consumers, regulators, clinicians, and payers before innovations can be scaled. Consequently, new business models, including small innovators partnering with large digital platforms as well as shared-value models like Discovery's, can be used to leverage existing technological innovations and reputations to foster the diffusion of health-tech innovations across emerging markets.

Businesses can also help accelerate trust by having terms-of-use and consents that can be easily understood by customers or patients, and being transparent in the intended use of data, particularly where business models achieve feasibility through the sale of data to third parties. Development finance institutions, impact investors, and governments can play a role in diffusion by encouraging best-practice governance arrangements and investment in the human capital needed to embed AI within new and existing healthcare organizations.

IFC is Playing a Role in Mobilizing Capital Toward Health Solutions Using AI in Emerging Markets

IFC invests in healthcare ventures that improve access to quality and affordable healthcare. These include direct and indirect exposures through fund investments to a number of companies using AI, including China-based oncology big-data company Linkdoc; India-based Niramai, which is developing an AI-enabled software solution to detect breast cancer at a much earlier stage than traditional methods or self-examination; and Brazil-based TNH Health, which builds AI-powered chatbots to monitor patient populations at scale. In response to COVID, TNH launched a chatbot to facilitate access to COVID treatment and surveillance that was rolled out for free in Brazil's Amazon State. The chatbot also provided information for pregnant women about COVID and tools to mitigate anxiety and stress.[44]

Conclusion

The importance of digital technologies, including AI, in promoting equitable, affordable, and universal access to health for all was recognized by the World Health Assembly in May 2018; and the current pandemic has only served to highlight the potential beneficial application of such technologies in healthcare.[45] Applications of AI technologies in healthcare are beginning to move the dial on these objectives by supporting the speed and accuracy of diagnostics, improving service affordability by delivering system efficiencies and new business

BOX 1 IFC and its TechEmerge Program—Accelerating Health-Tech Deployment in Emerging Markets

IFC also facilitates acceleration of health-tech deployment in emerging markets through its TechEmerge program. TechEmerge looks to accelerate the adoption of innovative health technologies in emerging markets to drive improved healthcare delivery and patient outcomes. It does this by identifying the core needs of healthcare providers and matching them with best-in-class solutions from health-tech companies from around the world to conduct local pilot projects and build commercial partnerships.

IFC's TechEmerge inaugural health-tech program, launched in 2016, matched 17 health-tech innovators with 15 Indian providers (hospitals, clinics, labs, and home healthcare), to conduct 20 pilot projects at 70 clinical sites across India. Technologies, several of which included AI, enabled greater reach, increased affordability, and improved operational efficiency. Examples of solutions include India-based Tricog's AI-enabled ECG diagnostic aid for cardiologists based remotely; Israel-based Mobile ODT's AI-supported portable cervical cancer screening tool; and U.S.-based Welldoc, with an AI-based virtual coach to support diabetes care. To date, 22 commercial contracts worth almost $1 million have been signed by TechEmerge innovators for broader deployment of their technologies in India, which are expected to benefit more than 300,000 people each year. During the program, innovators raised more than $14.5 million in financing, and one innovator was acquired for $102 million.

Subsequently, IFC launched TechEmerge Health Brazil in late 2017. From 295 applications, 21 innovators were selected for 27 pilots with 16 Brazilian healthcare providers. Again several of the pilots were with health-tech companies offering AI-enabled solutions: Brazil's TNH Health piloted its AI-driven virtual nurse assistant with two Brazilian health providers; and Israel-based Aidoc undertook two pilots with leading Brazilian providers, supporting their radiologists with AI-supported diagnostic aids. The program is now being implemented in East Africa and AI-enabled solutions are expected to be part of the health-tech solutions piloted to the benefit of local patients.

In 2020, IFC initiated TechEmerge Health East Africa. Among more than 415 tech companies from 50 countries, 53 tech companies across multiple categories were identified to have market-relevant solutions that may meet the needs of participating East Africa healthcare providers. There are ca. 25 leading providers in Kenya, Uganda and Ethiopia participating in the program, serving over 6.5 million patients across mor than 285 facilities, with 2,850 beds. Selected innovators receive funding and guidance from the TechEmerge team to pilot their tech solutions in the East African market, with the ultimate goal of wider commercial deployment. The selected innovators from around the world offer a range of solutions including tools in artificial intelligence/machine learning, point-of-care diagnostics, maternal and child health, patient engagement, quality management, and operational efficiency. Please see for more details: https://www.techemerge.org/country/tech-emerge-east-africa models, guiding consumers in preventative behaviors, and improving transparency in the quality of services.

However, the game-changing potential of AI technologies in improving the speed, affordability, remote access, and preventative focus of health-tech innovations requires an ecosystem in which investors, regulators, technologists, medical and research professionals, and consumer advocates develop consensus on regulatory frameworks to govern these technologies and agree on the ethical boundaries of their applications. The recently launched Lancet and FT Commission initiative to develop recommendations on the implementation and governance of digital health over the next two years is a welcome initiative toward achieving the clarity required to scale up AI health-tech innovations.[46] Additionally, public and private investments in ICT infrastructure, human capital, data infrastructure, and interoperability are required for widespread diffusion of heath-tech innovations across markets.[47] Although aligning stakeholders, values, objectives, and investments across jurisdictions is a difficult and time-consuming task, doing nothing would be a tragic missed opportunity for achieving impactful disruption to the global health system.

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Please see the following additional reports about the role of artificial intelligence and technology in emerging markets: *Artificial Intelligence in Emerging Markets—Opportunities, Trends, and Emerging Business Models (September 2020); Reinventing Business Through Disruptive—Sector Trends and Investment Opportunities for Firms in Emerging Markets (March 2019).*

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