Seven for the Twenties: A Futurist Looks at the Next Decade
By Jeff Goldsmith

After a decade dominated by ObamaCare- its enactment in 2010, the fraught implementation, its near repeal in 2017, and the welter of inconclusive experiments with Medicare payment reform - healthcare in the 2020s is likely to be reshaped by technological and scientific advances, as well as continued political struggles over societal and family cost. We can expect major change in seven areas:

1) Rising Patient Safety Risks.

Two emerging patient safety risks will spike in seriousness during the 20s. One risk, that of drug resistant bacterial infections, boiled under the surface for more than two decades, with the rise of *MRSA*, *Candida aureas*, *Clostridiodes difficele* and more than a dozen other agents*:* https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf Nearly three million people were infected with these agents in 2017, and more than 48 thousand died. While hospital infection control has improved, and deaths from hospital infections fell during the 2010's, antibiotic drug development has lagged, and the potential for one or more breakout infection risks is highly likely in the 2020s. *The Economis*t published a chilling and entirely possible scenario in July, 2019: https://www.economist.com/the-world-if/2019/07/06/what-if-antibiotics-stop-working

The second major risk has resulted from the confluence of two information technology (IT) trends- the migration of health system clinical and financial operations to the Cloud and the 5G-enabled connectedness of medical devices and hospital infrastructure to the Internet, the so-called Internet of Things (IOT). These two linked migrations opened a gaping digital "back door" in hospitals and systems to "black hat" hackers.

The fall of 2019 saw two major health systems-Tuscaloosa-based DCH Health System (AL) and Hackensack Meridian (NJ) – succumb to ransomware attacks that paralyzed clinical operations for days before the system paid cyber-extortionists to stand down. However, there is a more threatening risk of mass patient casualty episodes in hospitals if hackers gain control over critical life support functions like respirators, infusion pumps, oxygen systems, HVAC and electrical systems. https://www.wsj.com/articles/rattled-by-cyberattacks-hospitals-push-device-makers-to-improve-security-11557662400 The virtually unmanaged spread of connected devices and systems in hospitals is a significant threat to patient safety. Health systems and regulators will be playing catch up in both these patient safety domains during the 20s as the degree of patient risk becomes more clearly understood.

2) AI (Artificial Intelligence) Surfaces in Unexpected Places.

The past decade saw breathless forecasts of massive disruption in health services from artificial intelligence (AI). Vinod Khosla predicted in 2012 that 80% of physicians would be replaced by AI: https://www.wired.co.uk/article/doctors-replaced-with-machines In 2014, Eric Topol forecast that the smart phone apps and "DIY medicine" would displace the physician as the pivot point in medicine, eliminating the prospect of a shortage of clinicians: https://www.wsj.com/articles/the-future-of-medicine-is-in-your-smartphone-1420828632.

Neither of these forecasts has yet to come to pass, or likely will during the 20s. IBM Watson's disastrous incursion into oncology diagnosis became a multi-billion embarrassment not only for the company but for healthcare AI as a whole. https://spectrum.ieee.org/biomedical/diagnostics/how-ibm-watson-overpromised-and-underdelivered-on-ai-health-care.

With the radiant clarity of hindsight, forecasters and corporate executives have both grossly underestimated the complexity of medicine and grossly overestimated the state of development of the AI toolset and applications. As a consequence, AI in healthcare enters the 20s at of Gartner's Peak of Inflated Expectations (preparing for its plunge into the Trough of Disillusionment) https://www.gartner.com/en/documents/3953717/hype-cycle-for-healthcare-providers-2019.

However, the 20s will see rapid growth in two big AI application sets: AI for medical claims management and AI for image interpretation both in radiology and pathology. Unlike AI for medical diagnosis, AI for medical claims management operates on a smaller and more orderly data set. Insurers stole a march on, particularly, hospitals in the latter part of this decade by using AI driven data mining and rich new "value-based" data sets to deny or reprice claims after services had been provided. This is leading to a compensatory surge of hospitals' use of rules engines and automated documentation routines to backstop their claims and defeat machine-driven surveillance of and incursions into their revenue cycles. Active, real-time surveillance of and management of insurer contracts will be essential.

However, the most significant disruptive potential for AI in medicine in the next decade is going to be in radiology and pathology image interpretation. Though initial AI forays into breast cancer diagnosis proved disappointing https://www.jacr.org/article/S1546-1440(17)31674-5/abstract, it is likely that by mid-20s, the "first read" in complex imaging scans like CT and MR will be done by software in the machine itself, flagging a small number of troublesome images for radiologists' viewing. This will markedly improve radiologists' workflow without rendering the ultimate human interpretation superfluous.

Suggestions that radiologists will disappear due to AI are overblown. Moreover, AI will not displace interventional radiology, and radiologists' role as consultants in surgical cases seems secure. Pathology image interpretation will prove more challenging, because the images involve much larger data sets, and interpretation is more subjective.

3) Advances in Critical Care

General and specialized intensive care units (ICUs) and the emergency room (ER), are the most expensive places in the health system, and the most fraught for patients. Major advances are likely to improve critical care in the 20s: rapid progress in septic infection treatment and harnessing the power of "hibernation" to extend the "golden hour" after major trauma to many hours. These technologies were fostered by investments from DARPA's ambitious Office of Biological Technology.

Septic infections affect 1.7 million Americans every year, and kill 270 thousand. The risk of septic infection will likely increase given the spread of antibiotic resistant bacteria discussed above. However, DARPA funded researchers at Harvard have created what amounts to a special purpose artificial spleen that uses filters comprised of hollow fibers bonded to a sticky bioengineered immune system agent to cleanse the blood of the pathogens that cause sepsis as well as the toxic chemicals they shed. https://wyss.harvard.edu/news/wyss-institute-and-miraki-innovation-unveil-boa-biomedical-to-reduce-sepsis-deaths/

In addition, clinicians may be on the verge of being able to induce biostasis, effectively hibernation, in humans through chemical means, potentially extending from one to many hours the time in which victims of trauma can be treated without dying or incurring permanent disability https://wyss.harvard.edu/news/harvards-wyss-institute-commences-multidisciplinary-project-to-identify-mechanisms-and-means-to-induce-a-state-of-suspended-animation/ Additionally, researchers have infused ice water into trauma victims in cardiac arrest after catastrophic blood loss- what Univ of Maryland researchers have called Emergency Preservation and Recovery (ERP)- to stave off vital organ damage and create a window for emergency surgery https://www.umms.org/ummc/health-services/shock-trauma/news/body-cooling-study Both of these advances will markedly reduce deaths from trauma and infection.

4) Major Progress Against Schizophrenia

Psychiatric illness has proven an elusive and frustrating target both for basic science research and drug development for the past thirty-plus years https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2019.01609 However, a major breakthrough was achieved in 2016 with the apparent discovery both of a genetic trigger for schizophrenia (which affects nearly 2.5 million Americans) and a convincing theory of its biological mechanism of action. https://www.technologyreview.com/s/546136/immune-system-offers-major-clue-to-schizophrenia/ A landmark study at the Harvard Medical School https://www.ncbi.nlm.nih.gov/pubmed/26814963 found that variation in genes that encode for an immune system regulator molecule, c4 is tightly linked to schizophrenia. An excess supply of c4 during an otherwise normal process of "synaptic pruning" in adolescent brains https://www.scientificamerican.com/article/why-is-synaptic-pruning-important-for-the-developing-brain/\may, in a mechanism not unlike that in autoimmune disease, lead to irreversible brain damage.

There are major questions about how much external control can be exerted over synaptic pruning, and whether the receptors that govern c4 supply are "druggable" targets. But this research has led to the possibility of identifying young people at genetic risk of schizophrenia and either immunizing them against the destructive immune system malfunction or creating a genetic therapy to correct the inherited flaw.

5) Boomers Check Out Early

Health policy analysts have worried for decades about the effect on health costs of the aging of the baby boom generation. Tragically, this generation may end up checking out a lot earlier than forecast. Almost 3/4 of boomers are overweight or obese, and nearly 40% of boomers are obese. Research has established that obesity reduces life span by 6 ½ years and extreme obesity by thirteen years https://www.latimes.com/science/la-sci-sn-extreme-obesity-cuts-lifespan-20140708-story.html. due to the complications of diabetes and heightened risk of strokes and heart attacks.

Since boomers entered their late 40's (beginning in 1997), we have seen more than a 15% increase in death rates in mid-life driven by what Nobel Laureate Angus Deaton referred to as "diseases of despair"- drug overdoses, suicides and alcohol related illness (https://www.brookings.edu/wp-content/uploads/2017/08/casetextsp17bpea.pdf).

It may well be that the 20s will become the pivotal decade in the long anticipated generational transition of the baby boom, not the 2030s, generating a surge of expensive hospitalizations and stress for their loved ones.

6) UnitedHealth Group Reaches 10% of Total US Health Spending

Even though health spending nearly reached 18% of US GDP by end of the decade, analysts have long observed how fragmented the health system is. However, it is possible that a single sprawling health enterprise, UnitedHealth Group, $260 billion in revenues in 2020, will comprise 10% of the US health system by later in the decade. UnitedHealth's health insurance subsidiary has the largest presence in the two fastest growing segments of health insurance, Medicare Advantage and Managed Medicaid. United's non-health insurance arm, Optum, at nearly $115 billion in annual revenues, is growing at 13% a year, and throwing off $1 billion a month in cash flow.

OptumCare, United's care delivery subsidiary, claims to employ 47 thousand physicians, double that of Kaiser's Permanente Medical Groups, and will reach $30 billion in 2020, making it the third largest private healthcare enterprise in the US, after Kaiser and HCA. The non-care delivery parts of Optum include a rapidly growing business process outsourcing activity, industry leading business intelligence and healthcare claims management activities, a large diversified consulting operation and the nation's second largest pharmaceutical benefits management firm.

The only things standing between UnitedHealth Group and a 10% share of total health spending are the possibility of running out of accretive acquisitions, leading investors to demand that management return a larger portion of its cash to shareholders, or that United's health insurance business's profitability erodes to the point where continuing to own it constrains Optum's growth and management decides to spin one or the other business off to investors (OR if private health insurance is eliminated by enactment of Medicare for All, which appears at this writing to be extremely unlikely).

Whatever happens, United's presence in healthcare dwarfs that other oft-cited corporate "disrupters" in healthcare, like Amazon, CVS and Google. United's rapidly growing care system presence will challenge the dominant actors in regional healthcare markets all across the US.

7) Hospitals Hold Share in the 20s, But . . .

Despite breathless forecasts of "disruption" from technology and non-hospital corporate enterprises, hospitals, which gained share of total health spending in the past decade despite stagnant admissions growth, will continue to account for about a third of total health spending thru the next decade. This is because, for better or worse, they will maintain an unchallenged monopoly on acute and critical care, demand for which is likely, net net, to rise due to the accelerating demise of the baby boomers discussed above.

Whether hospitals are able to operate *profitably* in this environment will be determined by two factors: federal policy and the actions of their managements. Further expansion of Medicare and Medicaid enrollment could erode private insurance coverage, and damage hospital cash flow. Unless managements can leverage information technology to make continuous improvements in productivity and clinical effectiveness, many hospitals could face significant financial challenges.

Nearly half of the US population could not afford to use hospitals in 2019 without either public subsidy or direct public coverage, or else significant family financial hardship. This means that affordability challenges for American families will create significant political exposure for the industry. Further increases in hospital cost will raise the political pressure to cap hospital spending via rate controls and/or restrictions on hospital billing practices. Recessions will increase pressure on state and federal governments to constrain hospital spending, particularly for Medicaid (which presently covers nearly one-quarter of the US population!).

Thus, the 20s will pressure healthcare managements to innovate to reduce the cost of care, and make their care systems much more efficient and productive. The industry will be skating on thin ice politically throughout the decade, vulnerable to moments where one political party or the other controls both Congress and the White House.