

Re-Envisioning Electronic Health Records

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The latest technological advances may finally turn EHR data troves into better medicine—if the systems can get out of doctors' way.

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By Aaron Ricadela

Twenty years ago, RAND Corporation published a sweeping study forecasting the US health system could save US\$81 billion annually by adopting electronic records to replace paper-based processes for logging diagnoses, prescribing medications, and ordering tests. Electronic health records would reduce redundant care, speed patients through the system, help doctors manage chronic diseases, and all but eliminate prescription mistakes that compromised safety, the analysis maintained. It was a pillar of a subsequent federal law that unleashed US\$35 billion in government incentives for hospitals and practices that implanted EHRs into their work.

Eight years later, in 2013, the California think tank concluded that the rush to digitization had yielded no cost savings whatsoever, owing mostly to incompatible and hard-to-use systems, as well as hospitals' failure to redesign their processes to reap the benefits. Instead of declining, US healthcare costs had ballooned by US\$800 billion a year, RAND reported.¹ More recently, those costs have been climbing at about 5% annually—off a base of US\$4.5 trillion—after rising at about twice that rate during the pandemic.

Tempered by the tough lessons they learned from that first swell of EHR implementations, global healthcare systems and the technology companies that supply them are regrouping for the next wave, driven by rapid AI advancements, congealing communications standards, and a willingness to re-engineer workflows. Rather than viewing the systems mainly as platforms for ordering tests and medicines, coding diagnoses, and sending bills, health organizations are looking to EHRs to improve care team collaboration, personalize treatment plans,



and understand how patients’ access to transportation, diet, and other external factors should influence care. They also need to make it easier to input, access, and analyze EHR data and exchange it with laboratories, insurers, pharmaceutical companies, and researchers.

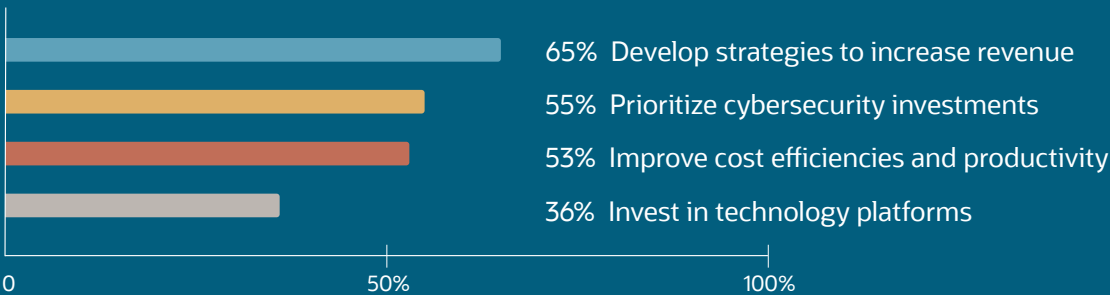
“A lot of this stuff is in the ground game,” says John Glaser, an executive-in-residence at Harvard Medical School, who helped define the US Health and Human Services Department standards that qualified sites for federal EHR incentives. “Not a lot of it is automatic. There is ROI there, but you have to go get it.”

EHRs’ value has been hindered by isolated systems, unwieldy clinical notes, a glut of government-mandated data fields, and tides of alerts that doctors often ignored. Physicians and nurses in UK National Health Service hospitals widely use WhatsApp to share X-rays and blood test results, circumventing incompatible IT systems. Research from Stanford Medicine has shown that doctors spend 19 minutes in EHRs for every 12 minutes with patients. Data from digital records that could inform research on cancer therapies or heart disease is expensive to extract or inconsistently formatted. And computer files that show how people’s genetic variants affect their propensity to contract diseases or respond to drugs can be hard to integrate.

Coming EHRs will incorporate generative AI to let doctors see summaries of patients’ charts and lab results and filter information pertinent to a specific ailment. They’ll support the shift to value-based care plans that reward physicians for completing courses of treatment under budget and above quality bars by showing insurers how patients fare over time.

And they’ll be able to process genomic data using query formats such as FHIR Genomics Operations—part of an industry standard for exchanging health information called Fast

Healthcare CXO priorities for 2025



Source: Deloitte survey of 80 C-level executives from large US healthcare systems and insurance plans, conducted August-September 2024. Note: Figures reflect the percentage of respondents who said the action is “very important” or will have a “significant impact” on their business.

Healthcare Interoperability Resources—to help develop personalized treatment plans that account for differences in DNA.

EHRs will also need more connectivity to the smartphone health trackers, home medical devices, and fitness watches consumers use to collect and monitor their vital signs. They'll need to connect to one another too so patients' data can follow them around.

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The potential is huge.”**

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Chair of the University of California San Francisco's Department of Medicine
and author of the 2015 bestseller “The Digital Doctor”

“That has been the biggest disappointment of digitization: It accomplished some things that had to happen, but it has not accomplished the real reason you do it, which is to understand all the data in the records and take actions based on it that make care better and less expensive,” says Bob Wachter, chair of the University of California San Francisco's Department of Medicine and author of “The Digital Doctor,” a 2015 bestseller. “The question is whether now is the moment when all that happens.”

AI-enabled EHRs can make sense of heretofore inaccessible unstructured data, marshal evidence from hundreds or thousands of hospitals or medical specialists, and tap information stored in cloud computing environments so researchers can look at diverse data sets across institutions, says Wachter, whose follow-up book on AI's impact on medicine is due out in 2026. “The next 10 years are going to be pretty cool,” he says. “The potential is huge.”

Here are five areas where healthcare providers and EHR vendors need to consider investing, and those still in need of improvement.

1. Put patient face time first

Doctors have long been dissatisfied with EHRs' usability and the work hours they add.² Typing during patient visits draws attention from conversations. Getting paid by insurers can involve answering checklists of questions tangential to the case at hand. Pop-up best practice alerts badger caregivers as they click through record tabs. And data views aren't always customizable.

US physicians average 15 hours a week of “pajama time” outside their practices or hospitals inputting EHR data, typing notes, or completing online training, according to a 2024 survey of 1,003 US doctors conducted by The Harris Poll.³ Nearly all reported regularly feeling burned out from the extra admin work.

Generative AI can make it easier for doctors to interact with EHRs by speaking or typing plain language commands to view information by illness, summarize test results along a timeline, or look up drug dosages and interactions without interrupting their work. Voice recognition apps can listen during exams and draft EHR notes, saving time and eliminating copy-and-paste shortcuts that lead to information overflow. Soon, a doctor will be able to click on a patient's profile to see his or her chart—with an AI summary at the top listing conditions and medications—then query the underlying model about dosages, side effects, and previous visits.

“We created a litany of top-down requirements that were imposed on doctors and hospitals,” says John Halamka, a physician and president of the Mayo Clinic Platform, which develops



and licenses healthcare technology and invests in startups globally. “We’re on the cusp of being able to give them something back because all of that data entry now forms the corpus of the training for AI.”

To maximize AI’s effectiveness, hospitals and clinics need to redefine workflows around it. For example, AI tools can prompt doctors within an EHR to complete timely refresher training on procedures. AI applications can also analyze insurance details, patient histories, and policies to generate the preauthorization requests insurers need to pay for MRIs, surgeries, and expensive medicines, according to a recent McKinsey & Co. report.⁴ AI systems can also help manage emergency room traffic flow and hospital bed transfers to avoid backlogs.

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Their ability to learn about relationships and patterns can help hospitals and other care providers gather all the available information that affects people’s health, extending EHRs beyond today’s modules aimed at specific disciplines, says David Feinberg, chairman of Oracle Health and former CEO of Cerner, Geisinger Health System, and UCLA Health. “The coolest thing about AI is it actually could break this cycle of departmental modules,” Feinberg says, and give doctors a more complete view of each patient.

It’s also getting easier for doctors and patients to share reports about medical images. Files can get marooned on older computing platforms that are incompatible with the databases where diagnoses and drug information are stored and are often emailed as PDFs, a legacy of the fax machine era. Advancing standards are letting physicians and patients share radiology and pathology reports across EHRs on different platforms.

2. Keep rising costs in check

Insurers in the United States have long reimbursed doctors for each office visit, procedure, and test—hardly an incentive to reduce costs or improve care. Annual premiums paid by US companies and workers for employer-sponsored family health insurance plans rose 7% for the second year in a row in 2024, surpassing the rate of inflation and reaching nearly US\$25,600, according to healthcare researcher KFF.⁵ The US spends more on healthcare per capita than any other developed country yet ranks poorly on life expectancy, access to care, and administrative complexity.

Aiming to boost quality, reduce redundant testing, and lower the number of costly complications and hospital readmissions, insurers are shifting from line-item payments to value-based compensation. The programs pay doctors fixed amounts for completing successful courses of treatment or pare reimbursements when they fall short of clinical yardsticks. The plans work well for cases with clear beginning and end points, accepted quality measures to make sure patients don't get shortchanged, and widely accepted interventions, such as medications or dietary changes.

Bundled payments cover preliminary tests; required procedures, surgeries, and other treatments; and follow-up care for managing diabetes, replacing problem knees and hips,

Projected annual cost savings from AI use, 2025-2029

Hospitals

\$24B-\$48B

Physician groups

\$10B-\$30B

Source: McKinsey's December 2024 healthcare outlook.
Figures in US dollars.

delivering babies, and implanting pacemakers. This payment model is making its way into oncology and kidney disease care.

While still unproven, value-based payment arrangements are compelling more information-sharing among specialists, pharmacies, and insurers. Healthcare organizations need accurate data on the costs of treating specific conditions while hitting quality measures and turning a profit. Doctors benefit from reminders to monitor certain patients or equip them with wearable devices such as glucose monitors.

By 2027, an estimated 90 million US patients will be covered by value-based care models, up from 43 million in 2022, according to McKinsey.⁶ The US Medicare program, which covers nearly 68 million people, mostly seniors, has adopted a value-based care model, and the UK, continental Europe, and India have employed bundled payment arrangements. Germany’s federal hospital reform law, which went into effect in January 2025, overhauls reimbursement so hospitals are compensated mainly for having the right equipment and staff on hand for specific surgeries versus earning more based on the number of operations they perform. EHRs can ease the transition to value-based care by capturing information about how

Healthcare spending per capita



Source: Peterson-KFF Health System Tracker. 2022 figures, in US dollars, adjusted for purchasing power parity.

patients fared during and after a procedure or surgery and whether they needed to return to the hospital. That's a change from just tracking transactions such as office visits, lab tests, and prescriptions. EHRs are also storing data on the social determinants of health—their access to healthy food, how easy it is for them to travel to appointments, and their need for assisted living. “The next step is getting that person into a nutrition program, or showing a doctor they haven't done enough mammograms for the size of their population, how much it will cost, and who may be eligible,” Feinberg says.

Industry standards are advancing to codify value-based care communications. The HL7 international standards body's Da Vinci Project has developed FHIR-based protocols so doctors can request authorization for scans and tests, submit quality documentation, and see flags for recommended tests or treatment.⁷ The National Committee for Quality Assurance is automatically extracting data from EHRs to accredit healthcare plans based on how well doctors in their networks perform in specialties including cardiology and diabetes management. This helps employers compare plans according to predominant gender, age group, or other workforce demographics.

3. Tailor genomic treatments

Increasingly affordable gene sequencing can reveal patients' hereditary conditions, qualification for clinical trials, and likely response to drugs, a branch known as precision medicine. But sequencing-workflow software hasn't readily interacted with EHRs, which contain the health histories and vital signs needed for doctors to act on genetic insights. Hospital groups, healthcare IT companies, and testing laboratories are working to change that.

One difficulty has been translating genetic testing lab results into prescriptions and healthcare decisions informed by EHR data.

The genome, a person's set of DNA molecules, contains about 30,000 genes. Knowing patients' gene variants, both inherited and occurring during their lifetime, can help doctors adapt treatments, such as cutting-edge cancer immunotherapies. These include



checkpoint inhibitors, which assist the body's immune system in attacking cancer cells, and chimeric antigen receptor T-cell therapies, in which patients' immune cells are modified to better attack tumors. One difficulty has been translating genetic testing lab results into prescriptions and healthcare decisions informed by EHR data. Gene sequencing files of 150 MB or more are too big to be stored in most records systems and require complex, multistep computer processing to turn them into information geneticists or doctors can act on.

The good news is that the FHIR Genomics Operations data format can wrap repositories of downstream variant calling files so they're readable by EHR screens and other applications. That helps match patients to clinical trials, screen them for hereditary disease markers, and gauge the risk of an adverse drug reaction.

Software for managing the flow of genetic data files from a sequencing machine to computer analysis can also now run on the same cloud platforms as the databases that underpin EHRs. Sequera's Nextflow, a widely used software package that lets bioinformaticians code the computing steps for analyzing sequencing data, runs on Oracle Cloud Infrastructure, Microsoft Azure, Amazon Web Services, and Google Cloud, saving the need to port data later.

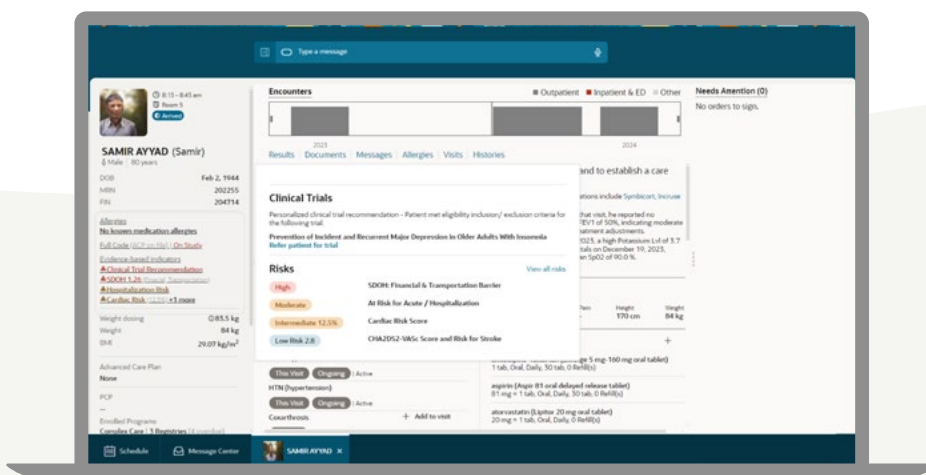
4. Tap EHR data for research

Back in 2004, pharmaceutical maker Merck & Co. pulled its multi-billion-dollar-a-year Vioxx painkiller from the market after EHR analyses and a key clinical trial revealed a years-long spike in heart attacks among patients taking it. More recently, during the pandemic, EHR data helped prove treatment plans' efficacy and showed how patients' health histories affected the severity of their COVID-19 conditions. In 2023, Oracle Health research services teamed with the US Food and Drug Administration's Sentinel Initiative and medical AI company John Snow Labs to analyze unstructured data in 17 million EHR notes, examining the psychological side effects in children who took the asthma drug montelukast.⁸ In 2024, FDA researchers said the drug could potentially be linked to mental health side effects in some patients.

The examples underscore the value of so-called real-world clinical data stored in EHRs for identifying both effective and potentially harmful medical treatments. AI is spinning such analyses forward. For example, drug safety specialists want to apply large language models to pharmaceutical company data sets, assisted by a technique called retrieval-augmented generation, to single out patients with higher risks of adverse drug reactions. They're looking to do the same to measure medicines' efficacy and risk among different demographic groups.

Pharma companies are combing EHRs for data on health outcomes and demographics to find recruits for clinical trials; AI can speed up the process by sifting through medical histories faster and identifying relationships among complex sets of indicators.

Data standardization is also a priority. An industry initiative called Minimal Common Oncology Data Elements (mCODE) aims to populate cancer patients' EHRs with a uniform



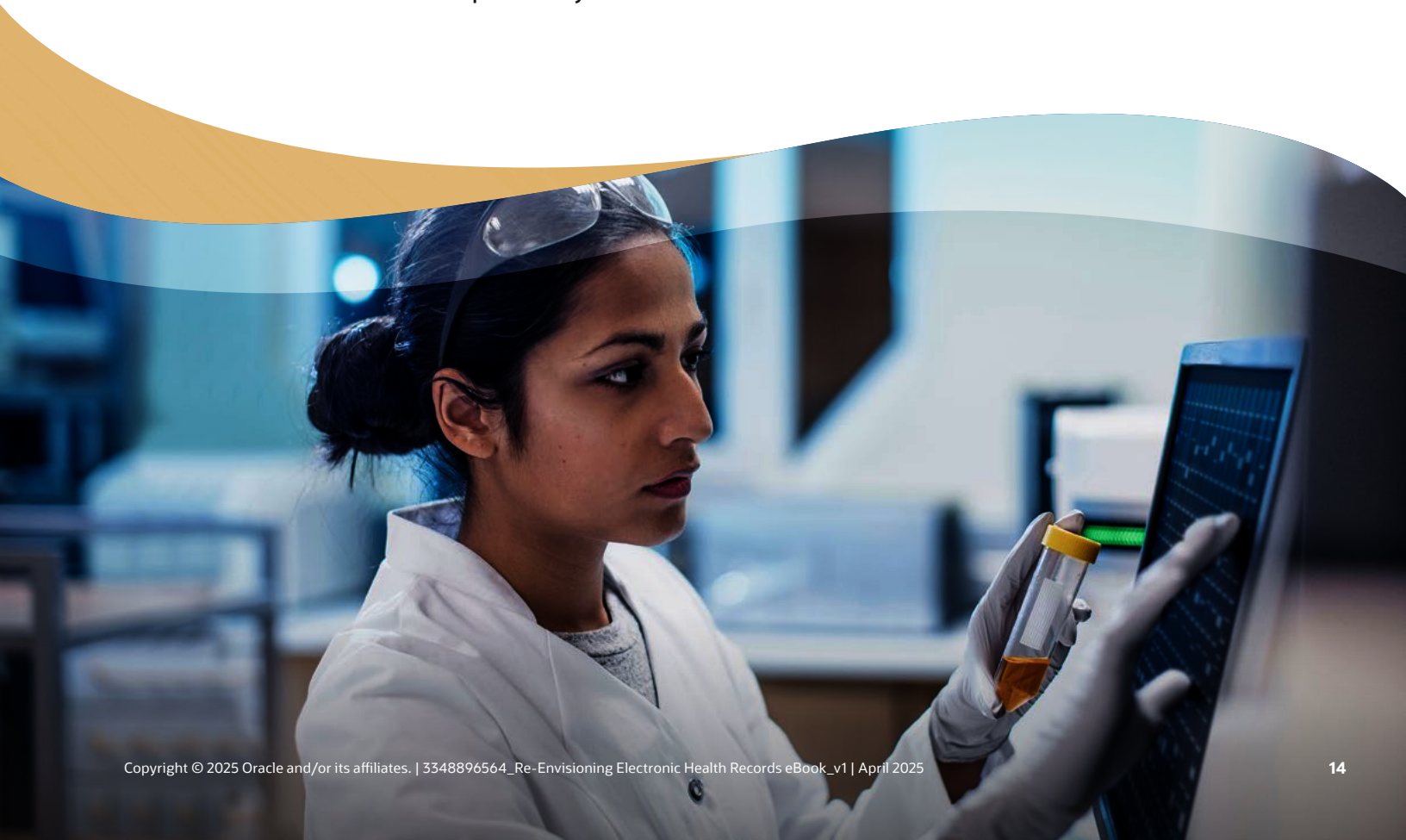
By integrating with Oracle Health Life Sciences solutions, Oracle Health EHR can recommend clinical trial opportunities.

set of data about conditions, disease progression, test results, and genomic variants to let researchers compare treatments. The effort uses a FHIR extension for cancer data to help overcome inconsistent formats in that field.

Tech companies are using the SMART on FHIR application programming interface to build software that can automatically extract EHR data for inclusion in public disease registries. EHR vendors agreed in 2024 to include key cancer data under the federal USCDI+ Cancer program in their records.

Governments are also standardizing more medical research data. The European Health Data Space establishes a common European Union format for patient summaries, electronic prescriptions, lab results, and hospital discharge reports. Starting in 2025, Germans covered under public health insurance plans will automatically receive a personal health record, and the data included will be available for clinical research unless they apply for an exemption.

There's still work to do. Applying AI to show physical or mental health outcomes across thousands or millions of patients will be tougher than using it to write patient summaries, says Harvard's Glaser, a former hospital and industry executive. And enrolling patients in clinical trials or updating government databases containing treatment and quality-of-care information has involved manually typing EHR data into separate applications, earning the moniker "swivel-chair interoperability."



5. Maximize IT investments

Since the late 1990s, sectors including retail, banking, travel, and logistics have invested aggressively in IT to improve their services and speed them to market. In contrast, the healthcare sector, which has underinvested in tech, needed the push of government subsidies.

“There was a huge infusion, but it was hurry-up-and-spend money,” says Harvard’s Glaser. “A lot of places saw this as a regulatory mandate, and we tolerated a lot of sloppy data.” That’s changing as industry executives realize they need to redesign their processes, not just automate existing ones, he says.

Past healthcare AI applications faltered in part by aiming at the toughest challenge first: providing decision support for doctors. Academic expert systems in the 1980s weren’t widely put into production. Decades later, IBM’s Watson Health initiative to apply AI-based predictive analytics to improve cancer diagnoses fell short of expectations at prominent medical schools and cancer centers amid a dearth of data and underpowered prediction models. IBM sold the business in 2022 to a financial firm for a fraction of its investment.

What’s different now is that medical centers and tech companies are putting more achievable goals first, looking to augment existing IT with AI and cloud computing.

Moving existing EHRs to the cloud lets hospitals and medical practices access some built-in AI capabilities and receive regular feature and performance updates without a lot of custom development. Meantime, hospitals can wrap legacy EHRs with functions for communicating with AI and analytics applications, helping them report to regulators on

“The private and public sectors need to collaborate to protect patient privacy and safeguard mission-critical infrastructure.”

Seema Verma

Executive Vice President and General Manager
Oracle Health and Life Sciences

quality measures, comb through workflow data for cost savings, predict which patients may not stick to treatment plans, and identify chronic conditions needing special care.

AI is also finding back-office adherents by helping billing departments maximize revenue, automating scheduling, sending reminders to patients due for screening, and writing prior authorization requests, UCSF's Wachter explains. "They are the correct early steps," he says.

In a March 2024 IDC survey of 307 US hospital IT and business executives, two-thirds of respondents said their organizations planned to increase their annual IT spending, driven by investments in EHRs, cloud computing, and security.⁹

"Most healthcare CIOs are developing software the old way—making low-risk bets, pitching for procurement budget, gathering requirements, and managing projects step by step," says Sandip Kumar, chief digital and innovation officer at King's College Hospital London in Dubai, which plans to triple its patient capacity and expand across the region in coming years. "Where I see the real potential is constant innovation, leveraging data collected over a decade, stored in a system of record, to predict how patients will fare. The shift to the cloud isn't about infrastructure—it's about speed, scale, and acceleration you previously didn't have."

Financially strapped US and European hospitals will need to spend judiciously, given that prices for labor, medicines, and supplies are rising faster than insurance reimbursements while a spate of cyberattacks has been increasingly expensive to deter, according to a 2024 report from the American Hospital Association (AHA).¹⁰

Seema Verma, executive vice president of Oracle Health and Life Sciences and the former administrator of the US Centers for Medicare & Medicaid Services, says cloud computing infused with AI services can strengthen the healthcare sector's cyberdefenses. Verma encourages US government funding of IT security programs. "The private and



public sectors need to collaborate to protect patient privacy and safeguard mission-critical infrastructure,” she says.

Shoring up cyberdefenses is among the biggest IT investment priorities for healthcare, which was hit by ransomware attacks more than any other critical infrastructure sector in 2023, according to the FBI—more than manufacturers, government agencies, tech companies, and banks.¹¹ The 2024 ransomware attack on UnitedHealth Group subsidiary Change Healthcare, a medical claims payment processor, affected the cash flow of 82% of the 1,000 US hospitals surveyed by the AHA. Nearly 60% of respondents reported at least US\$1 million of lost daily revenue a month later, and nearly 75% reported an impact on patient care.¹²

Medical records sell at a premium compared with other personal information on the black market. A 2023 data breach at genetic testing company 23andMe exposed personal information, including customers’ locations, birth years, and family trees. Storing EHR and other health data in the cloud, rather than in databases in hospital server rooms, helps make it more secure.

Further pressuring budgets are the efforts needed to clean and anonymize patient data so it’s ready to train AI models, a process that costs between US\$1 million and US\$2 million per institution, says Mayo Clinic’s Halamka, who helped define US federal healthcare IT standards for the George W. Bush and Obama administrations. For a top global hospital spending 3% to 6% of its operating profit on IT, that’s doable. “At a community hospital it’s not,” he says, though philanthropy can help offset costs. “You can’t go into messy data and assume it’s good enough for predictive or generative AI.”

—With additional reporting by Margaret Lindquist

How Oracle can help*

Oracle Health applications and data analytics can help healthcare organizations prioritize cases, reduce manual data entry, manage operations, and improve patient care.

[Oracle Health EHR](#) enhances numerous aspects of care delivery, including through generative AI. It helps personalize staff workflows, streamline daily patient management, provide relevant information before exams, automate routine tasks, deliver timely insights, and support point-of-care decision-making.

[Oracle Health Clinical AI Agent](#) lets doctors retrieve information from patients' medical histories through voice commands instead of visual menus. It captures doctor-patient conversations during exams to generate draft EHR notes, saving time and letting physicians focus on their patients. The mobile application, which will integrate with Oracle Health EHR, can propose follow-up lab tests and referrals to specialists.

[Oracle Health Data Intelligence](#) lets healthcare providers and payers perform AI analyses on clinical and financial data through a data warehouse. Oracle Health Data Intelligence services can help prioritize high-risk patients, flag overdue screenings, send patients educational information or prompts to schedule appointments, and help reduce care-team time pressures by employing generative AI to create referrals and automate administrative tasks.

[Oracle Health Patient Accounting](#) can work across various EHR, registration, and scheduling systems, offering automated workflows to bill and track reimbursement for healthcare services.

[Oracle Health Command Center Dashboard](#) creates digital twin models of a health system's enterprise operations and staff, letting managers visually plan capacity, see where patients will be routed, and set staffing levels. Near real-time information access helps providers limit manual spreadsheet data entry, identify bottlenecks, and reduce patients' length of stays.

[Oracle Health Patient Administration](#) guides ambulatory practice staff through registering patients, scheduling appointments, and creating bills. It also includes workflows for financial approvals. Self-service capabilities let patients schedule, register, and check in for appointments at their convenience.

[Oracle Health Patient Portal](#) lets patients conveniently search for care options, complete registration tasks before appointments, and readily call up their health records—including lab results and medications lists. It can simplify patients' access to care and relieve front-office staff of administration burdens.

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